

Case No. 84739

IN THE SUPREME COURT OF THE STATE OF NEVADA

Electronically Filed
Nov 08 2022 04:38 p.m.
Elizabeth A. Brown
Clerk of Supreme Court

ADAM SULLIVAN, P.E., NEVADA
STATE ENGINEER, et al.

Appellants,

vs.

LINCOLN COUNTY WATER
DISTRICT, et al.

JOINT APPENDIX

VOLUME 44 OF 49

In The Matter Of:

*DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES*

*Vol. I
September 23, 2019*

*Capitol Reporters
123 W. Nye Lane, Ste 107

Carson City, Nevada 89706*

Original File 9-23-19VolumeIFINALFINALSE_1.txt

Min-U-Script® with Word Index

SE ROA 52960

JA_17357

Page 1

1 STATE OF NEVADA
 2 DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
 3 DIVISION OF WATER RESOURCES
 4 BEFORE MICHELINE N. FAIRBANK, HEARING OFFICER
 5
 6
 7 IN THE MATTER OF THE ADMINISTRATION
 AND MANAGEMENT OF THE LOWER
 8 WHITE RIVER FLOW SYSTEM WITHIN
 COYOTE SPRING VALLEY HYDROGRAPHIC
 9 BASIN (210), A PORTION OF BLACK
 MOUNTAINS AREA HYDROGRAPHIC
 10 BASIN (215), GARNET VALLEY
 HYDROGRAPHIC BASIN (216), HIDDEN
 11 VALLEY HYDROGRAPHIC BASIN (217),
 CALIFORNIA WASH HYDROGRAPHIC BASIN
 12 (218), AND MUDDY RIVER SPRINGS AREA
 (AKA UPPER MOAPA VALLEY HYDROGRAPHIC
 13 BASIN (219)).
 14 _____/
 15
 16 TRANSCRIPT OF PROCEEDINGS
 17 PUBLIC HEARING
 18 HEARING ON ORDER 1303
 19 VOLUME I
 20 MONDAY, SEPTEMBER 23, 2019
 21
 22
 23
 24 Reported by: Michel Loomis, RPR

Page 2

1 APPEARANCES:
 2 Micheline N. Fairbank,
 Hearing Officer
 3
 4 Tim Wilson,
 Acting State Engineer
 5 Adam Sullivan,
 Deputy State Engineer
 6
 7 Melissa Flatley,
 Chief of the Hearing Officer Section
 8 Michelle Barnes,
 Supervising Professional Engineer
 9
 10 Levi Kryder,
 Chief of the Hydrology Section
 11 Jon Benedict,
 Hydrologist
 12
 13 Christi Cooper,
 Geologist
 14 Bridget Bliss,
 Basin Engineer
 15
 16 For SNWA: Taggart & Taggart, Ltd.
 By: Paul G. Taggart, Esq.
 Carson City, Nevada
 -and-
 18 Tim O'Connor, Esq.
 19 For CSI: Robison, Belaustegui, Sharp
 & Low
 20 By: Kent R. Robison, Esq.
 Reno, Nevada
 21
 22 For CSI: Brownstein Hyatt Farber Schreck
 By: Brad Herrema, Esq.
 Los Angeles, California
 23
 24 For NV Energy: Justina Caviglia, Esq.

Page 3

1 APPEARANCES:
 2 For Lincoln County
 Water District
 3 -and-
 Vidler Water Company: Allison MacKenzie
 4 By: Karen Peterson, Esq.
 Carson City, Nevada
 5
 6 For Moapa Band of Paiutes: Beth Baldwin, Esq.
 7 For NCA: Alex Flangas, Esq.
 Reno, Nevada
 8
 9 For Moapa Valley
 Water District: Greg Morrison, Esq.
 10
 11 For Bedroc: Schroeder Law
 By: Laura Schroeder, Esq.
 12
 13 For City of North Las Vegas: Schroeder Law
 By: Laura Schroeder, Esq.
 14 For National Park Service: Karen Glasgow
 15 For Center for Biologic
 Diversity: Patrick Donnelly
 16
 17
 18
 19
 20
 21
 22
 23
 24

Page 4

1 INDEX
 2 THE PANEL: DIRECT CROSS REDIRECT EXAMINATION
 3 By Mr. Herrema: 12 224
 4 By Mr. Robison: 100
 5 By Ms. Glasgow: 132
 6 By Ms. Baldwin: 139
 7 By Mr. Taggart: 141,192,
 212
 8 By Mr. Morrison: 152
 9 By Ms. Peterson: 159
 10 By Mr. Donnelly: 162,201
 11 By Ms. Schroeder: 177
 12 By Mr. Flangas: 172
 13 By Ms. Caviglia: 181
 14 By Ms. Cooper: 186
 15 By Mr. Benedict: 209,232
 16
 17 EXHIBITS: MARKED ADMITTED
 18 1 229
 19 2 230
 20
 21
 22
 23
 24

Page 5

1 CARSON CITY, NEVADA, MONDAY, SEPTEMBER 23, 2019, A.M. SESSION
2 -o0o-
3
4 HEARING OFFICER FAIRBANK: Let's go ahead and go
5 on the record. Good morning. So this is the time and place
6 set for the hearing in the matter of Lower White River Flow
7 System in the Order 1303 proceedings.
8 My name is Micheline Fairbank, I will be the
9 hearing officer today. And with me is the staff from the
10 Division of Water Resources. We have Tim Wilson, acting State
11 Engineer. We have Adam Sullivan, Deputy State Engineer. Levi
12 Kryder who is our chief of our hydrology section. Jon
13 Benedict who is one of our hydrologists. Christi Cooper who's
14 staffed out of our Las Vegas office who's a geologist and
15 familiar with and works quite extensively in the Lower White
16 River Flow System area.
17 With me also is Melissa Flatly who is the chief
18 of our hearing section. Michelle Barnes, the supervising
19 professional engineer of our hearing section. And
20 Bridget Bliss who is the basin engineer for the Lower White
21 River Flow System basins.
22 Just as a couple preliminary remarks. I wish to
23 go ahead and remind everyone that this proceeding is for the
24 express purpose of providing the State Engineer a concise

Page 6

1 summary of the salient conclusions set forth in the Order 1303
2 reports and rebuttal reports and to direct our office to the
3 evidence and analysis that is supportive of that testimony.
4 I want to just reiterate, and we've been trying
5 to make this clear, that this is not a contested or
6 adversarial proceeding. The scope of this proceeding is for
7 the limited purpose of addressing those four issues plus the
8 fifth.
9 And while that fifth issue is we're on it is not
10 intended to expand the scope of this hearing into making
11 policy determinations with respect to management of the Lower
12 White River Flow System basin's individual water rights, those
13 different types of things, because those are going to be
14 decisions that would have to be made in subsequent proceedings
15 should they be necessary.
16 Additionally, just to go ahead and provide some
17 procedural matters. This morning we'll be starting with
18 Coyote Springs Investments, they were going to have half of
19 the time today and today we have a total of about seven hours.
20 So they're going to have approximately three and
21 a half hours today to go through all of the presentation of
22 the conclusions and reports and evidence on behalf of CSI as
23 well as for cross-examination.
24 And again the opportunity for cross-examination

Page 7

1 is not for an adversarial or contested proceeding, it's to
2 provide the State Engineer a robust record in which to analyze
3 all of the data and conclusions that are being provided to our
4 office.
5 Cross-examination this afternoon will be limited
6 to 14 minutes for the participants and we will have an audible
7 alarm at the end of that time period. We're going to go ahead
8 and take two breaks today, the first one will be about two
9 hours in around 10:30 and then we'll take another ten-minute
10 break this afternoon.
11 Additionally, time left this afternoon after
12 those -- the participants are provided their time for
13 questioning will be reserved for the State Engineer and his
14 staff to ask questions.
15 And if there's additional time remaining at the
16 end of the day before we have to conclude at 4:30, then we may
17 open that up for additional questions by participants and
18 cross-examination. But we do have to conclude at 4:30. We
19 have to be -- everyone has to be out of the legislative
20 building no later than 5:00 today and that's pursuant to LCB's
21 requirements.
22 Additionally, if you plan on leaving documents or
23 materials in the office at the conclusion of -- excuse me, in
24 the hearing room the conclusion today, if there's anything

Page 8

1 that you -- is confidential or is something that you don't
2 want to have publicly accessible you will need to take that
3 with you. While the room is locked up there's no guarantee of
4 security or anything of that nature.
5 Let's see, finally, when it comes to the
6 cross-examination of the witnesses, I just want to go ahead
7 and just make it very clear, the expectation on behalf of the
8 State Engineer and staff is that the witnesses are being
9 responsive and courteous to the time during those that are
10 cross-examining.
11 We understand that this is a limited time period
12 and so we want to have -- we are going to conduct this hearing
13 in a manner to allow a fair opportunity for individuals to ask
14 questions of witnesses.
15 And if there's any perceived effort to stall or
16 to draw out the time of a cross-examining party, then we're
17 going to go ahead and address those matters. Because those --
18 this is intended to be a fair opportunity and really the focus
19 of this is to provide the State Engineer with the most
20 comprehensive evaluation of the data.
21 Also as a reminder, the proceedings are available
22 to be viewed on the internet via the legislative website. And
23 we also have it being cast down to the Las Vegas legislative
24 offices as well.

Page 9

1 And so with that being said, we'll probably go a
2 little bit about maybe five minutes into the lunch hour so we
3 may take a little less than 60 minutes for lunch today just
4 because I want to make sure CSI has their full time. And I'm
5 going to go ahead and open up to Coyote Springs Investments
6 for the presentation of their case. Thank you.
7 MR. HERREMA: Good morning, my name is
8 Brad Herrema, I'm counsel for Coyote Springs Investment. As a
9 logistical -- in terms of logistics, to begin with, we'd like
10 to reserve 30 minutes for redirect and so we'll plan to make
11 our presentation this morning in three hours.
12 In terms of the presentation, we have two
13 different pieces, the first is a presentation on the
14 conclusions that were in the initial CSI report filed in July
15 and the second is the presentation on the conclusions in the
16 rebuttal report that was filed in August.
17 We think that the first part should take about
18 two hours and the second part one hour. And maybe that will
19 align with our break schedule as well.
20 So I want to first thank the State Engineer for
21 the opportunity to have the authors of CSI's reports here
22 today to be able to highlight the salient conclusions of their
23 responses to the Order 1303 questions.
24 The panel will explain the conceptual model of

Page 10

1 the Lower White River Flow System and the work that's been
2 done this year to assist the State Engineer in understanding
3 the system, including new study regarding geology creating
4 flow paths within the system and focused analysis of recharge
5 in the Coyote Springs area.
6 The panel will highlight those salient
7 conclusions of their answers to the State Engineer's four 1303
8 questions, including that the State Engineer's Order 1303
9 boundary for the flow system may be used so long as there is
10 accounting for resources in the Lower Moapa Valley.
11 That in reviewing the Order 1169 test data, that
12 data demonstrates the climatic conditions dominate the water
13 level signature and carbonate wells and geologic structures
14 control the occurrence of movement of water within the system.
15 That there's roughly 12,000-acre-feet per year of
16 evapotranspiration and 19,700-acre-feet per year of subsurface
17 outflow from the Lower White River Flow System.
18 That new calculations estimate 5,280-acre-feet
19 per year of local recharge from the sheep range within the
20 Coyote Springs Valley. That the impacts of pumping within the
21 flow system are dependent on their location.
22 That the faults identified in 2017 and confirmed
23 by work done in April of this year define a structural block
24 that creates western and eastern compartments in the Coyote

Page 11

1 Springs Valley. And that local recharge from the sheep range
2 is contained west of the carbonate block which limits its
3 contribution to the Muddy River Springs area.
4 The panel members will also summarize their
5 observations regarding the reports and information submitted
6 by other stakeholders.
7 And finally, the panel members are here to answer
8 all of your questions to ensure that you fully understand
9 their findings and observations.
10 So with that, I'd like to have our panelists
11 please introduce themselves by stating and spelling their
12 names for the record.
13 MR. REICH: Good morning, my name is
14 Stephen Reich, last name is R-E-I-C-H. I'm a principal with
15 Stetson Engineers and I'm a registered engineer and
16 professional geologist in the state of California.
17 MS. MORAN: Good morning, my name is Jean Moran,
18 J-E-A-N, last name M-O-R-A-N. I am a hydrogeologist with
19 Stetson Engineers, a senior hydrogeologist with many years of
20 experience. I'm here to test -- to support the testimony
21 today.
22 MR. CARLSON: Yes. My name is Norman Carlson,
23 spelled C-A-R-L-S-O-N. And I'm chief geophysicist at Zonge
24 International. We have offices down in Tucson and up here in

Page 12

1 Reno. Or in Reno further up. And I'm here to testify on the
2 geophysical survey that was done in April of 2019.
3 MS. PALMER: My name is Molly Palmer, M-O-L-L-Y,
4 P-A-L-M-E-R. I'm a registered civil engineer and I'm a senior
5 engineer with Stetson Engineers.
6 DIRECT EXAMINATION
7 MR. HERREMA: Thank you. Mr. Reich, just as a
8 matter of housekeeping, are you familiar with the document
9 labeled as CSI Exhibit Number 1, which has been in shorthand
10 labeled CSI July 3, 2019 Order 1303 report?
11 ANSWERS BY MR. REICH:
12 A. Yes, I am.
13 Q. Did you prepare that report or was that report
14 prepared at your direction?
15 A. The report was prepared at my direction with
16 members from my team Stetson Engineers and working with Zonge
17 International.
18 Q. And is that report a true and correct summary of
19 your conclusions regarding the State Engineer's five questions
20 for this hearing?
21 A. Yes, it is.
22 Q. Are you familiar with the document that's been
23 marked as CSI Exhibit 2 and the shorthand reference to that
24 document as August 16, 2019 rebuttal report?

Page 13

1 A. Yes, I am.
2 Q. Did you prepare that report or was that report
3 prepared at your direction?
4 A. The report was prepared at my direction with
5 members of the same team.
6 MR. TAGGART: Madam Hearing Officer,
7 Paul Taggart, Southern Nevada Water Authority. Have the
8 witnesses been sworn in?
9 HEARING OFFICER FAIRBANK: They have not. We
10 should probably do that. Thank you, Mr. Taggart.
11 (Witness panel sworn.)
12 MR. HERREMA: Does that cover the questions we've
13 already answered or do we need to go back?
14 HEARING OFFICER FAIRBANK: I think we're good.
15 Thank you.
16 MR. HERREMA: Okay. Thank you.
17 I think you were indicating, Mr. Reich, that you
18 did prepare the rebuttal report or it was prepared at your
19 direction?
20 ANSWERS BY MR. REICH:
21 A. Yes, I did. It was -- it was -- we prepared it
22 as a team, so we prepared it together with the same members of
23 the July 3rd report.
24 Q. And is the rebuttal report a true and correct

Page 14

1 summary of the team's conclusions regarding the -- the report
2 submitted by the other parties and their conclusions to the
3 State Engineer's five questions for this hearing?
4 A. Yes, it is.
5 Q. All right. Thank you.
6 Turning your attention to slide number 1, which
7 is shown up on the screen. Mr. Reich, can you please explain
8 what you were tasked to do in this case?
9 A. Yes. Stetson was originally hired in early 2018
10 to look at the results from the Order 6255 and the Order 1169
11 pumping tests and then to assess the results of that and then
12 investigate more into the geology and the occurrence of
13 movement of groundwater in the Lower White River Flow System.
14 We then proceeded to participate in some of the
15 public meetings that took place in 2018 and I believe early
16 2019 and as well as perform geologic investigations in the
17 field itself.
18 We went out and we visited -- we visited, we did
19 some geologic mapping along some of the faults and formations
20 that exist out there. We visited monitoring wells and
21 production wells throughout the area. And -- and also drove
22 through many of the different basins that comprise of the
23 Order 1303 administrative basin.
24 One of the field trips we met earlier this year

Page 15

1 was actually in the wildlife refuge with also members of the
2 Fish and Wildlife Service. So we've been able to perform
3 field investigations of the area to help form some of our
4 opinions.
5 Q. And following that -- that work you prepared the
6 reports, Exhibits 1 and 2; is that correct?
7 A. Yes. In -- we then prepared our July 3rd report
8 which was in response to the -- the four questions issued in
9 Order 1303 in order to help provide information to the State
10 Engineer and his staff that -- that provides understanding of
11 a conceptual model, you know, really one of our -- our goals
12 was to -- to be able to provide scientific and technical
13 information to help -- help others really form an opinion on
14 how water occurs and moves through the basin.
15 So that was presented in our July 3rd report.
16 And then continuing we then prepared the August 16th report as
17 a rebuttal report to the other -- other reports that were
18 issued by the other parties in the July 3rd report.
19 Q. Mr. Reich, did you also prepare a document that
20 was submitted to the -- it's labeled as CSI Exhibit Number 4,
21 June 13, 2019 submittal of May 31, 2019 technical report and
22 large lot, Village A map?
23 A. Yes. We prepared that report in May of 2019 in
24 order to -- that was kind of the beginning -- our initial

Page 16

1 presentation of our conceptual model. So to look at the
2 availability of water in the Coyote Spring Valley, you know,
3 that was -- that was the initial report that where we
4 introduced a lot of the understanding that we have of the
5 scientific information that we've assessed over the years --
6 over the -- over the last couple of years.
7 So that -- that report was -- is -- I believe
8 that was May 31st; correct, of this year?
9 Q. Yes, May of this year.
10 A. May of this year, yes.
11 Q. If you could switch to slide 2. Mr. Reich, could
12 you please describe what the panelists are going to present to
13 us today?
14 A. Yeah, you know, we're also very appreciative of
15 the opportunity to present the findings to the panel. We've
16 really been able to, you know, get together I think with a lot
17 of great resources that -- that have been able to form these
18 opinions.
19 And so we're going to kind of walk through in a
20 step wise fashion kind of the logic which has helped develop
21 our opinion, we want to present that to you today.
22 You know, some of the issues -- and not
23 necessarily issues, but some of the factors that we really
24 come to understand is presented in this outline. And that's

Page 17

1 really -- you know, starting with the basic understanding of
2 the geology and the geologic structure of the area and how
3 that affects the occurrence of movement of water.
4 You know, we -- we really took the order very
5 seriously and -- and we went out and looked for new data. So
6 that's when we worked with Zonge International to go out and
7 do geophysical investigation. That geophysical investigation
8 that we'll discuss is -- is -- has really provided a lot of
9 information that allows us to confirm some of the other data
10 that's been presented by others.
11 So, you know, I think a lot of the folks that are
12 more technically based have heard about Page and other
13 geologists who have really been working in the area over the
14 last 20 or 30 years that have formed geologic maps or cross
15 sections.
16 So -- so as we talk about how structure controls
17 the occurrence of movement and water, it's really important
18 for us to go out there and to perform this geophysical
19 analysis. So we're going to talk about that. And then how
20 that moves into the movement of water.
21 Again, some of the things that we're going to
22 talk about are the heterogeneity of the aquifer, how the
23 structures affect that aquifer and then move into climate and
24 a little bit about how the climatic signature is seen and how

Page 18

1 that's a common feature in a lot of the groundwater levels.
2 So we're going to go through. And I know a lot of the staff,
3 a lot of us have all looked at these groundwater levels for
4 many years.
5 But, you know -- and I think germane to this
6 hearing today is what -- what have we learned since the end of
7 the Order 1169 tests? What have we learned since -- since the
8 reports were submitted in June of 2013?
9 So we're going to talk about that. And then we
10 want to wrap that up into a conceptual model. So in order to
11 -- to really provide the -- the State Engineer with the
12 information he needs to make decisions.
13 We want to wrap that into the conceptual models
14 and the groundwater budget and then -- and then summarize our
15 conclusions. So that's kind of a short overview of what we'd
16 like to talk about today.
17 Q. If we could turn to slide 3. Mr. Reich, can you
18 describe what we're looking at in slide 3, please?
19 A. Yeah, slide 3, and hopefully it comes out better
20 on your screen than it does on the projector, but, you know,
21 what this is, a lot of the work that we based was -- was from
22 a rally in 2017.
23 And we talk about that a lot in our report, but
24 what I really wanted to do was to -- to use this slide to show

Page 19

1 the geologic units and the extent of the -- of the regional
2 aquifer, carbonate aquifer in eastern Nevada and for -- for,
3 you know, for purposes of today I've identified where Ely is
4 up in the north. And you can see the boundary starting from
5 Ely coming down towards Lake Mead and the area.
6 That's the -- we call that the modified Colorado
7 River Basin. We -- we relied on the State Engineer's
8 description and list of basins and his basin identification
9 map. And those would have been concluded, Cave and Dry Lake
10 in that -- in that lower -- or in that Colorado River basin as
11 defined by the State Engineer.
12 We also wanted to show you where -- where the
13 White River Flow System is. So again, you know, we're today
14 talking about Order 1303 administrative basin. And what we're
15 looking at here, you can see the boundary within the screen a
16 little bit better.
17 What that boundary is of the entire Lower White
18 River -- of the White River Flow System. And then finally, on
19 top of this we want to show you of course where we are today
20 and what we're going to really focus our discussion on.
21 You know, it's important for me to show you this
22 because these are the -- these are the units, this is the
23 area. And every -- I think that we need to look at the large
24 conceptual picture of the entire carbonate aquifer so that we

Page 20

1 can talk specifically about what we're going to address today,
2 and that's that flow in the middle of the White River Flow
3 System.
4 So together we can see that, you know, that we
5 have different boundaries and different extents that we're
6 going to talk about. We're also going to focus in too on --
7 as you can see I've identified this cross section EE.
8 So as we go through today the cross section EE,
9 which was -- or EE prime, I should be more exact, is -- is
10 information that was published by Rowley again in 2017, which
11 also sets up some of the understanding and ideas of structure
12 in the area.
13 Q. Mr. Reich, you've been talking about a series of
14 slides labelled slides 3, 4, 5 and 6; is that correct?
15 A. That's correct. I -- 6 is the summary of all the
16 different basin boundaries -- or slide 6 is a summary of all
17 the different basin boundaries that we put together.
18 Q. If you could advance to slide 7?
19 A. So slide 7 is a blowup of the Lower White River
20 Flow System. And if you look on your -- if you look on your
21 screen you can see that I've really -- we've generalized it,
22 there's different units and there's different ages of
23 formations.
24 And what's important in here that we wanted to

Page 21

1 point out was the -- the carbonate aquifer and the carbonate
2 where it outcrops. So this is a surface map. So, you know,
3 when we look -- if you look across that cross section EE you
4 can see on the left that blue section along the top, that's --
5 that's a sheep range, and we're going to talk a little bit
6 more about that today.
7 So the sheep range is a -- is a carbonate
8 aquifer. The basin fill material is that yellow. There's
9 volcanic formations that we talk about that are located
10 further in the north, that's represented by the pink.
11 And then, you know, there's some older
12 sedimentary, you know, plastic rocks that are shown in brown,
13 which are down closer towards the -- the downgradient portion
14 of the Lower White River System Flow System down towards the
15 Lower Moapa.
16 Q. If you could advance to slide 8. Mr. Reich, what
17 are we looking at here?
18 A. Well, slide 8, I -- I mentioned earlier before
19 there was that cross section of E -- of EE prime that was
20 presented by Rowley. So the purpose of presenting this cross
21 section is to -- is to give an understanding of some of the
22 different both faults and structure that exist within the
23 Lower White River Flow System, specifically associated with
24 that EE prime cross section.

Page 22

1 So if you start on the left near EE you can see
2 the sheep range up top. And then as you go across later on
3 this morning we're going to talk about thrust faults, the
4 faults that have the -- it's identified there right near the
5 elbow range, there's a gas peak thrust, we want to talk about
6 that.
7 And then as we move across there's more types of
8 normal -- normal faulting which is associated with extensional
9 tectonics. So each of these different ideas we're going to --
10 we're going to touch on how today in terms of how they affect
11 the occurrence of movement of water.
12 What was important to slow on this slide is
13 really -- I mentioned in our introduction about doing the
14 geophysics, so where it's labeled as CSAMT, that's a control
15 source geophysics method that we use to identify some of these
16 faults that were introduced by Rowley. So -- so -- and
17 others, but they're summarized by Rowley in his report.
18 But again, it's really -- what we wanted to do
19 was to go out and use these geophysical techniques in order to
20 identify, you know, A, that they exist and where they existed.
21 So -- so again, that's -- those two arrows kind of point to
22 the extent of our survey.
23 Also, we put on this the location of the Muddy
24 River Springs area to give you an understanding of, you know,

Page 23

1 how you move across cross section EE prime, the relationship
2 between the different geologic lithologic units and the
3 faulting, so...
4 Q. If we could advance to slide 9, what does this
5 show us, Mr. Reich?
6 A. Well, you know, I keep talking about this idea of
7 a -- of a conceptual model. And -- and when -- when we do
8 in-house -- and every basin that we worked on we always tend
9 to put -- we always put together a conceptual model.
10 A conceptual model is important for us to
11 understand, you know, where the water occurs, how does a
12 recharge occur, where may there be evapotranspiration,
13 groundwater outflow. So -- so this is -- this is just a
14 conceptual model, it's our general understanding of where
15 we're going to start from in order to talk about, you know,
16 how we can account for the different flow.
17 So -- so as you see in this we have -- we have
18 these different layers, these lithologic units as you go from
19 the bottom to the top. And -- and what those are are really
20 different sequences of carbonates.
21 In general, they're older -- older carbonates on
22 the bottom, you know, and they -- and they move up to younger
23 carbonates on the surface.
24 And they're -- they're -- you know, I always like

Page 24

1 to go back. I try -- I don't want to get too longwinded on
2 the historical geology section, but I think in terms of why
3 we're here today, it's important to understand, you know,
4 those older formations on the bottom are 500 million years
5 old, they started 500 millions years ago and a lot of those
6 carbonates were deposited during the Paleozoic period.
7 And then -- and then after they were deposited we
8 had different forms of tectonics that affected those. So we
9 had -- we had compressional tectonics that happened, you know,
10 140 million years ago, those compressional tectonics formed
11 thrust faults and thrusts -- we were -- we were pushing --
12 and, you know, in the basic form we're literally pushing some
13 rocks on top of the other and that's where we get some of
14 these thrusts faults.
15 And that's depicted by the gas peak thrust fault
16 on the left. So -- so that fault itself was more than -- was
17 approximately 140 million years ago.
18 And then as the system -- or as time went on,
19 what we see today is really a -- a result of the basin and
20 range extensional tectonics. And so the extensional tectonics
21 is really what pulled some of these formations apart. And
22 that pull apart of that extensional tectonics created what we
23 call normal faulting.
24 And then normal faulting is identified in this

Page 25

1 figure. So we have older compressional faults, which is a
 2 thrust fault. We have newer normal faults, which is an
 3 extensional environment. And then approximately about 10
 4 million. So those started about 20 million years ago,
 5 those -- those extensional and normal faultings.
 6 And then about 10 million years ago, you know, is
 7 really -- really the beginning of the formation of the
 8 mountains that we see today where they were up -- or they were
 9 -- they were turned and erosion occurred and the basin flow
 10 started to occur.
 11 So -- so that's kind of a, you know, a short,
 12 very short history of -- of some of the geologic processes
 13 that have occurred since about 500 million years ago.
 14 Q. Mr. Reich, you mentioned thrust faults and normal
 15 faults. Why are these faults important?
 16 A. Well, you know, we largely relied on a
 17 description by Rowley, you know, who went through and, you
 18 know, did kind of a comprehensive analysis on the relationship
 19 of how these faults are with the occurrence of water.
 20 So in a -- in a compressional fault or in a
 21 thrust fault there's a lot of forces that really push -- push
 22 these different formations together and then they tend to be
 23 tighter and less permeable.
 24 In extensional faulting we tend to have a little

Page 26

1 bit more of a pull apart and it creates different zones. We
 2 create a core zone, and that's depicted by the red here and
 3 that's a -- kind of a fault. We would get deposits of gouge
 4 and so forth that's in the center of the fault. And then we
 5 also get damage zones along the side. So you can imagine, you
 6 know, we have these extensional forces, things are turning and
 7 twisting and pulling apart. And then along the sides you can
 8 get this -- this kind of damage area. And that's depicted by
 9 the green.
 10 And according to Rowley what we see is where the
 11 damage zones are and carbonated records the -- it provides for
 12 kind of preferred pathways, higher permeabilities along those
 13 damage areas. And -- and in essence also the -- the flow in a
 14 perpendicular manner across the fault, that tends to be
 15 impeded because of the fault gouge that exists along that
 16 fault.
 17 So we have both, you know, this kind of preferred
 18 pathways through this damage zone which tend to see some -- we
 19 see some of the higher transmissivities and higher values of
 20 productivities of the wells in these damage zones.
 21 And then -- and then a perpendicular direction we
 22 see more of a -- they can act as barriers or they're -- or
 23 they're, you know, some -- some type of barrier to that flow.
 24 So it's important to understand, you know, really

Page 27

1 how these faults can help us determine that direction of flow
 2 and the occurrence of flow in the area.
 3 Q. Mr. Reich, you've been just now describing a
 4 slide marked number 10 labeled preferred flow paths along
 5 exceptional faults; is that correct?
 6 A. Yes, it is.
 7 Q. Did you see evidence of preferred flow paths
 8 within -- in wells within the Coyote Springs Valley?
 9 A. Yeah, we investigated the -- the pump test of
 10 different wells in Coyote Springs Valley and you can see
 11 faults -- wells that are located, you know, close to faults
 12 have a very high production rates where faults by some -- by
 13 some other wells have lower production rates.
 14 We also looked at, you know, changes in water
 15 levels across those faults and how there may or may not be
 16 impact, you know, as -- from pumping on one site compared to
 17 water levels on the other site.
 18 So there's -- so there's different evidence that
 19 we've used to, you know, we can -- that we've used to observe
 20 the impact of those faults.
 21 Q. You've mentioned a few times that your analysis
 22 started with the faults that were described by Rowley. What
 23 did you do to -- to further analyze those faults?
 24 A. Well, again, it was -- it was important for us in

Page 28

1 order to provide the information to the State Engineer of how
 2 we view the conceptual model, the location of these faults
 3 becomes very important. Not only the location but just the
 4 existence themselves.
 5 So in order to verify their extension and their
 6 location we -- we employed Zonge International to perform a
 7 geophysical investigation of the area to identify and locate
 8 those faults. And -- and here today Mr. Norm Carlson who's
 9 our chief geophysicist has come to help explain that -- the
 10 survey that was performed.
 11 Q. Good morning, Mr. Carlson.
 12 ANSWERS BY MR. CARLSON:
 13 A. Morning.
 14 Q. If you could advance to slide 11. Mr. Carlson,
 15 could you please describe for us the geophysical survey that
 16 you were engaged to run?
 17 A. Yes, we were -- we were contracted to run a
 18 resistivity survey called CSAMT. Resistivity information is
 19 very useful because different materials conduct electricity
 20 differently.
 21 So core spaces in a material in a rock affect the
 22 resistivity. The fluid that's in the core spaces affects it,
 23 the TDS of the fluid affects it, temperature, these all affect
 24 the resistivity of the subsurface. By making measurements of

1 the resistivity it helps us understand what's down there. Is
 2 there water present, is it absent, is it high TDS, and so on.
 3 The -- there are a lot of methods you can use to
 4 measure resistivity in the subsurface. And the one you choose
 5 to use depends on the -- what the surface environment is, how
 6 deep you want to see, the background resistivities you might
 7 encounter, how much culture there is, are there pipelines, are
 8 there power lines?
 9 So all of those affect which resistivity method
 10 you use. There are of course other geophysical methods like
 11 seismic and gravity, those -- those are measuring different
 12 physical properties of the subsurface.
 13 But since groundwater affects the resistivity so
 14 much, that's one of the reasons why we use resistivity methods
 15 in both the vast majority of our groundwater work.
 16 The CSAMT stands for controlled source
 17 audiofrequency magnetotellurics, which is why you never see
 18 that written out. You see CSAMT. The CS -- well, CSAMT is
 19 kind of a subset of -- of a method called magnetotellurics.
 20 And the idea there is that you measure an
 21 electric field on the ground and you measure the magnetic
 22 field on the ground at the same location. And if you do this
 23 at different frequencies you can calculate a resistivity at
 24 different depths.

1 give you a kind of a physical layout of everything. In the
 2 upper right is -- it's labeled transmitter source. What we do
 3 is lay out a long insulated wire on the ground. It might be
 4 4,000 or 5,000 feet long, just -- just literally laying on the
 5 ground. And then it's grounded HN with a bunch of metal
 6 stakes or metal plates so it has good electrical contact with
 7 the ground.
 8 We transmit an alternating current into that. To
 9 get deep data we transmit it at a lower frequency, say about
 10 one hertz so it's changing polarity once every second. And
 11 for the shallow information we go to high frequency. And
 12 that -- for these surveys it was 8,192 hertz. So it's
 13 alternating polarity 8,192 times per second.
 14 So we measure a whole suite of frequencies and
 15 then use that to calculate a resistivity at all these
 16 different depths.
 17 Q. If we could advance to slide 12. Mr. Carlson, is
 18 this type of geophysical survey accepted by the scientific
 19 community as a valid tool to map the subsurface?
 20 A. Yes. Actually the -- for example, the Rowley
 21 report, the 2017 report and the map and such that everybody
 22 relies on so much, that report includes more than 20 lines of
 23 AMT data, the -- the audiofrequency magnetotellurics, which is
 24 exactly what we did from at least five different valleys.

1 The CS in CSAMT means controlled source. And
 2 that -- that means that we actually transmitted the signal
 3 that we were measuring. Put out the motor generator set and
 4 the transmitter equipment and transmitted the signal.
 5 Sometimes you'll see it labeled as just AMT, audiofrequency
 6 magnetotellurics. That implies that you're only measuring a
 7 certain frequency range.
 8 You can also forget about the use of a
 9 transmitter and you just measure the naturally occurring
 10 electromagnetic signals that are generated by lightning on the
 11 other side of the planet literally and by the solar storms
 12 that are affecting the upper stratosphere, there's these EM
 13 fields going on all the time.
 14 So you can either measure those, make that your
 15 source or you can put out your own source which you have
 16 control of. And that's what we did for this survey.
 17 The CSAMT method was first developed
 18 theoretically back in the mid-'70s and became commercially
 19 available as a tool back in the early '80s.
 20 Since that time, it's -- it's used most commonly
 21 in minerals exploration because it has very good lateral
 22 resolution. And then the last 20 years or so more and more in
 23 the groundwater and geothermal fields.
 24 The bottom part of this slide is a sketch just to

1 Most of that is work done by the USGS.
 2 They happen to use a different equipment system
 3 than we did. So they transmitted some signal and then they
 4 also measured the naturally occurring signals.
 5 Our -- our own experience with geo -- well,
 6 geophysics in general, we've been in business for 47 years,
 7 you know, I looked back at the records, in the past ten years
 8 we've done about 1600 different geophysical surveys, gravity,
 9 seismic, CSAMT, MT magnetics. Out of those 1600 surveys about
 10 350, 360 of them were CSAMT or MT, this magnetotellurics. So
 11 it's a -- as I say, commonly used method, particularly in the
 12 minerals.
 13 And we've been doing this specific kind of survey
 14 for about -- about 38 years since we started building
 15 equipment for it.
 16 On the next slide, slide 13, this is a list of
 17 some of the other groups in most cases national agencies that
 18 use our equipment and do CSAMT and things like that. So the
 19 USGS has several surveys, several systems. Sandia, Idaho,
 20 Lawrence Livermore, all the national laboratories.
 21 We sell the equipment to government agent --
 22 foreign government agencies, they use them in their -- their
 23 equivalent of the USGS in their countries. And then many
 24 private mining companies and groundwater companies and

Page 33

1 environmental firms use the equipment as well, so...
2 So it is indeed a well-established tool, very
3 well-accepted peer -- peer-reviewed results, everything. So
4 it's -- it's not a -- it's not a black box kind of secret
5 proprietary thing that gives you wonderful results.
6 Unfortunately, because of the money involved and
7 the oil and minerals, you get a lot of black box geophysics.
8 But this is -- this is definitely not black box, well
9 reviewed, peer reviewed, plus we paint our boxes white, so...
10 Q. If you could advance to slide 14. Mr. Carlson,
11 what did you do in the Coyote Spring Valley?
12 A. Yes. In Coyote Spring, in 2019 specifically, we
13 ran three survey lines. The station spacing along the lines
14 was 200 feet. So every 200 feet we were making measurements
15 of those electric and magnetic fields at a variety of
16 frequencies.
17 So that -- and we covered 13.8 miles on those
18 three lines. So it works out to about 369 specific individual
19 measurement points to give us resistivity at different depths.
20 Q. Could we advance to slide 15? Does this slide
21 show those three survey lines?
22 A. Yes, this is -- this shows the three survey lines
23 we did for Coyote Spring and sort of zero in -- sort of in the
24 center of Coyote Spring Valley. The very northern nose of the

Page 34

1 Arrow Canyon Range is just about dead center in this slide.
2 We did lines A and B, those were east/west lines running at --
3 running through there.
4 We've labeled only every fifth station on these
5 lines because you can't pack all the labels in there, it's
6 very tight spacing. Because one of our targets were faults.
7 Sometimes faults or fault zones can be very narrow. So we
8 needed good lateral resolution.
9 We had -- we couldn't put a station out once
10 every mile or once every half a mile because we may jump right
11 over a fault and never see it.
12 Lines A and B were the east/west lines. As you
13 see there B is almost right in the middle. And line C is
14 oriented -- more of a different orientation. And that's
15 crossing the Pahranaagat Wash where it sort of takes a bend
16 towards the southeast and goes on towards Moapa.
17 In this next slide, which is slide 16, what we've
18 done is just overlay the line locations onto the Rowley map
19 for this area. And colors kind of fade out a little bit, but
20 basically the bulk of the survey, most of lines A and B and
21 all of line C are over basin fill.
22 So everything is hidden, all the bedrock is
23 invisible. And that's -- that's the reason you do geophysics
24 is you're trying to see something that you can't see at the

Page 35

1 surface.
2 Up on line A, A ran across a small kind of
3 isolated sort of island of limestone, that's that blue, it's
4 labeled MD. And then line B right at the very nose of the
5 Arrow -- Arrow Canyon Range ran over a little bit of
6 limestone, same -- same unit.
7 And then line C is in -- as I said is entirely
8 over basin fill. The dotted lines that you see there are
9 faults as shown on the Rowley map. So we have on -- on the
10 west running right through the labeled line B there you can
11 see a dotted line fault.
12 Parallel to that is a blue line on the Rowley map
13 that indicates a -- sort of a secondary, a less important
14 fault right up against the limestone. As we move further east
15 we see another fault parallel to the first one right -- right
16 on the eastern edge of the limestone.
17 Then we see what's probably part of a basin
18 bounding fault as we go further -- further, sort of about --
19 first the east end of line B about a third of the way in.
20 Then on line C we crossed two faults that are
21 oriented north, call it north 60 east. But all of those are
22 shown as dashed lines indicating that they're -- that's where
23 the geologists have placed them based on what they can see on
24 the surface someplace else, but by dashing them they're

Page 36

1 basically admitting okay, this is a good guess, but we -- we
2 don't know. Those are all concealed faults.
3 Q. Could we advance to slide 17? What does this
4 show, Mr. Carlson?
5 A. These are the results in cross section form for
6 the CSAMT survey. This is the final result.
7 So what we're looking at is along the top of the
8 plot is the surface of the ground. And you can see it's basic
9 -- mostly flat. And the station numbers, again, this every
10 fifth one or tenth one is shown for clarity.
11 And then down the side we're looking at
12 elevations. We're looking downward through the earth. If you
13 can see it on your screens, the elevation in feet is down on
14 the left side and in meters is down the right side.
15 And then the color shading is the resistivity,
16 that's what the final computer model came up with for all of
17 these measurements we made. We shade high resistivity
18 material towards blue and we shade low resistivity, meaning it
19 conducts electricity better, towards red.
20 Though the first thing you notice on this
21 particular slide is that big block of blue sort of towards the
22 center of the line. That's where this line A crossed over
23 that little isolated -- little island of limestone. And
24 limestone is often very high resistivity. It's -- so that's

1 perfectly normal.
 2 As we go further towards the east you can see
 3 some high resistivities, that dark blue on the very far end,
 4 that's where this line crossed over a small outcrop dolomite.
 5 Good correlation what we do know at the surface at least. But
 6 the rest of the line of course is just basin fill.
 7 If we could go to slide 18. All we've done here
 8 is sort of tilted the world for you. We have the Rowley map
 9 draped on top of the US digital -- USGS digital elevation map.
 10 So you get kind of a perspective. You can see how the data,
 11 how the results line up with the map.
 12 And we can see the -- the blue high -- high
 13 resistivity feature right in the middle lined up nicely
 14 crossed over that little island of limestone. And the blue on
 15 the east end where it crosses a little tiny nose of the
 16 dolomite sort of crossing over in high resistivity ground.
 17 And then out in the basin we see some more low
 18 resistivity values, the yellows and reds. And what we've also
 19 put on here is the -- what's -- what's on here is where Rowley
 20 put those faults, these dotted lines. The solid line farthest
 21 to the west is the highway, so don't -- don't interpret that
 22 as a fault.
 23 And we see good agreement with what we see on the
 24 ground. We see interesting things in the data. For example,

1 west end of line 1 does look like good data when we look at
 2 all the stations individually. So we have faith on that end
 3 of it.
 4 Out there on that very end around 1500 to 2,000
 5 we do see a fault that's not shown on the Rowley map. And
 6 here I think we can go to line B, which would be slide 19.
 7 So this is line B, this is the one that crosses
 8 the nose of the Arrow Canyon Range. And they're -- as we
 9 would expect nice high resistivities, dark blue right there in
 10 the center as we go over that -- that little nose of the
 11 range. It looks very similar to the -- to line A. We see low
 12 resistivities on either side of it. That's -- that's all
 13 quite good.
 14 One thing to notice though is on this map the
 15 eastern concealed -- the fault that was east of the -- of the
 16 blue, the high resistivity stuff on line A, it was quite a
 17 ways away from it on this line, it is actually right up
 18 against it. Which made sense and looks like a fault to us.
 19 There's also a fault shown on the western edge of
 20 that blue nob. And that makes sense to us, that looks like a
 21 fault too, there's big change in resistivity as you go from
 22 west to east. The Rowley map also has a concealed fault about
 23 a quarter of the way from the western end of the line kind of
 24 out there in the middle of nowhere.

1 in that basin fill you can see that -- we see a lot of low
 2 resistivity material, which would -- you know, if you were
 3 interpreting this brine we'd say that's -- okay, that's basin
 4 fill or that's some of the volcanics, some water present,
 5 things like that.
 6 You can see that -- if we look on the west side
 7 versus the east side of that central limestone island the two
 8 sides are different. We see two -- two distinct layers on the
 9 east side and then those low resistivities, all that
 10 conductive material kind of thickens and plunges as you get
 11 towards that basin valley fault.
 12 On the west side we see weakly two layers. And
 13 one of them drops off fairly deep and the other stays
 14 horizontal. It's a little hard to see on this screen but
 15 probably easier on here, but towards the end of the west line
 16 around stations 1900 to 2500 or so there's some construction
 17 going on for -- for Coyote Springs and the data was -- was
 18 affected by what we call cultural effects. Anything out there
 19 that conducts electricity or radiates noise causes us
 20 problems.
 21 So there's a -- there's kind of a little tiller
 22 feature out there that looks unrealistic and that's because it
 23 is unrealistic, it's -- it's the effects of culture.
 24 The last 1,000 -- 1500 feet to 2,000 feet the

1 We don't see a fault there. We think -- we think
 2 that fault is -- is misplaced and should be further west.
 3 Actually around station 2000 on this in the deep data you'll
 4 see a change from -- from sort of medium to dark blue towards
 5 green. That indicates to us a fault out on this west end of
 6 line B.
 7 Rowley's map, if we jump to the eastern side of
 8 the -- of the nob Rowley's map shows a concealed fault there
 9 right about halfway between the nob and the east end of the
 10 line. And we would put that fault based on the changes in
 11 resistivity as you go from west to east about 500 to 1,000
 12 feet further west. Otherwise it's well placed. You can see
 13 where the -- the resistivities change from fairly dark blues
 14 to light blues and then to greens, that's where we see that.
 15 Q. If we could advance to slide 20. What does this
 16 show, Mr. Carlson?
 17 A. Yes. This is similar to the line A, that line A
 18 plot that just draped the Rowley map onto the digital
 19 elevation file. So it gives you kind of a 3D perspective. So
 20 we're looking -- looking to the north looking kind of downward
 21 as if we're a couple thousand feet in the air.
 22 And you can see that the western fault on the
 23 Rowley map, that western dotted line running along the surface
 24 in the middle there, doesn't really line up with a change in

Page 41

1 resistivity. But the change in resistivity further to the
2 west around station 2000 or so is definitely there.
3 The -- the black dotted line on the Rowley on the
4 east side of that little nob does indeed line up exactly where
5 we would put it as a very significant fault.
6 And then further to the east, that basin bounding
7 fault that we saw just -- just saw a little bit of on line A,
8 we can see that kind of in the middle of the eastern half of
9 line B and very well-defined change in resistivity there. So
10 that fault is in good agreement.
11 So what -- what we're seeing is three faults on
12 the Rowley map, two of which agree well with the CSAMT data
13 and the western line should be moved further out to the west
14 to about station 1500 to 2000.
15 Q. Advancing to slide 21. Does this show the
16 results of your work on line C?
17 A. Then -- yes, on line C, that's the one that runs
18 in a different direction, it's kind of southwest up to
19 northeast, crosses Pahrangat Wash. And after it makes the
20 bend there by the nose of the Arrow Canyon Range.
21 This is interesting in that it shows concealed
22 faults very well defined as we go from the west end of the
23 line towards the east down in the deep data we see the dark
24 blues showing high resistivity and changes to light blues and

Page 42

1 then into greens.
2 The whole central section of this line is lower
3 resistivities, not as dark blue, not as -- more green.
4 And then where Rowley puts a concealed fault as
5 we move further east we see a big change to the darker blues.
6 So the -- the agreement on this line between
7 CSAMT and Rowley are very good. Plus we see that the whole
8 central section of this line, which is actually a couple of
9 miles is lower resistivity than the ends of the line.
10 Basically what we see often in large fault zones
11 and we've seen this type of thing in the Horst and Graben-type
12 structures. So the western third of this line and the eastern
13 third are the Horst -- part of the Horst and Graben in your
14 geology. And the central section is the down dropped lower
15 resistivity. Or it's a very broad fault zone.
16 HEARING OFFICER FAIRBANK: Ms. Caviglia?
17 MS. CAVIGLIA: Hearing Officer, Justina Caviglia
18 from NV Energy. Do we have a pointer or something that's
19 easier to follow the map section? It's hard --
20 MR. CARLSON: I forgot mine today. I'm sorry.
21 MR. ROBISON: I have two and four dead batteries.
22 HEARING OFFICER FAIRBANK: I will take that as a
23 no. But thank you.
24

Page 43

1 BY MR. HERREMA:
2 Q. If we could advance to slide 22?
3 A. Slide 22 shows the line, seeing data with the
4 perspective again. This time we're looking west, so north is
5 to your right. We have the CSAMT cross section there and you
6 can see the dotted lines coming -- extending away from it in
7 good agreement with those big changes from lighter blue to
8 darker blue. And then the Arrow Canyon Range, you can see
9 that just above the cross section.
10 But really the key point here is very -- very
11 good agreement with the Rowley interpretation of the area.
12 Again, this line crossed it off at all -- this is all. All of
13 the structure in geology is -- very good. Thank you.
14 HEARING OFFICER FAIRBANK: Thank you,
15 Mr. Carlson.
16 BY MR. HERREMA:
17 Q. Okay. Advancing to slide 23, what does this
18 show, Mr. Carlson?
19 A. Yes. This -- this sort of summarizes our view of
20 the faults after the CSAMT. Down here, this is the nose of
21 the Arrow Canyon Range that we've been talking -- talking
22 about, barely even visible and it doesn't really even show up
23 on much of the topographic maps, is the little limestone
24 island that Rowley drew there. So this is line A crossing

Page 44

1 that little limestone island.
2 And then extending on out, that's -- that's
3 probably the extension of the Basin Valley fault. Line B and
4 the nose of the Arrow Canyon Range.
5 Rowley had faults extending from this side on up
6 and out and then another fault extending up here. And then
7 that secondary fault, the one shown in blue extended up to
8 about here and stopped.
9 What we see is a very narrow band of high
10 resistivities between these -- from here to here with the
11 faults right up against the high resistivity line.
12 So don't see a fault out here. But as you
13 recall, on line B and the little more weakly on line A you saw
14 a fault out here on the west end.
15 This orientation when you line up the fault we
16 see here and the one you see here is almost identical to the
17 orientation of these two, which is about north 30th west,
18 north 30 west. And then the other fault that we saw in Rowley
19 intersected line A up here where we crossed a little bit of
20 dolomite and intersected line B down here. There's no
21 outcrop, but a very nice change in resistivity.
22 Q. Mr. Carlson, if there's anyone who might wish to
23 read the transcript of this proceeding later, could you
24 please --

Page 45

1 A. Oh.
2 Q. -- when you're using the pointer just describe on
3 the figure what you're pointing out?
4 A. Right. Sorry. So, the -- and we've shown our
5 faults where we place them as dashed lines. We know -- we
6 know where they are next to the -- next to the limestone, we
7 can see them in the data in between the lines. We dashed them
8 because we're assuming they go there.
9 And on line C in the lower right of the slide you
10 can see line C crossing two Rowley faults, those faults are
11 shown as dashed black lines. And again, those occurred right
12 where we see them.
13 Also on the map we see well locations. We have
14 MX-5, which is -- you can see in aerial photos and it's almost
15 exactly on top of one of the faults, the eastern fault.
16 CSI-2, which is very, very close to the same fault. And then
17 CS-1 -- CSI-1 is in between two -- two faults out in the
18 middle sort of near the golf course on this slide.
19 MR. TAGGART: Madam Hearing Officer, is there an
20 exhibit to reference for this slide?
21 MR. HERREMA: Mr. Taggart, if I can direct your
22 attention to the upper right-hand corner of the slide it's got
23 a reference. And each of the slides have references from
24 where this information is taken from.

Page 46

1 MR. TAGGART: We can't find this in Exhibit 2,
2 so...
3 HEARING OFFICER FAIRBANK: Mr. Taggart, I believe
4 it's also maybe at CSI, Exhibit 13.
5 MR. TAGGART: Thank you.
6 MR. HERREMA: Thank you, Ms. Fairbank.
7 BY MR. HERREMA:
8 Q. Mr. Carlson, moving to slide 24, what does slide
9 24 show us?
10 A. Yes, slide -- slide 24 is a list of the
11 summarized results of the CSAMT survey. First of all, the
12 CSAMT data did show good valid realistic results.
13 During the course of the survey the equipment
14 does -- does its own internal checks every time it sets up at
15 a station. The field critique can see the data coming in so
16 he knows if a wire is suddenly broken and things like that.
17 We didn't experience any equipment problems. No
18 unusual weather conditions, thunderstorms of course with all
19 the lightning really -- really drive us crazy.
20 We had no weather problems, no equipment
21 problems. So we look at this dataset as -- as a good
22 realistic valid dataset. And the data seemed to be providing
23 us with specific locations for faults that were identified as
24 concealed on Rowley. It also indicates that at least one of

Page 47

1 those faults has shifted significantly west of where Rowley
2 put it.
3 We see other weakly -- weakly apparent faults,
4 but the main ones that we're worried about would cross line A
5 and B, in particular the far western fault is the Rowley fault
6 that shifted quite a ways west.
7 And line C was in very good agreement with the
8 Rowley map. Those were our summarized results for CSI.
9 Q. Thank you, Mr. Carlson.
10 Mr. Reich, as part of your team's work, did you
11 review the climate and precipitation in the Lower White River
12 Flow System?
13 ANSWERS BY MR. REICH:
14 A. Yes, we did. One of the -- one of the things
15 that I mentioned earlier before was the impact of climate.
16 So one of the -- one of the things that I asked
17 Ms. Molly Palmer to do was to review the available data that
18 we used to characterize the climactic conditions in the Lower
19 White River Flow System. So maybe -- maybe Ms. Palmer could
20 help explain a little bit about what we -- what we found.
21 Q. Okay. Advancing to slide 25. Ms. Palmer, can
22 you tell us what data you looked at to characterize climate in
23 the Lower White River Flow System?
24

Page 48

1 ANSWERS BY MS. PALMER:
2 A. Yes. There are two maps on this slide, the small
3 map in the upper right corner is showing the climate divisions
4 for the state of Nevada. There are four divisions as defined
5 by the National Oceanic and Atmospheric Administration which
6 defines climate divisions in the United States.
7 So the Lower White River Flow System is shown on
8 both maps. And you can see that it's located mostly within
9 division 4, which is the southern extreme climate division.
10 NOAA maintains climate records for the climate divisions that
11 date back to 1895.
12 They're also showing a single point station in
13 Pahranaagat Valley for -- which we're showing that one because
14 it's upgradient of the Lower White River Flow System. It has
15 data going back to 1964.
16 In general, for each climate division, the
17 records in that division are based upon records at individual
18 stations in that division throughout history.
19 And as I said, for the division before goes back
20 to 1895. In general, the precipitation stations that are
21 located in the Lower White River Flow System are at lower
22 elevations, typically less than 5,000, more like 2,000 and
23 3,000 feet on the valley basin floor, not up in the
24 mountainous areas.

Page 49

1 And we reviewed all of the precipitation stations
 2 from the Lower White River Flow System. There are no
 3 long-term stations that are located at high altitude in the
 4 basin.
 5 Q. Ms. Palmer, could you speak up just a little bit
 6 so the reporter can hear you?
 7 A. Yeah, um-hum.
 8 Q. And I believe you used an acronym in your -- in
 9 your summary, NOAA, could you describe for the reporter what
 10 that stands for?
 11 A. Yes. That's National Oceanic and Atmospheric
 12 Administration.
 13 Q. Thank you. Advancing to slide 26, Ms. Palmer,
 14 what -- can you describe the data that's displayed on this
 15 slide?
 16 A. These are two graphs that show cumulative
 17 departure for the two climate records that I discussed on the
 18 previous slide. Both graphs show in blue bars the annual
 19 precipitation, the top is showing you the annual precipitation
 20 on a calendar year basis for the division 4 climate division.
 21 The lower graph is showing you the annual
 22 precipitation on the calendar year basis for the Pahrnagat
 23 Wildlife Refuge Station. And the blue bars as I said are
 24 total precipitation per year.

Page 50

1 The straight line should be sort of like a red or
 2 pink color is showing you the average annual precipitation on
 3 a calendar year basis for the period of record for each
 4 respective record. So the top one is the average for the
 5 division 4, the lower bar -- the lower average is for the
 6 Pahrnagat Wildlife Refuge Station.
 7 And the black curves that you see are what we
 8 refer to as cumulative departure from mean. And those lines
 9 track the deviation from average over the period of record for
 10 each respective record or station.
 11 And the black lines, the cumulative departure or
 12 CDM curves are extremely helpful for characterizing trends in
 13 the basin. Trends in precipitation as we look --
 14 MR. TAGGART: We're going to lodge an objection
 15 to the expert conclusions by this witness. We think it's
 16 improper for her to describe facts and data without any
 17 interpretation of this would require an expert opinion and --
 18 HEARING OFFICER FAIRBANK: Your objection is
 19 noted and we'll go ahead and allow the testimony and the State
 20 Engineer will assign the value based upon the decisions that
 21 were made at the hearing on the voir dire of witnesses and
 22 it's recognized that Ms. Palmer's not -- has not been admitted
 23 as an expert in these particular matters.
 24

Page 51

1 BY MR. HERREMA:
 2 Q. Please continue, Ms. Palmer.
 3 A. Thank you. So the black lines are cumulative
 4 departure from mean. What they show are that when there is an
 5 increasing slope that indicates a wetting trend and when there
 6 is a decreasing slope there is a drying trend.
 7 So we can point out a few features of the
 8 climatic trends on the top graph. You can see that there is
 9 approximately a 30-year drying trend that starts in about 1945
 10 to 1975, you can see that the line declines on the top graph.
 11 You can also see some shorter increasing wetting
 12 trends where the vine has an upward slope. That occurs for
 13 about a ten-year period in the early part of the graph and
 14 then again from about a 20-year period from 1967 to about 1985
 15 -- sorry, that's a ten-year period there.
 16 And so that tells us how the precipitation
 17 changes over time.
 18 Q. Okay. If we could advance to slide 27,
 19 Ms. Palmer, could you describe the data shown on this slide?
 20 A. Yes. The top graph is a repeated graphic from
 21 the previous slide 26 and just a cumulative departure from
 22 mean curve for the climate division 4.
 23 The arrows show you the period of record that has
 24 been blown up and shown on the bottom graph. The bottom graph

Page 52

1 is showing you monthly precipitation records for the extreme
 2 southern climate division 4.
 3 So it starts in January 1998 and goes through
 4 December of 2018. And it's showing you the monthly total
 5 precipitation for that climate division.
 6 You can see that there are some months that have
 7 significant amounts of precipitation. For example, in early
 8 1998 there's one month that has more than four inches per
 9 month. You also see months with bottom precipitation in 1998,
 10 2004, 2005 and 2010.
 11 HEARING OFFICER FAIRBANK: Mr. Donnelly?
 12 MR. DONNELLY: Thank you.
 13 HEARING OFFICER FAIRBANK: Please state your name
 14 for the record, please.
 15 MR. DONNELLY: Patrick Donnelly, Center for
 16 Biological Diversity for the record. The previous slide's
 17 data is quite different from what's in the filed report. On
 18 the second chart displayed in the previous line. That's a
 19 different chart that's not in the filed report.
 20 HEARING OFFICER FAIRBANK: Thank you. We'll note
 21 that.
 22 BY MR. HERREMA:
 23 Q. Turning to slide 28, Ms. Palmer, does this slide
 24 accurately summarize the data being collected?

Page 53

1 A. Yes. The data that we collected was for -- we
2 used this -- the division 4 climate data to characterize
3 precipitation in the Lower White River Flow System.
4 We showed two cumulative departure from mean
5 graphs to show the trends, wetting and drying and normal over
6 the period of record at those stations. We showed that there
7 were wetter than normal conditions occurring in 1998, 2004,
8 2005 and 2010.
9 And we also note that there was a downward trend
10 in 2006 to 2014. And the monthly data showed us that
11 precipitation primarily occurs during the winter months.
12 Q. Thank you, Ms. Palmer.
13 Mr. Reich, in your introduction you talked about
14 the movement of groundwater and the carbonate aquifer. Would
15 you elaborate on some of the hydrogeologic principles that you
16 relied on?
17 ANSWERS BY MR. REICH:
18 A. Yeah. In order to understand some of the
19 hydrogeologic parameters that we talk about and that really
20 control that occurrence of movement of water, Ms. Moran from
21 our office reviewed some of the available information that --
22 that describes the -- the flow occurring.
23 So, for instance, we looked at a Theis analysis
24 just to understand what we might expect from impacts in -- in

Page 54

1 a sample case of something similar to the carbonate rock
2 aquifer.
3 So I'm going to let Ms. Moran describe her
4 findings.
5 Q. Ms. Moran, we have slide 29 in front of us.
6 Could you please describe for us what this shows?
7 ANSWERS BY MS. MORAN:
8 A. Yes. So I was asked to look at the Theis
9 solution and look at probably drawdowns from a pumping well
10 within the Coyote Springs area and the -- the -- the -- close
11 to -- sorry, I got a little sidetracked. Close to Pederson
12 Springs.
13 So what the Theis solution is, it's a
14 nonequilibrium well equation. It was -- when it came on the
15 scene for hydrogeology in 1935 it finally answered some of the
16 major concerns that were at that time is how do you correlate
17 drawdown in a well to the pumping rate? What does that mean
18 and how does that characterize the hydraulic properties of the
19 aquifer around it?
20 But it is a very simple equation, there's a lot
21 of more complex equations that have grown out of it from then.
22 But this is also the equation of the SeriesSEE used by the
23 Fish and Wildlife Service, so we decided to stay with the
24 Theis equation looking simply at two wells pumping and what

Page 55

1 would be the effect at a spring located the distance of
2 Pederson Spring from those two pumping centers.
3 The relationship that the equation gives us is
4 drawdown, pumping rate, what's also needed is the
5 transmissivity and the storage and time.
6 If one piece of that is missing you can solve for
7 the other pieces in the equation. The assumptions though make
8 in very, very simple, it needs to be a homogeneous aquifer,
9 infinite, no boundaries, uniform thickness and no recharge
10 from any source, that the well is fully penetrating, that the
11 screen interval is open to that full saturated thickness.
12 And that the well is a hundred percent efficient.
13 It doesn't lose anything in the well drawer storage. And that
14 the potential metric surface is flat.
15 This is a very idealized system in that all water
16 pumped is from storage. And what it will give us is what the
17 shape of that cone of depression is that goes out into the
18 aquifer from a well pumping. So that's the beauty of this
19 equation, though it's very simplified in its method.
20 It helps us -- it conceptually see -- okay, well,
21 what would happen if I don't know really how those faults are
22 behaving and if I don't really know what the recharge is and
23 everything else is the same, what is happening there?
24 What the map shows is we took the average, a

Page 56

1 two-year average pumping rate for MX-5 location, which you'll
2 see over here. And it is pumping 5,217-acre-feet per year,
3 it's 11.5 miles away from the observation point, which is
4 around Pederson Springs or VH-4.
5 The other pumping well we're going to talk about
6 is at Arrow Canyon, and it will be pumping 3,000-acre-feet per
7 year at over two years. And it is 2.5 miles away from an
8 observation point.
9 So with the Theis equation again we're just
10 looking at a simplified how that cone of depression propagates
11 over time from that kind of pumping in an aquifer that's
12 homogeneous across it.
13 The next slide, please. So the first well
14 pumping, it's pumping the 5,217-acre-feet per year two years,
15 11.5 miles away. It causes a drawdown, its cone of
16 depression, you're only see half of that cone in this graphic.
17 But that cone of depression is -- causes a .289 feet drawdown
18 at that observation point.
19 The next slide.
20 Q. Could you please -- sorry, for the record, just
21 identify slide you were just speaking about?
22 A. Oh, thank you. So that was slide 30 that looked
23 at the well 11.5 miles from the observation point.
24 The next slide, 31, looks at a well that is only

Page 57

1 2.5 miles from an observation point pumping less, but it has a
2 greater impact because of where it is in the cone of
3 depression. So it's just 2.5 miles away. It's causing a
4 .46 feet drawdown at that observation point.
5 The next slide. What's nice with the Theis
6 equation is you can add different cones of depression
7 together. You can also put in image wells that could simulate
8 recharge or could simulate a boundary, but in this case we did
9 not simulate any -- anything that would affect the cone of
10 depression.
11 So this has two wells pumping. You can see that
12 the cone of depressions coalesce somewhere around the
13 20,000 feet or the 30,000 feet. But the -- the full drop at
14 the Pederson Spring observation point would be 0.74 feet. So
15 it sums the two together if it has no other influences.
16 Q. Here you're referring to which slide?
17 A. I'm referring to slide 32.
18 Q. Thank you.
19 A. The next slide. So in summary of this simple
20 equation, it shows the relative impact of pumping wells
21 located at different distances from an observation point.
22 And it's based on that the aquifer's homogeneous,
23 so it has the same value of transmissivity in storage that a
24 well pumping about 1800 gallons per minute but only located

Page 58

1 2.5 miles would have a greater impact at the observation point
2 than a well that was located 11.5 miles but pumping a lot more
3 in the 3200 gallons per minute.
4 The two components that describe how the
5 aquifer -- how groundwater occurs and moves within the aquifer
6 of the storage and transmissivity, the occurrence is
7 storativity, it's the storage of water in the pour space and
8 how much water from that pour space will yield to a well.
9 That's what storage -- that storativity coefficient is.
10 What transmissivity is is the movement of water.
11 It's the saturated thickness times the hydraulic conductivity.
12 So it describes how quickly water will move through the
13 subsurface.
14 When there's a higher T there will be a larger
15 aerial extent but a shallower cone of depression because its
16 pulse can move out through the aquifer to retrieve water from
17 storage to supply it to the well.
18 When there's a lower T, it draws a -- a deeper
19 cone of depression and the cone of depression doesn't go out
20 as far. It's still the same amount of water coming out of
21 storage, but the shape of the cone of depression is different.
22 Similarly with the storage coefficient, if you
23 have a higher storage there will be a shallower cone of
24 depression because the water will be released from storage.

Page 59

1 It doesn't have to go as deep to retrieve that water to -- to
2 pump it from a well. And with a lower storage you would get a
3 deeper cone of depression.
4 Again, it's all about how the water has to come
5 from somewhere to come out of the well. And it's coming from
6 that generation of a cone of depression.
7 So basically what I put together for this Theis
8 equation is to explain how it works and then how different
9 wells, different pumping rates, how that would affect at an
10 observation point.
11 Q. Thank you, Ms. Moran.
12 Mr. Reich, turning your attention to slide 34,
13 can you describe what slide 34 includes?
14 ANSWERS BY MR. REICH:
15 A. Yeah, slide 34 is kind of a summary of the
16 observations we've made of -- of the groundwater levels. I
17 think we spent the last hour or so, you know, talking about,
18 you know, some of the basic geology and the location of the
19 faults and the occurrence of movement and the hydrology.
20 So now that we've created that foundation we
21 wanted to move forward and apply that to the observations that
22 we've seen in the water levels.
23 So -- so really, you know, if -- if -- and we're
24 going to go through this in a second, but it's really kind of

Page 60

1 looking at different segments. We want to look what would
2 occur prior to Order 1169, what did we see during 1169, what
3 we have seen since.
4 So -- so before I do this I was wondering if I
5 could present a demonstrative aid that might help everybody
6 kind of locate where they are with respect to each of the
7 wells, because it gets -- it gets complicated with referring
8 to different well locations.
9 MR. HERREMA: Ms. Fairbank?
10 HEARING OFFICER FAIRBANK: That will be fine.
11 MR. HERREMA: We've prepared a figure that shows
12 the well locations.
13 ANSWERS BY MR. REICH:
14 A. Well, I think the one in your right hand would be
15 better for this conversation.
16 MR. ROBISON: Okay.
17 MR. REICH: I wonder if it would be better --
18 maybe a little bit closer over here. Because I don't want to
19 block anybody's view.
20 MR. ROBISON: This better?
21 MR. REICH: Maybe in just lean it up against --
22 without the easel maybe we could just lean it up against the
23 tray towards the State Engineer.
24 HEARING OFFICER FAIRBANK: Actually, I think if

Page 61

1 we could put it there, that way then it can also be viewed on
2 the camera so individuals who are viewing from Las Vegas as
3 well as on the internet can see.

4 MR. REICH: Okay. If we just move it. The only
5 problem is it blocks the -- so let me just -- let me do this.
6 What --

7 MR. ROBISON: This way. Towards you.

8 MR. WILSON: Like this of. Perfect.

9 MR. REICH: That's fine. So what I wanted to do
10 is summarize how we bring things together. So maybe I can
11 show that in the next slide.

12 HEARING OFFICER FAIRBANK: If I may just ask a
13 quick clarifying, this is a demonstrative of the different
14 well locations within Coyote Spring Valley?

15 MR. REICH: Coyote Spring and Muddy River area
16 and part of Garnet Valley in the southern portion. So it's
17 really -- it's a -- it's a -- it's just an accumulation or a
18 presentation of the location as we talk about it.

19 Because, you know, I realize, you know, our staff
20 and our group is -- we get so involved in understanding where
21 these wells are, but it's important as we go through this
22 discussion that we can see exactly where they're located. So
23 that's -- this is really just a demonstrative to -- to allow
24 us to go back and reference exactly where wells are with

Page 62

1 respect to other well locations.

2 So what -- what we're looking at on the screen on
3 slide 35 is MX-4. So MX-4 is located about 300 feet away from
4 MX-5 pumping well. And you can see it on the demonstrative,
5 but it's in Coyote Spring Valley. So one of the things that
6 we see in MX-4 water levels is its relationship to
7 precipitation.

8 So you can see Ms. Palmer described --
9 characterized what the precipitation events have been in the
10 past. And what's remarkable here is when we see the 1998
11 event, over four inches of rainfall.

12 So on the left we have precipitation axis and
13 measured in inches. On the right we have elevation. And that
14 right axis relates to the hydrograph that we'll be discussing.
15 We're going to go through a lot of these hydrographs today.
16 And so the theme is always going to be the elevation and/or
17 pumping in some cases or precipitation in other cases on the
18 left axis.

19 But for right now the black line on the top is
20 associated with the black axis on the right and the blue bars
21 are associated with the precipitation axis on the left.

22 Again, 1998, we don't have data prior -- we don't
23 have groundwater level data prior to 1998, but we see the 1998
24 was a wet event. We have a decline in stream flow. We've all

Page 63

1 talked about '04, '05 rainfall event. We can see that there's
2 a reaction or a response in the groundwater level. In '05
3 there's a jump up. And then again, there's a further decline.

4 There's a -- there is a decline in the
5 groundwater level until 2010. There's a small bump in the
6 water level due to the rainfall event in 2010. And then
7 average conditions -- what appear to be average conditions
8 from say 2015 to the present.

9 If we overlay that with the CDM curve that
10 Ms. Palmer introduced, again, we see that same formation, that
11 same characterization.

12 This particular graph, which is slide 36, shows
13 again the -- the -- kind of the dotted groundwater level line
14 on the top is -- is the water level at MX-4, the solid black
15 line is the CDM curve that we introduced earlier.

16 The gray bars are annual precipitation. The blue
17 bars are monthly precipitation. And the -- the pink line
18 going across horizontal is the average of the period of record
19 for -- for the precipitation at southern extreme division 4.

20 So, you know, we see the same characterizations,
21 we see -- again, back to '98 a response in the water level, a
22 decline down to '04, '05 rainfall event response. And so
23 there's a lot similarities between these two curves.

24 So we don't only see this in Coyote Spring

Page 64

1 Valley, but we also see this in the Muddy River Spring area.
2 So we can do the same for EH-4. If you -- if you can see the
3 chart, EH-4 is down near the -- near Muddy River Springs area
4 and you can see that this also is showing the carbonate water
5 level, the black line along the top, the hydrograph measured
6 in elevation on the right axis and then monthly precip.
7 So -- so we see almost an identical similarity in
8 EH-4 that we just saw in the MX-4 well. And again, when we
9 overlay that with the cumulative departure from mean and we
10 add annual precipitation, it's the same general, you know,
11 trend that we see going on.

12 We have a high rainfall again in '98, some
13 decline, a response in '04 and '05 to a wet event decline, you
14 know, basically from '06 down to 2013, that's punctuated by a
15 high rainfall event in 2010 and then average conditions from
16 '15 to '17 -- or '15 to -- '15 to the present.

17 So --

18 Q. And, Mr. Reich, in regard to well EH-4 you've
19 been referring to slides 37 and 38; is that correct?
20 A. That's correct. 38 meaning EH-4.

21 MR. TAGGART: For the record, we object. I don't
22 think this in their report. And unless it's offered for
23 demonstrative purposes, that's fine, unless they can point to
24 where this diagram is in the report.

1 MR. HERREMA: So these slides are a summary of a
2 compilation, it's different pieces of reports and exhibits
3 that have either been presented or admitted. We intend at the
4 end of the day to ask that the State Engineer accept the
5 slides as a part of the record, but we weren't intending to
6 offer them as evidence themselves.

7 HEARING OFFICER FAIRBANK: And for the purposes
8 as being offered as demonstrative exhibits in the summary
9 compilation of data, we will accept them.

10 Mr. Herrema, is there -- are there copies of your
11 presentations available and where are they located?

12 MR. ROBISON: On the table on the other side of
13 the room.

14 HEARING OFFICER FAIRBANK: Okay. So there's
15 copies of the presentation on the table over there? Thank you
16 very much.

17 MR. TAGGART: If I can just for the record, and I
18 understand your ruling, we will abide by it, I just want to
19 clarify whether this is in their exhibits or not, just for the
20 record so we know whether this is something different. If it
21 is we object to it being admitted as evidence and obviously
22 counsel said they will not offer it in evidence. But if it's
23 in their exhibits we would just like to know where it is.

24 HEARING OFFICER FAIRBANK: And if I understand

1 this.

2 However, it is being provided as a source of the
3 presentation today. And so to the extent it gets included in
4 the State Engineer's record, it may be included in the State
5 Engineer's record to the discretion of the State Engineer.
6 However, it is not being offer -- it's not going to be
7 accepted as an exhibit by CSI in these particular matters.

8 MR. TAGGART: I understand --

9 HEARING OFFICER FAIRBANK: Mr. Taggart, your
10 objection is noted, but we're on a tight time frame and that's
11 the ruling of the State Engineer right now. Thank you.

12 BY MR. HERREMA:

13 Q. Could we please advance to slide 39? Mr. Reich,
14 what does slide 39 show?

15 A. 39 are some -- are wells that I use for
16 observation of data prior to the beginning of the Order 1169
17 aquifer test.

18 So one of the -- one of the steps that we went
19 through was as I explained before, was to really truly
20 understand the data and see what -- what -- what those data
21 prior to the tests showed.

22 I think unfortunately -- I wish I could sit here
23 in front and say we have a very long period of record that --
24 that would characterize this area. I think what we'll see

1 correctly, it's a summarization or a compilation of documents
2 which is reflected in the upper corner of their slides, which
3 is -- if I understand correctly from prior statements from
4 counsel, is that's the -- where the source data is located and
5 if I understand it's a demonstrative exhibit?

6 MR. HERREMA: Yes.

7 HEARING OFFICER FAIRBANK: So that's -- that's
8 what it is at this point and it's not being offered as
9 evidence or as an exhibit, it's being offered for
10 demonstrative purposes?

11 MR. HERREMA: Yes. So we would like it made part
12 of the record so that it can be referred to in the transcripts
13 being reviewed.

14 MR. TAGGART: Those are two different things. It
15 can't be part of the record if it's not an exhibit.

16 MR. HERREMA: It's a demonstrative exhibit.

17 MR. TAGGART: It can't be part of the record if
18 it's not offered and accepted --

19 HEARING OFFICER FAIRBANK: So, Mr. Taggart, we
20 will go ahead, it's being presented, all the participants have
21 it available as a copy of it. It's being proffered for
22 demonstrative purposes.

23 And as the State Engineer stated previously, the
24 State Engineer will assign what, if any, weight to provide to

1 today is that there is somewhat of a limited amount of data,
2 but I wanted to present that today and show you how we came to
3 our conclusions regarding what we see prior to the order of
4 1169 aquifer test.

5 So, maybe I can jump to slide 40. And what slide
6 40 shows is a groundwater level of response in the MR -- in
7 the Muddy River Springs and EH-4. So there's a lot going on
8 in this graph. And I think I've introduced each one kind of
9 on a step wise fashion.

10 But I've -- I've shaded out the blue area. And
11 the purpose of that blue and what it represents is the period
12 that pumping was occurring in Coyote Springs Valley.

13 And so what I want to do today with you is
14 explain what I see prior to the beginning of pumping in Coyote
15 Springs Valley. So what I'm going to do is focus on the
16 information that's located on the left side of the graph.

17 And as we look at the information on the left
18 side of the graph, I -- I want to repeat what I said before,
19 and that is we've seen that that trend, that groundwater trend
20 reflects climactic conditions.

21 And we see that, we used EH-4 as an example
22 before, but we see it again in this graph 2, that solid line
23 is that CDM curve, that black solid line. And in this case
24 what the green lines are, the green bars is pumping in -- it's

Page 69

1 carbonate pumping in the Muddy River Springs area.
 2 So what that green is showing is monthly pumping
 3 from 1998 I believe up into 2019, it's showing that that
 4 pumping was in the Coyote Spring -- in the Muddy River Spring
 5 area.
 6 And what we're looking at in this is the seasonal
 7 response. So now instead of looking at the climatic response
 8 over periods of five or seven years, what I want to kind of
 9 focus in on is that annual response.
 10 And you can see that annual variation in that
 11 hydrograph at the top. It -- it -- it's high in the
 12 wintertime and early spring and then it's low in the late
 13 summer and early fall.
 14 And you can see how that kind of follows the
 15 peak pumping, so the top green bar would be the peak pumping.
 16 And what I've shown on this slide is that period.
 17 So there's two vertical lines. There's two
 18 vertical lines, and they kind of represent the time between
 19 the peak pumping, which is the green. That would be the first
 20 vertical line you see on the left and then the minimum
 21 groundwater level, which would be the second vertical line or
 22 the parallel vertical line just to the right of the first.
 23 So really, all that is doing is demarking kind
 24 of a time delay between when peak pumping occurs in the Muddy

Page 70

1 River Springs area and when we see minimum groundwater levels.
 2 So, again, you know, it's this annual variation
 3 that we relate to pumping. Pumping goes up, groundwater
 4 levels go down. Pumping reduces, and you see a response in
 5 that groundwater level.
 6 So this is -- I think it's pretty standard. We
 7 all have seen the signature before. But what -- what it
 8 allows us to do is to see what does it mean in the area that
 9 we're -- we're discussing today.
 10 So if I move further upgradient, if I move from
 11 EH-4 and now I'm looking at UMVM-1. UMVM-1 monitoring well is
 12 located at the northwestern end of the Muddy River Springs
 13 area right before you go into Coyote Spring Valley.
 14 Again, you know, we see that same trend in the
 15 long-term kind of climatic conditions of drying and wetting.
 16 And unfortunately, because of lack of data -- or I should say
 17 lack of period of record, we're really missing that early time
 18 just because of when these wells were built. But we see the
 19 same thing. We see this annual variation.
 20 And that annual variation is, again, due -- if
 21 we look to the left, if we look to prior to when pumping
 22 occurred in the Coyote Spring Valley, we see that that annual
 23 variation is occurring in -- in the -- in the UMVM-1.
 24 And, again, what I've done is I've demarked that

Page 71

1 period by two vertical lines between when peak pumping occurs,
 2 which is the top of that green bar, and when minimum
 3 groundwater levels are observed, which is the vertical bar on
 4 the right.
 5 And if you remember a little bit, it's gotten a
 6 little bit wider, so that gap is getting a little bit longer.
 7 You know, it kind of makes sense. You're getting further
 8 away. The impacts take longer. There is a time delay between
 9 peak pumping and draw-down.
 10 So this is fitting our conceptual model, and it
 11 supports the idea that pumping in the -- in Muddy River
 12 Springs area is impacting groundwater levels at UMVM-1 as
 13 shown in Slide 41.
 14 If we go a little bit further upstream as
 15 shown -- or upgradient. I should be careful. Upgradient in
 16 Slide 42. Slide 42 is CSVM-6. CSVM-6 is now located north of
 17 MX-5 in the Coyote Springs Valley. And the green bars
 18 represent, again, pumping in the Muddy River Springs area.
 19 The blue area, again, is when pumping was
 20 occurring in the Coyote Springs Valley.
 21 So we looked at this, and we tried to ask
 22 ourselves why are we seeing a seasonal response to early time
 23 groundwater levels in the Coyote Spring Valley, especially in
 24 CSVM-6.

Page 72

1 And so we saw what happened in VH-4, and we saw
 2 how that -- and also as shown in UMVM-1 and now, in CSVM-6
 3 with the available data, we see the same thing. We see that
 4 there's a seasonal variation prior to when pumping was
 5 initiated.
 6 So it really got us understanding that, you
 7 know, this -- that this pumping center in the Muddy River
 8 Springs area has impact as far north into this -- the area of
 9 CSVM-6, which is the -- kind of the eastern portion of Coyote
 10 Springs Valley just north of MX-5 as shown on the
 11 demonstrative aid.
 12 So we kept going further upgradient. And this
 13 is CDVF-2. And CDVF-2 is even that much -- it's further
 14 upgradient in Coyote Spring Valley. And, again, if we can
 15 look on the demonstrative aid, and what we see again is --
 16 is -- is the same -- is what's actually missing in this, and
 17 that is that seasonal variation.
 18 So one of the reasons that I hesitate is because
 19 one of the things I want to point out here is that there was a
 20 screen failure or a hole in the casing, and so the data after
 21 October -- I believe it was October 2011 in Figure 4- -- was
 22 it 43? -- for CEVF2, we're not really looking at that data.
 23 Again, we're just focusing on that early time
 24 data prior to pumping in the Coyote Springs Valley. So this

Page 73

1 kind of raised a question: Why are we seeing that seasonal
2 response on the eastern side of Coyote Springs Valley but not
3 necessarily seeing that seasonal response on this further
4 well, CEVF-2.
5 So with that, that went to help us understand,
6 you know, what the impact of these of these faults and
7 barriers may be along the -- along -- within the Coyote
8 Springs Valley.
9 Q. Okay. Advancing to Slide 44.
10 A. So as I mentioned before -- we looked at kind of
11 before, that was before the 1169. That's what we observed and
12 when we observed declining water levels during and somewhat
13 after the 1169 tests.
14 So what I want to do today is kind of want to
15 focus again on some of these monitoring wells, and I'm going
16 to be specific in looking at MX-4, UMVM-1, EH-4 as we go kind
17 of down gradient from MX-5 down towards the Muddy River
18 Springs area. So, again, the red lines that are showing the
19 location of some of the monitoring wells I want to discuss.
20 For instance, if we look at the next slide, which
21 is Slide 45, Slide 45 is MX-4. As I mentioned before, MX-4 is
22 located about 300 feet or so from MX-5. The yellow represents
23 the period of the Order 1169 tests.
24 The blue bars represent pumping in Coyote Spring

Page 74

1 Valley. So now -- I kind changed a little bit. Now we're on
2 those bars and those -- the bars themselves represent Coyote
3 Spring Valley pumping, not Muddy River.
4 So you can see during the aquifer test how much
5 that increased in 2011 and 2012, that big increase. And you
6 can see how MX-5 continued to pump all the way out through
7 April of 2013. So even beyond the Order 1169 aquifer test,
8 and what was reported, you know, that MX-5 still had pumping
9 going on.
10 One of the observations we see in MX-4 is that,
11 you know, during -- during that early part of 2013 when MX-5
12 was -- was continuing to pump, the groundwater levels remained
13 fairly constant.
14 And then after -- after that MX-5 was shut down,
15 you can see how MX-4 reacts immediately to that shutdown.
16 There's a jump in the hydrograph. It jumps straight up.
17 You also see in 2011 and 2012 when MX-5 was shut
18 down for repair for different purposes, you can see that
19 there's an immediate response in the groundwater level. So we
20 feel good that MX-4 is really -- is responsive to what's being
21 seen at MX-5.
22 So -- so now, we went further down-gradient, and
23 as shown on Slide 46, which is CSVM-1. Now, CSVM-1 is also
24 very nearby. We can see on the graph here CSVM-1 is almost

Page 75

1 immediately down-gradient of the MX-5 pumping well. We see a
2 lot of the same characteristics that I just talked about at
3 MX-4.
4 Besides the fact that, you know, we have that
5 seasonal response that we see that we talked about earlier, we
6 have the long-term climatic response, but we also have that
7 response due to MX-5. So in MX-5, you can see in 2011 and
8 2012 when it shuts down, there's a response by that
9 hydrograph, you know, kind of jumping up. The early part of
10 2013, you see a flat hydrograph. At the end of 2013 at the
11 end of those blue bars, there's a jump up in the groundwater
12 level.
13 So, you know, again, we can -- we can see that
14 CSVM-1 is tied together with what we see in the other areas.
15 So -- so we kept moving further down-gradient as
16 shown in Slide 47.
17 And when we go down 47, this is UMVM-1, and
18 UMVM-1 is, again, a lot of the same characteristics. And I
19 don't want to, you know, keep saying the same thing but, you
20 know, the -- the drawdown in early 2013, you know, that still
21 continues. But, you know, it's not as flat as it was.
22 You know, recovery -- there seems to be some of
23 type of recovery response in UMVM-1 that's different than what
24 you see in MX-4 and CSVM-1. But you still can see the

Page 76

1 seasonal pumping signature and can see -- and you see the
2 drawdown recovery.
3 So there's no question that, you know, we see
4 impacts from MX-5 into -- into Muddy River Springs area, which
5 is where -- where UMVM-1 is located.
6 HEARING OFFICER FAIRBANK: Mr. Donnelly.
7 MR. DONNELLY: Thank you.
8 Patrick Donnelly, Center for Biological
9 Diversity. For the record, we'd like to object to all these
10 charts being included. All these charts are citing CSI
11 Exhibit 1. They're not in CSI Exhibit 1. This certainly
12 feels like evidence, and we have not had a chance to review
13 this before.
14 HEARING OFFICER FAIRBANK: Your objection is
15 noted. Thank you.
16 MR. HERREMA: Miss Fairbank, if I may, there was
17 an e-mail that you sent out on August the 29th which talked
18 about PowerPoints and what they might include and when they
19 should be produced.
20 There's a Question Number 5 that talks about
21 PowerPoints that are a summarization of the expert report
22 taking data or analysis of hydrographs of other data in the
23 reports, and that's what we have put together in our
24 PowerPoint.

Page 77

1 It talks about those -- that particular question
2 talks about those as demonstrative exhibits and that they can
3 be produced and provided to everyone at the time that they're
4 being presented.
5 MR. TAGGART: And just for the record, I would
6 like to add that we've done this for decades, and absolutely,
7 a demonstrative can summarize expert conclusions. A
8 demonstrative should not make new experts, and that's the
9 basis for our objection.
10 HEARING OFFICER FAIRBANK: And that objection is
11 noted, Mr. Taggart.
12 MR. TAGGART: Thanks.
13 HEARING OFFICER FAIRBANK: Thank you.
14 BY MR. HERREMA:
15 Q. Mr. Reich, you were last speaking about Slide 47,
16 which is relating to Well UMVM-1.
17 A. Yeah. So I think I explained UMVM-1 that this is
18 at -- located at the kind of the northwestern portion of the
19 Muddy River Springs area, and you see the same type of
20 response.
21 And then we go further down-gradient in Slide 48,
22 we show EH-4. So EH-4, again, is -- you know, it's a longer
23 period of record. You can see that longer hydrograph. But,
24 you know, we start to see that even at the end of -- of the

Page 78

1 pumping, of the MX-5 pumping in 20 13, you know, you start to
2 see a recovery. You start to see an uptick in the groundwater
3 level.
4 So, you know, why we've submitted that, you know,
5 there's a relationship in the hydrologic connection between
6 Coyote Spring Valley and Muddy River Springs area, you know,
7 as we get further away, we start to see the impacts of other
8 issues, whether they be recharge or groundwater flow. But,
9 you know, there's -- there's -- there's different
10 characteristics that help us understand and explain, you know,
11 that movement of water.
12 So, you know, this is just important to see how,
13 you know, we can relate pumping in Coyote Springs Valley to
14 impacts in the Muddy River Springs area.
15 So, you know, if we -- if we move on, this was
16 the area that we looked at down-gradient. We also looked
17 upgradient. So, now, what I would like to do is walk you
18 through some of those wells, observation wells that we looked
19 at moving upgradient in Coyote Spring Valley.
20 So in this particular case, in 49, I'm just kind
21 of showing you -- if we start at the bottom and work our way
22 north, that's going to be the order of my presentation for
23 water level graphs.
24 So on page 50, I'm showing CSVM-6. And CSVM-6,

Page 79

1 again, I think, is very much tied to the pumping we see in
2 MS-5. There's a -- there's a flat level in the early 2013.
3 There is an immediate response in -- in May of 2013 after
4 MX-5's pumping is shut down. We see the seasonal variability
5 that we talked about before.
6 And also in -- in 2011 and 2012, you see the
7 response in the groundwater level due to the -- the shutdown
8 of the MX-5 pumping.
9 So, you know, CSVM-6, we go further north from
10 that and -- or upgradient. And as we look at Figure 51, we
11 look at CEVF-2. And, you know, I got to -- CEVF-2 is it's
12 just unfortunate that the well doesn't show us -- doesn't have
13 data later on up to present due to the failure of the well
14 itself.
15 But, you know, what's interesting about this is,
16 you know, what we -- what we don't see. And we don't -- we
17 don't see an immediate response in 2011.
18 And as I mentioned before, we -- and this is
19 supported by the fact that we don't really see that seasonal
20 response due to the pumping in the Muddy River Springs area,
21 but we do see a seasonal response to the pumping in the Coyote
22 Spring Valley area.
23 As we'll get on to later today or right now in
24 Slide 52, you know, we look at other pumping that occurred,

Page 80

1 say, on the west side of the -- of the structural block that
2 we pointed out before.
3 So, you know, groundwater pumping on the west
4 side, we talk about CSI-1 and we talk about CSI-3, and we
5 include CSI-4. You can see how there's a responsiveness to
6 the water level graph at CEVF-2 and seasonal variation pumping
7 from these other wells.
8 So as we then continue to move further north, you
9 know, we want to look at CSVM-4. So CSVM-4, which is at the
10 outflow area of -- or the top part of the Coyote Spring Valley
11 near the King Spring Valley, again, what's really interesting
12 here is we don't really see any seasonal response.
13 But we do see the climatic response, and the
14 climatic response is -- you know, when we plot that with the
15 cumulative departure for mean curve, you can see that there's
16 an increase, you know, following the '04-'05 wet period.
17 There's an upward trend in the groundwater
18 levels, and then there's a decline down to 2013, 2014, and
19 then groundwater levels have remained fairly stable from 2015
20 to the present.
21 So, you know, this -- this, you know, helped form
22 and support our conceptual model. This model that allows us
23 to understand what -- you know, what the impact of some of
24 these barriers are; where is the flow is occurring; how flow

Page 81

1 may or may not occur across those barriers. But, you know,
2 these data and the other data in -- in the Coyote Spring
3 Valley were used to assess that.
4 And so moving on to Slide 54, in the upper left,
5 we're looking at CSVM-4, which we just talked about; the lower
6 left, which is CSVM-5 -- 3. Sorry. And that's right at the
7 base of the Pahranaagat wash or the northern end of the Coyote
8 Springs Valley.
9 Again, it's very similar to the CSVM-4 in the
10 sense that you see a recovery and you see a decline, and what
11 is happening in that area, CSVM-5 is located south of the MX-5
12 pumping on the west side of the valley. It's located below
13 the sheep range in an area that is also controlled by faults,
14 and we see something completely different.
15 We see something that's in a -- in a different
16 characterization of increase in groundwater level going --
17 going up, which we haven't seen -- you know, today, we've
18 looked at a lot of water levels, and so we have to ask
19 ourselves: Why is this different. Why do we have some
20 different characterization of CSVM-5 that we don't see in the
21 other wells?
22 And that's -- and that's a question where it can
23 be explained by, you know, either a purge stone, a fault
24 barrier, crossed areas, and it really elicits the need to find

Page 82

1 out more about this area because this is -- this is unique to
2 what we've looked at in this basin.
3 So we're -- you know, as we are today, we're
4 still -- we're still looking at that and explaining why
5 that -- that change is occurring.
6 But then again, CSVM-2, as we move down towards
7 Hidden Valley, we see the same characterization of seasonal
8 water levels, but we don't see the response from the MX-5
9 pumping.
10 So to summarize all this, and I've done that in
11 the next slide, again, we -- we've seen this trend. Long-term
12 climatic conditions impact the groundwater levels. I think
13 we've seen that in all these different groundwater hydrographs
14 that we've looked at today.
15 And I -- what's most interesting to us in our
16 investigation was -- is really how the pumping in the Muddy
17 River Springs area affects the eastern portion of Coyote
18 Springs Valley.
19 So, again, how is that -- why is that something
20 that -- you know, how does that occur and why is it contained
21 in that eastern portion? And that's -- you know, and why,
22 similarly, do we not see that seasonal impact on the western
23 side of the Coyote Springs Valley.
24 So -- so, you know, that helps and support our

Page 83

1 conceptual model that these barriers, these faults, these
2 normal faults that were described by Rowley that we identified
3 in our geophysical survey really impact and control that
4 occurrence and movement of water throughout the area.
5 And so, you know, we come to the conclusion based
6 on these data that basically, you know, that the barrier to
7 flow or that the faults and the structural block and the
8 geology that exist, you know, act to -- to isolate the western
9 and eastern portions of Coyote Spring Valley.
10 Q. Mr. Reich, you're referring right now to
11 Slide 55; is that correct?
12 A. 55, yes.
13 HEARING OFFICER FAIRBANK: Mr. Herrema, we're
14 almost at 10:30. Is this a good time to take a ten-minute
15 break?
16 MR. HERREMA: We've got about ten more slides, so
17 I think we can.
18 HEARING OFFICER FAIRBANK: Let's go ahead and
19 take a ten-minute break, and we'll start back promptly in ten
20 minutes.
21 (Recess.)
22 HEARING OFFICER FAIRBANK: We're going to go
23 ahead and go back on the record.
24 So, Mr. Herrema, you may proceed.

Page 84

1 BY MR. HERREMA:
2 Q. Mr. Reich, we have Slide Number 56 projected on
3 the screen here. Would you please tell us what Slide 56 shows
4 us?
5 A. Yeah, we kind of ended before the break talking a
6 little bit about a summary of our observations on the water
7 levels, so I just want to continue about some of those, just
8 summarizing what our observations were, you know, after --
9 during and after the aquifer test.
10 So some of the points that -- that I want to push
11 out is really that during the -- during the aquifer test, you
12 know, we could really see that -- that CSVM-2 -- CSVM-2,
13 CSVM-3, CSVM-4, CSVM-5 -- and I know we jumped back into these
14 numbers again, but they're really -- they really show a
15 different environment.
16 You know, it's really a different hydrogeologic
17 and geologic environment. And characterization of water
18 levels from those wells are different than what we saw on the
19 eastern side is what we saw on MX-5 and the CSVM-1 and, you
20 know, the CSVM-6 in the northern Muddy River area and the
21 UMVM-1.
22 You know, we're really looking at -- at
23 something, a characterization. And when we look at those
24 water levels, we can see that there's different environments

Page 85

1 and a different geologic framework that's affecting those.
2 So as we move on this morning, you know, that's
3 something that's important to us to convey to your office
4 to -- to think about as you put together your own conceptual
5 model, how these really affect that occurrence of movement of
6 water throughout the system.
7 So, you know, moving on, I think is -- what I
8 really wanted to kind of end with is that -- that same point
9 is just we really see this long-term variability in water
10 level that's connected to the climate.
11 I think it's -- it's -- it's obvious throughout
12 all the wells, you know, that we've talked about today, except
13 that CSVM-5 which I indicated we're still looking at. But the
14 other water levels' response where we see an increase from
15 '98, an increase in '04-'05 and a long-term decline in average
16 conditions, it's really evident as we look throughout those
17 hydrographs and we see how climate plays a role. You know,
18 pumping plays a role. Climate plays a role. There's all
19 these different things that we have to consider when we start
20 to describe and characterize this.
21 So it's just something to think about and -- for
22 your consideration as -- as you think about managing the
23 resources in this basin.
24 Q. Mr. Reich, you're referring right now to

Page 86

1 Slide 57; is that correct?
2 A. Yes. Slide 57.
3 Q. Moving to Slide 58, Mr. Reich, how did you
4 address answering the State Engineer's Question 3 regarding
5 the long-term annual quantity of groundwater that may be
6 pumped from the Lower White River Flow System?
7 A. You know, we took an approach of -- of developing
8 a groundwater budget for the Lower White River Flow System.
9 We think -- or we know that budgets are important planning
10 tools that we use for understanding, you know, all the
11 different fluxes that affect the available resources.
12 When I talk about fluxes, you know, we talk
13 about groundwater inflow. We talk about local recharge,
14 evapotranspiration, spring flow, surface flow. Each one of
15 these fluxes, each one of these terms, you know, is what we
16 use to quantify what the resources are.
17 So as we make changes in the future, we go back
18 and we look at those different items, and we say: How are we
19 affecting those? How may we be affecting evapotranspiration?
20 How may we be affecting groundwater discharge? How we may
21 affecting surface flow because, you know, pumping -- pumping
22 and groundwater development is going to affect something.
23 It's -- it has -- there's no -- there's no free
24 lunch there. So if you take water out in one place, you know,

Page 87

1 how do -- how do we have enough information to be able to
2 describe and understand where those impacts are going to be?
3 And we -- we suggest that a groundwater budget is
4 a tool that allows us to begin to be able to inventory those
5 resources, to be able to figure out, you know, where those
6 impacts are going to occur. How much can we give up? And
7 so -- so what we did was -- was we outlined each one of those
8 types of fluxes or inflows, and we did that for the Lower
9 White River Flow System.
10 So in Figure 59, what we're showing here is -- is
11 the budget is some of the flux terms that we have for the
12 groundwater flow budget for the Lower White River Flow System.
13 I -- you know, I have another demonstrative that just might
14 help.
15 I know a lot of us are pretty comfortable with
16 all the basins, and maybe we can just change that one out for
17 that one. Just so everybody -- as we talk about names and we
18 talk about places, I think it's important for everybody here
19 to understand where those places are and where those valleys
20 are.
21 And so, you know, as I talk, what I'm showing in
22 the -- in the PowerPoint presentation is a summary of the
23 geology. I use this figure to demonstrate where that budget
24 and how those budget terms occur.

Page 88

1 As I talk about names, you can reference the
2 demonstrative here to make sure when I -- that you can
3 associate those with physical places and locations.
4 But, you know, in terms of the flux terms that we
5 have, we talk about groundwater inflow and regional
6 groundwater inflow.
7 And so what our office did was we kind of
8 performed a literature research. We didn't go out and develop
9 new data for groundwater -- regional groundwater flow.
10 Rather, we went out and relied on studies done by others. And
11 we reviewed a lot of those studies.
12 We reviewed studies that looked at deterring mass
13 balancing, carbon-14 dating, recharge analysis, precip runoff,
14 and Maxey-Eaken from the 60's, and we really went to a great
15 extent to see the kind of information that was out there.
16 And in order to get something that we could
17 present to you, present to the State Engineer for their use in
18 planning, we ended up relying on an SNWA 2007 report that also
19 used those data.
20 And we chose that report because it was fairly
21 comprehensive. It was fairly comprehensive, and we felt that
22 we could use that as a good budget that would be, you know,
23 somewhat balanced because it was all from the same report.
24 So we didn't feel like, you know, it -- it would

Page 89

1 have to -- you know, there's no mixing and matching from
2 different reports.
3 And so in short, what that report identified and
4 you can see in these -- in these dark blue lines, there was
5 regional groundwater inflow from Pahrangat Valley. There was
6 regional groundwater inflow from Delamar area and regional
7 groundwater inflow from Kane Springs, regional groundwater
8 inflow from the Lower Meadow Wash.
9 And the regional groundwater inflow from the
10 Lower Meadow Wash was identified to occur into both -- into
11 both the Muddy River Springs area and the California Wash.
12 And so when we talk about the groundwater
13 recharge or the groundwater regional flow, we talk about those
14 as being sources of -- of that groundwater flow.
15 We also -- we also looked at values from
16 groundwater outflow from the area. So, you know, in the same
17 report, we looked at groundwater outflow from the California
18 Wash area into lower Moapa, and we looked from -- and also
19 identified groundwater outflow from -- into the Black
20 Mountains area.
21 So there was specific areas that identified where
22 there was reasonable inflow into the system and regional
23 outflow into the system. So you can see on this map -- and we
24 also summarized it in a budget.

Page 90

1 So you can see in Slide 60 -- Slide 60 kind of is
2 the old classic groundwater budget that a lot of us have been
3 using and looking at for our whole lives. So you can see that
4 all the places in the -- and the terms that I just mentioned
5 are outlined with the addition of local recharge.
6 So not only do you have this regional groundwater
7 inflow into the Lower White River Flow System, you also have
8 local recharge, local recharge occurring on the Coyote Spring
9 Valley -- I mean, on the Sheep Range in the Lower Meadow
10 Mountains, you know.
11 Now, we didn't make an estimate because the --
12 because published estimates from recharge from the Lower
13 Meadow Mountains and from Arrow Canyon and other areas were
14 not available.
15 So we didn't add anything, but what we really
16 focused on was using those values from that 2007 report to put
17 together this balanced budget.
18 For instance, in the outflow terms, we also used
19 their estimates of evapotranspiration: How much
20 evapotranspiration is in California Wash, how much may be in
21 the Muddy River Springs area.
22 And it's important to remember these were
23 presented as predevelopment, so it might not be what's there
24 today but certainly, from a predevelopment groundwater budget

Page 91

1 perspective, what was existing overall.
2 So when we summarize this and we look at this
3 together in this budget, you can see the total outflow is
4 about 62,200-acre-feet, and the total -- I'm sorry. Total
5 inflow, excuse me, is 62,210-acre-feet, and the total outflow
6 is 63,630.
7 So when I use this budget to say to -- in our
8 conclusions that there's upwards of 30,000-acre-feet of
9 available groundwater in the Lower White River Flow System,
10 this is the basis for that presentation or this is the basis
11 for that conclusion.
12 And where that number comes from is looking at
13 the total amount of evapotranspiration and groundwater outflow
14 out of the basin, so we can talk about this later. But I
15 wanted to provide with -- you where those values are coming
16 from.
17 Q. Advancing to Slide 61, Mr. Reich, what is the
18 importance of local recharge from the Sheep Range?
19 A. Well, the local sheep -- the local recharge from
20 the Sheep Range is an important component in our conceptual
21 model and what we've been talking about today because the
22 local -- the local recharge is -- is really occurring off of
23 the Sheep Range. And what we've done today is -- is we
24 decided that, you know, it would be good to provide an

Page 92

1 independent analysis.
2 The independent analysis would allow us to use
3 the most up-to-date and modern techniques. And if I may be
4 allowed, I'd like to have Miss Palmer talk about the analysis
5 that she did with regards to precipitation and recharge from
6 the Sheep Range.
7 MS. PALMER: Right. Thank you.
8 We reviewed the literature, as Steve said. We
9 selected several empirical precipitation recharge models from
10 the literature, and we applied those using the most recent
11 spatial data for the State of Nevada.
12 We used something that's called PRISM, a gridded
13 raster data, which is a spatial dataset for outer general
14 precipitation. And the PRISM stands for precipitation
15 elevation regressions on independent slopes model.
16 It's developed -- the PRISM dataset has published
17 in literature since about 1994, and it's been developed by
18 research from Oregon State University. They produce a variety
19 of spatial climate datasets for use in the western -- well,
20 all the over the United States.
21 So we used this spatial information on
22 precipitation in our geographic information system or GIS
23 software to look at each of these areas that you see in the
24 figure on the slide. And each of those areas, we broke them

Page 93

1 up into recharge zones, and we used the spatial data to
2 compute the average annual precipitation in each zone.
3 And then we applied the coefficients and
4 parameters from the literature -- from the models that are in
5 the literature, and we came up with a range that's 5280 to
6 7380-acre-feet per year.
7 Again, we also went back through the literature
8 to put those numbers in context, and that's in one of the
9 appendix to our July 3rd report. There is a table that shows
10 that we reviewed more than a dozen numbers. They ranged from
11 1900 acre per year to 14,000-acre-feet per year.
12 MR. REICH: Thank you.
13 So that was an independent analysis of the local
14 recharge in the Sheep Range that was prepared for this area.
15 And what we did next was we used that to focus in on a
16 groundwater budget just for the Coyote Springs Valley.
17 So now what you're looking at is just a -- a new
18 budget different than what we looked at before. But, you
19 know, what would be the budget for just the Coyote Spring
20 Valley?
21 And, again, we look at the same terms, which is
22 groundwater inflow and local recharge. We now have an
23 independent number for local recharge, and then outflow, of
24 course, would be the groundwater outflow out of the Coyote

Page 94

1 Spring Valley, evapotranspiration, and any surface water out.
2 So we -- we used this updated precipitation
3 runoff analysis. We tightened up our boundary just for the
4 purposes of discussing the Coyote Spring Valley today in order
5 to develop the groundwater budget that's shown in Slide 64.
6 So Slide 64 is slightly different. It's just for
7 a description of -- to support our conceptual model, but you
8 can see that the inflow -- very similar terms, if not
9 identical, from Pahrnagat, Delamar and Kane for 22,400,
10 24,100-acre-feet. 4200-acre-feet from Kane.
11 And then local recharge, because we had an
12 estimate, we now have an independent estimate of local
13 recharge for the Coyote Spring Valley of 5280.
14 And then in terms of outflow, we have outflow
15 into the Muddy River Springs area which is 37,800, which is
16 identical to what we had in the previous budget or -- as based
17 on -- it's based on the same information that we used for the
18 previous budget. And then outflow out towards Hidden and
19 Garnet Valley.
20 Now, that number is based on -- on the 2007 SNWA
21 study, but we've adjusted it in order to provide you with a
22 balanced budget for the Coyote Spring Valley.
23 You can see under predevelopment conditions and
24 the previous -- the previous -- it was interesting. The

Page 95

1 previous studies had also identified up to a thousand
2 acre-feet of evapotranspiration. So the total inflow and
3 total outflow based on our analysis for the Coyote Springs
4 Valley is 55,980-acre-feet as shown in Slide 64.
5 BY MR. HERREMA:
6 Q. Sir, I -- again, in summary, could you please
7 summarize the responses to the State Engineer's Order 1303
8 questions, and could we bring up Slide 65, please.
9 A. So Slide 65 is really just a summary of a lot of
10 things that we've talked about today. But our -- specifically
11 directed to answering your question, and, you know, we really
12 looked at this as an opportunity to provide you with as much
13 information and observations and new data that we have.
14 So -- so, through that process, you know, we
15 believe that the Order 1303 boundary that was identified can
16 be used, but resources will need to be accounted for.
17 And those resources are not just as I've shown on
18 my slide here in the Lower Moapa Valley how much outflow is
19 there from the basin, you know, because of what's going on
20 downstream but also to be able to determine, you know, and
21 account for the inflow, the regional groundwater flow, that
22 flow that's coming in through Pahrnagat and Delamar and Kane
23 and Lower Meadow Valley Wash. All of those need to be
24 considered as -- as kind of, you know, impacts to the flow

Page 96

1 system.
2 But using the flow system boundary as defined in
3 Order 1303 is -- is a plausible way to -- that we recommend
4 that the State Engineer can do that.
5 The information from the Order 1169 aquifer test,
6 you know, there's -- there's two big things that we provide
7 with you today, and that is that the climatic conditions play
8 a large role, a signature in the water levels that we look at
9 today. And that needs to be considered, and it's something
10 that -- something that we've learned since -- since that Order
11 1169 pump test.
12 And also, it's the structure. It's the -- it's
13 the -- it's the geologic structures that are defined by normal
14 faults that support, you know, and support preferred pathways
15 and flow ways for water and also help to create barriers
16 through development of -- of those faults as well as
17 structural blocks.
18 And so, you know, keeping those in mind, those
19 are -- those are some of the -- the new information or
20 information that, you know, need to be considered when looking
21 at pumping in the Lower White River Flow System.
22 The long-term quantity of water that can be
23 pumped, I just -- I just recently finished with you on
24 Slides 62 -- I mean, excuse me, 64 and the previous budget

1 slide.
2 But, you know, 11- -- there's 11,900-acre-feet of
3 predevelopment evapotranspiration and 19,700-acre-feet of
4 subsurface outflow in the Lower White River Flow System, and
5 we also identified 52- -- 5,280-acre-feet of local recharge in
6 the Sheep Range.

7 So, you know, these are values that can be used
8 for -- for you to determine on managing pumping in the Lower
9 White River Flow System in the future.

10 The effects of moving water rights between
11 aquifers, we didn't address necessarily water rights that --
12 and I apologize if we missed that, but we -- we instead, you
13 know, addressed the physical relationships between pumping in
14 alluvial wells and pumping in the carbonate aquifer.

15 And what we really found was, you know, pumping
16 from the carbonate wells in the Muddy River Springs area
17 really -- and pumping from the alluvial wells really have
18 almost a direct impact on the surface flow and spring levels
19 in the Muddy River system area.

20 But what I also want to conclude from this is
21 that -- you know, and this is reason why we brought forward
22 today the groundwater budget is that, you know, pumping --
23 pumping is -- anywhere within the Lower White River Flow
24 System is going to affect something, and it's going to affect

1 total pumping in Coyote Spring Valley of up to
2 5,280-acre-feet.

3 So, you know, it's really -- using the available
4 information and the new information that we provided you with
5 today, that will allow you to look at that -- those stresses
6 and those -- those physical properties of the rock and the
7 movement of water to help form your decisions about total
8 pumping in the Lower White River Flow System.

9 MR. HERREMA: Miss Fairbank, this concludes the
10 first part of our presentation regarding the direct -- or the
11 report. We're going to change who it is that's going to be
12 questioning to do the next part of our presentation.

13 Could I have a time check?

14 HEARING OFFICER FAIRBANK: Yes. You are about
15 two hours and 26 minutes into your presentation thus far.

16 MR. HERREMA: Thank you.

17 MR. ROBISON: Miss Fairbank, I think I did not
18 leave the State Engineer's office with the slides for the
19 rebuttal presentation. May I?

20 HEARING OFFICER FAIRBANK: Thank you. So you
21 have provided us the slides for the rebuttal presentations.
22 Thank you.

23 MR. ROBISON: And they were on the table for
24 distribution.

1 groundwater outflow. It's going to affect evapotranspiration.
2 It's going to affect surface flows.

3 But really, what needs to be considered is -- is
4 where the location of that pumping is and where those effects
5 will occur when that pumping takes place.

6 So -- so I hope that we presented that
7 information for your consideration today to see how that
8 pumping can be managed based on the impacts that you're
9 looking at.

10 Q. Turning your attention to Slide 66. What do we
11 have here?

12 A. Well, the -- this question in Order 1303 was
13 specific to other matters relevant to the State Engineer. And
14 a lot of that, I've kind of addressed just in my last slide
15 presentation.

16 But, you know, I really wanted to point out again
17 that going out and getting new information, going out and
18 getting the -- performing the geophysical survey, identifying
19 the faults, locating these pathways and barriers and
20 developing a structural understanding of the amount of water
21 or the currents and that movement of water really supports the
22 conceptual model that we've been talking about all day that
23 we've presented to you and, you know, how -- how that can be
24 used to support, you know, pumping in Coyote Spring Valley, a

1 HEARING OFFICER FAIRBANK: And those two are
2 available on the table?

3 MR. ROBISON: They were. I think they've been
4 taken up by other participants.

5 HEARING OFFICER FAIRBANK: Okay. Just one quick
6 matter if I may, Mr. Herrema. It didn't appear that you
7 actually sought to have the -- Exhibit 1 and 2, the report and
8 rebuttal report, admitted.

9 The State Engineer's prehearing notice or the
10 hearing notice stated that -- it identified the all the
11 exhibits the State Engineer was admitting as well as the
12 order, with respect.

13 But the State Engineer has not admitted any of
14 the reports, and so I just wanted to ask if that's something
15 that you wanted to have admitted in this matter.

16 MR. HERREMA: Yes, Brad Herrema for CSI. I read
17 the report as saying it to needed to be verified or the order
18 saying it needed to be verified and submitted to cross before
19 they were admitted, so I was planning to move that they be
20 admitted at the end of the day.

21 HEARING OFFICER FAIRBANK: Okay. Thank you.

22 MR. HERREMA: We do certainly want them admitted,
23 yes.

24 MR. ROBISON: Thank you.

Page 101

1 DIRECT EXAMINATION
2 BY MR. ROBISON:
3 Q. Good morning, all. My name is Kent Robison. I'm
4 counsel -- co-counsel for Coyote Springs, and I am going to
5 ask our panel backwards questions with regard to the CSI
6 rebuttal report and some of the findings and analysis you did
7 in that respect.
8 Start with you, Mr. Reich. Would you please
9 summarize for us all what you reviewed with respect to this
10 part of your assignment?
11 ANSWERS BY MR. REICH:
12 A. As part of our assignment, we reviewed the
13 reports that were submitted by other parties to the Order 1303
14 July submittal.
15 So -- so we -- we limited that review to the
16 information that was provided in those reports.
17 Q. Are you prepared to give your analysis and
18 observations with respect to those other reports, sir?
19 A. Yes, I am.
20 Q. Because of the limitation of time, I'd like you
21 to first give us a summary of your findings overall if you
22 would, please.
23 A. You know, I'm going to -- I'm going to spare the
24 State Engineer to repeat what I just said to him for the last

Page 102

1 two hours because hopefully, most of that got through -- or we
2 as a group were able to present that to you.
3 I do want to -- I do want to emphasize the fact,
4 you know, that we used the available data that we could find
5 to present those findings with you.
6 So what we found in the rebuttal reports was we
7 not only looked to see what information was provided in those
8 that would represent and support or change our minds or change
9 views. So we were looking for new information.
10 We looked at those reports and determined, you
11 know, how do they -- how do they support or how do they
12 provide information that would say, hey, listen, you know,
13 there is a different view that needs to be looked at.
14 So in short, in summary, you know, we disagreed
15 with the findings of -- of, you know, A, how much water can be
16 pumped and for what reasons. And that goes back, really, to
17 the idea that we want to get across and that we found as
18 evidence in our information that the aquifer is heterogeneous;
19 that there are barriers that exist; that climate affects
20 streamflow -- affects groundwater levels. And -- and putting
21 that all together, you know, how -- how -- how do all these
22 fit together?
23 So that was -- that was kind of our -- you know,
24 the basis for our review. And then that led us to determine

Page 103

1 whether we agreed with all the different aspects or disagreed
2 with some of the aspects of those rebuttal reports.
3 Q. That overview is reflected on Rebuttal Slide
4 Number 3, sir?
5 A. That's correct.
6 Q. Would you then direct your attention to Rebuttal
7 Slide Number 4.
8 Can you tell us how you believe that your
9 findings may differ from previous conceptual considerations to
10 which the State Engineer has been submitted or subjected?
11 A. Yeah. You know, in summary, it's the impact of
12 the hydrologic conditions on the available water resources and
13 the climatic variability.
14 And -- and more importantly, I just mentioned the
15 word heterogeneity, but it's really the differences in the
16 past is how -- how homogenous the aquifer may or may not be.
17 How much does it affect pumping in one location versus
18 observations in another location.
19 You know, we need to consider that the Lower
20 White River Flow System administrative boundary is on the
21 order of a thousand square miles. So we have a
22 thousand-square-mile basin that we're looking at and, you
23 know, what -- what are some of those differences? And I think
24 it's a fundamental difference on how we view that -- that

Page 104

1 basin.
2 You know, is it homogenous or are there
3 heterogeneities in there that cause different changes and
4 different issues or difference fluxes to occur. Is there
5 spring flow here? Is there outflow into the Black Mountains
6 area? Is there flow on the western side and, you know, can
7 pumping in one area affect or not affect pumping in another?
8 And that gets to the, you know, impact of faults
9 and structural components: How important are those
10 components? You know, how important are those faults? You
11 know, how are they barriers to flow or conduits to -- and to
12 create preferred pathways.
13 So it's really -- it's really that which -- which
14 formulates our opinion on the amount of water that can be
15 pumped from the Lower White River Flow System.
16 Q. Would you, with regard to Rebuttal Slide
17 Number 4, focus on the third bullet point and elaborate on
18 that, sir.
19 A. The impacts of -- on Slide 4, I'm reading about
20 the impacts of faults and structural components on groundwater
21 flow.
22 So, you know, when I'm talking -- I -- faults are
23 the normal faults. We went back and in the beginning of our
24 direct presentation, we -- we brought up the idea that

Page 105

1 extensional faults, extensional tectonics create these normal
2 faults that create preferred pathways. We clearly showed, you
3 know, the support for that -- that opinion and where that came
4 from.
5 And then looking at our observations of -- of
6 different transmissivities and well properties and information
7 from the -- from the wells and the pumping wells we have in
8 the Coyote Springs area, we could see that.
9 And then in the geophysics, it's really the
10 geophysics that we did to confirm what Rowley had suggested in
11 2017: That these -- these faults exist and that -- you know,
12 the continuation of that Arrow Canyon Range, that structural
13 block.
14 So how do we define -- how do we really know that
15 those are there and now, how do we really feel confident that
16 that supports our conceptual model? So it's really a
17 combination of that, which is different, I think, than what
18 the State Engineer has considered in the past.
19 Q. These are differences since the 1169 aquifer
20 test, sir?
21 A. Yes.
22 Q. The four bullet points on this particular slide?
23 A. Yes. The 1169 aquifer test, which completed at
24 the end of 2012, and the reports were written in June of '13,

Page 106

1 certainly, you know, we relied a lot on recent data as well as
2 the data that we performed ourselves in the form of a
3 geophysical investigation.
4 Q. Did you review the initial reports submitted to
5 the State Engineer's office by the Southern Nevada Water
6 Authority?
7 A. Yes, we did.
8 Q. All right. And if we could look at Rebuttal
9 Slide Number 5, please. Could you just describe the structure
10 of that summary with your columns going from left to right.
11 A. So from left to right on Slide 5, what I tried to
12 do was to organize our rebuttal in the sense of, you know,
13 what were the questions being asked in Order 1303 -- you know,
14 how each of the different parties responded to that and then
15 just comments or remarks regarding that, which is the last
16 column.
17 So as we -- as we look at this slide, you know,
18 I've organized it into geographic boundary status as from top
19 to bottom on the left column; status of aquifer recovery;
20 annual quantity of groundwater that may be pumped; you know,
21 impact of pumping on the Muddy River Flow and the movement of
22 water rights between aquifers.
23 So -- so this is -- this is -- this particular
24 slide is a summary of what we found and -- and I think the

Page 107

1 most important thing that -- that we saw that we really
2 disagree with is the amount of groundwater that can be pumped
3 from the -- from the groundwater system.
4 And so it's really that disagreement which is
5 based on some of our differences in the understanding of how
6 climatic conditions and how structural barriers and -- and
7 faults are characterized.
8 Q. No dispute with respect to SNWA's findings on the
9 geographic boundaries?
10 A. You know, we agree with SNWA with regard to those
11 boundaries. The SNWA report identified the no change from the
12 State Engineer boundary and that, you know, the only -- and
13 so -- so we -- we don't disagree with that.
14 Q. Is it a disagreement with respect to the status
15 of aquifer recovery, the second item on your summary?
16 A. You know, I -- I -- I think that the -- what's
17 really important is that they -- they identify the fact that,
18 you know, recovery occurs during extraordinary events similar
19 to '04 and '05.
20 And so my -- my remark to that -- and so we -- so
21 SNWA is providing and acknowledging that those hydrologic
22 events have an impact on the resources that we see in the
23 Lower White River Flow System, and the only comment I make to
24 that is that, you know, the wet hydrologic condition is part

Page 108

1 of any boundary. I mean, it's part of any hydrologic balance
2 to hydrologic cycle.
3 So when you consider management in this area,
4 such things as, you know, wet years, you know, wet years like
5 '98, wet years like '04 and '05 and wet years like 2010 all
6 need to be considered when -- when determining the status of
7 the aquifer recovery.
8 Q. The Water Authority determines in its report that
9 the annual quantity of groundwater that can be pumped is
10 between 4- and 6,000-acre-feet per year.
11 Do you agree with that?
12 A. No, I do not.
13 Q. Please explain why.
14 A. You know, I really -- I really believe that the
15 evidence provided by -- in their report did not support
16 pumping that's occurring -- that -- the amount of pumping that
17 can occur from the carbonated rock.
18 Q. For what reasons?
19 A. Well, the best way to show this would be to look
20 at Slide 8.
21 Q. Rebuttal Slide 8, please.
22 A. Right. So Rebuttal Slide 8, which is -- you
23 know, I kind of quote that the -- the -- the summary, which
24 says that "if the conflicts with senior water right holders

Page 109

1 are adequately addressed, the total annual groundwater
2 production should be managed between 4,000 and 6,000-acre-feet
3 over the long run."
4 And the basis for that is presented in the report
5 in Section 6.2.4 which -- which compares the contribution of
6 Warm Springs West Flow to the Muddy River Flow.
7 So it's a -- it's an analysis where they identify
8 that approximately seven percent of the flow at the Muddy --
9 and I should be careful. It's not the Muddy River Flow but
10 the discharge from the Muddy River Springs area.
11 So, really, what -- what their analysis looked at
12 was a flow from the Warm Springs West compared to the
13 discharge from the Muddy River Springs area.
14 And in that -- in that analysis, they assume that
15 approximately seven percent of the discharge from the Muddy
16 River Springs area is due to contributions from the Warm
17 Springs West Gauge.
18 Q. Does the Water Authority explain why it does not
19 include the alluvial pumping?
20 A. No, they do not.
21 Q. Do you think that should be considered in this
22 analysis?
23 A. I think that the State Engineer asked to
24 understand how much -- the quantity of water that can be

Page 110

1 pumped from the Lower White River Flow System, and the
2 analysis presented in 6.2.4 addressed pumping from the
3 carbonate aquifer.
4 So -- so I think that, yes, the alluvial pumping
5 should be considered, maybe not in this analysis but in a
6 response to the State Engineer. Alluvial pumping should be
7 addressed.
8 Q. In the third bullet point on the bottom of
9 Rebuttal Slide 8, you refer to the Water Authority's use of
10 linear relationship.
11 Could you explain, please.
12 A. Yeah. I think the best way to show that would be
13 on Slide 9.
14 So what Slide 9 shows is a graphical
15 representation of a table that they presented in the July
16 report. So the table in the July report related decreases in
17 flow at Warm Springs West to decreases in flow or discharge
18 from the Muddy River Springs area.
19 So -- so we've chosen to -- for this analysis to
20 use the Moapa gauge as kind of a de facto discharge from the
21 Muddy River Springs area. But what we've shown on this graph
22 is the axis on the left is the flow at the Warm Springs West.
23 And the blue line is the Warm Springs West flow.
24 So, for instance, if you -- if you look on the

Page 111

1 left axis at approximately 3.82 -- I guess that's pretty
2 precise, but 3.82 is the estimated predevelopment flow in the
3 Warm Springs West Gauge.
4 And as that flow decreases down to zero -- you
5 can -- you can see zero on the bottom. If you go over on the
6 right axis, that also equates to 3.82. So that's a
7 relationship between, you know, flow on the left axis and
8 decrease in flow on the X axis. So the X axis is really how
9 much does the flow decrease.
10 So on the upper axis or on the upper line, we see
11 that -- we see that that red line or orange line, that's
12 actually discharge from the Muddy River at the Moapa gauge.
13 And it, too, but you read it off the right axis.
14 So at the top, it's 50.2. So you can see that
15 basically, it correlates with 50 CFS, which is predevelopment
16 flow in the Muddy River.
17 And so then, as we as look at the table that was
18 presented, you can see that what it -- basically, what it
19 shows is that when there's a 1.12 drop in CFS drop in flow at
20 Warm Springs West, which is -- you know, you can read it off
21 the X axis.
22 If you go over to 1.12 and then up, you can see
23 that that's that 1.12 CFS decrease from 3.82 down to 2.7; that
24 it results in a flow reduction in the Muddy River Springs -- I

Page 112

1 mean, from the discharge from the Muddy River Springs area
2 from 15 CFS.
3 And that's read by looking at the 50.2 down to
4 the approximately 35 CFS. So that's the data that's presented
5 in -- in their report. And as discussed in that report, then
6 that 15 CFS drop would be a decrease of approximately
7 10,000-acre-feet.
8 The numbers that they present to get to the 4,000
9 to 6,000 is -- is basically addressing the amount of flow
10 decrease when Warm Springs West would decrease from 3.82 down
11 to 3.2.
12 So I think it's important to understand that the
13 analysis that they presented for the 4,000 to 6,000 range is
14 based on this linear relationship. If you were to continue
15 this linear relationship down to the right, you can see that
16 when there's more and more flow decrease, that there's a
17 direct decrease in the flow at the Muddy River.
18 And -- and that's the part that I think is -- is
19 flawed in their analysis in the sense that it doesn't account
20 for a non-linear relationship of contributions that would
21 occur from the alluvial aquifer.
22 Q. And is there contributions from the alluvial
23 aquifer to the Muddy River?
24 A. Yes.

Page 113

1 Q. Accounted for by SNWA?
2 A. Not in this analysis, no.
3 Q. With respect to SNWA's report that CSI did not
4 ignore groundwater levels in CSV production wells, do you
5 recall that area of the report?
6 A. Yes, I do.
7 Q. Do you agree with that?
8 A. No, I do not.
9 Q. I'm referring to Rebuttal Slide Number 10.
10 Would you please explain.
11 A. So there's a statement in the report that the
12 hydrographs of the three CSI wells and CSV-1 exhibit the same
13 shape and general decline occurring during the two-year
14 aquifer test and the responsive MX-5 shutdown and restart in
15 the middle of the stake. And so they're staking, it was
16 unmistakable, and we ignored that.
17 And, you know, my response to that is, no, we did
18 not ignore that but, in fact, that SNWA ignored the specific
19 temporal distribution of pumping from the different CSI wells.
20 So, in fact, when you look at those wells, you
21 have to take into account the pumping that's occurring on the
22 west side and the pumping that's occurring on the east side of
23 that block in order to understand why those production wells
24 support -- support our analysis.

Page 114

1 CSI-1, -3, and -4, those -- those wells that are
2 located on the west side, they do behave differently than
3 those wells that are located on the east. I'm going to show
4 you that in a second.
5 But also, I wanted to point out that, you know,
6 we're not alone in this. Others have also identified that
7 there is a lack of information or lack of data that really
8 supports any type of hydraulic connection between -- between
9 the west and the east side.
10 But if you look on 11, on Slide 11 -- you know,
11 the purpose of Slide 11, again, is to remind everybody where
12 all these wells are.
13 So we look at the carbonate production wells, and
14 those are in blue: CSI-4, CSI- -- CSI-3. I'm kind of going
15 down and CSI-3, CSI-1, CSI- -- and MX- -- MX-5. So we look at
16 those wells and we also look at those monitoring wells which
17 is UMVM-1, which is the upper part of the Muddy River Springs
18 area. CSV-1 or -- and also CSV-6 -- no, I'm sorry, MX-4 and
19 CSV-6. Those are the monitoring wells that I want to show
20 you in the next slide.
21 So when we look at Slide 12 --
22 Q. Let's refer to these as rebuttal slides so
23 they're different than the ones that you previously -- so this
24 is Rebuttal Slide Number 12, please.

Page 115

1 A. Right.
2 Q. Go ahead and explain.
3 A. So Rebuttal Slide Number 12 shows you how we
4 viewed those similarities. You can see -- again, I don't want
5 to -- and, you know, so there's some of this information on
6 this graph.
7 But as you look at it, the bars on the bottom are
8 individual pumping in the Coyote Springs. Gray is pumping
9 from CSI-1. Yellow is pumping from CSI-2. Blue is pumping
10 from CSI-4, and green is pumping from CSI-5. And -- and then
11 kind of orange-pink is CSI-3.
12 So we can see -- and I believe that we've all
13 looked at this hydrograph many times today. And what the --
14 what we -- what we're presenting here is the fact that MX-4,
15 CSV-6, and UMVM-1 are all responding identically.
16 What I've done here for presentation purposes is
17 I want to make sure that we're not showing the true elevation.
18 It's important for everybody to understand what these are is
19 these are hydrographs that are all shown on -- based on the
20 same scale, but they've been offset so that we can show you
21 exactly how they compare.
22 It's just an important -- the right axis -- it's
23 important to understand that we're not trying to say that
24 these are the actual evaluations but rather, they're relative

Page 116

1 change in elevations from one to another.
2 So I think, you know, this really shows that.
3 And then we go ahead and we look at CSI-2, so when we throw on
4 the available data from CSI-2, we can see that it too also
5 behaves quite similarly to CSI-1 -- I mean MX-4, CSV-1,
6 CSV-6 and UMVM-1.
7 It's the same things that we talked about today.
8 It's -- it's the recharge in '05 event that you see the rise
9 in groundwater levels. It's a decline over the -- over the
10 long period down to 2013 at the end of the test.
11 It's a -- you know, it's a slight pump up in 2010
12 due to the recharge event in 2010 and then flat conditions
13 kind of over the last four or five years. But what's really
14 important that we look at is -- is also that -- that response
15 that occurred in 2011.
16 So -- so, you know, the data, I think, are pretty
17 remarkable that, you know, we have these observation wells and
18 monitoring wells, and we can compare, you know, nearby
19 production wells. They're all -- they're all pretty much
20 behaving the same.
21 And --
22 Q. Can I interrupt because I think we have
23 approximately ten minutes left, and I want to cover some
24 ground with you.

Page 117

1 What you have now displayed is Rebuttal Slide 13;
2 correct, sir?
3 A. Right.
4 Q. And that's slide from which you were just
5 testifying?
6 A. That's correct.
7 Q. And the significance of Rebuttal Slide 14 to this
8 hearing is what, sir?
9 A. The significance is is that the characterization
10 of the other production wells: CSI-1, CSI-3, and CSI-4 are
11 different than what we see when we compare CSI-2, MX-4,
12 CSVM-1, and CSVM-6.
13 Q. Does that reflect the significance of the block
14 that you referred to?
15 A. The block?
16 Q. The fault.
17 A. Oh, the fault. I'm sorry. Yes, it reflects the
18 importance of the structural block that exists between the
19 west and eastern sides of the Coyote Spring Valley.
20 Q. How so?
21 A. Because it works to isolate the hydraulic
22 connection between the two.
23 Again, we go back to this idea that these nominal
24 faults -- not just those along the block, but other normal

Page 118

1 faults that we've identified -- create these preferred flow --
2 flow ways and pathways.
3 And that in a perpendicular direction, we see
4 that not only the faults but also the structural blocks can
5 act as barriers to groundwater flow in a perpendicular
6 direction.
7 Q. Did you analyze the reports submitted to the
8 State Engineer's office by the United States Fish and Wildlife
9 Service?
10 A. Yes, we did.
11 Q. And would you take a look at Rebuttal Slide 15
12 and explain your analysis and findings, please.
13 A. We looked at the Fish and Wildlife report, and,
14 again, we disagreed with the assessment of the amount of
15 groundwater that can be pumped from the Lower White River Flow
16 System.
17 And I think that, you know, a lot of the basis
18 for our disagreement really comes down to the importance of
19 the hydraulic variability that we see in the system and how
20 groundwater levels are driven by that hydraulic variability.
21 Q. With respect to Rebuttal Slide 16, does that show
22 the analysis that you just referred to with respect to FWS's
23 estimate of groundwater availability?
24 A. Yeah. I think it does. And I -- I think one of

Page 119

1 the -- one of the things that we want to point out here is
2 that they identified that steady-state conditions were not
3 reached in EH-4 until late 2015, and spring flow and
4 streamflow were relatively constant.
5 And I apologize for that typo where it says 2017
6 to 2017. It should be 2015 to 2017. So that's -- that's an
7 error I made.
8 Q. In the first bullet point?
9 A. In the first bullet point.
10 Q. Thank you.
11 A. So one of the things that -- that really kind of
12 struck us was that it doesn't really account for local
13 pumping. And so this is, again, you know, what -- what is the
14 impact of local pumping on nearby spring flow and nearby
15 observation wells and how does that get taken into account
16 when you're trying to assess, you know, what -- what the --
17 what the resources are and how those resources react along
18 with that and climatic conditions. I think that's best
19 described in Slide 17.
20 Q. Rebuttal Slide 17, please.
21 A. I'm sorry. Rebuttal Slide 17.
22 And in Rebuttal Slide 17, you can see that, you
23 know, we -- we -- the green bars along the bottom are pumping
24 in carbonate wells in the Muddy River Springs area, and the

Page 120

1 squiggly line on the top with the hydrograph with the annual
2 variability, that's something that we've looked at for the
3 EH-4 before. And then, of course, the straight solid black
4 line is the cumulative departure from mean.
5 But what really struck out from us on this is the
6 fact that from 2013 to 2014, average pumping from those
7 carbonate wells in the Muddy River Springs area is about
8 1442-acre-feet. But when we get to 2015 and 2017, that
9 average pumping has increased to about 2700.
10 So you can see that when you look at the
11 hydrograph, if anything, there's been a slight recovery with
12 increased pumping rate in that, but in that near vicinity of
13 the Muddy River Springs area.
14 But, again, while pumping plays a big role in
15 describing, you know, the characteristics of a hydrograph,
16 it's also the -- the climate that can't be ignored on how that
17 also affects it.
18 Q. This might be a question better suited for one of
19 your colleagues, but was the Series C's analysis reliable in
20 your opinion?
21 A. You know, I -- Miss Jean Moran reviewed the
22 hydrogeologic aspects of both the Theis and the SeriesSEE, so
23 I'm going to defer to her to answer that question.
24 MS. MORAN: The SeriesSEE is a spreadsheet

Page 121

1 adaptation of handling the Theis curve, and it is developed by
2 the USGS. And it calls upon a Fortran code to solve for the
3 distribution of drawdown based on pumping.
4 And I did not do SeriesSEE. I mean, I do
5 numerical modeling and fairly complex models, but I do not do
6 this particular analytical tool.
7 So I did do the simplified Theis equation, as I
8 presented earlier, and I showed that as a cross-check, looking
9 at the SeriesSEE, if you had two wells pumping and their
10 distances and their two-year average pumping that was during
11 that pumping test, what effect would be at roughly VH-4.
12 How the report goes with SeriesSEE, it's an
13 appendix, and it's Appendix A. It is a really -- it's a good
14 analysis of things other than we do not have all of the data
15 to cross-check it.
16 But when I cross-checked it with my very simple
17 model, it showed that it had more influence from a well
18 pumping further away than a well that was closer.
19 So the -- the simple cross-check that I did
20 didn't check out with the SeriesSEE. I have no way of knowing
21 what the -- the -- the assumptions were that were used.
22 Clearly, we probably used different T's and different S's,
23 which were the hydraulic properties. But we would have used
24 the same, and it should have been relatively the same for

Page 122

1 those values.
2 The figure I'm referring to is in the 2013 July
3 report from Fish and Wildlife Service, and it's Page A.4-2.
4 What it shows is Arrow Canyon's contribution to EH-4's
5 drawdown would have been 0.7, and then MX-5 was 1.2.
6 So that's opposite just doing a cross-check. So
7 though I don't know SeriesSEE inside out, it's still the
8 simplified Theis equation, and to my knowledge, it didn't have
9 any recharge in it and it didn't have any boundaries in it
10 that could have been handled with image wells.
11 To my knowledge, that wasn't done. So I don't
12 have the full answer, but it put in question how this works.
13 Q. Would you please put up Rebuttal Slide Number 19
14 and let's turn our attention to the National Park Service.
15 Mr. Reich, did you analyze their initial report
16 and find flaws in it?
17 ANSWERS BY MR. REICH:
18 A. Yeah, I reviewed the National Park Service
19 report, and one of the comments that they make in their report
20 is that gravity data should not be ignored when defining the
21 geometry of some of these basins.
22 Q. Do you agree with their suggestion that there's
23 less than 14,500-acre-feet per year available for the
24 administrative unit?

Page 123

1 A. Yes, I disagree with that value because, again,
2 it's these hydraulic barriers and flow paths that, you know,
3 that support pumping in different parts of the Lower White
4 River Flow System, as I've shown in my previous water budget,
5 upwards of 30,000-acre-feet per year.
6 HEARING OFFICER FAIRBANK: Mr. Robison, just to
7 let you know that you're at your three hours if you wanted to
8 reserve your 30 minutes for rebuttal.
9 MR. ROBISON: I'm going to intrude on the
10 redirect time for three minutes or less.
11 HEARING OFFICER FAIRBANK: Sounds good.
12 MR. ROBISON: Mr. Reich, would you please turn
13 your attention to Rebuttal Slide 25 and tell us what your
14 analysis is concerning the report of the Moapa Valley Water
15 District.
16 ANSWERS BY MR. REICH:
17 A. I'm sorry. We reviewed the -- the Moapa Valley
18 Water District report. And for the most part, what we found
19 was that we disagreed that the carbonate aquifer is in
20 somewhat of a steady-state condition.
21 So if you turn to Slide -- Rebuttal Slide 26,
22 they're stating that the aquifer is in a somewhat steady-state
23 condition, and while they don't specify an amount of
24 groundwater that may be pumped, they do state that, you know,

Page 124

1 based on the -- Order 1303 that the current amount of pumping
2 corresponds to a period of time in which spring flows have
3 remained relatively constant and have not demonstrated a
4 continuing decline.
5 So, again, I wanted to stress the fact that
6 carbonate -- carbonate levels and spring flow in the Muddy
7 River system are driven by climatic conditions -- we've seen
8 that signature throughout today -- and that structural
9 features and heterogeneities also affect this -- affect
10 understanding and decisions that can be made regarding whether
11 we're in -- whether we're in steady-state conditions.
12 And also, importantly, we have seen similar rates
13 of decline in -- in spring flow at the -- at the Muddy River
14 Springs.
15 I think it's -- if you go back and you look at
16 the record, you can see that, you know, following wet periods
17 in '99 and 2000, we saw rates of decline. While -- while the
18 minimum levels did not reach what we've seen, certainly the
19 rates themselves, we do see those rates of decline.
20 So understanding that hydrologic condition with
21 respect to how pumping -- pumping and recharge affect spring
22 flow -- and spring flow, I think, is really fundamental to
23 understanding the system.
24 Q. Mr. Reich, we have had an estimate of 4- to

Page 125

1 6,000-acre-feet per year given by the Water Authority, 9318 by
2 Fish and Wildlife, something less than 14,5 from the Park
3 Service, and year similar, estimating that up to
4 30,000-acre-feet of availability for groundwater pumping in
5 the administrative unit.
6 Please explain why these -- your number is a
7 better number to be used by the State Engineer's office?
8 A. Well, I believe we brought forward today a set of
9 data and information that the State Engineer can use to assess
10 and develop his own conceptual model and water budget.
11 So what we've done today is we've provided that
12 information that provides a complete picture. I believe that
13 others have not provided that understanding of how the system
14 works, where groundwater flows, how -- what it affects.
15 You know, and that's something different, and I
16 think -- you know, we hope that the State Engineer will
17 consider the data that we presented today and understand why
18 we think that that information can be used to assess a pumping
19 number that can be used for the area.
20 MR. ROBISON: Thank you, sir.
21 We'll submit this part of our case.
22 HEARING OFFICER FAIRBANK: Thank you. So we have
23 about 15 minutes until we're going to go ahead and break for
24 lunch. So if we want to go ahead and we can start -- the

Page 126

1 first participant for asking questions of the panel for
2 cross-examination purposes is the United States Fish and
3 Wildlife Service.
4 And so if they have any questions, I'm going to
5 go ahead and give you guys 14 minutes to go ahead and make
6 that presentation.
7 And before you start asking questions, if you'll
8 just go ahead and state your name and make an appearance for
9 the record. And just for the purposes of making appearances
10 today, I'm going to ask each of the attorneys to do so when
11 they speak.
12 We're also going to go ahead and, for purposes of
13 identifying all the parties that are here, mark as an exhibit
14 the sign-in sheet. So if there's participants who have not
15 signed in on the sign-in sheet, please make sure you do so
16 before the close of business today.
17 Go ahead.
18 MR. MILLER: Okay. My name is Luke Miller. I'm
19 with the Department of the Interior's Office of the Solicitor
20 on behalf of the Fish and Wildlife service.
21 SPEAKER FROM THE AUDIENCE: Madam Chair, are you
22 going to swear the witness?
23 HEARING OFFICER FAIRBANK: I'm sorry?
24 SPEAKER FROM THE AUDIENCE: Are you going to

Page 127

1 swear in the witness?
2 HEARING OFFICER FAIRBANK: He's not a witness.
3 He's an attorney asking questions.
4 SPEAKER FROM THE AUDIENCE: Okay.
5 CROSS-EXAMINATION
6 MR. MILLER: Thank you.
7 I think we were trying to prioritize some of our
8 questions here, so I want to skip to the chase here.
9 I believe it's Ms. Moran did the SeriesSEE
10 analysis?
11 MS. MORAN: I did not do the SeriesSEE analysis.
12 I did a Theis equation checking the SeriesSEE analysis.
13 BY MR. MILLER:
14 Q. Okay. Well, in relation to the SeriesSEE
15 analysis by the Fish and Wildlife Service?
16 A. Yes. That's correct.
17 Q. Okay. Would you agree or are you aware that the
18 data interpreted using SeriesSEE Curve-fitting by DOI in 2013
19 like monthly pumping at major wells within the -- within the
20 study area, groundwater level data collected and reported in
21 that study area is available on the Nevada Division of Water
22 Resources' online and publicly accessible website?
23 A. Yes. I'm aware of that.
24 Q. Would you also agree that the -- the USGS

Page 128

1 SeriesSEE Excel add-in code is a public domain that has been
2 publicly available from I believe it's 2012 to present on the
3 USGS publications warehouse?
4 A. That's correct. 2012.
5 Q. Okay. And it sounded like you had familiarized
6 yourself somewhat with the SeriesSEE instructions, I guess we
7 want to call it, from the -- let's see if I found it here.
8 USGS Techniques and Methods, Halford, et al?
9 A. That's correct. It's available from the website.
10 I downloaded it.
11 Q. Okay. Well, do you agree with the USGS authors
12 of that SeriesSEE regarding their characterization of the
13 purpose methodology employed and intended application of
14 SeriesSEE?
15 A. I -- I guess I'd like you to restate it.
16 Q. Yes. How about this.
17 A. Okay.
18 Q. Would you agree that it's essentially a
19 Curve-fitting tool as opposed to a distributed groundwater
20 flow model?
21 A. That's correct.
22 Q. Okay. Would you also agree with the authors of
23 SeriesSEE that the parameters of, say, the Theis transforms as
24 applied in that SeriesSEE Curve-fitting analysis are neither

Page 129

1 intended to represent or serve as estimates of aquifer
2 parameters like such as transmissivity and storage
3 coefficients?
4 A. Well, I guess I'm not aware. Could you explain
5 what your statement means.
6 Q. Well, let's see here. Probably not, but give me
7 a second.
8 A. It seems a little twisted. If you state it
9 again, maybe I can --
10 Q. Okay.
11 A. -- figure it out.
12 Q. Well, we're trying to see if you agree with what
13 the authors of the SeriesSEE outlined as the use of parameters
14 or Theis transforms as applied in SeriesSEE in a Curve-fitting
15 analysis.
16 Are they neither intended to represent or serve
17 as estimates aquifer parameters?
18 A. They're not aquifer parameters. It's a
19 Curve-fitting. Yeah, it's still a little -- it sort of
20 misses.
21 Q. Okay. Well, I might just move on from that one.
22 A. Okay.
23 Q. So it sounds like you are knowledgeable about the
24 DOI's 2013 application of SeriesSEE to the analysis of the

Page 130

1 Order 1169 pumping tests?
2 A. Yes, I am.
3 Q. And the DOI's 2013 interpretation of those
4 reports?
5 A. Yes. They presented a series of graphs. It
6 was -- I could follow what they said, yes.
7 Q. And would you say that your approach to your
8 effort -- I believe you said it was a Theis -- central Theis?
9 A. Non-equilibrium well equation.
10 Q. And that was an effort to evaluate the SeriesSEE
11 analysis?
12 A. It was sort of independent. It was independent.
13 But it did come from having the 2013 report available and that
14 they did use the Theis equation.
15 And though I typically do numerical flow models
16 that handle a lot more pieces in it and this is more
17 analytical, I decided to do something similar but not -- it's
18 not identical because it doesn't move those curves. But it
19 does solve for what would be a drawdown.
20 And it helped while I was reviewing a report to
21 see the relative impacts from the different pumping. I
22 suppose I should have showed something, but it's in your
23 report.
24 What's nice about these graphs -- I mean, I could

Page 131

1 do to solve this other than I didn't agree with the results.
2 And I -- it shows the different pumping in the basin and then
3 it -- it puts the relative impact to that particular
4 observation well from those wells.
5 So it's pretty straightforward that way other
6 than I didn't know what the assumptions were that went in.
7 Because some kind of knob is in there that has to be adjusted
8 to weight the different wells, and that -- it got weighted
9 such that a well closer that, in my estimation, should have
10 had more impact had less.
11 It just sort of raised a red flag that I can't
12 resolve without more background data here.
13 Q. So did I understand earlier when you were
14 testifying that it's not necessarily that the Fish and
15 Wildlife Service's SeriesSEE analysis is completely or
16 necessarily unreliable but that you're potentially missing
17 some data in your perspective and to reproduce it?
18 A. That's correct with the caveat that just a simple
19 cross-check analytical model should be able to be
20 cross-checked. So do numerical models. You want to have a
21 cross-check in them so they don't become a black box.
22 And when I did my analysis, though simple, it
23 should have ran as a cross-check to it -- relative
24 cross-check, not absolute. And, yes, it -- it is a SeriesSEE.

Page 132

1 I have no problem with the program. I just don't have the
2 background information. So, yes, maybe background information
3 would resolve that, but I don't know.
4 Q. Okay.
5 MR. MILLER: No further questions.
6 HEARING OFFICER FAIRBANK: Okay. Thank you.
7 Next will be National Park Service.
8 CROSS-EXAMINATION
9 MS. GLASGOW: Good morning. I'm Karen Glasgow
10 with the Office of the Solicitor, Department of Interior, and
11 I represent the National Park Service. Hi. I just have a
12 couple of questions. Just sort of making sure I understood
13 what you testified to earlier.
14 BY MS. GLASGOW:
15 Q. So I understood that you testified that you
16 believe an appropriate estimate for recharge to the Coyote
17 Spring Valley from the Sheep Range was 5,280-acre-feet per
18 year?
19 ANSWERS BY MR. REICH:
20 A. Yes. That's correct.
21 Q. Okay. And is it not true, then, at 520-acre-feet
22 per year that that's greater than the mean value of
23 34,348-acre-feet per year that is contained in Appendix C for
24 the recharge to -- why do I want to not say that right? -- to

Page 133

1 Coyote Spring Valley from the Sheep Range?
2 A. Yeah, I can -- I'll be happy to answer that. I
3 think it's a good point that you look at. So what we did --
4 and the appendix that you're referring to is the literature
5 review that we did for other -- other reports that were out
6 there.
7 And as Ms. Palmer mentioned, there were more than
8 12 different reports that we looked at to come up with that --
9 with that average, and there is different techniques used for
10 each one of those.
11 What we did was we provided that information, so
12 I think people can ask a great question like that. But we --
13 we developed an independent analysis, and so our analysis was
14 independent. And while it might be greater, I don't know. I
15 am -- I guess they are responsive to yes, it's greater than
16 the average, yes.
17 Q. Thank you.
18 You talked about barriers from both natural
19 faults that were mapped by CSANT and structural blocks that
20 were mapped by CSANT that coincide with geological mapping
21 from I think you quoted Rowley.
22 A. Yes.
23 Q. Okay. How permeable is this structural block?
24 A. Oh, so how -- we -- we -- we assume that the

Page 134

1 structural block is not permeable.
2 Q. Is it true that MX-5 actually is within the
3 structural block?
4 A. It's drilled right on the edge of the -- in the
5 structural block, which I would consider to be in the damage
6 zone of that structural block.
7 Q. Lastly, so you talked about the SNWA 2000 -- I
8 think --7 report?
9 A. Correct.
10 Q. Okay. And in that report, SNWA states that
11 there's 4,190-acre-feet in a tributary that contributes to the
12 Lower White River Flow System and to the local recharge;
13 correct?
14 A. I would have to look to review which tributary is
15 that.
16 Q. Kane Springs.
17 A. Kane Springs. Yeah, I can look. It will take me
18 two seconds --
19 Q. Okay.
20 A. -- and I can confirm that.
21 Yes. We've summarized that in Table 9 as
22 4,200-acre-feet per year from Kane Springs based on the 2007
23 report.
24 Q. But -- okay. So -- so yes, the report does.

Page 135

1 Do you agree with that, I guess, is a better
2 question? Do you agree that the Kane Springs contributes any
3 acre feet of whatever amount to the local recharge?
4 A. You know, so I think -- could you rephrase the
5 sentence -- or question because I think there's two questions
6 there. I'm not sure which --
7 Q. Well, my question was: The report says that Kane
8 Springs contributes 4,200 -- I'm rounding up, as you did --
9 acre feet of water to the tributaries to the Lower Water --
10 Lower White River Flow System and contributes to the local
11 recharge; correct?
12 A. That's correct.
13 Q. Okay. But now -- and so -- and so my question, I
14 guess, is do you agree with that statement, that the Kane
15 Springs contributes acre feet to this -- to the Lower White
16 River Flow System and to recharge?
17 A. Yes, I agree that the Kane Springs Valley
18 contributes regional recharge to the Lower White River Flow
19 System similar to the other tributary basins that I discussed
20 in my testimony.
21 Q. Okay. And so then I guess my question is:
22 How -- you indicated on page 55 of your July 3rd report that
23 you did not believe that the Kane Springs should be included
24 in the Lower White River Flow System because of geologic

Page 136

1 characteristics.
2 A. Correct.
3 Q. Okay. So tell me -- explain how those two go
4 together. How is it if it's contributing to this recharge
5 that we're talking about, why is it not -- why is it, in your
6 opinion, not to be included?
7 A. Right. And the best way to describe that is if
8 we go back to my budget and I show that, you know, there is
9 inflow from Pahrnagat Wash and there's inflow from Delamar
10 and there's inflow from Kane and there's inflow from Lower
11 White River Flow System, you know, we've stated before and I
12 stated during our direct testimony that we agree with the
13 State Engineer's boundary for 1303, but we also state that
14 these other resources need to be accounted for.
15 So -- so we can -- we can isolate and manage the
16 Lower White River Flow System as per Order 1303, but in order
17 to understand how those resources occur and move through that
18 system, then it's important to understand what that regional
19 flow into the aquifer is.
20 So -- so I treat Kane Springs the same way I
21 treat Delamar and Pahrnagat and the other basins, and that is
22 as a source of regional groundwater inflow into -- into the
23 basin.
24 Q. But ones that should not be included as part of

Page 137

1 the flow system that we're talking about here?
2 A. It -- the answer --
3 Q. For management.
4 MS. GLASGOW: Okay. Thank you very much.
5 THE WITNESS: Thank you.
6 HEARING OFFICER FAIRBANK: All right. It is
7 noon, so we will go ahead and take a break for lunch.
8 And then we get back, next up for
9 cross-examination will be the Moapa Band of Paiute Tribe, and
10 we'll continue on down the list.
11 Thank you very much, and we will be back and
12 start promptly at 1:00 p.m.
13 (Lunch recess at 11:59 a.m.)
14
15
16
17
18
19
20
21
22
23
24

Page 138

1 CARSON CITY, NEVADA, MONDAY, SEPTEMBER 23, 2019, P.M. SESSION
2 -o0o-
3
4 HEARING OFFICER FAIRBANK: And I -- just as a
5 real quick preliminary matter, just to address some questions
6 and concerns that had been raised via an objection with
7 regards to the introduction of the PowerPoints or the use of
8 the PowerPoints, just to go ahead and clarify to make sure
9 that the record and the parties are abundantly clear that the
10 PowerPoints will be maintained in the hearing -- in the
11 hearing record as demonstrative exhibits. But they are not
12 the substitute for the reports or the exhibits submitted by
13 the parties timely.
14 So just as -- they'll be maintained in the
15 hearing file, but they are not going to be relied upon or, you
16 know, for the purposes and substitute that for the reports in
17 evidence that was submitted by the parties pursuant to the
18 scheduling order.
19 With that being said, we'll go ahead and move on
20 and next up will be the Moapa Band of Paiute Indians.
21 MS. BALDWIN: I am Beth Baldwin for the Moapa
22 Band of Paiute Indians, and with me is Debbie Leonard, local
23 counsel. I just have a few questions.
24

Page 139

1 CROSS-EXAMINATION
2 BY MS. BALDWIN:
3 Q. Mr. Carlson, you testified that fault zones can
4 be narrow and may not correspond to surface features; is that
5 correct?
6 A. Yes, that's true.
7 Q. And, Mr. Reich, is it accurate to say that known
8 faults depicted on geologic maps may be located differently
9 than assumed?
10 ANSWERS BY MR. REICH:
11 A. Yes, it is. We used geophysics to redirect where
12 those faults were going to be located.
13 Q. And the C -- I'm going to get this wrong. The
14 CSAMT survey was only in Coyote Springs Valley; correct?
15 A. Yes, it was only in Coyote and -- yes, Coyote
16 Springs Valley. I'd have to overlay it. They're -- yes, it
17 was. I was concerned -- the reason I hesitated was because it
18 might have been in the northern part of Muddy River Springs
19 area, but no, it was all in Coyote Springs Valley.
20 Q. Would -- could undetected or mislocated faults
21 exist elsewhere in the Lower White River Flow System?
22 A. Yes.
23 Q. And would you agree that accurate description of
24 groundwater flow depends upon knowing fault locations?

Page 140

1 A. Yes.
2 Q. And just to confirm, the panel concluded that the
3 carbonate aquifer is heterogenous throughout its entire
4 extent?
5 A. We identified the heterogenotes in Coyote Spring
6 Valley Muddy River Spring area based on the work that we
7 presented today. My -- we did not present evidence today
8 about heterogenotes outside of that area, but based on review
9 of Rowley's map and my review of reports by others, there are
10 both thrust faults and normal faults that exist throughout the
11 rest of the Lower White River Flow System.
12 MS. BALDWIN: Thank you. That's all.
13 HEARING OFFICER FAIRBANK: Thank you. Next will
14 be Southern Nevada Water Authority and Las Vegas Valley Water
15 District.
16 MR. TAGGART: Is it possible to have the
17 PowerPoint up on the screen? I'm going to have a few
18 questions for him.
19 MR. HERREMA: Which PowerPoint?
20 MR. TAGGART: Both. Starting though with the --
21 HEARING OFFICER FAIRBANK: Mr. Taggart, will you
22 make sure your mic is on?
23 MR. TAGGART: Yes. If it's possible, I may have
24 some questions about each one of the PowerPoints.

Page 141

1 HEARING OFFICER FAIRBANK: Okay. Looks like it's
2 up.
3 MR. TAGGART: Thank you. I want to make sure we
4 have a clock going.
5 HEARING OFFICER FAIRBANK: I have one, too, so
6 don't worry about that.
7 MR. TAGGART: All right.
8 CROSS-EXAMINATION
9 BY MR. TAGGART:
10 Q. Good afternoon, panel. My name is Paul Taggart.
11 I represent the Southern Nevada Water Authority and the
12 Las Vegas Valley Water District, and I have a few questions
13 for you.
14 First, to Mr. Reich, from your testimony, do you
15 agree that alluvial pumping in the Muddy River Springs area
16 affects the Muddy River?
17 ANSWERS BY MR. REICH:
18 A. Yes.
19 Q. Okay. And I think in your report, you indicated
20 immediately it affects the Muddy River; right?
21 A. I'd have to get the exact wording, but my intent
22 would be that immediately, yes.
23 Q. Okay. Would it be fair to characterize that as a
24 one-to-one effect from pumping versus capture of river flow at

Page 142

1 alluvial pumping in the Muddy River Springs area?
2 A. I'm sorry. Could you repeat that because -- is
3 it the -- just one section at a time. I'm sorry.
4 Q. That's fine. I'll move on.
5 A. And also -- no, I --
6 Q. I have very short time, so I'll just move on.
7 Do you also agree that carbonate pumping in the
8 Muddy River Springs area affects the Muddy River Springs?
9 A. Yes, I do.
10 Q. Okay. And you also agree that pumping in the
11 Coyote Spring Valley at MX-5 does impact the Muddy River
12 Springs; is that correct?
13 A. Yes, I do.
14 Q. Okay. Now, I have a couple questions for you
15 from Figure 10 in your report. And maybe I'll just use your
16 PowerPoint, but I didn't see this one.
17 A. Oh, my report. I'm sorry.
18 Q. Yes, Figure 10 is on page 26 of your report?
19 A. Yes, I'm looking at it now.
20 Q. Great. So is it fair to say that this figure
21 represents your modification of the Rowley geologic
22 understanding from 2017?
23 A. Yes, it's a close proximity.
24 Q. So let's go through. What changes did you make

Page 143

1 to the geologic map from Rowley and that are reflected on
2 this? And let me -- what I'll ask you first is, there's a
3 dotted line that runs along the highway. I'm going to refer
4 to that as the Highway Fault. Do you see the one I'm talking
5 about?
6 A. Are you suggesting there's CSM-5? CSM-5 -- or
7 no, CSI-4?
8 Q. Well, there's a Highway 93. Do you see that?
9 A. Oh, no, I'm just saying there's two parallel
10 dotted lines along Highway 93. There's one on the left and
11 one on the right.
12 Q. Okay. So you see the Highway 93 there?
13 A. Yes.
14 Q. And you see where CSI-4 is located right on the
15 highway?
16 A. Yep.
17 Q. And just to the right of that is a dashed line
18 that runs parallel to the highway. Do you see that?
19 A. Correct.
20 Q. And I'm going to be referring to that as the
21 Highway Fault. And is that new in your analysis to any prior
22 geologic understanding of the area?
23 A. That is a fault that Mr. Carlson's identified
24 earlier in his testimony that we would use Rowley's fault and

Page 144

1 move that to the west.
2 Q. Okay. So is that fault located in any other
3 geologic literature prior to your report?
4 A. Yeah, I believe that's -- it's located and I have
5 a -- located in Rowley, that we would take that and move it to
6 the west.
7 Q. Okay. Now, what other modifications have you
8 made to the Rowley map?
9 A. The boundary fault that's running through CSI-3
10 and just to the right of CSI-1, that was the fault that would
11 be on the west side of the structural block.
12 Q. Okay. Now, I have a question for Mr. Carlson.
13 So, Mr. Carlson, you see the -- good afternoon,
14 sir.
15 ANSWERS BY MR. CARLSON:
16 A. Yes, hello.
17 Q. Do you see the figure that we're talking about?
18 A. Yes.
19 Q. Okay. And do you see where the A-A prime
20 cross-section is located on that map?
21 A. Right.
22 Q. Okay. Now, I want to ask you about that
23 cross-section. And in your PowerPoint at slide number 17,
24 could we put that up, please?

Page 145

1 Okay. Now, you see we're on Figure 10 from the
2 CSI number one, the expert report from Mr. Reich and others,
3 do you see where the A-A prime cross-section crosses this
4 Highway Fault we've been talking about?
5 A. Right.
6 Q. Do you see that?
7 A. (Nodded head.)
8 Q. Okay. Now, I want to read from your report,
9 which is an appendix to CSI number two. Are you familiar with
10 that document?
11 A. Yes.
12 Q. All right. And on page 7 of that document, it
13 says -- it describes some man-made culture, some noise in that
14 area on the west end of that cross-section. And when I'm
15 looking up at the screen, I'm asking you specifically about
16 the area between site 1500 and site 3300. Do you see that?
17 A. Yes.
18 Q. And is that -- that's the area Mr. Reich is
19 relying upon for the location of the Highway Fault; correct?
20 A. No. The Highway Fault is just to the west of
21 that. That -- the label on there, that's the zone of cultural
22 effects I mentioned, man-made conductive features.
23 They were doing some construction of some sort
24 there, but there's man-made conductive features, pipelines, a

Page 146

1 lot of electrical noise. So that area there, I can't quite
2 see the label, but that area you just named is the cultural
3 effects.
4 Q. Okay. So in your report, you state "the very
5 unusual resistivity data near the west end of the line, line
6 A, and the upper thousand feet of this section centered at
7 station 2100 is likely the result of noise and is not likely a
8 valid geologic structure," right?
9 A. Right.
10 Q. And east of approximately station 3300, the data
11 appear reasonable, right?
12 A. Right.
13 Q. So isn't it -- is it fair to say that the
14 resistivity data west of the 3300 section should not be
15 considered because of the noise or the data?
16 A. No. I say that the infrastructure that's being
17 built and causing the noise is in the vicinity of stations
18 2,000 to 3,000, approximately 2,000, depending on exactly
19 where the -- where you land on the GPS. West of approximately
20 station 2,000 appears to be valid data.
21 Q. Okay. Even though, in your report, it says east
22 of approximately 3300, the data appear reasonable?
23 A. Right.
24 Q. Now you're saying the data east of 2,000 appear

Page 147

1 reasonable?
2 A. No, west of 2,000. The data in between the
3 cultural noisy things that were causing us problems and to the
4 west end of the line, that was good data.
5 Q. Okay.
6 A. From approximately 2,000 to 3,000 roughly is
7 noisy data that we consider invalid.
8 Q. All right. Now, Mr. Carlson, are you confident
9 that 5,000-acre-feet of water can be pumped to the west side
10 of the Highway Fault based on your resistivity data alone
11 without causing impacts to the Muddy River or the Muddy River
12 Springs?
13 A. I'm not a hydrologist, so I cannot answer that.
14 I can answer questions about the data, the resistivity, and
15 the measurements made. But I'm not a hydrologist, so I don't
16 know what can be pumped.
17 Q. But in -- given your expertise, do you consider
18 the resistivity data, itself, and alone to be sufficient to
19 make a conclusion I just asked you?
20 A. No, I can't draw that conclusion myself, A,
21 because I'm not a hydrologist, and B, because we have two
22 lines of data that show a fault. But, hydrologically, what's
23 happening from one side to the other is for the geologists and
24 the hydrogeologists to work out.

Page 148

1 Q. Okay. Now, Mr. Reich, back to Exhibit 10 -- I'm
2 sorry, Figure 10 from your report, so the Highway Fault I
3 asked about, that was moved and modified from where Rowley had
4 it; is that correct?
5 ANSWERS BY MR. REICH:
6 A. That's correct.
7 Q. Any other changes based upon your analysis to
8 what Rowley found in 2011?
9 A. Can I pull Rowley out real quick and I'll tell
10 you?
11 Q. Well, I don't really have time for that. So --
12 A. Yeah, that was the major change, yes.
13 Q. Okay. I want to ask you about the water budget
14 analysis that you did. Do you know how much water the State
15 Engineer indicated in ruling 6255?
16 And first of all, are you familiar with ruling
17 6255 that established the joint hydrologic area for
18 considering pending applications for groundwater rights?
19 A. Yes, I'm familiar with it.
20 Q. And are you -- do you know how much water the
21 State Engineer indicated was available as perennial yield in
22 the Lower White River Flow System in that order?
23 A. Available for perennial yield? I'd have to --
24 I'd have to go back and review the order. My understanding

Page 149

1 was that the order was looking at additional water rights
2 applications for appropriation and that the order decided that
3 there was none available.
4 Q. All right. Let me ask you to assume for the
5 purpose of my question that he indicated that 50,000-acre-feet
6 is the perennial yield available in the Lower White River Flow
7 System. Do you know how much of that perennial yield is
8 allocated to the Muddy River itself?
9 How many acre feet of perennial yield to the
10 Lower White River Flow System should be reserved for the flow
11 of the Muddy River?
12 A. Based on what was stated in 6255?
13 Q. Yes.
14 A. No, I do not know with 6255. I would have to go
15 back and review that document.
16 Q. Okay. Would you disagree that 37,000-acre-feet
17 was the predevelopment flow of the Muddy River on average?
18 A. No, I would not disagree with that.
19 Q. So if those numbers are correct and the State
20 Engineer indicated that 50,000-acre-feet was the perennial
21 yield and 37,000-acre-feet needed to be reserved for the
22 river, that only would leave 13,000-acre-feet of perennial
23 yield for the Lower White River Flow System, right?
24 A. Yes.

Page 150

1 Q. Okay. And your opinion is there's
2 30,000-acre-feet of perennial yield in the Lower White River
3 Flow System, right?
4 A. Yes.
5 Q. Okay. And that calculation is based, in part, on
6 your calculation of recharge; right?
7 A. Yes.
8 Q. You have a water budget that uses recharge as one
9 part of the equation to balance for the water budget, right?
10 A. Yes.
11 Q. And you calculate recharge using precipitation
12 data from PRISM and the Maxi Eakin coefficients; is that
13 correct?
14 A. No, let's clarify this because what we -- we used
15 estimates from SNWA on the entire Lower White River Flow
16 System for the available water that's available from
17 sustainable yield in the Lower White River Flow System.
18 When we changed our methodology to look to see
19 what was available in Coyote Springs Valley, we then performed
20 our own recharge analysis. So only in Coyote Springs Valley
21 did we identify the 5280 of local recharge from sheep ranch.
22 In our analysis --
23 Q. I understand, sir. So -- and I'm sorry if I
24 asked the question inaccurately. I just want to ask about the

Page 151

1 recharge that you calculated in Coyote Spring Valley?
2 A. Yes.
3 Q. Okay. So for that recharge, you used the PRISM
4 data set for precipitation and you used the Maxi Eakin
5 coefficients to generate a recharge value; is that correct?
6 A. Ms. Palmer can respond to that question.
7 Q. Go ahead.
8 ANSWERS BY MS. PALMER:
9 A. No, we looked at four different empirical
10 recharge models. We did do the analysis with the Maxi Eakin
11 method, but those have been shown to not be valid for use with
12 the more modern precipitation data sets. They are married to
13 the Hardman precipitation map, which is based on older data.
14 So our analysis is based on two citations, which
15 are in our July 3rd report that come from one from the USGS
16 and one from -- sorry, the other reference is XD -- we have
17 those citations.
18 Q. Well, then do you have an independent calculation
19 of recharge in this analysis?
20 A. Yeah, it's --
21 MR. REICH: Recharge from the sheep range.
22 Q. Yes, recharge in the sheep range. Do you have an
23 independent calculation of that value in this report?
24 A. Yes.

Page 152

1 Q. And what precipitation data did you use?
2 A. The PRISM precipitation data, which is based on
3 1981 to 2010 data.
4 Q. And what coefficients did you use?
5 A. I'd have to look in the report to tell you that.
6 HEARING OFFICER FAIRBANK: Mr. Taggart, your time
7 is up. If there's time remaining at the end, we can go ahead
8 and open it back up for further questions.
9 MR. TAGGART: Thank you.
10 HEARING OFFICER FAIRBANK: Next up is Moapa
11 Valley Water District.
12 CROSS-EXAMINATION
13 MR. MORRISON: Good afternoon. I'm Greg Morrison
14 and I represent Moapa Valley Water District. Let me get my
15 timer going.
16 Okay. Just a few questions here for you, a
17 couple of things that I thought might be inconsistencies or
18 maybe I didn't understand in the report.
19 First, I know we've talked about Kane Springs
20 already. I don't think too much needs to be asked about that.
21 But I just wanted to ask, are you aware if there were any
22 measurements taken in Kane Springs Valley pursuant to the 1169
23 pump testing?
24 ANSWERS BY MR. REICH:

Page 153

1 A. Are you specific about groundwater levels, or --
2 Q. Yeah, I'm sorry. I think it's the KSV-1,
3 alternately known as --
4 A. Yeah, actually I saw the water level. We didn't
5 review those as part of our July 3rd report. We saw those
6 water levels. We didn't address it. But I'm saying we
7 reviewed it, we didn't address it in our July 3rd report.
8 Q. Levels were monitored, though, pursuant to the
9 1169 pump testing?
10 A. Yeah, there was -- yes.
11 Q. Okay. Quick question about the Theis analysis, I
12 believe it was Ms. Moran, you completed that?
13 ANSWERS BY MS. MORAN:
14 A. That's correct.
15 Q. Okay. Now, you stated, I believe, that faults
16 affect and/or disturb groundwater flows within a basin?
17 A. They can.
18 Q. Or have the capacity to?
19 A. They have the capacity to, yes.
20 Q. All right. And those faults and/or features,
21 those aren't represented in any Theis analysis; is that
22 accurate?
23 A. Not in the one I did. You have to use image
24 wells to account for them.

Page 154

1 Q. So this Theis analysis, it's a pretty simple tool
2 when you're evaluating complex fragmented groundwater system?
3 A. It -- could you rephrase that? It's -- I think
4 what I said was that it has some very simplifying assumptions
5 to it and it doesn't represent what's happening here. And if
6 you're saying that this is a very fragmented system, and
7 therefore, it shouldn't be applied -- I don't understand your
8 question.
9 Q. I guess what I'm saying is, I believe your expert
10 reports, collectively viewed does say that this system is a
11 very fragmented and complex system. With that being the case,
12 is a Theis analysis not a somewhat limited utility?
13 A. That's correct.
14 Q. Okay. Let's see here. A couple things I wasn't
15 real sure on within your reports. I think this is all for
16 Mr. Reich. I want to ask about the effects on a couple of the
17 wells or at least one of the wells from the 1169 pump testing.
18 Page 49 of your initial report, I think you
19 stated that CSVM-4 did not show response to Coyote Springs
20 Valley carbonate pumping. So that being the case -- and I'm
21 looking at this -- this statement sites Appendix E, but the
22 statement's on page 49.
23 A. So are you referring to the rebuttal report or
24 the --

Page 155

1 Q. I have it in the report.
2 A. I have 49 as a figure.
3 Q. All right. Let me see. I could have left a typo
4 in there.
5 HEARING OFFICER FAIRBANK: Mr. Morrison, is it
6 page 48?
7 MR. MORRISON: Could be. It is, it's page 48 and
8 it is the first full paragraph, first sentence on that CSVM-4,
9 does not show a response to pumping, Muddy River Springs area
10 or eastern Coyote Springs Valley.
11 So I'm looking at -- the data that supports that
12 on page 5 of appendix E. And I'm looking at your hydrograph
13 of CSVM-4, and it looks to me like it reflects about a half a
14 foot of drawdown at CSVM-4 during the 1169 pump testing. Is
15 that accurate?
16 ANSWERS BY MR. REICH:
17 A. Yeah, I just want to make sure that we're looking
18 at the same graph. It's CSVM-4, page 5 of the appendix;
19 correct?
20 Q. Yep.
21 A. Okay. Yeah, and we addressed this issue before
22 and I think that what our -- what we see here is a response to
23 the hydrologic and climatic conditions.
24 Q. Yeah, I understand that your conclusions were

Page 156

1 different. I just want to make sure that you do agree that
2 there was a half a foot of drawdown show in that hydrograph
3 from the course of the 1169 pump testing?
4 A. Okay. Let's see. So basically from 1874.5 to --
5 yeah, a half a foot, maybe even more, but a half a foot.
6 Q. Okay. And there's a steady downward trend
7 throughout the 1169 pump testing?
8 A. There is a trend consistent with -- yes.
9 Q. All right. Now, Coyote Springs pumping began in
10 2005, I believe. And looking at this same hydrograph, I see
11 about a foot of drawdown since CSI began its pumping. Does
12 that look right to you?
13 A. A foot of drawdown since -- so what I -- I'm not
14 quite sure of the time frame that you're referencing. I see
15 that --
16 Q. '05 to the present.
17 A. From '05 to the present? Oh, so over the
18 entire --
19 Q. Since Coyote Springs began.
20 A. So over the entire period of record, yeah, I
21 would agree with you that there would be, yeah, a -- what was
22 the number you stated?
23 Q. About a foot?
24 A. About a foot.

Page 157

1 Q. Give or take?
2 A. I would agree with a foot.
3 Q. Okay. Thank you. I want to ask real quickly
4 about page 32 of your rebuttal report. And while you're
5 looking that up, at page 32, you state that from 2006
6 through 2009, carbonate pumping throughout the Lower White
7 River Flow System averaged about 7,000-acre-feet annually.
8 From 2010 through 2013, carbonate pumping averaged about
9 9,000-acre-feet annually.
10 So that 2,000-acre foot increase, you refer to
11 it, page 32 of your rebuttal report, it does refer to those
12 time frames in that 2,000-acre foot increase?
13 A. 2006 to 2009, range from 6500, averaging 7,000.
14 By 2010 to 2013, range 7500, averaging nine. So you -- what's
15 your question? I'm sorry.
16 Q. Well, I haven't asked a question yet. I was
17 making sure we were on the same page.
18 A. Oh, okay. I'm just getting caught up with you.
19 Q. All right. Great. So I want to talk about
20 Pederson Springs and Pederson East.
21 A. Okay.
22 Q. Your footnote 58 and 59, I believe, is on that
23 same page. You talk about the spring measurements at Pederson
24 Springs and Pederson East. And October 2006, which is the

Page 158

1 start of the time frame we're discussing here, Pederson East
2 flows were about .23 CFS?
3 A. Pederson East.
4 Q. This is in footnote 58.
5 A. Right. Yes.
6 Q. And the Pederson was .24 CFS?
7 A. Correct.
8 Q. All right. So at the end of that time frame,
9 which would be starting in 2006 and ending in 2013,
10 October 2013, Pederson East was flowing at .1 CFS. Is that
11 what your footnote 59 says or it might still be in 58?
12 A. No, you're good. No, you're on the 59. Pederson
13 Springs East spring flow was .1 in October 2013.
14 Q. All right. And Pederson Springs was 0.7 CFS that
15 same time?
16 A. Correct.
17 Q. All right. So you agree, then, that from 2006 to
18 2013, Pederson Springs East flowed -- flows reduced from 0.23
19 CFS to .01 CFS?
20 A. Yes, I do.
21 Q. And the same time frame, Pederson Springs
22 declined from 0.24 to 0.07; is that correct?
23 A. Yes.
24 Q. All right. And would you consider those declines

Page 159

1 in spring flows measurable?
2 A. Yes.
3 Q. Okay. That's all I have for you. Thanks a lot
4 for your time.
5 MR. REICH: Thank you.
6 HEARING OFFICER FAIRBANK: Next will be Lincoln
7 County and Vidler Water Company.
8 CROSS-EXAMINATION
9 BY MS. PETERSON:
10 Q. Hello, panel. Karen Peterson from Allison
11 MacKenzie law firm, representing the County water district and
12 Vidler Water Company. So I did have a copy follow-up
13 questions. Slide 15 on your rebuttal presentation, I don't
14 know if you can bring that up.
15 Mr. Reich, one of the items I think you discussed
16 was questions regarding, including Kane Springs Valley into
17 the Lower White River Flow System boundaries, and you
18 indicated in your rebuttal comments that Kane Springs Valley
19 should not be included. Do you see that?
20 ANSWERS BY MR. REICH:
21 A. Yes, I do.
22 Q. And did you have an opportunity, during the
23 course of all these proceedings, to review all the CSAMT
24 information performed by Zonge?

Page 160

1 A. Yes, I did.
2 Q. And what data supports your rebuttal conclusion
3 on this slide regarding, including Kane Springs Valley and the
4 boundaries?
5 A. My understanding -- or my review of the data
6 indicates that there's a series of en echelon faults that help
7 to create a -- some type of a hydraulic barrier or a barrier
8 to groundwater flow in this area that isolates the Kane
9 Springs Valley area from the -- from the Coyote Spring Valley.
10 And a lot of the data I looked at was also based
11 on water level data that shows that there is a very large, a
12 very steep hydraulic gradient between the two valleys.
13 Q. And is the CSAMT information new data for the
14 State Engineer to consider since the 1169 pump test?
15 A. Yes. My understanding is that the data was
16 performed or the survey was performed in March of this year.
17 Q. And to your knowledge, have you seen any other
18 data provided by Southern Nevada Water Authority, the Moapa
19 band of Paiute Indians, the U.S. Fish and Wildlife Service, or
20 the National Park Service? Any new information regarding
21 locations of faults or geologic structures in this whole area?
22 A. I believe the Moapa band presented a conductive
23 model -- or effective model, excuse me, a heat transfer using
24 finite difference in the Colorado -- in this lower region.

Page 161

1 So I believe that to be -- I first heard about
 2 that at a hydrologic review team meeting that we had at SNWA
 3 three or four months ago, and then looked at the presentation
 4 or the reports submitted by them.
 5 But besides that and the geophysical data, you
 6 know, without going back and reviewing all the reports, that's
 7 my only understanding of the new data.
 8 Q. And you were just asked some questions by
 9 Mr. Morrison regarding the hydrograph in Appendix -- I believe
 10 it's Appendix E for CSVM-4?
 11 A. Yes.
 12 Q. Do you recall those questions?
 13 A. Yes, I do.
 14 Q. And what's -- do you have the hydrograph in front
 15 of you?
 16 A. Yeah, I'm looking at it right now.
 17 Q. All right. What's occurring in the hydrograph to
 18 cause the overall pattern?
 19 A. The impact of the hydrologic conditions that
 20 we've talked about, the wetting and drying and the average
 21 where we see the response to the '04 and '05 rainfall events,
 22 the long-term decline. Over that 2006 to 2013, '14 period and
 23 then recent average conditions since that.
 24 So this hydrograph, to me, reflects a lot of --

Page 162

1 it's driven a lot by the climate and the precip.
 2 MS. PETERSON: That's all the questions I have.
 3 HEARING OFFICER FAIRBANK: Next will be the City
 4 of North Las Vegas.
 5 MS. SCHROEDER: I'm representing the City of
 6 North Las Vegas, Laura Schroeder. We have no questions.
 7 HEARING OFFICER FAIRBANK: Thank you. Centers
 8 for Biologic Diversity.
 9 CROSS-EXAMINATION
 10 MR. DONNELLY: Thank you. For the record,
 11 Patrick Donnelly, representing the Center for Biological
 12 Diversity. For the record, I am not an attorney. I play one
 13 on television sometimes, so I'm going to do my best and I am
 14 sure people in this room will let me know if I wander astray.
 15 So I'm going to direct my questions to Mr. Reich
 16 and perhaps the appropriate person can jump in if they are
 17 better suited for someone else.
 18 I'd like to start with the topic of
 19 evapotranspiration capture. Is it true that
 20 evapotranspiration capture would result from the lowering of
 21 the water table?
 22 ANSWERS BY MR. REICH:
 23 A. Yes, it is.
 24 Q. Are you aware of the elevation of well MX-5?

Page 163

1 A. I can look it up. I have it stated in my report.
 2 But, no, not off the top of my head.
 3 Q. That's fine. The well of MX-5 elevation is 1813.
 4 A. Oh, the groundwater level.
 5 Q. Yes, I'm sorry.
 6 A. Oh, I'm sorry. I thought you were asking about
 7 the surface level, so that's why I was -- no, yeah, 1813 is
 8 appropriate for that.
 9 Q. And does a groundwater elevation of 1811 at
 10 Pederson Springs sound about right to you?
 11 A. Yeah. Yes.
 12 Q. So because groundwater elevations are so similar,
 13 how would one draw down the water table to capture ET without
 14 also impacting spring discharge? Are we . . .
 15 A. Well, there's a question that I think we have to
 16 talk about, and that is one of the themes that we've really
 17 promoted today is the idea that location of pumping has a
 18 great deal to do with how much pumping can be -- occur in the
 19 Lower White River Flow System.
 20 So when we talk about that and we talk about the
 21 structural control, so again, it's that normal faulting. It's
 22 the structural control that -- where we see flow paths that
 23 come through Coyote Springs down into Hidden Valley and Garnet
 24 and California wash or flow paths that go through Coyote

Page 164

1 Spring Valley into Muddy River Springs area, California wash.
 2 I -- and we have to look at that as a whole. It's important
 3 that we see the whole picture.
 4 So why there are wells, and I've stated in my
 5 earlier testimony, that pumping on the east side of Coyote
 6 Spring Valley would absolutely impact groundwater levels and
 7 result in spring flow. There's also other locations where you
 8 can pump that necessarily do not go directly through Muddy
 9 River Springs area.
 10 Q. Thank you. Are you aware of what environmental
 11 impacts might results from capturing of evapotranspiration and
 12 the die off of phreatophytic vegetation?
 13 A. I am -- I'm not a biologist, so I'm not going to
 14 opine on the impact of that. But I am aware that the
 15 groundwater level has a direct relationship on the health or
 16 the habitat that it supports.
 17 Q. Thank you. You state that there is
 18 30,000-acre-feet of water available for pumping in the Lower
 19 White River Flow System per year; is that correct?
 20 A. Yes.
 21 Q. How would -- sorry, are you aware of the
 22 significance of 3.2 cubic feet per second of discharge at the
 23 Warm Springs west?
 24 A. Yes, I am.

Page 165

1 Q. Would removing 30,000-acre-feet of water per year
2 from the ground in the Lower White River Flow System maintain
3 levels at the spring above 3.2 CFS?
4 A. It's a multi faceted response, and so I'm trying
5 to figure out the best way to respond to give you the answer,
6 because again, I just talked earlier about the location of
7 pumping and the importance that the location of pumping has on
8 the resources.
9 And so when we talk about, you know, what is
10 sustainable and -- or what kind of pumping can occur, we
11 really have to focus in on what is actually causing that and
12 controlling that -- those water levels.
13 So if we're talking about pumping in, say, Garnet
14 Valley or pumping in certain parts of California wash, how
15 does that affect Warm Springs west flow? How does that
16 affect, you know, sub flow that might be captured as
17 evapotranspiration in the bottom part of the Moapa Valley?
18 So it's really -- the answer I want to provide to
19 you is that, yes, we can pump up to 30,000-acre-feet based on
20 how we distribute that pumping and how we use our conceptual
21 model to do that.
22 Q. Thank you. You stated that -- in your report
23 that your model is at least partially based on the Maxi Eakin
24 model; correct?

Page 166

1 A. I'm going to let Ms. Palmer respond to the --
2 you're talking about local recharge from the sheep range.
3 Q. Thank you.
4 ANSWERS BY MS. PALMER:
5 A. Yeah, that's what you mean when you say "model"?
6 Q. Yes?
7 A. No, it's -- the numbers that we presented are not
8 based on the Maxi Eakin coefficients.
9 Q. Without using the coefficients, was the
10 methodology based on the framework of Maxi Eakin, different
11 coefficients granted?
12 A. It's based on the same type of empirical model.
13 Q. Yes.
14 A. That relates precipitation to recharge. But it
15 is not the coefficients that were established by Maxi Eakin,
16 but by papers and literature that established other methods
17 and other coefficients.
18 Q. Given that it's a different set of coefficients
19 with the same framework, was that framework designed to be
20 evaluating entire basins or -- I'll leave the question at
21 that.
22 A. Can you clarify what you mean by --
23 Q. The question is: Was the framework designed to
24 evaluate recharge on an entire basin scale or is it meant to

Page 167

1 be slicing up a basin and evaluating pieces of it in that
2 fashion that you did?
3 A. I would say that, generally, the method is
4 applied to regional areas, but I think that there are some
5 applications that have been done for the scope of the size of
6 the sheep range is within the bounds of what's been done.
7 Q. Taking a broader look at the overall conceptual
8 model for the basin, do you assert that discharge equals
9 recharge?
10 ANSWERS BY MR. REICH:
11 A. In predevelopment conditions or --
12 Q. Yes, yes. Thank you.
13 A. Well, our budget shows that there's a difference
14 of approximately 1200-acre-feet. I'd have to do the exact
15 math. But there's an imbalance in our budget of some -- I
16 don't know, 1 or 2 percent or something.
17 Q. Do you have ideas as to where that 1 or 2 percent
18 comes from?
19 A. Oh, yeah. You know, the values could easily
20 be -- you know, could be connected to evapotranspiration
21 because we got to remember, we're using different methods to
22 establish different fluxes in this budget.
23 So while we might be using, you know, mass
24 balance, deterrent mass balance to look at recharge rates and

Page 168

1 fluxes of groundwater coming in, you know, we might be looking
2 at historical photographs or different precip or other records
3 to measure ET.
4 So there can be variations in those estimates,
5 which would explain why the budgets don't necessarily equal
6 out. You know, the goal of our budget was really to provide
7 the State Engineer what we felt was the best available data
8 for describing the 1303 administrative units. So we chose
9 consistency among data sets to provide that.
10 Q. Is the water being discharged generally from
11 recent origin and provenance or is water discharged from past
12 epics, for instance, Pleistocene?
13 A. Yeah. So there's a -- you know, this is a great
14 question because I really enjoy this part of the geology and
15 hydrogeology because, you know, we got to remember, you know,
16 what has happened over the last 12,000 years compared to what
17 might have happened over the last 40,000 years or
18 50,000 years.
19 So, you know, as we've had the last ice age melt
20 off and, you know, you have this vision of this basin and
21 range area with these lakes and very, you know, paleo areas.
22 And then what has happened to that -- you know,
23 what I want to say recent water, you know, that's kind of
24 recent water, that last, you know, 12 to 15,000 years,

Page 169

1 whatever you want to call that last ice age, then compared to,
2 you know, some of the dating that we've seen in the recharge
3 estimates that we use. So I guess that's a very long way of
4 saying that there is older water in the system.
5 Q. Granted that, isn't it entirely possible that
6 there is more waters -- appreciably more water discharging
7 from the system than is coming in in new recharge, given that
8 the -- given that the knowledge of interbasin flow and
9 recharge is entirely speculative?
10 A. Sure.
11 Q. Isn't it entirely possible that this is fossil
12 water discharging that will not be replaced?
13 A. Yeah. So there's two components to the
14 discharge. There's local recharge that we've identified, and
15 so every year, there's a local amount of recharge that's being
16 mixed in. And then there's the old -- you know, the
17 groundwater flow system that we suggest starts as high up as
18 in the Ely range where that flow has been drained through.
19 So you -- if you -- if I understand your question
20 correctly, is -- are you asking me if discharge is greater
21 than recharge?
22 Q. Potentially. Isn't that possible?
23 A. Well, two things are going on. So I look at it
24 as a -- the potential metric head, right? So let's say

Page 170

1 further upstream as the head drops, you know, the rate of flow
2 is going to decrease, right? So everything has to be in
3 balance.
4 And so something has to be -- something has to
5 give, like one of the -- when we look at that -- when that
6 budget, if recharge is going to go down, then discharge is
7 going to go down also, right, because that -- those budgets
8 have to balance out.
9 So maybe not only does discharge go down, but
10 also ET would go down and spring flow would go down. It would
11 be a combination of all those different factors if you were
12 to -- if you were to suggest that recharge was going down
13 also.
14 MS. MORAN: I'd like to look at it just a little
15 bit differently, and that is if your question is if recharge
16 is changing over time, it can be out of balance with discharge
17 until the new steady state is reached.
18 And that occurs all the time because if a change
19 in pumping occurs, there has to be a new steady state and that
20 can take 50 years or it could take ten years or it could take
21 100 years.
22 But if what you're asking is if recharge is
23 changed over historical -- not even historical, you're asking
24 for something prehistorical.

Page 171

1 Q. Well, let me clarify. Is there any reason to
2 believe that a predevelopment state in the Lower White River
3 Flow System was a steady state? Why do we assume that it was
4 a steady state?
5 ANSWERS BY MS. MORAN:
6 A. Right, because even our budget shows that it's
7 slightly not steady state with there being a difference in
8 what's an inflow and an outflow. It was the best numbers that
9 we have at the time. So we're going to start with the best
10 numbers that we have. I don't think we know to the nearest
11 foot, notice we round them at least somewhat.
12 Q. Right. Sure.
13 A. But yes.
14 Q. One final line of questioning to build on the
15 Moapa Valley Water District. We had talked about Kane Springs
16 Valley. Isn't it true that well KSV-1 declined slightly
17 during the pump test?
18 ANSWERS BY MR. REICH:
19 A. Could you -- I didn't present any information on
20 it. Could you provide me a view of an exhibit?
21 Q. I cannot. So I will withdraw that. I will
22 withdraw that question. I cannot provide an exhibit.
23 A. We never presented in our reports, so --
24 Q. Okay. No more questions. Thank you.

Page 172

1 HEARING OFFICER FAIRBANK: Next will be Georgia
2 Pacific Republic Industries Dry Lake.
3 MS. HARRISON: Good afternoon, panel. Sylvia
4 Harrison from McDonald Carano appearing for Georgia Pacific
5 and Republic Environmental Technologies.
6 Also appearing with me for Georgia Pacific is
7 Paulina Williams from Baker Botts in Austin, Texas, and Sarah
8 Ferguson from McDonald Carano for Georgia Pacific Republic?
9 Just to clarify the record, Broadbent prepared
10 its report for three entities, including Dry Lakes Water, LLC.
11 Dry Lakes is not participating in these hearings
12 and we do not represent them. So with all of that being said,
13 we have no questions for these witnesses.
14 HEARING OFFICER FAIRBANK: Thank you,
15 Ms. Harrison. Next is Nevada Cogen Associates 1 and 2.
16 CROSS-EXAMINATION
17 BY MR. FLANGAS:
18 Q. Hello, my name is Alex Flangas. I'll present
19 this to the panel. I'm not really sure if it would be best.
20 Referring to your CSI Exhibit 1, your initial
21 report, you show in Table 8, a predevelopment water budget for
22 the LWRFS based on SNWA's 2007 report. This is on page 41.
23 ANSWERS BY MR. REICH:
24 A. Yes, I'm looking at it.

Page 173

1 Q. You essentially accepted that table and said that
2 table was essentially a valid water budget; isn't that
3 accurate?
4 A. Where do I state that? I'm just curious.
5 Q. Page 43. This third -- beginning of the third
6 full paragraph, the water budget provided in Table 8 and shown
7 in Figure 16 presents an initial budget that may be used for
8 groundwater sustainability in the LWRFS?
9 A. Yes, that's an accurate statement.
10 Q. And so essentially the water table you're showing
11 for inflows and outflows in Table 8, that's something you
12 accepted as valid; correct?
13 A. We accepted the Table 8 as an initial budget for
14 the State Engineer to start his planning process. So I -- you
15 know, we presented this budget because no other party, up to
16 this point, had put together a comprehensive budget that we
17 were able to review.
18 So we went and used the best data available to
19 provide an initial budget and we fully believe that initial
20 budget will be improved upon over the years as more
21 information is learned.
22 Q. But the budget you used drew from these various
23 valleys that you have contained in the inflow; correct?
24 A. Yes.

Page 174

1 Q. And Kane Springs Valley, you show 4200-acre-feet
2 coming in; correct?
3 A. That's correct.
4 Q. And then in Figure 16, which is on page 42 of
5 that report, you actually show the 4200-acre-feet coming in
6 from Kane Springs Valley; right?
7 A. That's correct.
8 Q. Didn't you just testify a little while ago about
9 a boundary condition, a fault that would prevent or a block
10 that would prevent that water from coming in from Kane
11 Springs?
12 A. No, I did not.
13 Q. I thought that's what you just said a little
14 while ago, that there was not water coming in from Kane
15 Springs, that it was blocked?
16 A. No, I did not. I never said that.
17 Q. Okay. Isn't it consistent with your report on
18 page 9 -- just so that I'm clear then, is it consistent with
19 your Figure 9 -- not page 9, I'm sorry, Figure 9 that the
20 faults in that area run lateral to Kane Springs Valley?
21 A. No, we identify in our write-up, and are we on --
22 we're on the July 3rd report. Yeah, there's a series of these
23 northwest/southeast trending faults and subparallel faults to
24 those.

Page 175

1 So I don't want to get confused with you on what
2 you're calling lateral or axes or whatever. But there -- I
3 think a great example, and we see this just southeast of MX-5
4 are these subparallel faults that are connecting -- that are
5 connecting the Coyote Springs Valley with the Muddy River
6 Springs area.
7 So, no, there's other -- you know, not all faults
8 run northwest/southeast. There are a series of subparallel
9 faults that have been developed over different geologic
10 episodes.
11 Q. I'm not worried about all faults, sir. I'm
12 focused on the ones running from Kane Springs Valley into
13 Coyote Springs Valley. What does your -- what does your
14 mapping show?
15 A. Which map are you referring to?
16 Q. I'm looking at Figure 9.
17 A. It reflects the Rowley map. So this figure was
18 based on Rowley and others from 2017. So the purpose of this
19 was to show the general geology.
20 Q. And what does it show, sir?
21 A. It shows a -- kind of a north -- so after -- I'll
22 go back to Mr. Taggart's Highway Fault. If you start down
23 towards the Highway Fault and work your way directly north,
24 there is a fault that's running approximately north, northeast

Page 176

1 direction that runs along the northern part of Kane Springs
2 Valley. It also shows a fault system that runs along the
3 southern side of Kane Springs Valley.
4 Q. And the faulting system on the southern side of
5 Kane Springs Valley runs what direction towards Coyote Spring?
6 A. It runs in a northeast/southwest direction.
7 Q. Toward -- essentially, when I say "laterally,"
8 I'm talking this way, not crossways as a block towards Coyote
9 Spring; correct?
10 A. Laterally would be along the long axis of the
11 Kane Springs Valley.
12 Q. Along -- okay. Thank you, sir. So is it your
13 contention, then, that the tables shown in Table 8 that shows
14 the 4200-acre-feet flowing in is accurate?
15 A. Not -- it's a best available data that was --
16 that we could use in order to provide the State Engineer. I
17 think another example might be to look at some of the
18 literature review that we did for that.
19 So there's a literature review, I believe
20 appendix C, that might be -- that might be helpful to look at.
21 But again --
22 Q. To answer that question, sir, do I need to go to
23 Appendix 3 to answer a question as to whether you find the
24 4200-acre-feet shown on Table 8 flowing into Kane Springs

Page 177

1 accurate or inaccurate? Do we need to look at Appendix 3?
2 A. No. I find it -- no, I find it's based on the
3 2007 SNWA report, we think it's a valid estimate for an
4 initial budget for the Lower White River Flow System.
5 Q. Thank you.
6 MR. FLANGAS: That's all the questions I have.
7 Thank you.
8 HEARING OFFICER FAIRBANK: Next would be Muddy
9 Valley Irrigation Company.
10 THE STATE ENGINEER: Good afternoon, Steve King
11 from Muddy Valley Irrigation Company and we have no questions
12 for this panel.
13 HEARING OFFICER FAIRBANK: And just so -- for
14 those individuals watching on the internet, that was Mr. Steve
15 King making his appearance and not having any questions.
16 Next would be Bedroc.
17 MS. SCHROEDER: Laura Schroeder, representing
18 Bedroc. I just have a couple of questions. Thank you.
19 CROSS-EXAMINATION
20 BY MS. SCHROEDER:
21 Q. You -- CSI estimated that there was about
22 5,280-acre-feet of recharge in the Coyote Spring Valley that
23 originated in the sheep range.
24 My question is whether -- where CSI suggests that

Page 178

1 that flow -- where is that flow going?
2 ANSWERS BY MR. REICH:
3 A. So the recharge that falls on the eastern side of
4 the sheep range, it contributes to multiple different
5 drainages along the base of the sheep range itself, or I
6 believe is it Steptoe, the Steptoe Range. The water comes
7 down and then drains into the -- what we would call the
8 western side of the Coyote Spring Valley. So that local
9 recharge is contributing with regional groundwater flow that
10 comes in from the north.
11 Q. Okay. And is that local flow, that flow on the
12 western side then, is that something that can be pumped in
13 that alluvial fill without impacting the carbonate aquifer?
14 A. So I'm also hearing two questions. I want to
15 make sure I answer accurately.
16 Q. Um-hum?
17 A. So is your question whether the recharge
18 occurs -- what is your question because I hear a couple
19 different questions.
20 Q. All right. So we -- you've testified that we
21 have this flow from the sheep range that goes into the west
22 side. And my question is whether that is contained by -- in
23 that area such that it's not contributing to the carbonate
24 flow?

Page 179

1 A. Oh. So the mechanisms for recharge, I think, are
2 very -- it's very common what we see throughout eastern
3 Nevada. So there's a rainfall that occurs and, you know,
4 there's direct precipitation in the carbonate rock and there's
5 runoff that comes down. And that runoff also contributes to
6 and supports recharge directly into the carbonate and there's
7 also runoff into the basin fill.
8 So one of the things that we looked at also was,
9 you know, what happens to that basin fill water in that area
10 and what are the water level differences. So we were -- we
11 went through and we looked at some of the alluvial water
12 levels and saw that they were higher actually than that of the
13 carbonate aquifer.
14 So our conceptual model, if we were to continue
15 to describe it, would indicate that areas along the west
16 contribute -- the basin fill contributes into the carbonate
17 rock in that area.
18 Q. So is the flow on the west side of the Coyote
19 Spring Valley, is it at all hydrologically isolated from the
20 Muddy River Springs aquifer?
21 A. Is it all isolated?
22 Q. Is it isolated by a fault or other structural
23 impediment?
24 A. Yes. So I think now we're talking specific

Page 180

1 elevations, right?
2 Q. Right.
3 A. So you -- you're -- and I don't mean to read into
4 your question, but you're asking, is there a mechanism or
5 there is a mechanism for water to flow from the west to the
6 east, is that what you --
7 Q. Yes. Is there or isn't there, yes?
8 A. No, it's a great question, and I think that's why
9 if we were to look at the very northern portion of Coyote
10 Spring up towards bedrock, for instance.
11 Q. Um-hum?
12 A. Or even closer up towards -- I believe it's
13 CSM-3, you know, we've shown through our geology and
14 geophysics that that's a northern part of the Arrow Canyon
15 Range that's coming through and diving down.
16 And so as that dives down, it's plunging, going
17 for northward. And so recharge that occurs in the very
18 northern end of the sheep range, does it have an opportunity
19 to mix with basin fill material and end up contributing to the
20 west side is kind of --
21 Q. Um-hum?
22 A. Is kind of a good, you know, way to look at this
23 conceptual model, and my answer would be, yes, there could be.
24 Q. Okay.

Page 181

1 MS. SCHROEDER: I think that's it. Thank you
2 very much.
3 HEARING OFFICER FAIRBANK: Next will be NV
4 Energy.
5 MS. CAVIGLIA: Hi, my name is Justina Caviglia
6 and I represent NV Energy and I just have a couple of
7 questions for you.
8 CROSS-EXAMINATION
9 BY MS. CAVIGLIA:
10 Q. So, Mr. Reich, you stated towards the end of your
11 testimony this morning that you interpret the structural
12 blocks to be impermeable; is that correct?
13 A. Yes, it is.
14 Q. What evidence do you have that they are
15 impermeable?
16 A. Groundwater level data.
17 Q. Okay. Can you please change the slide to
18 rebuttal testimony on page 14.
19 So in your reports, CSI -- I want to understand,
20 CSI-1 is on the west side of the fault zone; is that correct?
21 A. That's correct.
22 Q. Can you focus your attention on the -- during the
23 pumping inventory testing? When you look at, I would say
24 quarter three in 2011, and you look at CSI-1, is there an

Page 182

1 increase in water level at that time?
2 A. No, there's not.
3 Q. There's no increase right there?
4 A. I'm --
5 MS. MORAN: I'm looking at the same thing.
6 MR. REICH: Yeah, what are we looking at?
7 BY MS. CAVIGLIA:
8 Q. CSI-1?
9 A. Right.
10 Q. During the pumpage time, so probably the third
11 quarter of 2011?
12 A. Yes.
13 Q. Is there an increase in the groundwater?
14 A. Third quarter of 2011, no.
15 Q. Is it the second quarter? It's hard to tell
16 exactly. Does there look like there's a small increase in
17 2000 --
18 A. Oh, a small -- oh, you mean -- you're talking
19 about that very slight little bump up?
20 Q. Correct.
21 A. Yeah, it appears that there's a small bump up in
22 the --
23 Q. Okay. And can we go to 2012 for the same one?
24 Is there also a small bump up?

Page 183

1 A. Yes, small bump up.
2 Q. Right in here?
3 A. Yes.
4 Q. Now, that CSI-1 is on the west side of defaults;
5 is that correct?
6 A. That's correct.
7 Q. So let's go down to, say, MX-4, and that is on
8 the east side of the faults; is that correct?
9 A. That's correct.
10 Q. So around the same time in 2011, is there also a
11 slight bump up?
12 A. Yes, there is.
13 Q. And then you go to 2012, is there also a slight
14 bump up?
15 A. Yes, there is.
16 Q. So would those lines be somewhat consistent
17 during or around the same time period?
18 A. They seem to look a little bit different. The
19 2012 appears to occur later in CSI-1. But, yeah, that -- I'd
20 have to take a look at that. And I think, again, you know,
21 this is where we go back and talk about the impact of
22 hydrologic events and rainfall events. So seeing something
23 similar like that, yeah.
24 Q. And then I have another question for you. Can we

Page 184

1 go to slide 25?
2 So when you go up to the rebuttal comments, you
3 state there is no hydrologic -- or hydraulic connection
4 between north Coyote Springs Valley and south Coyote Spring
5 Valley; is that correct? Is that what that states?
6 A. Northern Coyote Spring Valley and southern Kane
7 Spring Valley.
8 Q. Yes, with MX-5?
9 A. Yeah.
10 Q. So MX-5 is in southern Coyote Spring Valley?
11 A. MX-5 is -- there's -- well, okay, MX-5 is -- I
12 would consider it to be kind of central or south central
13 Coyote Spring.
14 Q. Okay.
15 A. And so I chose that as the pumping well to
16 describe that.
17 Q. So is that saying that for the northern Kane
18 Springs, Coyote Springs Valley and southern Coyote Springs
19 Valley, there's no connection? Is that what you're stating
20 there?
21 A. I just -- I'm going to help you. The northern
22 Coyote Spring Valley.
23 Q. Yes.
24 A. Southern Kane Spring Valley.

Page 185

1 Q. Yes, and southern Coyote Springs Valley?
2 A. Right. So is there a hydraulic -- is there a
3 connection there? My review of the data showed that there was
4 no response from pumping MX-5 in the CSVM-4 well.
5 Q. Okay. So does that mean that your testimony
6 today is that you can pump as much water as you want from that
7 northern area without affecting the Muddy River Springs?
8 A. Pump as much area as you want? So what areas
9 specifically? Let's -- if we're going to go down this, let's
10 make sure that we're going to identify the right area.
11 Q. Okay. So what I read when I read your comment is
12 that there is a line basically in the middle of the Coyote
13 Springs; is that correct?
14 That there is no connection between northern
15 Coyote Springs, southern Kane Springs Valley and where MX-5 is
16 in southern Coyote Springs. Is that what you're stating right
17 there?
18 A. No, I'm saying there's a hydraulic barrier. So
19 that's a -- yeah, there's a hydraulic -- there's a hydraulic
20 barrier in the sense that from -- there's no hydraulic
21 connection from MX-5 pumping in Kane Spring Valley, yet there
22 still is flow out of the Kane Springs Valley are into the
23 Coyote Spring Valley area.
24 Q. Okay.

Page 186

1 A. So there's a downward vertical gradient into the
2 Coyote Spring Valley area. So as I've showed in the water
3 budget, there would absolutely be an impact if there was
4 unlimited pumping upstream.
5 MS. CAVIGLIA: I think that's all the questions I
6 have.
7 HEARING OFFICER FAIRBANK: Thank you. Now we'll
8 go ahead and open it up to staff. Do we have any questions?
9 MS. COOPER: Hi, thank you.
10 HEARING OFFICER FAIRBANK: Please state your
11 name.
12 MS. COOPER: Christi Cooper, DWR. I'll start
13 with -- I think anyone on the panel could ask -- answer this
14 question.
15 EXAMINATION
16 BY MS. COOPER:
17 Q. I'm looking in your initial submittal report,
18 Figure 10, specifically at the location of MX-6 and slide 23
19 of your presentation today, your very first presentation.
20 Could you verify which location of MX-6 is
21 correct?
22 ANSWERS BY MR. REICH:
23 A. Yeah, that's -- I believe that's --
24 HEARING OFFICER FAIRBANK: Can you turn on your

Page 187

1 microphone?
2 MR. REICH: Yeah, I apologize. That exhibit, I
3 believe, has MX-6 in the wrong location. So slide 21.
4 MS. MORAN: 23.
5 MR. REICH: Oh, slide 23, sorry.
6 BY MS. COOPER:
7 Q. Your report is the correct location then?
8 A. Yes.
9 Q. Thank you. I have a few more questions, please.
10 Ms. Moran, you did the Theis analysis?
11 ANSWERS BY MS. MORAN:
12 A. That's correct.
13 Q. Could you explain what the reason for using
14 solely MX-5 pumping and not total Coyote Spring Valley
15 carbonate pumpage was?
16 A. The way the Theis equation works, I wanted
17 pumping in a center versus in multiple locations. And I was
18 only looking at four being an example, the pumping that occurs
19 at two places.
20 And given MX-6 was the largest pumping volume, I
21 took that average pumping of the pumping test to look at what
22 its effect would be at the spring, just using the simple Theis
23 equation.
24 Q. MX-5?

Page 188

1 A. MX-5, right. That was the greatest pumping in
2 those two years, representative two years.
3 Q. But you used both Arrow Canyon wells and the
4 Muddy River Springs area?
5 A. Right. They're fairly close together as a
6 pumping center.
7 Q. Okay. Do you think that if you would have
8 used -- combined Coyote Spring Valley pumpage, that would have
9 made any difference in your analysis?
10 A. I would have to do it to know if it would.
11 Q. Okay.
12 A. Thanks.
13 Q. Thank you. Can I have one more question? I can
14 go to slide 14 in your initial presentation. Oh, maybe the
15 rebuttal, I'm sorry.
16 Mr. Reich, do you believe that CSI differs
17 from -- number two differs from wells 1, 3 and 4? And in what
18 ways again, please?
19 ANSWERS BY MR. REICH:
20 A. Sorry. I was reading the previous slides you had
21 for well. Does well -- does well one?
22 Q. Two, did you say previously two differed from 1,
23 3 and 4?
24 A. Yes, I did. So there's a couple -- there's a

Page 189

1 couple of characteristics I would like to point out here. The
2 CSI-3, the -- you see the large decline during the Order 1169
3 aquifer test. And, you know, we have to then go and compare
4 that to the pumping that was going on on the west side.
5 So if you look at CSI-3, the data, you know,
6 shows the red bars at the bottom. But we also have to
7 remember that the transmissivity of that well tested out at
8 about 13,000 feet squared per day.
9 And so, you know, when you think of a lower
10 transmissivity as compared to CSI-4, which had 130,000 feet
11 per day, then we start to think about how these different
12 wells will react to different stresses.
13 So, for instance, I believe we're all in
14 agreement that CSI-2 mimics MX-4 or CSVM-6, UMVM-1 water
15 levels. But CSI -- and so CSI-2, so when you look at CSI-3
16 and the CSI-4, and we look at the pumping that's occurring on
17 the west side at the same time, I see that as an explanation
18 of -- that explains why those are behaving during that time.
19 When I look previously, or afterwards, I also see
20 a change in the recovery. If you look at -- if you look at
21 kind of the long slope from 2014 to the present of CSI-3,
22 that -- it's kind of generally trending, I don't know about
23 upwards, but it has a different type of trend during those
24 last 5 or 6 years than it does before.

Page 190

1 So when I look at this together and I look at
2 those different periods, I really feel strongly that there's
3 different geologic kind of environments that control the water
4 levels that we're looking at in each of these different
5 periods.
6 Q. So would you say, to follow up that pre-1169
7 tests and post tests, that all four CSI wells do have a
8 decline in water levels?
9 A. Oh, yes, they all have a decline in water levels.
10 If -- starting from the beginning of their period of record to
11 today, yes, they all have a decline.
12 MS. COOPER: Thank you.
13 HEARING OFFICER FAIRBANK: So given that we have
14 some additional time, I guess I'll say thank you to everyone
15 for being concise and honoring the spirit of what the purpose
16 of a hearing is. We're going to go ahead and open it back up
17 for questions, and so I'm going to just kind of go back down
18 in the order.
19 Does United States Fish and Wildlife Service have
20 any additional questions that they'd like to ask? And I'm
21 going to limit the parties to approximately three minutes for
22 any follow-up questions.
23 MR. MILLER: No further questions.
24 HEARING OFFICER FAIRBANK: And then National Park

Page 191

1 Service?
2 MS. GLASGOW: No questions. Thank you.
3 HEARING OFFICER FAIRBANK: Okay. So I've gotten
4 declined from Fish and Wildlife Service and Park Service.
5 The Moapa Tribe, do they have any follow-up
6 questions at this time? Seeing none.
7 Mr. Taggart, does Southern Nevada Water Authority
8 and Las Vegas Valley Water District have some follow-up
9 questions?
10 MR. TAGGART: We do.
11 HEARING OFFICER FAIRBANK: And given the fact
12 that the prior parties have not asked any follow-up questions,
13 I'll go ahead and extend that time to -- I'll give you seven
14 minutes.
15 MR. TAGGART: Okay. Thank you.
16 BY MR. TAGGART:
17 Q. Okay.
18 HEARING OFFICER FAIRBANK: Make sure you use the
19 mic. Thank you.
20 MR. TAGGART: Thank you. For the record, Paul
21 Taggart for the Southern Nevada Water Authority and Las Vegas
22 Valley Water District.
23
24

Page 192

1 FURTHER CROSS-EXAMINATION
2 BY MR. TAGGART:
3 Q. Mr. Reich, I'm going to ask you, if you could, to
4 use the demonstrative that you guys prepared. And I have a
5 couple questions that I'm going -- I'd like to walk over there
6 and ask you, but I'll be off the mic temporarily. Is that
7 okay? Folks in the internet won't hear me?
8 HEARING OFFICER FAIRBANK: Mr. Taggart, we can
9 probably share one of our mics with you.
10 MR. TAGGART: Okay. Great.
11 BY MR. TAGGART:
12 Q. Okay. We'll see how this works. All right. So
13 where on this map can this pumping happen, this 5288 feet of
14 pumping happen on the west side of Coyote Spring Valley
15 without impacting the Muddy River or the Muddy River Springs?
16 Can you show me?
17 HEARING OFFICER FAIRBANK: And, Mr. Taggart, will
18 you put the demonstrative on the easel so that those that are
19 watching from afar can see.
20 BY MR. TAGGART:
21 Q. And I don't want to offend my colleagues, but do
22 you mind if he writes -- if he draws this on there so we can
23 see where it is, Mr. --
24 A. See, which one is it? It's the direct --

Page 193

1 HEARING OFFICER FAIRBANK: And, Mr. Reich, when
2 you go -- and if you'll also provide a verbal description of
3 where you're putting that so that it's clear on the record,
4 and you can use the mic that Mr. Taggart is using to do that.
5 MR. REICH: Great.
6 BY MR. TAGGART:
7 Q. And I can help you along there a little bit
8 because -- so you see where CSVM-6 is?
9 A. Yeah.
10 Q. So you've acknowledged that that is impacted by
11 the MX-4 pumping; is that right?
12 A. That's correct.
13 Q. So that would be on the right side of the
14 structure you talked about?
15 A. So let me --
16 Q. But CSI-1 is not impacted, right? So that would
17 be on the other side --
18 HEARING OFFICER FAIRBANK: Mr. Taggart, if you'll
19 let him just make his answer so that we can have a clear
20 record as well.
21 MR. TAGGART: Okay.
22 HEARING OFFICER FAIRBANK: And so that it can be
23 heard both here and on the internet and in our southern Nevada
24 location.

Page 194

1 MR. REICH: So which question? I just want to
2 make sure I answer the question correct.
3 BY MR. TAGGART:
4 Q. I'll ask you a specific question. Where does the
5 line of no impacts run north/south between CSVM-6 and CSI-1?
6 A. CSI. Okay. So as we've seen with Rowley and,
7 you know, we have this -- I'm going to not do dashes and dots
8 and other things that we would normally do with geologists.
9 But it's -- what we've done is we've used the CSAMT in order
10 to map what the boundary of this fault is.
11 So we got -- sorry. It goes something like this
12 and something like this. We already had all this up here and
13 then we talked about the fault running through A and B here.
14 So we have these series of down-drop blocks.
15 This is the horse that we've talked about, the structural
16 block that's in the center.
17 BY MR. TAGGART:
18 Q. Okay. Can I just stop you there? So is it west
19 of the structural --
20 HEARING OFFICER FAIRBANK: Mr. Taggart, if you'll
21 please use the microphone.
22 BY MR. TAGGART:
23 Q. Is it west of that structural block or is it
24 within the structural block that --

Page 195

1 A. That's west of the structural block.
2 Q. Okay. So a well west of the structural block
3 pumped will not impact the river. Is that your testimony?
4 A. That is my testimony, correct.
5 Q. Okay. And you've dashed that or you've hashed
6 that structural block, right?
7 A. So, yes, and I want to be clear that when we talk
8 about, you know -- so now we're going to look at a cross
9 section.
10 And when we look at a cross section and we have
11 some type of horse structure and we have a series of faults
12 that move these boundaries up and down, and then we have --
13 this area has Rowley described the different structural
14 components of whether it's a damage zone or a core zone that's
15 creating some type of barrier in this direction --
16 Q. Okay. That's not really my question, but --
17 A. No, wait --
18 Q. -- so what's the southern boundary of the
19 quadrant that you've identified where pumping can occur
20 without impacting the river? What's the southern boundary of
21 that area?
22 A. Well, so now -- what's the southern boundary of
23 this quadrant? Is that what you're asking?
24 Q. Is there a southern boundary running from east to

Page 196

1 west of the quadrant you believe can be developed without
2 impacting the river?
3 A. It's the -- so what we've talked about before and
4 what we've presented is where the flow goes through the Coyote
5 Springs Valley, and we have flow on the western side, I've
6 shown in my budget and in my conceptual model that there's
7 another either 11 or 17,000-acre-feet of flow that comes down
8 into this area. And as we come down into this area, now the
9 question is, where does the water go.
10 Q. Okay. So where is the southern -- okay. Let me
11 just -- I don't have a lot of time.
12 A. No, I --
13 Q. So your testimony is the State Engineer can
14 authorize 5280-acre-feet of pumping in Coyote Spring Valley,
15 west of this fault structure.
16 And I'm asking you: Is there a southern boundary
17 to that area where this water can be developed? Is it the
18 Coyote Spring Valley hydrographic basin boundary?
19 A. No, it's beyond that.
20 Q. Okay.
21 A. I'm sorry. Is there 5280 -- you're asking if the
22 5280 is within Coyote Spring Valley or if we're pumping 5280
23 within this area, are you saying -- are you asking, is there a
24 southern boundary to that?

Page 197

1 Q. No, you saying there's an area that can be pumped
2 5280-acre-feet without impact. I want to know where it is.
3 So what's the northern -- I mean, is there a box that you can
4 put around it?
5 A. So let's talk about -- let's talk about the
6 recharge because where did the 5280 come from?
7 Q. Well, sir, either there's a box or there's not.
8 Can you tell me what the box is from which this 5280-acre-feet
9 could be pumped without impacting the river?
10 A. The 5280 comes from the amount of water --
11 Q. I know where it comes from. Is there a box?
12 A. -- so as that -- so the question is always where
13 is the water going.
14 MR. TAGGART: I withdraw the question.
15 MR. REICH: No, no --
16 BY MR. TAGGART:
17 Q. If you can't show the State Engineer where it is,
18 how is it --
19 A. -- it is going out into the California -- into
20 the Hidden Valley, Garnet, Black Mountain and the Black
21 Mountain area. And it's going to be -- like I said before,
22 the pumping is going to impact subsurface, outflow, ET. Those
23 kind of issues.
24 Q. Okay.

Page 198

1 A. So I'm not the only one --
2 Q. So there's no southern boundary?
3 A. Southern boundary of -- so -- and that's why --
4 Q. Just as --
5 A. I just want to tell you why I'm confused.
6 MR. TAGGART: I withdraw the question.
7 MR. REICH: You're asking --
8 HEARING OFFICER FAIRBANK: -- Mr. --
9 MR. TAGGART: -- can I -- 5280 --
10 HEARING OFFICER FAIRBANK: Mr. Taggart, if -- you
11 can intervene just to have -- so that we can have a clear
12 record, because the court reporter cannot record multiple
13 people, excuse me, multiple people at the same time.
14 MR. TAGGART: And I think I can just clarify it.
15 BY MR. TAGGART:
16 Q. Is it a fair statement that your testimony is as
17 long as you stay to the west of that structure, that the 5280
18 can be developed?
19 A. Yes, in the Coyote Springs Valley.
20 Q. All right.
21 HEARING OFFICER FAIRBANK: Okay. I'm --
22 Mr. Taggart, do you have any additional questions?
23 MR. TAGGART: I do, but I don't want to get in
24 trouble.

Page 199

1 HEARING OFFICER FAIRBANK: Well, let's see if
2 there's addition people that have questions.
3 MR. TAGGART: All right.
4 HEARING OFFICER FAIRBANK: And then if there's
5 still time, we'll allow you a little bit more time.
6 Moapa Valley Water District, do you have any
7 further questions?
8 MR. MORRISON: Just one.
9 HEARING OFFICER FAIRBANK: Okay.
10 FURTHER CROSS-EXAMINATION
11 MR. MORRISON: All right. Once again, Greg
12 Morrison, Moapa Valley Water District. I just -- I really
13 want to nail down what your position is on the Kane Springs
14 Valley.
15 After me, Ms. Peterson, on behalf of Lincoln
16 County Vidler, asked you about Kane Springs and its exclusion.
17 And you stated that your exclusion of Kane Springs Valley from
18 the management unit was supported by en echelon faults that
19 isolate Kane Springs Valley from Coyote Springs Valley.
20 And then shortly thereafter, Mr. Flangas asked
21 you about Kane Springs and faulting, and you stated that you
22 didn't testify about impediments to flow from Kane Springs
23 Valley.
24 So I guess I really want to nail down CSI's

Page 200

1 position on: Are there strict impediments to flow from Kane
2 Springs Valley into Coyote Springs Valley or is there a
3 substantial amount or say 4200-acre-feet of interbasin flow
4 from Kane Springs into Coyote Springs Valley?
5 ANSWERS BY MR. REICH:
6 A. So question one would be -- and I don't mean
7 to -- or I will summarize is, is there impediments between --
8 maybe you can just state -- if you can just give me one
9 question at a time, I really would look forward to answering
10 this.
11 Q. Do en echelon faults justify the exclusion of
12 Kane Springs Valley from the management area?
13 A. Yes, they do.
14 Q. Are there interbasin flows between Kane Springs
15 Valley and Coyote Springs Valley?
16 A. Yes, in a similar manner that there is -- and
17 that there is flows and faulting between Delamar and Coyote
18 Springs Valley and Pahrnagat and Kane Spring Valley -- Coyote
19 Spring Valley.
20 Q. Okay. And the 4200-acre-feet that you have in
21 your report, is that a fair estimate of that flow, do you
22 believe?
23 A. It is an initial estimate that I -- as the best
24 information I can provide today to the Nevada State Engineer.

Page 201

1 Q. That's the best estimate of interbasin flow that
2 you're aware of?
3 A. That I am aware of.
4 Q. Thank you.
5 HEARING OFFICER FAIRBANK: Okay. So next would
6 be Vidler Lincoln County, no additional questions? Okay.
7 Thank you, Ms. Peterson? City of North Las Vegas?
8 MS. SCHROEDER: No.
9 HEARING OFFICER FAIRBANK: No? Okay. Mr.
10 Donnelly for Centers for Biological Diversity?
11 MR. DONNELLY: It's actually singular, Center.
12 FURTHER CROSS-EXAMINATION
13 BY MR. DONNELLY:
14 Q. Thank you. Patrick Donnelly from the Center for
15 Biological Diversity. I want to follow up on a couple things
16 I hit on in my first round that I wasn't able to follow
17 through on.
18 I'd like to refer you to page 54 of SNWA's
19 July 3rd report. So that is page 54 of the PDF file of SNWA's
20 July 3rd report, Figure 5-6 is what I'm referencing. I'll
21 give you a minute to find it?
22 A. 5-6, yes, we're looking at it.
23 Q. Yes. So there is a figure for well KMW-1, the
24 monitoring well in Kane Springs Valley. Do you see any

Page 202

1 declines of that well -- monitoring well during the pump test?
2 A. Yes, I do.
3 Q. Approximately how much?
4 A. On this scale, half a foot.
5 Q. And is there further decline subsequent to the
6 pump test?
7 A. There appears to be a decline in 2014 at which
8 point the -- there's fairly average conditions or level
9 groundwater levels.
10 Q. In a generic hypothetical groundwater model,
11 would decline signals take longer to spread through a system
12 the further away from the point of diversion you are? I can
13 rephrase.
14 A. Yes.
15 Q. Is there a lag -- is there a lag time between a
16 pumping and the signal being picked up far away from the point
17 of diversion?
18 A. Yes, there is. I testified to that this morning
19 when I was talking about our observations of groundwater
20 levels and Coyote Spring Valley.
21 Q. Do you observe here that the Kane Springs well is
22 declining in -- declined during that period in parallel to
23 other wells and Coyote Spring Valley?
24 A. The Coyote -- Kane Spring well has a similar

Page 203

1 hydrologic response as other wells, yes.
2 Q. And are you aware of the elevation --
3 A. I'm sorry.
4 Q. Sorry.
5 A. Earlier I testified about the seasonality of
6 that, and that is something that I do not see in this well, is
7 the annual type of variability. But I do see the other
8 characteristics, which are observed of in the wells.
9 Q. Understood, yes. Thank you. Are you aware of
10 elevation difference -- groundwater elevation difference
11 between Kane Springs Valley and northern Coyote Springs?
12 A. Yes, I am.
13 Q. And how much is that difference?
14 A. Well, I know in the groundwater elevations, we're
15 looking at approximately 40 -- I believe if we look at CSVM-4,
16 which is right down -- it's what, 40 feet.
17 And then if we go down all the way to -- into the
18 main part, CSM-4 -- so it appears to be about a seven-foot
19 decline to CSVM-4.
20 Q. A seven-foot difference in groundwater elevation?
21 A. Yeah, and then from CSVM-4 down towards CSVM-6,
22 there's approximately another 40 or 50 feet of decline.
23 Q. Okay. Thank you. To shift gears completely to
24 evapotranspiration, you say the location of pumping makes a

Page 204

1 difference as far as -- well, you assert that the location of
2 pumping makes all the difference.
3 Is there a location in Coyote Springs Valley
4 where they can -- where one could pump the 5,280-acre-feet of
5 water while also capturing ET?
6 A. ET and --
7 Q. Yeah, okay. I'm sorry. Do you -- are you aware
8 as to which side of that north/south fault the ET is occurring
9 on in Coyote Springs Valley?
10 A. Oh. Right now, there -- our initial budget says
11 there's only 1,000-acre-feet of ET in Coyote Spring Valley and
12 I would guess that that's even overestimated today.
13 So under predevelopment conditions, there might
14 have been 1,000-acre-feet. I think today there's probably
15 much less, if any, phreatophytic ET that's occurring.
16 Q. And which side of the fault would that have
17 occurred on or be occurring on? Where is that locus of ET?
18 A. As I stated today, I don't believe it exists in
19 Coyote Spring Valley, so --
20 Q. Okay. So the thousand-acre-feet is
21 predevelopment only?
22 A. Yes.
23 Q. And there's none now?
24 A. Yes.

Page 205

1 Q. Okay. I guess my question is: Is there a place
2 one could place a well to pump such that ET within the LWRFS
3 is captured that doesn't affect the springs? Where is that
4 pumping location?
5 A. That would be located on the western side of the
6 fault.
7 Q. That accounts for 5,200-acre-feet. What about
8 the other 25,000-acre-feet? Where can that be pumped where it
9 affects ET, but not spring discharge?
10 A. So let's go back to identify a little bit more
11 about -- I think where you're headed on this because I want to
12 read my exact statement if that's okay.
13 So total -- so my documents states that after
14 accounting for 32000-acre-feet of surface flow of the Muddy
15 River, total evapotranspiration and groundwater outflow from
16 the Lower White River Flow System would be 30000. So that's
17 why I'm asking you exactly what your question is.
18 Q. Okay. My question is: You've stated
19 30,000-acre-feet can come out of the ground sustainably in the
20 Lower White River Flow System and that 5280-acre-feet of that
21 would be on the west side of the fault in Coyote Springs
22 Valley.
23 So my question is: Where can the other
24 25,000-acre-feet be pumped such that it is capturing ET, but

Page 206

1 it is not affecting spring discharge?
2 A. So my response, sir, is I didn't -- I think that
3 they're the -- the important response here is that it's total
4 evapotranspiration and subsurface outflow.
5 So when we -- if we're talking about designing a
6 system where we want to capture a certain amount of
7 evapotranspiration and a certain amount of groundwater
8 outflow, you can't assign all 3,000-acre-feet just to ET.
9 You have to determine how much of the outflow are
10 you going to capture, because I've stated clearly throughout
11 my testimony today that, you know, all the pumping that's
12 going to go on, something's going to happen.
13 There's no -- you know, something has to --
14 something has to be measured. There has to be a reduction in
15 ET. There has to be a reduction in outflow. There has to be,
16 you know, some type of impact that occurs from that.
17 So what I've suggested in my report is that, you
18 know, that can be captured from, as I state here, total
19 evapotranspiration and groundwater outflow. So I'm not saying
20 that there's 30,000-acre-feet of ET. In fact, I'm suggesting
21 there's 11,900-acre-feet of ET.
22 Q. Well, again, my question would be then: Where
23 can you pump such that you can accomplish 11,000-acre-feet of
24 ET without affecting any surface discharge of springs?

Page 207

1 HEARING OFFICER FAIRBANK: And that will be your
2 last question.
3 BY MR. TAGGART:
4 Q. Yeah, yeah. It's been one question.
5 A. Well, no, it's important that I answer. I want
6 to provide information to you and to the State Engineer on how
7 that can be managed, and I think that's where we have to go
8 and look to see where that evapotranspiration is. How much
9 is -- how much does the State want to capture, you know? How
10 much is there willing to put up?
11 I mean, I've always said there is a trade-off for
12 the imbalance of groundwater pumping and what is it going to
13 capture? Is it going to capture ET? Is it going to capture
14 groundwater outflow? Let's map those areas and go find out
15 where those areas are.
16 MR. TAGGART: Thank you.
17 HEARING OFFICER FAIRBANK: Mr. Reich, and I guess
18 I -- the question, though, and -- was: Have you identified
19 where?
20 MR. REICH: Oh.
21 HEARING OFFICER FAIRBANK: I think that was the
22 question that was being asked of you. And so I guess that's
23 the answer that we're waiting for is: Have you identified
24 where that pumping could occur?

Page 208

1 MR. REICH: Oh, no, I have not. I -- if it was
2 that easy in the beginning, I'm sorry, I would have answered
3 that way. But did I miss --
4 HEARING OFFICER FAIRBANK: All right. Next,
5 Georgia Pacific, do you have any additional questions or
6 follow-up questions?
7 MS. HARRISON: No further questions.
8 HEARING OFFICER FAIRBANK: Seeing none. Nevada
9 Cogen, do you have any follow-up questions?
10 MR. FLANGAS: I have no further questions.
11 HEARING OFFICER FAIRBANK: No additional
12 questions. Okay. Thank you, Mr. Flangas.
13 Muddy Valley Irrigation Company?
14 MR. KING: No questions. Thank you.
15 HEARING OFFICER FAIRBANK: Seeing no other
16 questions. Bedroc, any further questions?
17 MS. SCHROEDER: Nope.
18 HEARING OFFICER FAIRBANK: Okay. Seeing none.
19 And then Nevada Energy, any further questions?
20 MS. CAVIGLIA: (Shakes head.)
21 HEARING OFFICER FAIRBANK: Okay. Just one
22 moment. All right.
23
24

Page 209

1 EXAMINATION
2 MR. BENEDICT: For the record, John Benedict.
3 My question goes to hydrograph for CSVM-5, and I
4 know it's one that you said you haven't spent as much time
5 researching, but it is kind of an interesting area with
6 respect to the Coyote Springs area and it's on the west side
7 of the basin.
8 And so I think this is in your July report,
9 there's a -- oh, do you have one up there.
10 ANSWERS BY MR. REICH:
11 A. Yeah.
12 Q. Yeah, okay. You have it up there. So I was
13 curious about the climate relationship that you've been
14 talking about and what this hydrograph tells you. I know
15 there's a bump in 2005, '6, it's relatively small and water
16 levels continue to increase.
17 Would you like to speculate on what you think or
18 what your opinion is on how the recharge that you're defining
19 in sheep mountains is impacting that hydrograph?
20 A. Yeah, no, we'd love to.
21 We find this is a real challenge to understanding
22 and developing our conceptual model in the area, and so we've
23 asked ourselves a couple of different questions.
24 One of the first questions we've talked about

Page 210

1 amongst ourselves is just a different in elevation. You know,
2 why are we looking at -- now I'm going off of memory, was it
3 20.
4 MS. MORAN: About 60 feet.
5 MR. REICH: About 60 feet. So we have about a
6 60-foot difference in elevation in this well than we do in the
7 other wells in the main part of Coyote Spring Valley.
8 So what's causing that? Is it a -- is it a
9 perched, an area perched water? And we've seen in this other
10 mountainous areas. So we could have an area of perched area
11 water, we could have a boundary, we could have -- you know, we
12 didn't get into technicalities today. But when we talk about
13 boundaries, we often talk about leaking boundaries and what
14 the permeability across those boundaries could be, whether
15 they be faults. And so this is something special.
16 We went up and actually visited this well. This
17 well is -- it really -- it peaked our interest on why this was
18 going on.
19 So we drove up the -- it's an old rocky road that
20 goes up the side of this hill out to where drainage is through
21 the Steptoe Range there. And not only is the well there, but
22 there's also -- Clark County flood control also runs a precip
23 station at that location.
24 Unfortunately, the data period is not real long

Page 211

1 for that precip station because that's where we want to go
2 with this. We want to -- we really want to develop higher
3 elevation rainfall. We think that's an important factor of
4 understanding how this recharge system is working.
5 So with that recharge and with that rainfall
6 runoff relationship, we start to try to better understand
7 that. As we stand here today, you know, right now, we can
8 hypothesize on what's causing that.
9 As I mentioned before, there's either perched
10 water supply, a barrier. There could be a couple different
11 fault structures that are going on there that could cause
12 this. But, no, we're looking forward to actually addressing
13 this issue.
14 Jean, you were with me, too. Do you have
15 anything additional?
16 MS. MORAN: Given where the well is located way
17 up on the side of the valley, I -- obviously it's not
18 connected with what's happening on the valley floor, and
19 either it is a pocket that is seeing the recharge and the
20 collective recharge coming up.
21 We haven't seen a spring nearby to say that maybe
22 it reaches a certain level and then it becomes a spring. You
23 know, why did it go flat. We haven't fully determined why
24 this well is behaving this way. But it is in the recharge

Page 212

1 zone, so it is an area that does receive more precip.
2 HEARING OFFICER FAIRBANK: All right.
3 Mr. Taggart. And we'll go until 3:00, when we'll take a
4 break, and that's when we're going to go ahead and call it
5 good for opportunities for cross-examination.
6 FURTHER CROSS-EXAMINATION
7 BY MR. TAGGART:
8 Q. Hello, again, Paul Taggart for the record. I
9 have a question about that line that you just talked about.
10 Is that CSVM-3 we're talking about, up on the -- up north in
11 Coyote Spring Valley along the --
12 A. It is CSVM-5.
13 Q. Okay. And that's up in the right panel, upper
14 right panel?
15 A. That's correct.
16 Q. So it does not reflect an increasing trend in
17 water levels in that area?
18 A. Yes, it does.
19 Q. And doesn't that reflect the increased
20 precipitation regionally?
21 A. I think as I stated in my direct testimony, this
22 is an area that we have not been able to answer as thoroughly
23 as we have others. This is the one well that doesn't fit the
24 same characteristics as all the other wells that we've looked

Page 213

1 at in the area.
2 As we just testified to, there's different
3 reasons for it. One of them being it could be a purge supply.
4 Another reason being that it could be a pocket of some area
5 that is causing that faulting, and then lastly, it just -- it
6 could actually be reflecting of some type of regional increase
7 in recharge.
8 And so, no, you know, we've stated clearly today
9 that we intend to continue to investigate this well to be able
10 to answer that question.
11 Q. You're familiar with the reports that were
12 submitted by the Park Service and the Fish and Wildlife
13 Service?
14 A. Yes, I am.
15 Q. And you're familiar with their analysis of
16 regional precip in areas surrounding Coyote Spring Valley, are
17 you not?
18 A. Yes, I am.
19 Q. And you're familiar with their conclusions that
20 regionally around Coyote Spring Valley to the north, east and
21 west, precipitation and climate has actually been trending up?
22 A. Yes, I am.
23 Q. All right. And so it's possible that this well
24 is reflecting that, right?

Page 214

1 A. Yes.
2 Q. And I want to ask you -- I have one other quick
3 question about this in your PowerPoint on page 17, and I
4 already asked Mr. Carlson a little bit about this.
5 This is the resistivity data from cross-section
6 A-A paren. And where -- Mr. Reich, where on this do you see a
7 fault on the west side? What exact resistivity data do you
8 see there that you believe is a fault?
9 A. We lost our pointer. So I -- oh, is this one?
10 Can I use this? Oh, we need paper. It's not showing up.
11 MS. MORAN: It is. There it is --
12 MR. REICH: So I -- you see where my arrow is
13 there, and I wish I could read those numbers for you, but I
14 believe that number is 700. And you see that high resistivity
15 blue layer and then you see the low resistivity, red, and then
16 you get into this area of cultural noise that Mr. Carlson
17 testified to.
18 Well, then when you go across that, I mean,
19 you're above that 3,000 as we talked about the data that was
20 east of 3,000 and you see, again, this lower high conductive
21 area. So what I'm looking at here and what I'd like to point
22 out about this fault is this vertical offset.
23 So you can see kind of this level here where
24 there's this main elevation of the low velocity, low

Page 215

1 conductivity layer, and a different elevation on this side.
2 Q. Well, what is it that shows your vertical offset?
3 A. Right in this section. The difference between --
4 Q. This being located where?
5 A. Between 700 and 11,000. If you look at that
6 resistivity layer, you can see that there's a difference in
7 that resistivity in those layers up there.
8 Q. In colors? You see -- do you see -- I mean, this
9 is the -- this is the primary basis for your determination of
10 the Highway Fault, this evidence, right?
11 A. Yeah. Well, do you see -- excuse me, do you see
12 the blue?
13 Q. But am I right about that?
14 A. Do you --
15 Q. This is the primary evidence you're relying upon
16 for the existence of this Highway Fault along this A-A prime,
17 right? I object to you guys -- if, Mr. Carlson, you want to
18 answer the question, you can answer it.
19 But I mean, it's a bit of a privilege that we do
20 this in panels. But I think folks talking among each other
21 during the answer isn't proper. If you want to answer the
22 question, go ahead and answer it. But if it -- I don't want
23 him giving me your answer.
24 MR. CARLSON: Okay. Sure, I'll answer.

Page 216

1 BY MR. TAGGART:
2 Q. Well, the standing question to Mr. Reich was: Is
3 this the primary evidence that you're relying upon for the
4 existence of that Highway Fault, Mr. Reich?
5 MR. CARLSON: Yes, and line B. And as I said
6 earlier, line B, it is better defined on the disk. But, yes,
7 this line does show a fault near the western end of the line.
8 It also shows the cultural noise that we talked about earlier.
9 BY MR. TAGGART:
10 Q. Well, because when I look at your Figure 13,
11 forgive me, but this line that -- this Highway Fault, I don't
12 know if we have that handy.
13 MR. REICH: Which figure is 13? In the report
14 or --
15 MR. TAGGART: Your Exhibit 13, it's page 23 of
16 your slideshow. Do you see that? I mean, forgive me, but I
17 see that -- I see the fault, the Highway Fault cutting through
18 the 2000 number on A-A prime, not where you just identified it
19 at 700.
20 MR. CARLSON: 700 to 1,000 is where we put it.
21 MR. TAGGART: But it's not -- that's not where
22 it's shown on --
23 MR. CARLSON: On this -- you're right, it does
24 look like it's drawn closer to 2,000. The culture starts at

Page 217

1 about 1900. We can't put an exact edge on it with a culture
2 sitting there.

3 MR. TAGGART: So Exhibit 13, which is shown on
4 page 23, that's inaccurate showing you where the fault is? It
5 shouldn't be going through that location on line A, right?
6 MR. CARLSON: I would say that's approximate, but
7 it's not inaccurate, no.

8 MR. TAGGART: Now, because -- well, forget that.
9 Where is -- so now you have Exhibit -- so I'm
10 looking at Figure -- the figure up on the screen, Exhibit 13,
11 I think.

12 When I look at Figure 10 in your report, and I
13 wish I could have them both up on the screen at the same time,
14 but Figure 10 in your report, can you get a copy of that in
15 front of you?

16 ANSWERS BY MR. CARLSON:
17 A. Yes, I've got that.
18 Q. Okay. And this Highway Fault that I'm calling
19 it, it doesn't cross line B at all on this figure, right?
20 A. Right. I think that's a typographical error.
21 Q. Oh, so this one doesn't -- this one's not
22 depicted properly either on this figure?
23 MR. REICH: I'd like to clarify. You know,
24 because of the -- because of the rush that we went through to

Page 218

1 get Mr. Carlson and his company out there in April, it really
2 was a lot to do in a very short period of time.

3 So unfortunately, when the July report came out,
4 we had not received the final results. That's why, as you see
5 in our August 16th submittal, we had attached Zonge
6 Engineering, Zonge International's final results.

7 So why there might have been, you know, different
8 changes in between when we submitted the preliminary results
9 from the Zonge Engineering and the final, you know, there are
10 going to be discrepancies and changes in our understanding of
11 what constitutes that change.

12 BY MR. TAGGART:
13 Q. But when you completed your report in July, CSI
14 number one, you did not basis your conclusion about this
15 Highway Fault and its location on the resistivity evidence,
16 did you, because you didn't have it yet?

17 ANSWERS BY MR. REICH:
18 A. If you look at Figure 11, I think a good picture
19 would be to look at 11 and that is the April 29th, these are
20 the preliminary results.

21 So if you're looking at the same report, it's
22 literally the next page. You can see, you know, a good
23 example would be as Mr. Carlson previously testified to, and
24 this is in July, we knew the same thing. There was a

Page 219

1 construction area of unknown cultural effects.
2 Q. Right. And I guess my point just is that you
3 didn't draw your line through the cross-section of BB prime on
4 Figure 10, even though you had the BB prime resistivity data
5 because it was also submitted as part of the same report.
6 But now you're testifying that the resistivity
7 data in BB prime is actually support for your position. But
8 you didn't make that support in your report when you filed it;
9 is that true?

10 A. Is that a question?
11 Q. It is.
12 A. Oh, we didn't submit it. Why wasn't that --
13 Q. Well, maybe I'll make it easier. Strike the
14 question.
15 Is Figure 10 -- you would draw it differently if
16 you could draw it today, right?
17 A. Yes, I would.
18 Q. Okay. And let's look at BB prime, and where on
19 there do you see this evidence of fault? That's at about the
20 200 -- I'm sorry, 2,000 site; is that the same?
21 MR. CARLSON: Yes, the faults, it's -- when I'm
22 looking at them, I'm primarily looking in the deep data down
23 there where the shades are dark blue. On the actual printed
24 plot, if you have those, you can see some contour lines.

Page 220

1 They're roughly horizontal in the middle of the
2 line and then they take a sudden downward plunge. That
3 happens to be right about station 2500.

4 As you move further, you go into lower
5 resistivities than that. This suggested to me that the fault
6 is someplace in that zone, a different geophysicist could draw
7 that at 1500, somebody else might draw it as 2300, and then we
8 can also argue about what direction the fault goes. My
9 impression is it dips to the west.

10 BY MR. TAGGART:
11 Q. All right. But aren't you interpreting there to
12 be carbonate rocks on top of basin fill rocks?
13 A. No.
14 Q. Okay. So the dark blue is, in your opinion,
15 carbonate; right?
16 A. The dark blue in the -- at the bottom of the
17 cross-section is carbonates, right, most likely.
18 Q. Um-hum.
19 A. The dark blue up near the surface is probably
20 very dry alluvial cover.
21 Q. So just -- Mr. Reich, on the 30,000-acre-feet
22 that you were asked by Mr. Donnelly about, I have a similar
23 question. Of the 30,000 feet, 30,000-acre-feet, why didn't
24 you do two water budgets, one on each side of the fault?

Page 221

1 A. You have to -- my goal was to respond to the
2 State Engineer for the Lower White River Flow System. So, you
3 know, I really looked at this as an exercise to be able to
4 provide that information.
5 So I wasn't focused on just necessarily where the
6 individual flowed paths throughout, you know, as they go
7 into -- from MX-5 area down to the Muddy River area or the
8 flow pass around through Garden and Hidden or into Black
9 Mountains area. I think that's all very important stuff, but
10 no, I didn't break it down to that level of detail.
11 Q. How much water does CSI own?
12 A. I'm not familiar with their water rights. I
13 believe it's over 4,000-acre-feet.
14 Q. Okay. And of the 30,000 that you opined as a
15 water budget, 5,000 is what you believe can be developed on
16 the west side; right?
17 A. Um-hum.
18 Q. And that's -- that would be enough for CSI's
19 water rights; right?
20 A. Yes.
21 Q. Okay. And what about the other 25,000? I think
22 the question to you was: Could it be developed without
23 capturing ET or capturing ET without affecting spring
24 discharge. I mean, do you have an opinion on whether the

Page 222

1 remaining 25,000-acre-feet in your water budget can be
2 developed at all?
3 A. Yes, I do.
4 Q. Can it be developed without impacting the Muddy
5 River?
6 A. Yeah, there's going to be impact. I want to
7 state this really clearly and I've stated all day today is
8 that as water withdrawn and is used and put under production,
9 there is going to be an impact. And the goal here that we're
10 here today is to be able to identify, you know, how that water
11 moves through the system.
12 I'm not here to say what are an acceptable
13 impact, you know, what was an acceptable reduction in
14 groundwater outflow or what is an acceptable reduction in
15 evapotranspiration. Rather, we've really taken this as an
16 opportunity to provide the information that we see.
17 So, no, I have not identified exactly where the
18 30,000-acre-feet would occur, nor have I identified what would
19 be the resulting impacts from that 30,000-acre-feet.
20 Q. So, hypothetically, if the standard was no
21 impacts to senior rights, where could that water be developed?
22 A. So no -- so what senior could -- so maybe you
23 could just tell me exactly what those senior rights are.
24 Q. Let's say no impact to the senior surface water

Page 223

1 rights in the Muddy River?
2 A. Right. And then I would ask the question, you
3 know, do you look at the point of measurement and the point of
4 impact at different locations throughout the Muddy River? Are
5 you measuring it at one location or are you measuring that at
6 multiple locations or what would be your metric? And this is
7 a --
8 Q. Sir, sir, the metric would be capturing senior
9 water rights. That's the metric.
10 A. Right.
11 Q. Capturing river flow. Can 25,000-acre-feet be
12 captured somewhere else outside of the compartment you've
13 identified without impacting senior rights, without depleting,
14 in any quantity, the Muddy River?
15 A. Yes, I believe that, sir.
16 Q. Where?
17 A. I did not identify where that would occur.
18 HEARING OFFICER FAIRBANK: It's 3:00 p.m. We're
19 going to go ahead and take a break. We'll go off the record
20 for about ten minutes and we'll come back, and then we can go
21 ahead and proceed with Coyote Springs rebuttal.
22 (Recess.)
23 HEARING OFFICER FAIRBANK: All right. Let's go
24 ahead and go back on the record.

Page 224

1 And before we get started, I just have one
2 question for counsel. It looks as though there's a missing
3 page in your original presentation. The copy that we received
4 did not have a slide number 62, so we jumped from page 61 to
5 page 62. So I didn't know if that was intentional or an
6 accidental omission.
7 MR. ROBISON: Intentional.
8 HEARING OFFICER FAIRBANK: Okay. Thank you. Go
9 ahead and proceed.
10 MR. HERREMA: I just have three questions on
11 redirect. I hope to be very brief.
12 REDIRECT EXAMINATION
13 BY MR. HERREMA:
14 Q. Mr. Reich or Ms. Moran, could one of you please
15 explain for the State Engineer and the staff why you decided
16 to do the Theis analysis that's included in your reports?
17 ANSWERS BY MS. MORAN:
18 A. We decided to do the Theis analysis to look -- to
19 use something similar to what the Series C did as a cross
20 check of how they approached it and to try to check to see if
21 it made sense for the different wells.
22 Q. Thank you. Mr. Reich, Mr. Morrison asked you
23 some questions regarding page 3 of the rebuttal report
24 specifically related to the declines in water levels at the

Page 225

1 Pederson Springs east and Pederson Springs locations.
2 Do you recall that exchange?
3 ANSWERS BY MR. REICH:
4 A. Yes, I do.
5 Q. Did you have page 32 of the rebuttal report
6 before you?
7 A. Yes, I'm looking at page 32.
8 Q. Okay. The very last paragraph of that page,
9 there's a sentence that says "these data support the
10 conclusion that the change in spring flow at Pederson Springs
11 east and Pederson Springs is closely tied to climatic
12 conditions and not to carbonate groundwater pumping."
13 Is that still your opinion that that's the case?
14 A. Yes, it is.
15 Q. Thank you. I'd like to turn your attention to
16 Exhibit 13, CSI's Exhibit 13, which is also one of the slides.
17 Give me just a second. It's also slide 23 in the direct
18 examination slides. Okay. Thank you.
19 In response to one of the State Engineer staff
20 folks, the -- we've identified the locations of MX-6 is -- may
21 not be correct on this figure. Other than that, is the
22 interrelationship between the wells and the faults accurately
23 represented on this figure?
24 ANSWERS BY MR. CARLSON:

Page 226

1 A. Yes, with the exception of the MX-6, which we
2 pointed out the relationship with the faults, the
3 orientations, the placement relative to the wells that are
4 established there is correct, yes.
5 Q. Okay. Okay. Mr. Carlson, is there -- in
6 addition to the work that you did in your survey, is there any
7 other data that you reviewed that supports that answer?
8 A. Yes. In the rebuttal slides this morning, we ran
9 out of time, so we weren't able to present two or three of the
10 slides. And one of those slides shows data from the USGS open
11 file report. I don't remember the name, but it will be on the
12 slide.
13 Q. And could we pull up slide 22, please, rebuttal
14 slide 22?
15 A. From the rebuttal. Yes. So this is slide 22
16 from the rebuttal and copies are -- were passed out this
17 morning. The base map of this is the southern section of
18 plate one, which is titled isostatic gravity anomaly, USGS
19 open final reports, 00420. They -- faults at all. It was
20 2000 open file report.
21 So all these contour lines that you see are --
22 all the contour lines that -- I'm just showing you the general
23 location. That's the isostatic anomaly contours and what
24 that's telling us is where the density of the subsurface rock

Page 227

1 changes.
2 For example, if we included the entire map, we'd
3 see the -- as we go this way across the contours, we're
4 getting into higher and higher density rock. As we go down
5 towards here and we see some negative contours in the lower
6 left, that's the very low density rock. And it's just like
7 topographic contours. The more contours you see in a given
8 area, the steeper the slope basically.
9 And the USGS in 2000 did a fairly dense gravity
10 survey along these orange lines called S -- gravity profile
11 S1, S3, S2 down here and S4. And apparently their geologists
12 were thinking the same thing as the CSI geologists and us.
13 This is an important area in Coyote Spring
14 Valley. So they ended up putting their lines pretty much
15 where we did. So our line A is right up here, our east/west
16 line B is right here, and then C is over here. It runs behind
17 the cross-section.
18 And all we've done here is align and size our
19 cross-section for line B line, which is right here, lined up
20 so we can look at what they saw versus what we saw.
21 On their map, they're showing faults that they
22 interpret from the gravity data as these gray ovals. You see
23 two of them up here, one right in here. There's actually two
24 or three overlapped right in here, and then two down here that

Page 228

1 we don't cross at all.
2 But if you follow these gray ovals that they
3 interpret -- they call gravity faults because there's a big
4 change in the gravity, which means there's a big change in
5 density. If you just trace those overlay back -- those back
6 to our line, that's where we see a big fault on the edge of
7 that resistive rock.
8 They have a hole here, which is where we see a
9 big change in color. That's where we see -- where we verified
10 the concealed fault from. And out here, they put a gray fault
11 right -- a very steep fault, you can see that by all the
12 contours in that short area.
13 And if you project that onto our line, that's the
14 west end of line B, approximately station 1500 to 2000, that
15 general area. And they draw their faults as big, fat circles
16 because they know that they can't place them exactly down to
17 the 200-foot interval or anything like that.
18 But they can tell from all these contour lines in
19 a very short area that there's a fault there, and that lines
20 up virtually perfectly with the fault that we see on line B.
21 They don't have any dense gravity stations out
22 here, so we can't verify the fault on line A, but we do verify
23 the fault on line B very, very nicely.
24 Down here is their gravity cross-section. They

Page 229

1 divide the results up into just two rock types basically.
2 Cenozoics, which would include basin fill and some of the
3 volcanics and the deeper Paleozoics. That's the high density
4 harder rock. And you can see in their cross-section, that
5 fault right there where we go from high density Paleozoic rock
6 to low density Cenozoic fill and volcanics.
7 So it's -- I honestly wish we had seen the report
8 before we did the survey because we would have adjusted our
9 lines a little bit to line up even better. But this is a very
10 pleasing result, at least to a geophysicist, because we're
11 seeing a big change in two different physical properties at
12 the subsurface at exactly the right points along those lines.
13 We're seeing a big change in electrical
14 resistivity, which is how it conducts electricity, and we're
15 seeing a big change in density, which is how dense that rock
16 is, how tight it is. So a very good result, a very good
17 correlation. And as I say, it's included in our rebuttal
18 slide this morning, but we just didn't get to it.
19 MR. HERREMA: I have no further questions at this
20 point. I'd like to move to have CSI Exhibits 1 and 2
21 admitted.
22 HEARING OFFICER FAIRBANK: The exhibits have been
23 admitted. Thank you.
24 (Exhibit 1 admitted into evidence.)

Page 230

1 (Exhibit 2 admitted into evidence.)
2 MR. HERREMA: Thank you. And then in terms of
3 the slide presentations, should -- how should we mark those
4 for identification in the record?
5 HEARING OFFICER FAIRBANK: Those will be included
6 by the State Engineer in the hearing and filed. They're not
7 being marked as exhibits.
8 MR. HERREMA: Okay. And these lovely posters
9 that we brought today, I know one of them has already been
10 used for additional purposes. Should we, perhaps, mark them
11 and see if they're -- they continue to be used during the
12 seatings?
13 HEARING OFFICER FAIRBANK: Again, they were
14 presented for demonstrative purposes and I think we'll go
15 ahead and just like the PowerPoint presentations, they will be
16 maintained, we'll keep them available for the purposes of the
17 hearing, and -- but I don't see that they're going to be
18 marked as an Exhibit because the deadline for marking
19 exhibits, again, it was a demonstrative document.
20 That was what was it was presented for, so it'll
21 maintain -- be maintained summarily as the PowerPoint
22 presentations that were not marked as exhibits in this list.
23 MR. HERREMA: Okay. I may have been -- or I
24 meant just to mark them so that we can refer to them if

Page 231

1 necessary.
2 HEARING OFFICER FAIRBANK: Well, yes, we'll have
3 them. And then also I think there's some additional follow-up
4 questions, if you don't mind, by our staff.
5 MR. HERREMA: Certainly.
6 MR. BENEDICT: John Benedict for the record.
7 EXAMINATION
8 BY MR. BENEDICT:
9 Q. So I'd like to follow up on the structures and
10 make sure I understand the importance of these structures.
11 The first question, and I guess go to page 24 of
12 this presentation -- no, it's not. It's the one that actually
13 shows the structures based on, I guess, the interpretations of
14 some aerial photos. Do you have that?
15 Yeah. So I wanted to make sure I understood
16 which one of these structures represents what would be called
17 the divide, I guess, or the isolating feature of the barrier
18 of these, just so I'm clear?
19 ANSWERS BY MR. REICH:
20 A. So when we're -- excuse me, this is Steve Reich.
21 What we're identifying as the carbonated block or the
22 isolating feature would be if you look at MX-5, it would be
23 the fault trending north, 30 degrees west, running through the
24 location. And then the fault parallel to that on the other

Page 232

1 side, which is also trending, there we go.
2 So this fault here, which is a continuation of
3 the Arrow Canyon Range, and this fault here, which is the
4 other side of that structural block. What you've seen today
5 is the center area here is that dark blue area, which we're
6 saying is high resistive formation. What we just discussed a
7 minute ago then was this highway fault.
8 So the isolation faults there would be not only
9 the structural block in between, but like we've seen in other
10 areas, normal faults that can also act as barriers or conduits
11 to flow. So there could be, you know -- there could be a
12 movement or, you know, prevention of movement of water across
13 a highway fault, across this fault, across that fault, you
14 know. So those are the main -- those are the main faults that
15 I think are germane to this discussion.
16 Q. So would it be fair to say then there are series
17 of structures that represent that barrier or would you say
18 that that horse block is primarily the feature of importance?
19 A. So I would say they're both important. The horse
20 block is important as well as the other normal faults. If --
21 Anne, you could go to slide 5 or 6 or 7, which is the
22 cross-section, maybe the conceptual drawing.
23 You know, the -- so I bring this up not because
24 it represents that structural block, but rather it represents

Page 233

1 the importance of faults that are in the Coyote Spring Valley.
2 So again, as we look at these faults that are
3 what we considered normal faults or due to extensional. Each
4 one of these faults can impact the flow of water both in a
5 lateral direction as well as a cross direction.
6 So when we look at that conceptual model and then
7 we go to the -- that gravity survey that we were just showing
8 a minute ago, I think it really gives us an understanding
9 that -- the other slide -- of the importance of these and
10 where they're located.
11 So again, looking at those -- looking at that
12 last figure, imagining that one of those normal faults is
13 trending that way. One of those nominal faults is trending
14 that way, one of those normal faults might be trending that
15 direction, a normal fault going up and down there, and also
16 coinciding with that structural block. And then as we've
17 shown before that the fault is located on that side.
18 So that's how we tie that conception model into
19 what we're looking at from the geophysics data and then from
20 the hydrology in terms of groundwater movement.
21 MR. HERREMA: Mr. Reich, can I just interrupt?
22 When you're using the pointer for the purposes of the record,
23 if you could just describe what you're pointing out with your
24 words as well, that would be great.

Page 234

1 MR. REICH: So I was responding to the question
2 by indicating that on the rebuttal Exhibit 22, that there was
3 a fault located through the gravity confirmed by the CSAMT.
4 And when I'm using the pointer here, we -- these are high
5 angle faults. So normal faults would typically be a high
6 angle fault as compared to a low angle thrust fault.
7 So typically somewhere in this range, we would
8 expect to see a high angle fault, and what I'm doing is
9 drawing a near vertical line through the -- just a Paleozoic
10 sediments to represent that high angle fault.
11 Same thing further in the gravity profile, the
12 lower figure in rebuttal slide 22, we would expect there to be
13 some type of fault in this direction. I don't want to venture
14 too far into geophysics, but as we discussed earlier, there's
15 both a down-drop side, as we see, and that's the vertical
16 displacement that we would expect to see.
17 And I think that when you look at how this
18 corresponds, you look at that low resistivity material that's
19 shown in the geophysics slides and you compare that to the low
20 density material that's in the gravity.
21 That correlation -- and I'm circling the low --
22 the red low gravity, low electrical resistivity material at
23 the west end of line B, how that corresponds with the thick
24 sequence of basin fill.

Page 235

1 And then, of course, that's what allows us to
2 draw the conclusion that there's a fault. I think when we go
3 further to the right and we look at that dark red low high
4 conductivity and low rate resistivity section, that also
5 corresponds to the same thing that they saw in the gravity.
6 It's a thickening wedge to the right. So that fault is
7 located there.
8 And then, again, the high carbonate, high
9 resistivity carbonate located here and then -- and again I'm
10 just circling with the pointer on the geophysics on the CSAMT
11 where, you know, you can see a slide replica in the same shape
12 that we see.
13 So again, it's really combining the amount of
14 information that's out there and putting it all together for
15 us to understand why these faults are important, not just a
16 structural block that we talked about, but also the normal
17 faults that occur in the center of the valley, how they offset
18 different sediments and forms.
19 Q. Okay. So last question. The structure that's
20 identified that we've talked about quite a bit on the west, is
21 there any reason from a geophysical perspective to
22 characterize those two faults that are, I guess, mapped or
23 interpreted based on the cross sections as being the same
24 structure as you do in the map? I'm just curious.

Page 236

1 You've got a couple of cross sections and you've
2 identified a structure on the very west side on both of them,
3 and then you've defined that as a single structure inferred on
4 your plan view map.
5 Any reason that they need to be the same
6 structure?
7 A. I'm -- I apologize. I'm not following exactly.
8 Is there a figure that we can look at?
9 Q. Yeah, back to the aerial --
10 A. Yeah.
11 Q. -- photo image.
12 A. And I'm going to let the geophysicist answer
13 that.
14 Q. Yeah.
15 ANSWERS BY MR. CARLSON:
16 A. Yeah, yes. I --
17 Q. You have the aerial photo? Yeah.
18 A. Yeah.
19 Q. So the western most, I'm just curious why that's
20 drawn as a -- connecting the interpreted structures there. Is
21 there an offset that's similar for both of those in the
22 profile or some reason that they have --
23 A. No, the appearance of the fault is complicated on
24 line A by all that culture. So we can't say that they look

Page 237

1 similar enough to be 100 percent sure that it's the same
2 structure.

3 We feel it is based on the fact that we have the
4 continuation of this fault. We see it clearly on both lines,
5 this fault clearly on both lines, and this one was at the same
6 orientation as those.

7 So, yes, we are interpolating across from line B
8 up to line A. There's no way that we can say geophysically
9 that it's absolutely the same feature, but true.

10 MR. REICH: That's all I have.

11 HEARING OFFICER FAIRBANK: All right. Having no
12 other questions from our staff, we can go ahead and conclude
13 today's hearing. And so just to get everyone aware for
14 tomorrow, we'll practice the same procedures again.

15 But, again, if people are expedient and efficient
16 with their use of their time, which is much appreciated by the
17 State Engineer and our staff here, we certainly appreciate
18 that. And we will begin tomorrow with the United States Fish
19 and Wildlife Service. So we'll see you tomorrow. Thank you
20 very much.

21 MR. ROBISON: Thank you.

22 (Proceedings concluded at 3:36 p.m.)

23
24

Page 238

1 STATE OF NEVADA)
2) ss.

3 CARSON CITY)
4

5 I, MICHEL LOOMIS, a Certified Court Reporter, do
6 hereby certify;

7 That on the 24th of September, 2019, in Carson
8 City, Nevada, I was present and took stenotype notes of the
9 hearing held before the Nevada Department of Conservation and
10 Natural Resources, Division of Water in the within entitled
11 matter, and thereafter transcribed the same into typewriting
12 as herein appears;

13 That the foregoing transcript, consisting of
14 pages 1 through 237 hereof, is a full, true and correct
15 transcription of my stenotype notes of said hearing to the
16 best of my ability.

17 Dated at Carson City, Nevada, this 24th day of
18 September, 2019.

19
20
21

MICHEL LOOMIS, RPR

22 NV CCR #228

23
24

#	155:15;173:3,9; 176:14;177:1	6:7;112:9;211:12	71:18,19;72:14,15,23; 73:15,18;75:13,18; 77:22;79:1;80:11;81:9; 82:6,11,19;84:14;93:7; 21;95:6;98:16;114:11; 115:4;117:23;118:14; 119:13;120:14;123:1; 124:5;129:9;163:21; 165:6;176:21;183:20; 188:18;199:11;206:22; 212:8;214:20;230:13, 19;233:2,11;235:8,9, 13;237:14,15	9:19;227:18
#228 (1) 238:22	accurately (3) 52:24;178:15;225:22	adequately (1) 109:1		Allison (1) 159:10
A	acknowledged (1) 193:10	adjusted (3) 94:21;131:7;229:8		allocated (1) 149:8
A4-2 (1) 122:3	acknowledging (1) 107:21	ADMINISTRATION (3) 1:7;48:5;49:12		allow (6) 8:13;50:19;61:23; 92:2;99:5;199:5
A-A (5) 144:19;145:3;214:6; 215:16;216:18	acre (5) 93:11;135:3,9,15; 149:9	administrative (6) 14:23;19:14;103:20; 122:24;125:5;168:8		allowed (1) 92:4
abide (1) 65:18	acre-feet (1) 95:2	admitted (13) 50:22;65:3,21;100:8, 13,15,19,20,22;229:21, 23,24;230:1		allows (5) 17:9;70:8;80:22; 87:4;235:1
ability (1) 238:15	acronym (1) 49:8	admitting (2) 36:1;100:11	against (5) 35:14;39:18;44:11; 60:21,22	alluvial (12) 97:14,17;109:19; 110:4,6;112:21,22; 141:15;142:1;178:13; 179:11;220:20
able (18) 9:22;15:2,12;16:16, 17;87:1,4,5;95:20; 102:2;131:19;173:17; 201:16;212:22;213:9; 221:3;222:10;226:9	across (18) 21:3;22:2,7;23:1; 26:14;27:15;35:2; 56:12;63:18;81:1; 102:17;210:14;214:18; 227:3;232:12,13,13; 237:7	advance (12) 20:18;21:16;23:4; 28:14;31:17;33:10,20; 36:3;40:15;43:2;51:18; 67:13	age (2) 168:19;169:1	almost (7) 34:13;44:16;45:14; 64:7;74:24;83:14; 97:18
above (3) 43:9;165:3;214:19	act (4) 26:22;83:8;118:5; 232:10	Advancing (6) 41:15;43:17;47:21; 49:13;73:9;91:17	agencies (2) 32:17,22	alone (3) 114:6;147:10,18
absent (1) 29:2	Acting (2) 2:4;5:10	adversarial (2) 6:6;7:1	agent (1) 32:21	along (29) 14:19;21:4;26:5,7, 12,15;27:4;33:13;36:7; 40:23;64:5;73:7,7; 117:24;119:17,23; 143:3,10;176:1,2,10, 12;178:5;179:15; 193:7;212:11;215:16; 227:10;229:12
absolute (1) 131:24	actual (2) 115:24;219:23	aerial (5) 45:14;58:15;231:14; 236:9,17	ages (1) 20:22	alternately (1) 153:3
absolutely (4) 77:6;164:6;186:3; 237:9	actually (23) 15:1;30:2;31:20; 39:17;40:3;42:8;60:24; 72:16;100:7;111:12; 134:2;153:4;165:11; 174:5;179:12;201:11; 210:16;211:12;213:6, 21;219:7;227:23; 231:12	afar (1) 192:19	agree (25) 41:12;107:10; 108:11;113:7;122:22; 127:17,24;128:11,18, 22;129:12;131:1; 135:1,2,14,17;136:12; 139:23;141:15;142:7, 10;156:1,21;157:2; 158:17	alternating (2) 31:8,13
abundantly (1) 138:9	Adam (2) 2:5;5:11	affect (24) 17:23;22:10;28:21, 23;29:9;57:9;59:9; 85:5;86:11,22;97:24, 24;98:1,2;103:17; 104:7,7;124:9,9,21; 153:16;165:15,16; 205:3	agreed (1) 103:1	altitude (1) 49:3
accept (2) 65:4,9	adaptation (1) 121:1	affected (2) 24:8;38:18	agreement (7) 37:23;41:10;42:6; 43:7,11;47:7;189:14	always (6) 23:8,9,24;62:16; 197:12;207:11
acceptable (3) 222:12,13,14	add (4) 57:6;64:10;77:6; 90:15	affecting (10) 30:12;85:1;86:19,19, 20,21;185:7;206:1,24; 221:23	ahead (36) 5:4,23;6:16;7:7,8,6, 17;9:5;50:19;66:20; 83:18,23;115:2;116:3; 125:23,24;126:5,5,8, 12,17;137:7;138:8,19; 151:7;152:7;186:8; 190:16;191:13;212:4; 215:22;223:19,21,24; 224:9;230:15;237:12	among (2) 168:9;215:20
accepted (6) 31:18;66:18;67:7; 173:1,12,13	add-in (1) 128:1	affects (13) 17:3;28:22,23;29:13; 82:17;102:19,20; 120:17;125:14;141:16, 20;142:8;205:9	aid (3) 60:5;72:11,15	amongst (1) 210:1
accessible (2) 8:2;127:22	addition (3) 90:5;199:2;226:6	afternoon (8) 7:5,10,11;141:10; 144:13;152:13;172:3; 177:10	air (1) 40:21	amount (18) 58:20;68:1;91:13; 98:20;104:14;107:2; 108:16;112:9;118:14; 123:23;124:1;135:3; 169:15;197:10;200:3; 206:6,7;235:13
accidental (1) 224:6	additional (12) 7:15,17;149:1; 190:14,20;198:22; 201:6;208:5,11; 211:15;230:10;231:3	afterwards (1) 189:19	al (1) 128:8	amounts (1) 52:7
accomplish (1) 206:23	Additional (3) 6:16;7:11,22	again (74) 6:24;17:21;19:13; 20:10;22:18,21;27:24; 36:9;43:4,12;45:11; 51:14;56:9;59:4;62:22; 63:3,10,13,21;64:8,12; 68:22;70:2,14,20,24;	alarm (1) 7:7	AMT (2) 30:5;31:23
according (1) 26:10	address (7) 8:17;20:1;86:4; 97:11;138:5;153:6,7		Alex (2) 3:7;172:18	analysis (61) 6:3;10:4;17:19; 25:18;27:21;53:23; 76:22;88:13;92:1,2,4; 93:13;94:3;95:3;101:6, 17;109:7,11,14,22;
account (7) 23:16;95:21;112:19; 113:21;119:12,15; 153:24	addressed (6) 97:13;98:14;109:1; 110:2,7;155:21		align (2)	
accounted (3) 95:16;113:1;136:14	addressing (3)			
accounting (2) 10:10;205:14				
accounts (1) 205:7				
accumulation (1) 61:17				
accurate (8) 139:7,23;153:22;				

<p>110:2,5,19;112:13,19; 113:2,24;118:12,22; 120:19;121:14;123:14; 127:10,11,12,15; 128:24;129:15,24; 130:11;131:15,22; 133:13,13;143:21; 148:7,14;150:20,22; 151:10,14,19;153:11, 21;154:1,12;187:10; 188:9;213:15;224:16, 18</p> <p>analytical (3) 121:6;130:17;131:19</p> <p>analyze (4) 7:2;27:23;118:7; 122:15</p> <p>and- (1) 3:3</p> <p>and/or (3) 62:16;153:16,20</p> <p>Angeles (1) 2:23</p> <p>angle (5) 234:5,6,6,8,10</p> <p>Anne (1) 232:21</p> <p>annual (19) 49:18,19,21;50:2; 63:16;64:10;69:9,10; 70:2,19,20,22;86:5; 93:2;106:20;108:9; 109:1;120:1;203:7</p> <p>annually (2) 157:7,9</p> <p>anomaly (2) 226:18,23</p> <p>answered (3) 13:13;54:15;208:2</p> <p>apart (4) 24:21,22;26:1,7</p> <p>apologize (4) 97:12;119:5;187:2; 236:7</p> <p>apparent (1) 47:3</p> <p>apparently (1) 227:11</p> <p>appear (5) 63:7;100:6;146:11, 22,24</p> <p>appearance (3) 126:8;177:15;236:23</p> <p>APPEARANCES (3) 2:1;3:1;126:9</p> <p>appearing (2) 172:4,6</p> <p>appears (6) 146:20;182:21; 183:19;202:7;203:18; 238:11</p> <p>appendix (14) 93:9;121:13,13;</p>	<p>132:23;133:4;145:9; 154:21;155:12,18; 161:9,10;176:20,23; 177:1</p> <p>application (2) 128:13;129:24</p> <p>applications (3) 148:18;149:2;167:5</p> <p>applied (6) 92:10;93:3;128:24; 129:14;154:7;167:4</p> <p>apply (1) 59:21</p> <p>appreciably (1) 169:6</p> <p>appreciate (1) 237:17</p> <p>appreciated (1) 237:16</p> <p>appreciative (1) 16:14</p> <p>approach (2) 86:7;130:7</p> <p>approached (1) 224:20</p> <p>appropriate (3) 132:16;162:16;163:8</p> <p>appropriation (1) 149:2</p> <p>approximate (1) 217:6</p> <p>approximately (22) 6:20;24:17;25:3; 51:9;109:8,15;111:1; 112:4,6;116:23; 146:10,18,19,22;147:6; 167:14;175:24;190:21; 202:3;203:15,22; 228:14</p> <p>April (5) 10:23;12:2;74:7; 218:1,19</p> <p>aquifer (46) 17:22,23;19:2,2,24; 21:1,8;53:14;54:2,19; 55:8,18;56:11;58:5,5, 16;67:17;68:4;74:4,7; 84:9,11;96:5;97:14; 102:18;103:16;105:19, 23;106:19;107:15; 108:7;110:3;112:21, 23;113:14;123:19,22; 129:1,17,18;136:19; 140:3;178:13;179:13, 20;189:3</p> <p>aquifers (2) 97:11;106:22</p> <p>aquifer's (1) 57:22</p> <p>AREA (140) 1:12;5:16;10:5;11:3; 14:21;15:3;17:2,13; 19:5,23;20:12;22:24;</p>	<p>26:8;27:2;28:7;34:19; 43:11;54:10;61:15; 64:1,3;67:24;68:10; 69:1,5;70:1,8,13;71:12, 18,19;72:8,8;73:18; 76:4;77:19;78:6,14,16; 79:20,22;80:10;81:11, 13;82:1,17;83:4;84:20; 89:6,11,16,18,20; 90:21;93:14;94:15; 97:16,19;104:6,7; 105:8;108:3;109:10, 13,16;110:18,21; 112:1;113:5;114:18; 119:24;120:7,13; 125:19;127:20,21; 139:19;140:6,8; 141:15;142:1,8; 143:22;145:14,16,18; 146:1,2;148:17;155:9; 160:8,9,21;164:1,9; 168:21;174:20;175:6; 178:23;179:9,17; 185:7,8,10,23;186:2; 188:4;195:13,21; 196:8,8,17,23;197:1, 21;200:12;209:5,6,22; 210:9,10,10;212:1,17, 22;213:1,4;214:16,21; 219:1;221:7,9;227:8, 13;228:12,15,19;232:5, 5</p> <p>areas (17) 26:13;48:24;75:14; 81:24;89:21;90:13; 92:23,24;167:4; 168:21;179:15;185:8; 207:14,15;210:10; 213:16;232:10</p> <p>argue (1) 220:8</p> <p>around (13) 7:9;38:16;39:4;40:3; 41:2;54:19;56:4;57:12; 183:10,17;197:4; 213:20;221:8</p> <p>Arrow (16) 34:1;35:5,5;39:8; 41:20;43:8,21;44:4; 56:6;90:13;105:12; 122:4;180:14;188:3; 214:12;232:3</p> <p>arrows (2) 22:21;51:23</p> <p>aspects (3) 103:1,2;120:22</p> <p>assert (2) 167:8;204:1</p> <p>assess (5) 14:11;81:3;119:16; 125:9,18</p> <p>assessed (1) 16:5</p>	<p>assessment (1) 118:14</p> <p>assign (3) 50:20;66:24;206:8</p> <p>assignment (2) 101:10,12</p> <p>assist (1) 10:2</p> <p>associate (1) 88:3</p> <p>associated (4) 21:23;22:8;62:20,21</p> <p>Associates (1) 172:15</p> <p>assume (4) 109:14;133:24; 149:4;171:3</p> <p>assumed (1) 139:9</p> <p>assuming (1) 45:8</p> <p>assumptions (4) 55:7;121:21;131:6; 154:4</p> <p>astray (1) 162:14</p> <p>Atmospheric (2) 48:5;49:11</p> <p>attached (1) 218:5</p> <p>attention (9) 14:6;45:22;59:12; 98:10;103:6;122:14; 123:13;181:22;225:15</p> <p>attorney (2) 127:3;162:12</p> <p>attorneys (1) 126:10</p> <p>audible (1) 7:6</p> <p>AUDIENCE (3) 126:21,24;127:4</p> <p>audiofrequency (3) 29:17;30:5;31:23</p> <p>August (5) 9:16;12:24;15:16; 76:17;218:5</p> <p>Austin (1) 172:7</p> <p>Authority (10) 13:7;106:6;108:8; 109:18;125:1;140:14; 141:11;160:18;191:7, 21</p> <p>Authority's (1) 110:9</p> <p>authorize (1) 196:14</p> <p>authors (4) 9:21;128:11,22; 129:13</p> <p>availability (3) 16:2;118:23;125:4</p>	<p>available (32) 8:21;30:19;47:17; 53:21;65:11;66:21; 72:3;86:11;90:14;91:9; 99:3;100:2;102:4; 103:12;116:4;122:23; 127:21;128:2,9; 130:13;148:21,23; 149:3,6;150:16,16,19; 164:18;168:7;173:18; 176:15;230:16</p> <p>average (22) 50:2,4,5,9;55:24; 56:1;63:7,7,18;64:15; 85:15;93:2;120:6,9; 121:10;133:9,16; 149:17;161:20,23; 187:21;202:8</p> <p>averaged (2) 157:7,8</p> <p>averaging (2) 157:13,14</p> <p>aware (14) 127:17,23;129:4; 152:21;162:24;164:10, 14,21;201:2,3;203:2,9; 204:7;237:13</p> <p>away (12) 39:17;43:6;56:3,7, 15;57:3;62:3;71:8; 78:7;121:18;202:12,16</p> <p>axes (1) 175:2</p> <p>axis (17) 62:12,14,18,20,21; 64:6;110:22;111:1,6,7, 8,8,10,13,21;115:22; 176:10</p>
B				
			<p>back (37) 13:13;24:1;30:18,19; 32:7;48:11,15,19; 61:24;63:21;83:19,23; 84:13;86:17;93:7; 102:16;104:23;117:23; 124:15;136:8;137:8, 11;148:1,24;149:15; 152:8;161:6;175:22; 183:21;190:16,17; 205:10;223:20,24; 228:5,5;236:9</p> <p>background (4) 29:6;131:12;132:2,2</p> <p>backwards (1) 101:5</p> <p>Baker (1) 172:7</p> <p>balance (7) 108:1;150:9;167:24, 24;170:3,8,16</p> <p>balanced (3)</p>	

88:23;90:17;94:22 balancing (1) 88:13 Baldwin (5) 4:6;138:21,21;139:2; 140:12 band (6) 44:9;137:9;138:20, 22;160:19,22 bar (4) 50:5;69:15;71:2,3 barely (1) 43:22 Barnes (2) 2:8;5:18 barrier (11) 26:23;81:24;83:6; 160:7,7;185:18,20; 195:15;211:10;231:17; 232:17 barriers (14) 26:22;73:7;80:24; 81:1;83:1;96:15;98:19; 102:19;104:11;107:6; 118:5;123:2;133:18; 232:10 bars (14) 49:18,23;62:20; 63:16,17;68:24;71:17; 73:24;74:2,2;75:11; 115:7;119:23;189:6 base (3) 81:7;178:5;226:17 based (40) 17:12;18:21;35:23; 40:10;48:17;50:20; 57:22;83:5;94:16,17, 20;95:3;98:8;107:5; 112:14;115:19;121:3; 124:1;134:22;140:6,8; 147:10;148:7;149:12; 150:5;151:13,14; 152:2;160:10;165:19, 23;166:8,10,12; 172:22;175:18;177:2; 231:13;235:23;237:3 basic (4) 17:1;24:12;36:8; 59:18 basically (13) 34:20;36:1;42:10; 59:7;64:14;83:6; 111:15,18;112:9; 156:4;185:12;227:8; 229:1 BASIN (52) 1:9,10,11,13;5:20; 14:23;15:14;19:7,8,10, 14;20:16,17;21:8;23:8; 24:19;25:9;34:21;35:8, 17;37:6,17;38:1,3,11; 41:6;44:3;48:23;49:4; 50:13;82:2;85:23; 91:14;95:19;103:22; 104:1;131:2;136:23; 153:16;166:24;167:1, 8;168:20;179:7,9,16; 180:19;196:18;209:7; 220:12;229:2;234:24 basins (8) 5:21;14:22;19:8; 87:16;122:21;135:19; 136:21;166:20 basin's (1) 6:12 basis (11) 49:20,22;50:3;77:9; 91:10,10;102:24; 109:4;118:17;215:9; 218:14 batteries (1) 42:21 BB (4) 219:3,4,7,18 beauty (1) 55:18 became (1) 30:18 become (1) 131:21 becomes (2) 28:3;211:22 Bedroc (4) 3:11;177:16,18; 208:16 bedrock (2) 34:22;180:10 began (2) 156:9,11,19 begin (3) 9:9;87:4;237:18 beginning (8) 15:24;25:7;67:16; 68:14;104:23;173:5; 190:10;208:2 behalf (4) 6:22;8:7;126:20; 199:15 behave (1) 114:2 behaves (1) 116:5 behaving (4) 55:22;116:20; 189:18;211:24 behind (1) 227:16 Belaustegui (1) 2:19 below (1) 81:12 bend (2) 34:15;41:20 Benedict (8) 2:11;4:15;5:13; 209:2,2;231:6,6,8 Besides (2) 75:4;161:5 best (15) 108:19;110:12; 119:18;136:7;162:13; 165:5;168:7;171:8,9; 172:19;173:18;176:15; 200:23;201:1;238:15 Beth (1) 138:21 better (13) 18:19;19:16;36:19; 60:15,17,20;120:18; 125:7;135:1;162:17; 211:6;216:6;229:9 beyond (2) 74:7;196:19 big (15) 36:21;39:21;42:5; 43:7;74:5;96:6;120:14; 228:3,4,6,9,15;229:11, 13,15 Biologic (2) 3:15;162:8 Biological (5) 52:16;76:8;162:11; 201:10,15 biologist (1) 164:13 bit (27) 9:2;17:24;19:16; 21:5;26:1;34:19;35:5; 41:7;44:19;47:20;49:5; 60:18;71:5,6,6,14; 74:1;84:6;170:15; 183:18;193:7;199:5; 205:10;214:4;215:19; 229:9;235:20 BLACK (21) 1:9;33:4,7,8;41:3; 45:11;50:7,11;51:3; 62:19,20;63:14;64:5; 68:23;89:19;104:5; 120:3;131:21;197:20, 20;221:8 Bliss (2) 2:14;5:20 block (34) 10:23;11:2;36:21; 60:19;80:1;83:7; 105:13;113:23;117:13, 15,18,24;133:23;134:1, 3,5,6;144:11;174:9; 176:8;194:16,23,24; 195:1,2,6;231:21; 232:4,9,18,20,24; 233:16;235:16 blocked (1) 174:15 blocks (6) 61:5;96:17;118:4; 133:19;181:12;194:14 blown (1) 51:24 blowup (1) 20:19 blue (36) 21:4;35:3,12;36:18, 21;37:3,12,14;39:9,16, 20;40:4;42:3;43:7,8; 44:7;49:18,23;62:20; 63:16;68:10,11;71:19; 73:24;75:11;89:4; 110:23;114:14;115:9; 214:15;215:12;219:23; 220:14,16,19;232:5 blues (5) 40:13,14;41:24,24; 42:5 both (21) 21:22;26:17;29:15; 48:8;49:18;89:10,11; 120:22;133:18;140:10, 20;188:3;193:23; 217:13;232:19;233:4; 234:15;236:2,21; 237:4,5 bottom (16) 23:19,22;24:4;30:24; 51:24,24;52:9;78:21; 106:19;110:8;111:5; 115:7;119:23;165:17; 189:6;220:16 Botts (1) 172:7 boundaries (13) 20:5,16,17;55:9; 107:9,11;122:9; 159:17;160:4;195:12; 210:13,13,14 boundary (26) 10:9;19:4,15,17; 57:8;94:3;95:15;96:2; 103:20;106:18;107:12; 108:1;136:13;144:9; 174:9;194:10;195:18, 20,22,24;196:16,18,24; 198:2,3;210:11 bounding (2) 35:18;41:6 bounds (1) 167:6 box (8) 33:4,7,8;131:21; 197:3,7,8,11 boxes (1) 33:9 Brad (2) 9:8;100:16 break (10) 7:10;9:19;83:15,19; 84:5;125:23;137:7; 212:4;221:10;223:19 breaks (1) 7:8 Bridget (2) 2:14;5:20 brief (1) 224:11 brine (1) 38:3 bring (4) 61:10;95:8;159:14; 232:23 broad (1) 42:15 Broadbent (1) 172:9 broader (1) 167:7 broke (1) 92:24 broken (1) 46:16 brought (4) 97:21;104:24;125:8; 230:9 brown (1) 21:12 Brownstein (1) 2:22 budget (51) 18:14;86:8;87:3,11, 12,23,24;88:22;89:24; 90:2,17,24;91:3,7; 93:16,18,19;94:5,16, 18,22;96:24;97:22; 123:4;125:10;136:8; 148:13;150:8,9; 167:13,15,22;168:6; 170:6;171:6;172:21; 173:2,6,7,13,15,16,19, 20,22;177:4;186:3; 196:6;204:10;221:15; 222:1 budgets (4) 86:9;168:5;170:7; 220:24 build (1) 171:14 building (2) 7:20;32:14 built (2) 70:18;146:17 bulk (1) 34:20 bullet (5) 104:17;105:22; 110:8;119:8,9 bump (8) 63:5;182:19,21,24; 183:1,11,14;209:15 bunch (1) 31:5 business (2) 32:6;126:16				
C				

<p>calculate (3) 29:23;31:15;150:11</p> <p>calculated (1) 151:1</p> <p>calculation (4) 150:5,6;151:18,23</p> <p>calculations (1) 10:18</p> <p>calendar (3) 49:20,22;50:3</p> <p>California (9) 2:23;11:16;89:11,17; 90:20;163:24;164:1; 165:14;197:19</p> <p>call (9) 19:6;24:23;35:21; 38:18;128:7;169:1; 178:7;212:4;228:3</p> <p>called (5) 28:18;29:19;92:12; 227:10;231:16</p> <p>calling (2) 175:2;217:18</p> <p>calls (1) 121:2</p> <p>came (6) 36:16;54:14;68:2; 93:5;105:3;218:3</p> <p>camera (1) 61:2</p> <p>can (238) 14:7;18:17;19:4,15; 20:1,4,7,21;21:4;22:1; 23:16;26:5,7,22;27:1, 10,19;29:3,23;30:8,14, 15;34:7;35:10,23;36:8, 13;37:2,10,12;38:1,6; 39:6;40:12,22;41:8; 43:6,8;45:7,10,14,21; 46:15;47:21;48:8;49:6, 14;51:7,8,10,11;52:6; 55:6;57:6,7,11;58:16; 59:13;61:1,3,10,22; 62:4,8;63:1;64:2,2,4, 23;65:17;66:12;68:5; 69:10,14;72:14;74:4,6, 15,18,24;75:7,13,13, 24;76:1;77:2,7,23; 78:13;80:5,15;81:22; 83:17;84:24;87:6,16; 88:1,2;89:4,23;90:1,3; 91:3,14;94:8,23;95:15; 96:4,22;97:7;98:8,23; 102:15;103:8;104:6, 14;107:2;108:9,17; 109:24;111:5,5,14,18, 20,22;112:15;115:4,12, 20;116:4,18,22;118:4, 15;119:22;120:10; 124:10,16;125:9,18,19, 24;129:9;133:2,12; 134:17,20;136:15,15; 139:3;147:9,14,16;</p>	<p>148:9;151:6;152:7; 153:17;159:14;162:16; 163:1,18;164:8; 165:10,19;166:22; 168:4;170:16,20; 178:12;181:17,22; 182:23;183:24;185:6; 186:24;188:13,13; 192:8,13,16,19,22; 193:4,7,19,22;194:18; 195:19;196:1,13,17; 197:1,3,8;198:9,11,11, 14,18;200:8,8,24; 202:12;204:4;205:8, 19,23;206:18,23,23; 207:7;211:7;214:10, 23;215:6,18;217:14; 218:22;219:24;220:8; 221:15;222:1,4; 223:11,20;227:20; 228:11,18;229:4; 230:24;232:10;233:4, 21;235:11;236:8; 237:8,12</p> <p>Canyon (13) 34:1;35:5;39:8; 41:20;43:8,21;44:4; 56:6;90:13;105:12; 180:14;188:3;232:3</p> <p>Canyon's (1) 122:4</p> <p>capacity (2) 153:18,19</p> <p>capture (10) 141:24;162:19,20; 163:13;206:6,10; 207:9,13,13,13</p> <p>captured (4) 165:16;205:3; 206:18;223:12</p> <p>capturing (7) 164:11;204:5; 205:24;221:23,23; 223:8,11</p> <p>Carano (2) 172:4,8</p> <p>carbon-14 (1) 88:13</p> <p>carbonate (37) 10:13;11:2;19:2,24; 21:1,1,7;53:14;54:1; 64:4;69:1;97:14,16; 110:3;114:13;119:24; 120:7;123:19;124:6,6; 140:3;142:7;154:20; 157:6,8;178:13,23; 179:4,6,13,16;187:15; 220:12,15;225:12; 235:8,9</p> <p>carbonated (3) 26:11;108:17;231:21</p> <p>carbonates (5) 23:20,21,23;24:6;</p>	<p>220:17</p> <p>careful (2) 71:15;109:9</p> <p>Carlson (36) 11:22,22;28:8,11,12, 14;31:17;33:10;36:4; 40:16;42:20;43:15,18; 44:22;46:8;47:9;139:3; 144:12,13,15;147:8; 214:4,16;215:17,24; 216:5,20,23;217:6,16; 218:1,23;219:21; 225:24;226:5;236:15</p> <p>C-A-R-L-S-O-N (1) 11:23</p> <p>Carlson's (1) 143:23</p> <p>Carson (6) 2:17;5:1;138:1; 238:2,6,17</p> <p>case (10) 9:6;14:8;54:1;57:8; 68:23;78:20;125:21; 154:11,20;225:13</p> <p>cases (3) 32:17;62:17,17</p> <p>casing (1) 72:20</p> <p>cast (1) 8:23</p> <p>caught (1) 157:18</p> <p>cause (3) 104:3;161:18;211:11</p> <p>causes (3) 38:19;56:15,17</p> <p>causing (8) 57:3;146:17;147:3, 11;165:11;210:8; 211:8;213:5</p> <p>Cave (1) 19:9</p> <p>caveat (1) 131:18</p> <p>Caviglia (11) 2:24;4:13;42:16,17, 17;181:5,5,9;182:7; 186:5;208:20</p> <p>CCR (1) 238:22</p> <p>CDM (4) 50:12;63:9,15;68:23</p> <p>CDVF-2 (2) 72:13,13</p> <p>Cenozoic (1) 229:6</p> <p>Cenozoics (1) 229:2</p> <p>Center (17) 3:15;26:4;33:24; 34:1;36:22;39:10; 52:15;72:7;76:8; 162:11;187:17;188:6;</p>	<p>194:16;201:11,14; 232:5;235:17</p> <p>centered (1) 146:6</p> <p>centers (3) 55:2;162:7;201:10</p> <p>central (7) 38:7;42:2,8,14; 130:8;184:12,12</p> <p>certain (5) 30:7;165:14;206:6,7; 211:22</p> <p>certainly (7) 76:11;90:24;100:22; 106:1;124:18;231:5; 237:17</p> <p>Certified (1) 238:4</p> <p>certify (1) 238:5</p> <p>CEVF2 (1) 72:22</p> <p>CEVF-2 (4) 73:4;79:11,11;80:6</p> <p>CFS (13) 111:15,19,23;112:2, 4,6;158:2,6,10,14,19, 19;165:3</p> <p>Chair (1) 126:21</p> <p>challenge (1) 209:21</p> <p>chance (1) 76:12</p> <p>change (27) 39:21;40:4,13,24; 41:1,9;42:5;44:21; 82:5;87:16;99:11; 102:8,8;107:11;116:1; 148:12;170:18;181:17; 189:20;218:11;225:10; 228:4,4,9;229:11,13,15</p> <p>changed (3) 74:1;150:18;170:23</p> <p>changes (12) 27:14;40:10;41:24; 43:7;51:17;86:17; 104:3;142:24;148:7; 218:8,10;227:1</p> <p>changing (2) 31:10;170:16</p> <p>characteristics (8) 75:2,18;78:10; 120:15;136:1;189:1; 203:8;212:24</p> <p>characterization (8) 63:11;81:16,20;82:7; 84:17,23;117:9;128:12</p> <p>characterizations (1) 63:20</p> <p>characterize (8) 47:18,22;53:2;54:18; 67:24;85:20;141:23;</p>	<p>235:22</p> <p>characterized (2) 62:9;107:7</p> <p>characterizing (1) 50:12</p> <p>chart (3) 52:18,19;64:3</p> <p>charts (2) 76:10,10</p> <p>chase (1) 127:8</p> <p>check (4) 99:13;121:20; 224:20,20</p> <p>checking (1) 127:12</p> <p>checks (1) 46:14</p> <p>Chief (6) 2:7,10;5:12,17; 11:23;28:9</p> <p>choose (1) 29:4</p> <p>chose (3) 88:20;168:8;184:15</p> <p>chosen (1) 110:19</p> <p>Christi (2) 5:13;186:12</p> <p>circles (1) 228:15</p> <p>circling (2) 234:21;235:10</p> <p>citations (2) 151:14,17</p> <p>citing (1) 76:10</p> <p>City (9) 2:17;5:1;138:1; 162:3,5;201:7;238:2,7, 17</p> <p>civil (1) 12:4</p> <p>clarify (8) 65:19;138:8;150:14; 166:22;171:1;172:9; 198:14;217:23</p> <p>clarifying (1) 61:13</p> <p>clarity (1) 36:10</p> <p>Clark (1) 210:22</p> <p>classic (1) 90:2</p> <p>clear (9) 6:5;8:7;138:9; 174:18;193:3,19; 195:7;198:11;231:18</p> <p>clearly (7) 105:2;121:22; 206:10;213:8;222:7; 237:4,5</p>
--	---	--	---	--

climactic (2) 47:18;68:20	105:17;170:11	comprehensive (5) 8:20;25:18;88:21,21; 173:16	155:23;161:19,23; 167:11;202:8;204:13; 225:12	238:12
climate (25) 17:23;47:11,15,22; 48:3,6,9,10,10,16; 49:17,20;51:22;52:2,5; 53:2;85:10,17,18; 92:19;102:19;120:16; 162:1;209:13;213:21	combined (1) 188:8	compressional (4) 24:9,10;25:1,20	conduct (2) 8:12;28:19	constant (3) 74:13;119:4;124:3
climatic (16) 10:12;17:24;51:8; 69:7;70:15;75:6;80:13; 14;82:12;96:7;103:13; 107:6;119:18;124:7; 155:23;225:11	combining (1) 235:13	comprise (1) 14:22	conductive (5) 38:10;145:22,24; 160:22;214:20	constitutes (1) 218:11
clock (1) 141:4	comfortable (1) 87:15	compute (1) 93:2	conductivity (3) 58:11;215:1;235:4	construction (3) 38:16;145:23;219:1
close (7) 27:11;45:16;54:10, 11;126:16;142:23; 188:5	coming (15) 19:5;43:6;46:15; 58:20;59:5;91:15; 95:22;168:1;169:7; 174:2,5,10,14;180:15; 211:20	computer (1) 36:16	conducts (3) 36:19;38:19;229:14	contact (1) 31:6
closely (1) 225:11	comment (2) 107:23;185:11	concealed (8) 36:2;39:15,22;40:8; 41:21;42:4;46:24; 228:10	conduits (2) 104:11;232:10	contained (5) 11:2;82:20;132:23; 173:23;178:22
closer (6) 21:13;60:18;121:18; 131:9;180:12;216:24	comments (4) 106:15;122:19; 159:18;184:2	conception (1) 233:18	cone (15) 55:17;56:10,15,16, 17;57:2,9,12;58:15,19, 19,21,23;59:3,6	contention (1) 176:13
coalesce (1) 57:12	commercially (1) 30:18	conceptual (29) 9:24;15:11;16:1; 18:10,13;19:24;23:7,9, 10,14;28:2;71:10; 80:22;83:1;85:4;91:20; 94:7;98:22;103:9; 105:16;125:10;165:20; 167:7;179:14;180:23; 196:6;209:22;232:22; 233:6	cones (1) 57:6	context (1) 93:8
co-counsel (1) 101:4	common (2) 18:1;179:2	conceptually (1) 55:20	confident (2) 105:15;147:8	continuation (3) 105:12;232:2;237:4
code (2) 121:2;128:1	commonly (2) 30:20;32:11	concerned (1) 139:17	confidential (1) 8:1	continue (9) 51:2;80:8;84:7; 112:14;137:10;179:14; 209:16;213:9;230:11
coefficient (2) 58:9,22	community (1) 31:19	concerning (1) 123:14	confirm (4) 17:9;105:10;134:20; 140:2	continued (1) 74:6
coefficients (11) 93:3;129:3;150:12; 151:5;152:4;166:8,9, 11,15,17,18	companies (2) 32:24,24	concerns (2) 54:16;138:6	confirmed (2) 10:22;234:3	continues (1) 75:21
Cogen (2) 172:15;208:9	Company (6) 159:7,12;177:9,11; 208:13;218:1	conclude (4) 7:16,18;97:20; 237:12	conflicts (1) 108:24	continuing (3) 15:16;74:12;124:4
coincide (1) 133:20	compare (5) 115:21;116:18; 117:11;189:3;234:19	concluded (3) 19:9;140:2;237:22	confused (2) 175:1;198:5	contour (4) 219:24;226:21,22; 228:18
coinciding (1) 233:16	compared (6) 27:16;109:12; 168:16;169:1;189:10; 234:6	concludes (1) 99:9	connected (3) 85:10;167:20;211:18	contours (6) 226:23;227:3,5,7,7; 228:12
colleagues (2) 120:19;192:21	compares (1) 109:5	conclusion (10) 7:23,24;83:5;91:11; 147:19,20;160:2; 218:14;225:10;235:2	connecting (3) 175:4,5;236:20	contracted (1) 28:17
collected (3) 52:24;53:1;127:20	compartment (1) 223:12	conclusions (17) 6:1,22;7:3;9:14,15, 22;10:7;12:19;14:1,2; 18:15;50:15;68:3;77:7; 91:8;155:24;213:19	connection (8) 78:5;114:8;117:22; 184:3,19;185:3,14,21	contribute (1) 179:16
collective (1) 211:20	compartments (1) 10:24	conclude (4) 7:16,18;97:20; 237:12	CONSERVATION (2) 1:2;238:8	contributes (9) 134:11;135:2,8,10, 15,18;178:4;179:5,16
collectively (1) 154:10	compilation (3) 65:2,9;66:1	concluded (3) 19:9;140:2;237:22	consider (10) 85:19;103:19;108:3; 125:17;134:5;147:7, 17;158:24;160:14; 184:12	contributing (4) 136:4;178:9,23; 180:19
color (3) 36:15;50:2;228:9	complete (1) 125:12	concludes (1) 99:9	consideration (2) 85:22;98:7	contribution (3) 11:3;109:5;122:4
Colorado (3) 19:6,10;160:24	completed (3) 105:23;153:12; 218:13	conclusion (10) 7:23,24;83:5;91:11; 147:19,20;160:2; 218:14;225:10;235:2	considerations (1) 103:9	contributions (3) 109:16;112:20,22
colors (2) 34:19;215:8	completely (3) 81:14;131:15;203:23	conclude (4) 7:16,18;97:20; 237:12	considered (10) 95:24;96:9,20;98:3; 105:18;108:6;109:21; 110:5;146:15;233:3	control (9) 10:14;22:14;30:16; 53:20;83:3;163:21,22; 190:3;210:22
column (2) 106:16,19	complex (4) 54:21;121:5;154:2, 11	conclude (4) 7:16,18;97:20; 237:12	considering (1) 148:18	controlled (3) 29:16;30:1;81:13
columns (1) 106:10	complicated (2) 60:7;236:23	conclude (4) 7:16,18;97:20; 237:12	consistency (1) 168:9	controlling (1) 165:12
combination (2)	component (1) 91:20	conclude (4) 7:16,18;97:20; 237:12	consistent (4) 156:8;174:17,18; 183:16	controls (1) 17:16
	components (6) 58:4;104:9,10,20; 169:13;195:14	conditions (27) 10:12;46:18;47:18; 53:7;63:7,7;64:15; 68:20;70:15;82:12; 85:16;94:23;96:7; 103:12;107:6;116:12; 119:2,18;124:7,11;	consisting (1)	conversation (1) 60:15
				convey (1)

<p>85:3 Cooper (8) 4:14;5:13;186:9,12, 12,16;187:6;190:12 copies (3) 65:10,15;226:16 copy (4) 66:21;159:12; 217:14;224:3 core (4) 26:2;28:21,22; 195:14 corner (3) 45:22;48:3;66:2 correctly (3) 66:1,3;169:20 correlate (1) 54:16 correlates (1) 111:15 correlation (3) 37:5;229:17;234:21 correspond (1) 139:4 corresponds (4) 124:2;234:18,23; 235:5 counsel (6) 9:8;65:22;66:4; 101:4;138:23;224:2 countries (1) 32:23 County (6) 3:2;159:7,11;199:16; 201:6;210:22 couple (19) 5:22;16:6;40:21; 42:8;132:12;142:14; 152:17;154:14,16; 177:18;178:18;181:6; 188:24;189:1;192:5; 201:15;209:23;211:10; 236:1 course (11) 19:19;29:10;37:6; 45:18;46:13,18;93:24; 120:3;156:3;159:23; 235:1 court (2) 198:12;238:4 courteous (1) 8:9 cover (3) 13:12;116:23;220:20 covered (1) 33:17 Coyote (130) 6:18;9:5,8;10:5,20, 24;16:2;27:8,10;33:11, 12,23,24;38:17;54:10; 61:14,15;62:5;63:24; 68:12,14;69:4;70:13, 22;71:17,20,23;72:9,</p>	<p>14,24;73:2,7,24;74:2; 78:6,13,19;79:21; 80:10;81:2,7;82:17,23; 83:9;90:8;93:16,19,24; 94:4,13,22;95:3;98:24; 99:1;101:4;105:8; 115:8;117:19;132:16; 133:1;139:14,15,15,19; 140:5;142:11;150:19, 20;151:1;154:19; 155:10;156:9,19; 160:9;163:23,24; 164:5;175:5,13;176:5, 8;177:22;178:8; 179:18;180:9;184:4,4, 6,10,13,18,18,22; 185:1,12,15,16,23; 186:2;187:14;188:8; 192:14;196:4,14,18,22; 198:19;199:19;200:2, 4,15,17,18;202:20,23, 24;203:11;204:3,9,11, 19;205:21;209:6; 210:7;212:11;213:16, 20;223:21;227:13; 233:1 crazy (1) 46:19 create (7) 26:2;96:15;104:12; 105:1,2;118:1;160:7 created (2) 24:22;59:20 creates (2) 10:24;26:1 creating (2) 10:3;195:15 critique (1) 46:15 CROSS (22) 4:2;17:14;20:7,8; 21:3,19,20,24;23:1; 36:5;43:5,9;47:4; 100:18;195:8,10; 217:19;224:19;228:1; 233:5;235:23;236:1 cross-check (8) 121:8,15,19;122:6; 131:19,21,23,24 cross-checked (2) 121:16;131:20 crossed (7) 35:20;36:22;37:4,14; 43:12;44:19;81:24 crosses (4) 37:15;39:7;41:19; 145:3 cross-examination (22) 6:23,24;7:5,18;8:6; 126:2;127:5;132:8; 137:9;139:1;141:8; 152:12;159:8;162:9; 172:16;177:19;181:8;</p>	<p>192:1;199:10;201:12; 212:5,6 cross-examining (2) 8:10,16 crossing (4) 34:15;37:16;43:24; 45:10 cross-section (12) 144:20,23;145:3,14; 214:5;219:3;220:17; 227:17,19;228:24; 229:4;232:22 crossways (1) 176:8 CS (2) 29:18;30:1 C's (1) 120:19 CS-1 (1) 45:17 CSAMT (23) 22:14;28:18;29:16, 18,18;30:1,17;32:9,10, 18;36:6;41:12;42:7; 43:5,20;46:11,12; 139:14;159:23;160:13; 194:9;234:3;235:10 CSANT (2) 133:19,20 CSI (34) 2:19,22;6:22;9:4,14; 12:9,10,23;15:20;46:4; 47:8;67:7;76:10,11; 100:16;101:5;113:3, 12,19;145:2,9;156:11; 172:20;177:21,24; 181:19;188:16;189:15; 190:7;194:6;218:13; 221:11;227:12;229:20 CSI- (2) 114:14,15 CSI-1 (15) 45:17;80:4;114:1,15; 115:9;116:5;117:10; 144:10;181:20,24; 182:8;183:4,19; 193:16;194:5 CSI-2 (7) 45:16;115:9;116:3,4; 117:11;189:14,15 CSI-3 (10) 80:4;114:14,15; 115:11;117:10;144:9; 189:2,5,15,21 CSI-4 (8) 80:5;114:14;115:10; 117:10;143:7,14; 189:10,16 CSI-5 (1) 115:10 CSI's (4) 9:21;199:24;221:18; 225:16</p>	<p>CSM-3 (1) 180:13 CSM-4 (1) 203:18 CSM-5 (2) 143:6,6 CSV (1) 113:4 CSVM-1 (10) 74:23,23,24;75:14, 24;84:19;113:12; 114:18;116:5;117:12 CSVM-2 (3) 82:6;84:12,12 CSVM-3 (2) 84:13;212:10 CSVM-4 (15) 80:9,9;81:5,9;84:13; 154:19;155:8,13,14,18; 161:10;185:4;203:15, 19,21 CSVM-5 (7) 81:6,11,20;84:13; 85:13;209:3;212:12 CSVM-6 (18) 71:16,16,24;72:2,9; 78:24,24;79:9;84:20; 114:18,19;115:15; 116:6;117:12;189:14; 193:8;194:5;203:21 cubic (1) 164:22 cultural (7) 38:18;145:21;146:2; 147:3;214:16;216:8; 219:1 culture (6) 29:7;38:23;145:13; 216:24;217:1;236:24 cumulative (9) 49:16;50:8,11;51:3, 21;53:4;64:9;80:15; 120:4 curious (4) 173:4;209:13; 235:24;236:19 current (2) 31:8;124:1 currents (1) 98:21 curve (6) 51:22;63:9,15;68:23; 80:15;121:1 Curve-fitting (5) 127:18;128:19,24; 129:14,19 curves (4) 50:7,12;63:23; 130:18 cutting (1) 216:17 cycle (1) 108:2</p>	<p style="text-align: center;">D</p> <p>damage (8) 26:5,8,11,13,18,20; 134:5;195:14 dark (13) 37:3;39:9;40:4,13; 41:23;42:3;89:4; 219:23;220:14,16,19; 232:5;235:3 darker (2) 42:5;43:8 dashed (6) 35:22;45:5,7,11; 143:17;195:5 dashes (1) 194:7 dashing (1) 35:24 data (121) 7:3;8:20;10:11,12; 17:5,9,31;9:23;37:10, 24;38:17;39:1;40:3; 41:12,23;43:3;45:7; 46:12,15,22;47:17,22; 48:15;49:14;50:16; 51:19;52:17,24;53:1,2, 10;62:22,23;65:9;66:4; 67:16,20,20;68:1; 70:16;72:3,20,22,24; 76:22,22;79:13;81:2,2; 83:6;88:9,19;92:11,13; 93:1;95:13;102:4; 106:1,2;112:4;114:7; 116:4,16;121:14; 122:20;125:9,17; 127:18,20;131:12,17; 146:5,10,14,15,20,22, 24;147:2,4,7,10,14,18, 22;150:12;151:4,12, 13;152:1,2,3;155:11; 160:2,5,10,11,13,15, 18;161:5,7;168:7,9; 173:18;176:15;181:16; 185:3;189:5;210:24; 214:5,7,19;219:4,7,22; 225:9;226:7,10; 227:22;233:19 dataset (4) 46:21,22;92:13,16 datasets (1) 92:19 date (1) 48:11 Dated (1) 238:17 dating (2) 88:13;169:2 day (8) 7:16;65:4;98:22; 100:20;189:8,11; 222:7;238:17</p>
--	---	---	--	--

de (1) 110:20	degrees (1) 231:23	45:2;49:9,14;50:16; 51:19;54:3,6;58:4; 59:13;85:20;87:2; 106:9;136:7;179:15; 184:16;233:23	188:9;203:10,10,13,20; 204:1,2;210:6;215:3,6	disagree (5) 107:2,13;123:1; 149:16,18
dead (2) 34:1;42:21	Delamar (6) 89:6;94:9;95:22; 136:9,21;200:17		differences (5) 103:15,23;105:19; 107:5;179:10	disagreed (4) 102:14;103:1; 118:14;123:19
deadline (1) 230:18	delay (2) 69:24;71:8	described (5) 27:22;62:8;83:2; 119:19;195:13	different (113) 6:13;9:13;14:22; 20:5,5,16,17,22,22; 21:22;22:9;23:2,16,18, 20;24:8;25:22;26:1; 27:10,18;28:19;29:11, 23,24;31:16,24;32:2,8; 33:19;34:14;38:8; 41:18;52:17,19;57:6, 21;58:21;59:8,9;60:1, 8;61:13;65:2,20;66:14; 74:18;75:23;78:9; 81:14,15,19,20;82:13; 84:15,16,18,24;85:1, 19;86:11,18;89:2; 93:18;94:6;102:13; 103:1;104:3,4;105:6, 17;106:14;113:19; 114:23;117:11;121:22, 22;123:3;125:15; 130:21;131:2,8;133:8, 9;151:9;156:1;166:10, 18;167:21,22;168:2; 170:11;175:9;178:4, 19;183:18;189:11,12, 23;190:2,3,4;195:13; 209:23;210:1;211:10; 213:2;215:1;218:7; 220:6;223:4;224:21; 229:11;235:18	disagreement (3) 107:4,14;118:18
deal (1) 163:18	demarked (1) 70:24	describes (3) 53:22;58:12;145:13		discharge (20) 86:20;109:10,13,15; 110:17,20;111:12; 112:1;163:14;164:22; 167:8;169:14,20; 170:6,9,16;205:9; 206:1,24;221:24
Debbie (1) 138:22	demarking (1) 69:23	describing (3) 27:3;120:15;168:8		discharging (2) 168:10,11
decades (1) 77:6	demonstrate (1) 87:23	description (5) 19:8;25:17;94:7; 139:23;193:2		discrepancies (1) 218:10
December (1) 52:4	demonstrated (1) 124:3	designed (2) 166:19,23		discretion (1) 67:5
decided (6) 54:23;91:24;130:17; 149:2;224:15,18	demonstrates (1) 10:12	designing (1) 206:5		discuss (2) 17:8;73:19
decisions (5) 6:14;18:12;50:20; 99:7;124:10	demonstrative (22) 60:5;61:13,23;62:4; 64:23;65:8;66:5,10,16, 22;72:11,15;77:2,7,8; 87:13;88:2;138:11; 192:4,18;230:14,19	detail (1) 221:10		discussed (6) 49:17;112:5;135:19; 159:15;232:6;234:14
decline (25) 62:24;63:3,4,22; 64:13,13;80:18;81:10; 85:15;113:13;116:9; 124:4,13,17,19;161:22; 189:2;190:8,9,11; 202:5,7,11;203:19,22	dense (3) 227:9;228:21;229:15	determination (1) 215:9		discussing (4) 62:14;70:9;94:4; 158:1
declined (4) 158:22;171:16; 191:4;202:22	density (9) 226:24;227:4,6; 228:5;229:3,5,6,15; 234:20	determinations (1) 6:11		discussion (3) 19:20;61:22;232:15
declines (4) 51:10;158:24;202:1; 224:24	DEPARTMENT (4) 1:2;126:19;132:10; 238:8	determine (5) 27:1;95:20;97:8; 102:24;206:9		disk (1) 216:6
declining (2) 73:12;202:22	departure (9) 49:17;50:8,11;51:4, 21;53:4;64:9;80:15; 120:4	determined (2) 102:10;211:23		displacement (1) 234:16
decrease (9) 111:8,9,23;112:6,10, 10,16,17;170:2	dependent (1) 10:21	determines (1) 108:8		displayed (3) 49:14;52:18;117:1
decreases (3) 110:16,17;111:4	depending (1) 146:18	determining (1) 108:6		dispute (1) 107:8
decreasing (1) 51:6	depends (2) 29:5;139:24	deterrent (1) 167:24		distance (1) 55:1
deep (7) 29:6;31:9;38:13; 40:3;41:23;59:1; 219:22	depicted (5) 24:15;26:2,8;139:8; 217:22	detrerring (1) 88:12		distances (2) 57:21;121:10
deeper (3) 58:18;59:3;229:3	depleting (1) 223:13	develop (5) 16:20;88:8;94:5; 125:10;211:2		distinct (1) 38:8
defaults (1) 183:4	deposited (2) 24:6,7	developed (14) 30:17;92:16,17; 121:1;133:13;175:9; 196:1,17;198:18; 221:15,22;222:2,4,21		distribute (1) 165:20
defer (1) 120:23	deposits (1) 26:3	development (2) 86:22;96:16		distributed (1) 128:19
define (2) 10:23;105:14	depression (14) 55:17;56:10,16,17; 57:3,6,10;58:15,19,19, 21,24;59:3,6	deviation (1) 50:9		distribution (3) 99:24;113:19;121:3
defined (7) 19:11;41:22;48:4; 96:2,13;216:6;236:3	depressions (1) 57:12	diagram (1) 64:24		District (12) 123:15,18;140:15; 141:12;152:11,14; 159:11;171:15;191:8, 22;199:6,12
defines (1) 48:6	depths (3) 29:24;31:16;33:19	die (1) 164:12		disturb (1) 153:16
defining (2) 122:20;209:18	Deputy (1) 5:11	differ (1) 103:9		diversion (2) 202:12,17
definitely (2) 33:8;41:2	describe (19) 16:12;18:18;28:15;	differed (1) 188:22		Diversity (6)
		difference (15) 103:24;104:4; 160:24;167:13;171:7;		
			directly (3) 164:8;175:23;179:6	

52:16;76:9;162:8,12; 201:10,15 dives (1) 180:16 divide (2) 229:1;231:17 diving (1) 180:15 DIVISION (18) 1:3;5:10;48:9,9,16, 17,18,19;49:20,20; 50:5;51:22;52:2,5; 53:2;63:19;127:21; 238:9 divisions (4) 48:3,4,6,10 document (8) 12:8,22,24;15:19; 145:10,12;149:15; 230:19 documents (3) 7:22;66:1;205:13 DOI (1) 127:18 DOI's (2) 129:24;130:3 dolomite (3) 37:4,16;44:20 domain (1) 128:1 dominate (1) 10:12 done (19) 10:2,23;12:2;32:1,8; 34:18;37:7;70:24;77:6; 82:10;88:10;91:23; 115:16;122:11;125:11; 167:5,6;194:9;227:18 Donnelly (15) 4:10;52:11,12,15,15; 76:6,7,8;162:10,11; 201:10,11,13,14; 220:22 dots (1) 194:7 dotted (9) 35:8,11;37:20;40:23; 41:3;43:6;63:13;143:3, 10 down (68) 8:23;11:24;19:5; 21:13,14;29:1;36:11, 13,14;41:23;42:14; 43:20;44:20;63:22; 64:3,14;70:4;73:17,17; 74:14,18;75:8,17;79:4; 80:18;82:6;111:4,23; 112:3,10,15;114:15; 116:10;118:18;137:10; 163:13,23;170:6,7,9, 10,10,12;175:22; 178:7;179:5;180:15, 16;183:7;185:9;	190:17;195:12;196:7, 8;199:13,24;203:16,17, 21;219:22;221:7,10; 227:4,11,24;228:16,24; 233:15 down-drop (2) 194:14;234:15 downgradient (1) 21:13 down-gradient (5) 74:22;75:1,15;77:21; 78:16 downloaded (1) 128:10 downstream (1) 95:20 downward (6) 36:12;40:20;53:9; 156:6;186:1;220:2 dozen (1) 93:10 drainage (1) 210:20 drainages (1) 178:5 drained (1) 169:18 drains (1) 178:7 draped (2) 37:9;40:18 draw (10) 8:16;147:20;163:13; 219:3,15,16;220:6,7; 228:15;235:2 drawdown (14) 54:17;55:4;56:15,17; 57:4;75:20;76:2;121:3; 122:5;130:19;155:14; 156:2,11,13 draw-down (1) 71:9 drawdowns (1) 54:9 drawer (1) 55:13 drawing (2) 232:22;234:9 drawn (2) 216:24;236:20 draws (2) 58:18;192:22 drew (2) 43:24;173:22 drilled (1) 134:4 drive (1) 46:19 driven (3) 118:20;124:7;162:1 drop (4) 57:13;111:19,19; 112:6	dropped (1) 42:14 drops (2) 38:13;170:1 drove (2) 14:21;210:19 Dry (5) 19:9;172:2,10,11; 220:20 drying (5) 51:6,9;53:5;70:15; 161:20 due (9) 63:6;70:20;75:7; 79:7,13,20;109:16; 116:12;233:3 during (29) 8:9;24:6;46:13; 53:11;60:2;73:12;74:4, 11,11;84:9,11,11; 107:18;113:13;121:10; 136:12;155:14;159:22; 171:17;181:22;182:10; 183:17;189:2,18,23; 202:1,22;215:21; 230:11 DWR (1) 186:12	east/west (3) 34:2,12;227:15 eastern (18) 10:24;19:2;35:16; 39:15;40:7;41:8;42:12; 45:15;72:9;73:2;82:17, 21;83:9;84:19;117:19; 155:10;178:3;179:2 easy (1) 208:2 echelon (3) 160:6;199:18;200:11 edge (5) 35:16;39:19;134:4; 217:1;228:6 EE (8) 20:7,8,9;21:3,19,24; 22:1;23:1 effect (4) 55:1;121:11;141:24; 187:22 effective (1) 160:23 effects (8) 38:18,23;97:10;98:4; 145:22;146:3;154:16; 219:1 efficient (2) 55:12;237:15 effort (3) 8:15;130:8,10 EH-4 (13) 64:2,3,8,18,20;68:7, 21;70:11;73:16;77:22, 22;119:3;120:3 EH-4's (1) 122:4 either (9) 30:14;39:12;65:3; 81:23;196:7;197:7; 211:9,19;217:22 elaborate (2) 53:15;104:17 elbow (1) 22:5 electric (2) 29:21;33:15 electrical (4) 31:6;146:1;229:13; 234:22 electricity (4) 28:19;36:19;38:19; 229:14 electromagnetic (1) 30:10 elevation (20) 36:13;37:9;40:19; 62:13,16;64:6;92:15; 115:17;162:24;163:3, 9;203:2,10,10,20; 210:1,6;211:3;214:24; 215:1 elevations (6)	36:12;48:22;116:1; 163:12;180:1;203:14 elicits (1) 81:24 else (5) 35:24;55:23;162:17; 220:7;223:12 elsewhere (1) 139:21 Ely (3) 19:3,5;169:18 EM (1) 30:12 e-mail (1) 76:17 emphasize (1) 102:3 empirical (3) 92:9;151:9;166:12 employed (2) 28:6;128:13 en (3) 160:6;199:18;200:11 encounter (1) 29:7 end (36) 7:7,16;18:6;35:19; 37:3,15;38:15;39:1,2,4, 23;40:5,9;41:22;44:14; 65:4;70:12;75:10,11; 77:24;81:7;85:8; 100:20;105:24;116:10; 145:14;146:5;147:4; 152:7;158:8;180:18, 19;181:10;216:7; 228:14;234:23 ended (3) 84:5;88:18;227:14 ending (1) 158:9 ends (1) 42:9 Energy (5) 2:24;42:18;181:4,6; 208:19 engaged (1) 28:16 Engineer (56) 2:4;5:11,11,19,20, 24;7:2,13;8:8,19;9:20; 10:2;11:15;12:4,5; 15:10;18:11;19:11; 28:1;50:20;60:23;65:4; 66:23,24;67:5,11; 88:17;96:4;98:13; 100:11,13;101:24; 103:10;105:18;107:12; 109:23;110:6;125:9, 16;148:15,21;149:20; 160:14;168:7;173:14; 176:16;177:10;196:13; 197:17;200:24;207:6; 221:2;224:15;225:19;
E				
		Eakin (7) 150:12;151:4,10; 165:23;166:8,10,15 earlier (15) 14:24;21:18;47:15; 63:15;75:5;121:8; 131:13;132:13;143:24; 164:5;165:6;203:5; 216:6,8;234:14 early (14) 14:9,15;30:19;51:13; 52:7;69:12,13;70:17; 71:22;72:23;74:11; 75:9,20;79:2 earth (1) 36:12 easel (2) 60:22;192:18 easier (3) 38:15;42:19;219:13 easily (1) 167:19 east (36) 35:14,19,21;37:2,15; 38:7,9;39:15,22;40:9, 11;41:4,6,23;42:5; 113:22;114:3,9; 146:10,21,24;157:20, 24;158:1,3,10,13,18; 164:5;180:6;183:8; 195:24;213:20;214:20; 225:1,11		

230:6;237:17 Engineering (2) 218:6,9 Engineers (4) 11:15,19;12:5,16 Engineer's (15) 10:7,8;12:19;14:3; 19:7;67:4,5;86:4;95:7; 99:18;100:9;106:5; 118:8;125:7;136:13 enjoy (1) 168:14 enough (3) 87:1;221:18;237:1 ensure (1) 11:8 entire (9) 19:17,24;140:3; 150:15;156:18,20; 166:20,24;227:2 entirely (4) 35:7;169:5,9,11 entities (1) 172:10 entitled (1) 238:9 environment (4) 25:3;29:5;84:15,17 environmental (3) 33:1;164:10;172:5 environments (2) 84:24;190:3 epics (1) 168:12 episodes (1) 175:10 equal (1) 168:5 equals (1) 167:8 equates (1) 111:6 equation (19) 54:14,20,22,24;55:3, 7,19;56:9;57:6,20; 59:8;121:7;122:8; 127:12;130:9,14; 150:9;187:16,23 equations (1) 54:21 equipment (9) 30:4;32:2,15,18,21; 33:1;46:13,17,20 equivalent (1) 32:23 erosion (1) 25:9 error (2) 119:7;217:20 especially (1) 71:23 Esq (6) 2:18,20,24;3:4,7,13	essence (1) 26:13 essentially (5) 128:18;173:1,2,10; 176:7 establish (1) 167:22 established (4) 148:17;166:15,16; 226:4 estimate (11) 10:18;90:11;94:12, 12;118:23;124:24; 132:16;177:3;200:21, 23;201:1 estimated (2) 111:2;177:21 estimates (7) 90:12,19;129:1,17; 150:15;168:4;169:3 estimating (1) 125:3 estimation (1) 131:9 et (22) 128:8;163:13;168:3; 170:10;197:22;204:5, 6,8,11,15,17;205:2,9, 24;206:8,15,20,21,24; 207:13;221:23,23 evaluate (2) 130:10;166:24 evaluating (3) 154:2;166:20;167:1 evaluation (1) 8:20 evaluations (1) 115:24 evapotranspiration (23) 10:16;23:12;86:14, 19;90:19,20;91:13; 94:1;95:2;97:3;98:1; 162:19,20;164:11; 165:17;167:20;203:24; 205:15;206:4,7,19; 207:8;222:15 even (13) 43:22,22;72:13;74:7; 77:24;146:21;156:5; 170:23;171:6;180:12; 204:12;219:4;229:9 event (9) 62:11,24;63:1,6,22; 64:13,15;116:8,12 events (6) 62:9;107:18,22; 161:21;183:22,22 everybody (6) 31:21;60:5;87:17,18; 114:11;115:18 everyone (5) 5:23;7:19;77:3; 190:14;237:13	evidence (21) 6:3,22;27:7,18;65:6, 21,22;66:9;76:12; 102:18;108:15;138:17; 140:7;181:14;215:10, 15;216:3;218:15; 219:19;229:24;230:1 evident (1) 85:16 exact (6) 20:9;141:21;167:14; 205:12;214:7;217:1 exactly (14) 31:24;41:4;45:15; 61:22,24;115:21; 146:18;182:16;205:17; 222:17,23;228:16; 229:12;236:7 EXAMINATION (8) 4:2;12:6;101:1; 186:15;209:1;224:12; 225:18;231:7 example (9) 31:20;37:24;52:7; 68:21;175:3;176:17; 187:18;218:23;227:2 Excel (1) 128:1 except (1) 85:12 exception (1) 226:1 exceptional (1) 27:5 exchange (1) 225:2 exclusion (3) 199:16,17;200:11 excuse (7) 7:23;91:5;96:24; 160:23;198:13;215:11; 231:20 exercise (1) 221:3 Exhibit (31) 12:9,23;15:20;45:20; 46:1,4;66:5,9,15,16; 67:7;76:11,11;100:7; 113:12;126:13;148:1; 171:20,22;172:20; 187:2;216:15;217:3,9, 10;225:16,16;229:24; 230:1,18;234:2 Exhibits (14) 15:6;65:2,8,19,23; 77:2;100:11;138:11, 12;229:20,22;230:7,19, 22 exist (8) 14:20;21:22;22:20; 83:8;102:19;105:11; 139:21;140:10 existed (1)	22:20 existence (3) 28:4;215:16;216:4 existing (1) 91:1 exists (3) 26:15;117:18;204:18 expand (1) 6:10 expect (5) 39:9;53:24;234:8,12, 16 expectation (1) 8:7 expedient (1) 237:15 experience (3) 11:20;32:5;46:17 expert (7) 50:15,17,23;76:21; 77:7;145:2;154:9 expertise (1) 147:17 experts (1) 77:8 explain (19) 9:24;14:7;28:9; 47:20;59:8;68:14; 78:10;108:13;109:18; 110:11;113:10;115:2; 118:12;125:6;129:4; 136:3;168:5;187:13; 224:15 explained (3) 67:19;77:17;81:23 explaining (1) 82:4 explains (1) 189:18 explanation (1) 189:17 exploration (1) 30:21 express (1) 5:24 extend (1) 191:13 extended (1) 44:7 extending (4) 43:6;44:2,5,6 extension (2) 28:5;44:3 extensional (11) 22:8;24:20,20,22; 25:3,5,24;26:6;105:1, 1;233:3 extensively (1) 5:15 extent (6) 19:1;22:22;58:15; 67:3;88:15;140:4 extents (1)	20:5 extraordinary (1) 107:18 extreme (3) 48:9;52:1;63:19 extremely (1) 50:12
F				
				faceted (1) 165:4 fact (12) 75:4;79:19;102:3; 107:17;113:18,20; 115:14;120:6;124:5; 191:11;206:20;237:3 facto (1) 110:20 factor (1) 211:3 factors (2) 16:23;170:11 facts (1) 50:16 fade (1) 34:19 failure (2) 72:20;79:13 fair (8) 8:13,18;141:23; 142:20;146:13;198:16; 200:21;232:16 FAIRBANK (103) 1:4;2:2;5:4,8;13:9, 14;42:16,22;43:14; 46:3,6;50:18;52:11,13, 20;60:9,10,24;61:12; 65:7,14,24;66:7,19; 67:9;76:6,14,16;77:10, 13;83:13,18,22;99:9, 14,17,20;100:1,5,21; 123:6,11;125:22; 126:23;127:2;132:6; 137:6;138:4;140:13, 21;141:1,5;152:6,10; 155:5;159:6;162:3,7; 172:1,14;177:8,13; 181:3;186:7,10,24; 190:13,24;191:3,11,18; 192:8,17;193:1,18,22; 194:20;198:8,10,21; 199:1,4,9;201:5,9; 207:1,17,21;208:4,8, 11,15,18,21;212:2; 223:18,23;224:8; 229:22;230:5,13; 231:2;237:11 fairly (10) 38:13;40:13;74:13; 80:19;88:20,21;121:5; 188:5;202:8;227:9 faith (1)

39:2 fall (1) 69:13 falls (1) 178:3 familiar (10) 5:15;12:8,22;145:9; 148:16,19;213:11,15, 19;221:12 familiarized (1) 128:5 far (8) 37:3;47:5;58:20; 72:8;99:15;202:16; 204:1;234:14 Farber (1) 2:22 farthest (1) 37:20 fashion (3) 16:20;68:9;167:2 fat (1) 228:15 fault (127) 24:15,16;25:2,20,21; 26:3,4,14,15,16;34:7, 11;35:11,14,15,18; 37:22;38:11;39:5,15, 18,19,21,22;40:1,2,5,8, 10,22;41:5,7,10,42:4, 10,15;44:3,6,7,12,14, 15,18;45:15,16;47:5,5; 81:23;117:16,17; 139:3,24;143:4,21,23, 24;144:2,9,10;145:4, 19,20;147:10,22; 148:2;174:9;175:22, 23,24;176:2;179:22; 181:20;194:10,13; 196:15;204:8,16; 205:6,21;211:11; 214:7,8,22;215:10,16; 216:4,7,11,17,17; 217:4,18;218:15; 219:19;220:5,8,24; 228:6,10,10,11,19,20, 22,23;229:5;231:23, 24;232:2,3,7,13,13,13; 233:15,17;234:3,6,6,8, 10,13;235:2,6;236:23; 237:4,5 faulting (10) 22:8;23:3;24:23,24; 25:24;163:21;176:4; 199:21;200:17;213:5 faultings (1) 25:5 faults (111) 10:22;14:19;21:22; 22:3,4,16;24:11,14; 25:1,2,14,15,15,19; 27:1,5,11,11,12,15,20, 22,23;28:2,8;34:6,7;	35:9,20;36:2;37:20; 41:11,22;43:20;44:5, 11;45:5,10,10,15,17; 46:23;47:1,3;55:21; 59:19;73:6;81:13;83:1, 2,7;96:14,16;98:19; 104:8,10,20,22,23; 105:1,2,11;107:7; 117:24;118:1,4; 133:19;139:8,12,20; 140:10,10;153:15,20; 160:6,21;174:20,23,23; 175:4,7,9,11;183:8; 195:11;199:18;200:11; 210:15;219:21;225:22; 226:2,19;227:21; 228:3,15;232:8,10,14, 20;233:1,2,3,4,12,13, 14;234:5,5;235:15,17, 22 feature (7) 18:1;37:13;38:22; 231:17,22;232:18; 237:9 features (6) 51:7;124:9;139:4; 145:22,24;153:20 feel (5) 74:20;88:24;105:15; 190:2;237:3 feels (1) 76:12 feet (30) 31:4;33:14,14;36:13; 38:24,24;40:12,21; 48:23;56:17;57:4,13, 13,14;62:3;73:22; 135:3,9,15;146:6; 149:9;164:22;189:8, 10;192:13;203:16,22; 210:4,5;220:23 felt (2) 88:21;168:7 Ferguson (1) 172:8 few (7) 27:21;51:7;138:23; 140:17;141:12;152:16; 187:9 field (6) 14:17,24;15:3;29:21, 22;46:15 fields (3) 30:13,23;33:15 fifth (4) 6:8,9;34:4;36:10 figure (44) 25:1;45:3;60:11; 72:21;79:10;87:5,10, 23;92:24;122:2; 129:11;142:15,18,20; 144:17;145:1;148:2; 155:2;165:5;173:7;	174:4,19,19;175:16,17; 186:18;201:20,23; 216:10,13;217:10,10, 12,14,19,22;218:18; 219:4,15;225:21,23; 233:12;234:12;236:8 file (5) 40:19;138:15; 201:19;226:11,20 filed (6) 9:14,16;52:17,19; 219:8;230:6 fill (15) 21:8;34:21;35:8; 37:6;38:1,4;178:13; 179:7,9,16;180:19; 220:12;229:2,6;234:24 final (7) 36:6,16;171:14; 218:4,6,9;226:19 finally (4) 8:5;11:7;19:18; 54:15 find (10) 46:1;81:24;102:4; 122:16;176:23;177:2, 2;201:21;207:14; 209:21 findings (10) 11:9;16:15;54:4; 101:6,21;102:5,15; 103:9;107:8;118:12 fine (5) 60:10;61:9;64:23; 142:4;163:3 finished (1) 96:23 finite (1) 160:24 firm (1) 159:11 firms (1) 33:1 first (28) 7:8;9:13,17,20; 30:17;35:15,19;36:20; 46:11;56:13;69:19,22; 99:10;101:21;119:8,9; 126:1;141:14;143:2; 148:16;152:19;155:8, 8;161:1;186:19; 201:16;209:24;231:11 Fish (15) 15:2;54:23;118:8,13; 122:3;125:2;126:2,20; 127:15;131:14;160:19; 190:19;191:4;213:12; 237:18 fit (2) 102:22;212:23 fitting (1) 71:10 five (6)	9:2;12:19;14:3; 31:24;69:8;116:13 flag (1) 131:11 Flangas (8) 3:7;4:12;172:17,18; 177:6;199:20;208:10, 12 flat (7) 36:9;55:14;75:10,21; 79:2;116:12;211:23 Flatly (1) 5:17 flawed (1) 112:19 flaws (1) 122:16 flood (1) 210:22 floor (2) 48:23;211:18 FLOW (175) 1:8;5:6,16,21;6:12; 10:1,4,9,17,21;14:13; 19:13,18;20:2,2,20; 21:14,23;23:16;25:9; 26:13,23;27:1,2,4,7; 47:12,19,23;48:7,14, 21;49:2;53:3,22;62:24; 78:8;80:24,24;83:7; 86:6,8,14,14,21;87:9, 12,12;88:9;89:13,14; 90:7;91:9;95:21,22,24; 96:2,15,21;97:4,9,18, 23;99:8;103:20;104:5, 6,11,15,21;106:21; 107:23;109:6,6,8,9,12; 110:1,17,17,22,23; 111:2,4,7,8,9,16,19,24; 112:9,16,17;118:1,2,5, 15;119:3,14;123:2,4; 124:6,13,22,22;128:20; 130:15;134:12;135:10, 16,18,24;136:11,16,19; 137:1;139:21,24; 140:11;141:24;148:22; 149:6,10,10,17,23; 150:3,15,17;157:7; 158:13;159:17;160:8; 163:19,22,24;164:7,19; 165:2,15,16;169:8,17, 18;170:1,10;171:3; 177:4;178:1,1,9,11,11, 21,24;179:18;180:5; 185:22;196:4,5,7; 199:22;200:1,3,21; 201:1;205:14,16,20; 221:2,8;223:11; 225:10;232:11;233:4 flowed (2) 158:18;221:6 flowing (3) 158:10;176:14,24	flows (9) 98:2;124:2;125:14; 153:16;158:2,18; 159:1;200:14,17 fluid (2) 28:22,23 flux (2) 87:11;88:4 fluxes (7) 86:11,12,15;87:8; 104:4;167:22;168:1 focus (10) 8:18;19:20;20:6; 68:15;69:9;73:15; 93:15;104:17;165:11; 181:22 focused (4) 10:4;90:16;175:12; 221:5 focusing (1) 72:23 folks (4) 17:11;192:7;215:20; 225:20 follow (7) 42:19;130:6;190:6; 201:15,16;228:2;231:9 following (4) 15:5;80:16;124:16; 236:7 follows (1) 69:14 follow-up (8) 159:12;190:22; 191:5,8,12;208:6,9; 231:3 foot (13) 155:14;156:2,5,5,11, 13,23,24;157:2,10,12; 171:11;202:4 footnote (3) 157:22;158:4,11 forces (2) 25:21;26:6 foregoing (1) 238:12 foreign (1) 32:22 forget (2) 30:8;217:8 forgive (2) 216:11,16 forgot (1) 42:20 form (8) 15:3,13;16:17;24:12; 36:5;80:21;99:7;106:2 formation (3) 25:7;63:10;232:6 formations (6) 14:19;20:23;21:9; 24:4,21;25:22 formed (2)
--	---	---	---	---

<p>17:14;24:10 forms (2) 24:8;235:18 formulates (1) 104:14 forth (2) 6:1;26:4 Fortran (1) 121:2 forward (5) 59:21;97:21;125:8; 200:9;211:12 fossil (1) 169:11 found (8) 47:20;97:15;102:6, 17;106:24;123:18; 128:7;148:8 foundation (1) 59:20 four (13) 6:7;10:7;15:8;42:21; 48:4;52:8;62:11; 105:22;116:13;151:9; 161:3;187:18;190:7 fragmented (3) 154:2,6,11 frame (5) 67:10;156:14;158:1, 8,21 frames (1) 157:12 framework (5) 85:1;166:10,19,19, 23 free (1) 86:23 frequencies (3) 29:23;31:14;33:16 frequency (3) 30:7;31:9,11 front (4) 54:5;67:23;161:14; 217:15 full (7) 9:4;55:11;57:13; 122:12;155:8;173:6; 238:13 fully (4) 11:8;55:10;173:19; 211:23 fundamental (2) 103:24;124:22 further (46) 12:1;21:10;27:23; 35:14,18,18;37:2;40:2, 12;41:1,6,13;42:5; 63:3;70:10;71:7,14; 72:12,13;73:3;74:22; 75:15;77:21;78:7;79:9; 80:8;121:18;132:5; 152:8;170:1;190:23; 192:1;199:7,10;</p>	<p>201:12;202:5,12; 208:7,10,16,19;212:6; 220:4;229:19;234:11; 235:3 future (2) 86:17;97:9 FWS's (1) 118:22</p> <p style="text-align: center;">G</p> <p>gallons (2) 57:24;58:3 gap (1) 71:6 Garden (1) 221:8 GARNET (6) 1:10;61:16;94:19; 163:23;165:13;197:20 gas (2) 22:5;24:15 Gauge (4) 109:17;110:20; 111:3,12 gears (1) 203:23 general (11) 23:14,21;32:6;48:16, 20;64:10;92:13; 113:13;175:19;226:22; 228:15 generalized (1) 20:21 generally (3) 167:3;168:10;189:22 generate (1) 151:5 generated (1) 30:10 generation (1) 59:6 generator (1) 30:3 generic (1) 202:10 geo (1) 32:5 geographic (3) 92:22;106:18;107:9 geologic (21) 10:13;14:16,19;17:2, 14;19:1;23:2;25:12; 84:17;85:1;96:13; 135:24;139:8;142:21; 143:1,22;144:3;146:8; 160:21;175:9;190:3 geological (1) 133:20 Geologist (3) 2:13;5:14;11:16 geologists (6) 17:13;35:23;147:23;</p>	<p>194:8;227:11,12 geology (12) 10:3;14:12;17:2; 24:2;42:14;43:13; 59:18;83:8;87:23; 168:14;175:19;180:13 geometry (1) 122:21 geophysical (15) 12:2;17:7,7,18; 22:19;28:7,15;29:10; 31:18;32:8;83:3;98:18; 106:3;161:5;235:21 geophysically (1) 237:8 geophysicist (5) 11:23;28:9;220:6; 229:10;236:12 geophysics (13) 22:14,15;32:6;33:7; 34:23;105:9,10; 139:11;180:14;233:19; 234:14,19;235:10 Georgia (5) 172:1,4,6,8;208:5 geothermal (1) 30:23 germane (2) 18:5;232:15 gets (4) 60:7,7;67:3;104:8 GIS (1) 92:22 given (10) 125:1;147:17; 166:18;169:7,8; 187:20;190:13;191:11; 211:16;227:7 gives (4) 33:5;40:19;55:3; 233:8 giving (1) 215:23 Glasgow (7) 3:14;4:5;132:9,9,14; 137:4;191:2 goal (3) 168:6;221:1;222:9 goals (1) 15:11 goes (13) 34:16;48:19;52:3; 55:17;70:3;102:16; 121:12;178:21;194:11; 196:4;209:3;210:20; 220:8 golf (1) 45:18 Good (44) 5:5;9:7;11:13,17; 13:14;28:11;30:21; 31:6;34:8;36:1;37:5, 23;39:1,13;41:10;42:7;</p>	<p>43:7,11,13;46:12,21; 47:7;74:20;83:14; 88:22;91:24;101:3; 121:13;123:11;132:9; 133:3;141:10;144:13; 147:4;152:13;158:12; 172:3;177:10;180:22; 212:5;218:18,22; 229:16,16 gouge (2) 26:3,15 government (2) 32:21,22 GPS (1) 146:19 Graben (1) 42:13 Graben-type (1) 42:11 gradient (3) 73:17;160:12;186:1 granted (2) 166:11;169:5 graph (17) 49:21;51:8,10,13,20, 24,24;63:12;68:8,16, 18,22;74:24;80:6; 110:21;115:6;155:18 graphic (2) 51:20;56:16 graphical (1) 110:14 graphs (6) 49:16,18;53:5;78:23; 130:5,24 gravity (17) 29:11;32:8;122:20; 226:18;227:9,10,22; 228:3,4,21,24;233:7; 234:3,11,20,22;235:5 gray (5) 63:16;115:8;227:22; 228:2,10 great (12) 16:17;88:14;133:12; 142:20;157:19;163:18; 168:13;175:3;180:8; 192:10;193:5;233:24 greater (6) 57:2;58:1;132:22; 133:14,15;169:20 greatest (1) 188:1 green (12) 26:9;40:5;42:3; 68:24,24;69:2,15,19; 71:2,17;115:10;119:23 greens (2) 40:14;42:1 Greg (2) 152:13;199:11 gridded (1) 92:12</p>	<p>ground (11) 29:21,22;31:3,5,7; 36:8;37:16,24;116:24; 165:2;205:19 grounded (1) 31:5 groundwater (121) 14:13;18:1,3,14; 23:13;29:13,15;30:23; 32:24;53:14;58:5; 59:16;62:23;63:2,5,13; 68:6,19;69:21;70:1,3, 5;71:3,12,23;74:12,19; 75:11;78:2,8;79:7; 80:3,17,19,81:16; 82:12,13;86:5,8,13,20, 22;87:3,12;88:5,6,9,9; 89:5,6,7,7,9,12,13,14, 16,17,19;90:2,6,24; 91:9,13;93:16,22,24; 94:5;95:21;97:22;98:1; 102:20;104:20;106:20; 107:2,3;108:9;109:1; 113:4;116:9;118:5,15, 20,23;123:24;125:4, 14;127:20;128:19; 136:22;139:24;148:18; 153:1,16;154:2;160:8; 163:4,9,12;164:6,15; 168:1;169:17;173:8; 178:9;181:16;182:13; 202:9,10,19;203:10,14, 20;205:15;206:7,19; 207:12,14;222:14; 225:12;233:20 group (2) 61:20;102:2 groups (1) 32:17 grown (1) 54:21 guarantee (1) 8:3 guss (22) 36:1;111:1;128:6,15; 129:4;133:15;135:1, 14,21;154:9;169:3; 190:14;199:24;204:12; 205:1;207:17,22; 219:2;231:11,13,17; 235:22 guys (3) 126:5;192:4;215:17</p> <p style="text-align: center;">H</p> <p>habitat (1) 164:16 half (10) 6:18,21;34:10;41:8; 56:16;155:13;156:2,5, 5;202:4 Halford (1)</p>
--	---	---	---	--

128:8 halfway (1) 40:9 hand (1) 60:14 handle (1) 130:16 handled (1) 122:10 handling (1) 121:1 handy (1) 216:12 happen (5) 32:2;55:21;192:13, 14;206:12 happened (5) 24:9;72:1;168:16,17, 22 happening (5) 55:23;81:11;147:23; 154:5;211:18 happens (2) 179:9;220:3 happy (1) 133:2 hard (3) 38:14;42:19;182:15 harder (1) 229:4 Hardman (1) 151:13 HARRISON (4) 172:3,4,15;208:7 hashed (1) 195:5 head (5) 145:7;163:2;169:24; 170:1;208:20 headed (1) 205:11 health (1) 164:15 hear (3) 49:6;178:18;192:7 heard (3) 17:12;161:1;193:23 HEARING (123) 1:4;2:7;5:4,6,9,18, 19;6:10;7:24;8:12; 12:20;13:6,9,14;14:3; 18:6;42:16,17,22; 43:14;45:19;46:3; 50:18,21;52:11,13,20; 60:10,24;61:12;65:7, 14,24;66:7,19;67:9; 76:6,14;77:10,13; 83:13,18,22;99:14,20; 100:1,5,10,21;117:8; 123:6,11;125:22; 126:23;127:2;132:6; 137:6;138:4,10,11,15; 140:13,21;141:1,5;	152:6,10;155:5;159:6; 162:3,7;172:1,14; 177:8,13;178:14; 181:3;186:7,10,24; 190:13,16,24;191:3,11, 18;192:8,17;193:1,18, 22;194:20;198:8,10, 21;199:1,4,9;201:5,9; 207:1,17,21;208:4,8, 11,15,18,21;212:2; 223:18,23;224:8; 229:22;230:5,6,13,17; 231:2;237:11,13; 238:8,14 hearings (1) 172:11 heat (1) 160:23 held (1) 238:8 hello (4) 144:16;159:10; 172:18;212:8 help (16) 15:3,9,13,13;27:1; 28:9;47:20;60:5;73:5; 78:10;87:14;96:15; 99:7;160:6;184:21; 193:7 helped (3) 16:20;80:21;130:20 helpful (2) 50:12;176:20 helps (3) 29:1;55:20;82:24 hereby (1) 238:5 herein (1) 238:11 hereof (1) 238:13 Herrema (43) 4:3;9:7,8;12:7;13:12, 16;43:1,16;45:21;46:6, 7;51:1,52:22;60:9,11; 65:1,10;66:6,11,16; 67:12;76:16;77:14; 83:13,16,24;84:1;95:5; 99:9,16;100:6,16,16, 22;140:19;224:10,13; 229:19;230:2,8,23; 231:5;233:21 hertz (2) 31:10,12 hesitate (1) 72:18 hesitated (1) 139:17 heterogeneities (2) 104:3;124:9 heterogeneity (2) 17:22;103:15 heterogeneous (1)	102:18 heterogenotes (2) 140:5,8 heterogenous (1) 140:3 hey (1) 102:12 Hi (3) 132:11;181:5;186:9 hidden (6) 34:22;82:7;94:18; 163:23;197:20;221:8 high (31) 27:12;29:2;31:11; 36:17,24;37:3,12,12, 16;39:9,16;41:24;44:9, 11;49:3;64:12,15; 69:11;169:17;214:14, 20;229:3,5;232:6; 234:4,5,8,10;235:3,8,8 higher (9) 26:12,19,19;58:14, 23;179:12;211:2; 227:4,4 highlight (2) 9:22;10:6 highway (25) 37:21;143:3,4,8,10, 12,15,18,21;145:4,19, 20;147:10;148:2; 175:22,23;215:10,16; 216:4,11,17;217:18; 218:15;232:7,13 hill (1) 210:20 hired (1) 14:9 historical (4) 24:2;168:2;170:23, 23 history (2) 25:12;48:18 hit (1) 201:16 HN (1) 31:5 holders (1) 108:24 hole (2) 72:20;228:8 homogeneous (3) 55:8;56:12;57:22 homogenous (2) 103:16;104:2 honestly (1) 229:7 honoring (1) 190:15 hope (3) 98:6;125:16;224:11 hopefully (2) 18:19;102:1 horizontal (3)	38:14;63:18;220:1 horse (4) 194:15;195:11; 232:18,19 Horst (3) 42:11,13,13 hour (3) 9:2,18;59:17 hours (8) 6:19,21;7:9;9:11,18; 99:15;102:1;123:7 housekeeping (1) 12:8 hundred (1) 55:12 Hyatt (1) 2:22 hydraulic (16) 54:18;58:11;114:8; 117:21;118:19,20; 121:23;123:2;160:7, 12;184:3;185:2,18,19, 19,20 hydrogeologic (4) 53:15,19;84:16; 120:22 hydrogeologist (2) 11:18,19 hydrogeologists (1) 147:24 hydrogeology (2) 54:15;168:15 hydrograph (21) 62:14;64:5;69:11; 74:16;75:9,10;77:23; 115:13;120:1,11,15; 155:12;156:2,10; 161:9,14,17,24;209:3, 14,19 HYDROGRAPHIC (2) 1:11;196:18 hydrographs (6) 62:15;76:22;82:13; 85:17;113:12;115:19 hydrologic (14) 78:5;103:12;107:21, 24;108:1,2;124:20; 148:17;155:23;161:2, 19;183:22;184:3;203:1 hydrologically (2) 147:22;179:19 hydrologist (3) 147:13,15,21 hydrologists (1) 5:13 Hydrology (4) 2:10;5:12;59:19; 233:20 hypothesize (1) 211:8 hypothetical (1) 202:10 hypothetically (1)	222:20 <hr/> I <hr/> ice (2) 168:19;169:1 Idaho (1) 32:19 idea (7) 23:6;29:20;71:11; 102:17;104:24;117:23; 163:17 idealized (1) 55:15 ideas (3) 20:11;22:9;167:17 identical (5) 44:16;64:7;94:9,16; 130:18 identically (1) 115:15 identification (2) 19:8;230:4 identified (32) 10:22;19:3;20:7; 22:4;24:24;46:23;83:2; 89:3,10,19,21;95:1,15; 97:5;100:10;107:11; 114:6;118:1;119:2; 140:5;143:23;169:14; 195:19;207:18,23; 216:18;222:17,18; 223:13;225:20;235:20; 236:2 identify (12) 22:15,20;28:7;56:21; 107:17;109:7;150:21; 174:21;185:10;205:10; 222:10;223:17 identifying (3) 98:18;126:13;231:21 ignore (2) 113:4,18 ignored (4) 113:16,18;120:16; 122:20 image (4) 57:7;122:10;153:23; 236:11 imagine (1) 26:5 imagining (1) 233:12 imbalance (2) 167:15;207:12 immediate (3) 74:19;79:3,17 immediately (4) 74:15;75:1;141:20, 22 impact (36) 27:16,20;47:15;57:2, 20;58:1;72:8;73:6;
--	--	---	--	--

80:23;82:12,22;83:3; 97:18;103:11;104:8; 106:21;107:22;119:14; 131:3,10;142:11; 161:19;164:6,14; 183:21;186:3;195:3; 197:2,22;206:16; 222:6,9,13,24;223:4; 233:4	include (4) 76:18;80:5;109:19; 229:2 included (11) 67:3,4;76:10;135:23; 136:6,24;159:19; 224:16;227:2;229:17; 230:5 includes (2) 31:22;59:13 including (5) 10:3,8;159:16;160:3; 172:10 inconsistencies (1) 152:17 increase (13) 74:5;80:16;81:16; 85:14,15;157:10,12; 182:1,3,13,16;209:16; 213:6 increased (4) 74:5;120:9,12; 212:19 increasing (3) 51:5,11;212:16 indeed (2) 33:2;41:4 independent (12) 92:1,2,15;93:13,23; 94:12;130:12,12; 133:13,14;151:18,23 INDEX (1) 4:1 Indians (3) 138:20,22;160:19 indicated (8) 85:13;135:22; 141:19;148:15,21; 149:5,20;159:18 indicates (6) 35:13;40:5;46:24; 51:5;160:6;179:15 indicating (3) 13:17;35:22;234:2 individual (5) 6:12;33:18;48:17; 115:8;221:6 individually (1) 39:2 individuals (3) 8:13;61:2;177:14 Industries (1) 172:2 inferred (1) 236:3 infinite (1) 55:9 inflow (22) 86:13;88:5,6;89:5,6, 7,8,9,22;90:7;91:5; 93:22;94:8;95:2,21; 136:9,9,10,10,22; 171:8;173:23	inflows (2) 87:8;173:11 influence (1) 121:17 influences (1) 57:15 information (51) 11:5;15:9,13;16:5; 17:9;18:12;20:10;28:1, 18;31:11;45:24;53:21; 68:16,17;87:1;88:15; 92:21,22;94:17;95:13; 96:5,19,20;98:7,17; 99:4,4;101:16;102:7,9, 12,18;105:6;114:7; 115:5;125:9,12,18; 132:2,2;133:11; 159:24;160:13,20; 171:19;173:21;200:24; 207:6;221:4;222:16; 235:14 infrastructure (1) 146:16 in-house (1) 23:8 initial (16) 9:14;15:24;16:3; 106:4;122:15;154:18; 172:20;173:7,13,19,19; 177:4;186:17;188:14; 200:23;204:10 initiated (1) 72:5 inside (1) 122:7 instance (7) 53:23;73:20;90:18; 110:24;168:12;180:10; 189:13 instead (2) 69:7;97:12 instructions (1) 128:6 insulated (1) 31:3 intend (2) 65:3;213:9 intended (5) 6:10;8:18;128:13; 129:1,16 intending (1) 65:5 intent (1) 141:21 intentional (2) 224:5,7 interbasin (4) 169:8;200:3,14; 201:1 interest (1) 210:17 interesting (7) 37:24;41:21;79:15;	80:11;82:15;94:24; 209:5 Interior (1) 132:10 Interior's (1) 126:19 internal (1) 46:14 International (4) 11:24;12:17;17:6; 28:6 International's (1) 218:6 internet (5) 8:22;61:3;177:14; 192:7;193:23 interpolating (1) 237:7 interpret (4) 37:21;181:11; 227:22;228:3 interpretation (3) 43:11;50:17;130:3 interpretations (1) 231:13 interpreted (3) 127:18;235:23; 236:20 interpreting (2) 38:3;220:11 interrelationship (1) 225:22 interrupt (2) 116:22;233:21 intersected (2) 44:19,20 interval (2) 55:11;228:17 intervene (1) 198:11 into (65) 6:10;9:2;14:12; 17:20,23;18:10,13; 31:8;42:1;55:17;69:3; 70:13;72:8;76:4,4; 84:13;89:10,10,18,19, 22,23;90:7;93:1;94:15; 99:15;104:5;106:18; 113:21;119:15;136:19, 22,22;159:16;163:23; 164:1;175:12;176:24; 178:7,21;179:6,7,16; 180:3;185:22;186:1; 196:8,8;197:19,19; 200:2,4;203:17; 210:12;214:16;220:4; 221:7,8;227:4;229:1, 24;230:1;233:18; 234:14;238:10 introduce (1) 11:11 introduced (5) 16:4;22:16;63:10,15;	68:8 introduction (3) 22:13;53:13;138:7 intrude (1) 123:9 invalid (1) 147:7 inventory (2) 87:4;181:23 investigate (2) 14:12;213:9 investigated (1) 27:9 investigation (5) 17:7,7;28:7;82:16; 106:3 investigations (2) 14:16;15:3 Investment (1) 9:8 Investments (2) 6:18;9:5 invisible (1) 34:23 involved (2) 33:6;61:20 Irrigation (3) 177:9,11;208:13 island (6) 35:3;36:23;37:14; 38:7;43:24;44:1 isolate (4) 83:8;117:21;136:15; 199:19 isolated (5) 35:3;36:23;179:19, 21,22 isolates (1) 160:8 isolating (2) 231:17,22 isolation (1) 232:8 isostatic (2) 226:18,23 issue (3) 6:9;155:21;211:13 issued (2) 15:8,18 issues (6) 6:7;16:22,23;78:8; 104:4;197:23 item (1) 107:15 items (2) 86:18;159:15
J				
January (1) 52:3				
Jean (3) 11:17;120:21;211:14				

<p>J-E-A-N (1) 11:18</p> <p>John (2) 209:2;231:6</p> <p>joint (1) 148:17</p> <p>Jon (2) 2:11;5:12</p> <p>July (22) 9:14;12:10;13:23; 15:7,15,18;93:9; 101:14;110:15,16; 122:2;135:22;151:15; 153:5,7;174:22; 201:19,20;209:8; 218:3,13,24</p> <p>jump (7) 34:10;40:7;63:3; 68:5;74:16;75:11; 162:16</p> <p>jumped (2) 84:13;224:4</p> <p>jumping (1) 75:9</p> <p>jumps (1) 74:16</p> <p>June (3) 15:21;18:8;105:24</p> <p>justify (1) 200:11</p> <p>Justina (3) 2:24;42:17;181:5</p>	<p>26:3,8,12,17;29:19; 31:1;32:13;33:4;34:19; 35:2;37:10;38:10,21; 39:23;40:19,20;41:8, 18;56:11;59:15,24; 60:6;63:13;68:8;69:8, 14,18,23;70:15;71:7; 72:9;73:1,10,14,16; 74:1;75:9;77:18;78:20; 84:5;85:8;88:7,15; 90:1;95:24;98:14; 102:23;108:23;110:20; 114:14;115:11;116:13; 119:11;131:7;165:10; 168:23;175:21;180:20; 22;184:12;189:21,22; 190:3,17;197:23; 209:5;214:23</p> <p>King (4) 80:11;177:10,15; 208:14</p> <p>KMW-1 (1) 201:23</p> <p>knew (1) 218:24</p> <p>knob (1) 131:7</p> <p>knowing (2) 121:20;139:24</p> <p>knowledge (4) 122:8,11;160:17; 169:8</p> <p>knowledgeable (1) 129:23</p> <p>known (2) 139:7;153:3</p> <p>knows (1) 46:16</p> <p>Kryder (1) 5:12</p> <p>KSV-1 (2) 153:2;171:16</p>	<p>lakes (3) 168:21;172:10,11</p> <p>land (1) 146:19</p> <p>large (6) 15:22;19:23;42:10; 96:8;160:11;189:2</p> <p>largely (1) 25:16</p> <p>larger (1) 58:14</p> <p>largest (1) 187:20</p> <p>Las (10) 5:14;8:23;61:2; 140:14;141:12;162:4, 6;191:8,21;201:7</p> <p>last (22) 11:14,18;16:6;17:14; 30:22;38:24;59:17; 77:15;98:14;101:24; 106:15;116:13;168:16, 17,19,24;169:1; 189:24;207:2;225:8; 233:12;235:19</p> <p>Lastly (2) 134:7;213:5</p> <p>late (2) 69:12;119:3</p> <p>later (7) 7:20;22:2;44:23; 79:13,23;91:14;183:19</p> <p>lateral (5) 30:21;34:8;174:20; 175:2;233:5</p> <p>laterally (2) 176:7,10</p> <p>Laura (3) 3:13;162:6;177:17</p> <p>Law (2) 3:11;159:11</p> <p>Lawrence (1) 32:20</p> <p>lay (1) 31:3</p> <p>layer (3) 214:15;215:1,6</p> <p>layers (4) 23:18;38:8,12;215:7</p> <p>laying (1) 31:4</p> <p>layout (1) 31:1</p> <p>LCB's (1) 7:20</p> <p>leaking (1) 210:13</p> <p>lean (2) 60:21,22</p> <p>learned (4) 18:6,7;96:10;173:21</p> <p>least (7) 31:24;37:5;46:24;</p>	<p>154:17;165:23;171:11; 229:10</p> <p>leave (3) 99:18;149:22;166:20</p> <p>leaving (1) 7:22</p> <p>led (1) 102:24</p> <p>left (24) 7:11;21:4;22:1; 24:16;36:14;62:12,18, 21;68:16,17;69:20; 70:21;81:4,6;106:10, 11,19;110:22;111:1,7; 116:23;143:10;155:3; 227:6</p> <p>legislative (3) 7:19;8:22,23</p> <p>Leonard (1) 138:22</p> <p>less (10) 9:3;25:23;35:13; 48:22;57:1;122:23; 123:10;125:2;131:10; 204:15</p> <p>level (34) 10:13;62:23;63:2,5, 6,13,14,21;64:5;68:6; 69:21;70:5;74:19; 75:12;78:3,23;79:2,7; 80:6;81:16;85:10; 127:20;153:4;160:11; 163:4,7;164:15; 179:10;181:16;182:1; 202:8;211:22;214:23; 221:10</p> <p>levels (46) 18:1,3;27:15,17; 59:16,22;62:6;70:1,4; 71:3,12,23;73:12; 74:12;80:18,19;81:18; 82:8,12;84:7,18,24; 96:8;97:18;102:20; 113:4;116:9;118:20; 124:6,18;153:1,6,8; 164:6;165:3,12; 179:12;189:15;190:4, 8,9;202:9,20;209:16; 212:17;224:24</p> <p>levels' (1) 85:14</p> <p>Levi (1) 5:11</p> <p>light (2) 40:14;41:24</p> <p>lighter (1) 43:7</p> <p>lightning (2) 30:10;46:19</p> <p>likely (3) 146:7,7;220:17</p> <p>limestone (11) 35:3,6,14,16;36:23,</p>	<p>24;37:14;38:7;43:23; 44:1;45:6</p> <p>limit (1) 190:21</p> <p>limitation (1) 101:20</p> <p>limited (6) 6:7;7:5;8:11;68:1; 101:15;154:12</p> <p>limits (1) 11:2</p> <p>Lincoln (4) 3:2;159:6;199:15; 201:6</p> <p>line (111) 34:13,18,21;35:2,4,7, 10,11,12,19,20;36:22, 22;37:4,6,11,20;38:15; 39:1,6,7,11,16,17,23; 40:6,10,17,17,23,24; 41:3,4,7,9,13,16,17,23; 42:2,6,8,9,12;43:3,12, 24;44:3,11,13,13,15, 19,20;45:9,10;47:4,7; 50:1;51:10;52:18; 62:19;63:13,15,17; 64:5;68:22,23;69:20, 21,22;110:23;111:10, 11,11;120:1,4;143:3, 17;146:5,5;147:4; 171:14;185:12;194:5; 212:9;216:5,6,7,7,11; 217:5,19;219:3;220:2; 227:15,16,19,19;228:6, 13,14,20,22,23;229:9; 234:9,23;236:24; 237:7,8</p> <p>linear (3) 110:10;112:14,15</p> <p>lined (2) 37:13;227:19</p> <p>lines (43) 29:8;31:22;33:13,13, 18,21,22;34:2,2,5,12, 12,20;35:8,22;37:20; 43:6;45:5,7,11;50:8, 11;51:3;68:24;69:17, 18;71:1;73:18;89:4; 143:10;147:22;183:16; 219:24;226:21,22; 227:10,14;228:18,19; 229:9,12;237:4,5</p> <p>list (5) 19:8;32:16;46:10; 137:10;230:22</p> <p>listen (1) 102:12</p> <p>literally (4) 24:12;30:11;31:4; 218:22</p> <p>literature (12) 88:8;92:8,10,17; 93:4,5,7;133:4;144:3;</p>
K				
<p>Kane (53) 89:7;94:9,10;95:22; 134:16,17,22;135:2,7, 14,17,23;136:10,20; 152:19,22;159:16,18; 160:3,8;171:15;174:1, 6,10,14,20;175:12; 176:1,3,5,11,24;184:6, 17,24;185:15,21,22; 199:13,16,17,19,21,22; 200:1,4,12,14,18; 201:24;202:21,24; 203:11</p> <p>Karen (4) 3:4,14;132:9;159:10</p> <p>keep (3) 23:6;75:19;230:16</p> <p>keeping (1) 96:18</p> <p>Kent (2) 2:20;101:3</p> <p>kept (2) 72:12;75:15</p> <p>key (1) 43:10</p> <p>kind (74) 15:24;16:19,20; 18:15;22:21;25:11,18;</p>	<p>label (2) 145:21;146:2</p> <p>labeled (10) 12:9,10;15:20;22:14; 27:4;30:5;31:2;34:4; 35:4,10</p> <p>labelled (1) 20:14</p> <p>labels (1) 34:5</p> <p>laboratories (1) 32:20</p> <p>lack (4) 70:16,17;114:7,7</p> <p>lag (2) 202:15,15</p> <p>Lake (3) 19:5,9;172:2</p>	<p>L</p>		

<p>166:16;176:18,19 lithologic (2) 23:2,18 little (43) 9:2,3;17:24;19:16; 21:5;25:24;34:19;35:5; 36:23,23;37:14,15; 38:14,21;39:10;41:4,7; 43:23;44:1,13,19; 47:20;49:5;54:11; 60:18;71:5,6,6,14; 74:1;84:6;129:8,19; 170:14;174:8,13; 182:19;183:18;193:7; 199:5;205:10;214:4; 229:9 Livermore (1) 32:20 lives (1) 90:3 LLC (1) 172:10 local (29) 10:19;11:1;86:13; 90:5,8,8;91:18,19,19, 22,22;93:13,22,23; 94:11,12;97:5;119:12, 14;134:12;135:3,10; 138:22;150:21;166:2; 169:14,15;178:8,11 locate (2) 28:7;60:6 located (38) 21:9;27:11;48:8,21; 49:3;55:1;57:21,24; 58:2;61:22;62:3;65:11; 66:4;68:16;70:12; 71:16;73:22;76:5; 77:18;81:11,12;114:2, 3;139:8,12;143:14; 144:2,4,5,20;205:5; 211:16;215:4;233:10, 17;234:3;235:7,9 locating (1) 98:19 location (32) 10:21;22:23;28:2,3, 6;29:22;56:1;59:18; 61:18;73:19;98:4; 103:17,18;145:19; 163:17;165:6,7; 186:18,20;187:3,7; 193:24;203:24;204:1, 3;205:4;210:23;217:5; 218:15;223:5;226:23; 231:24 locations (16) 34:18;45:13;46:23; 60:8,12;61:14;62:1; 88:3;139:24;160:21; 164:7;187:17;223:4,6; 225:1,20 locked (1)</p>	<p>8:3 locus (1) 204:17 lodge (1) 50:14 logic (1) 16:20 logistical (1) 9:9 logistics (1) 9:9 long (11) 10:9;31:3,4;67:23; 109:3;116:10;169:3; 176:10;189:21;198:17; 210:24 longer (5) 71:6,8;77:22,23; 202:11 long-term (9) 49:3;70:15;75:6; 82:11;85:9,15;86:5; 96:22;161:22 longwinded (1) 24:1 look (104) 14:10;16:1;19:23; 20:20,20;21:3,3;38:6; 39:1,1;46:21;50:13; 54:8,9;60:1;68:17; 70:21,21;72:15;73:20; 79:10,11,24;80:9; 84:23;85:16;86:18; 91:2;92:23;93:21;96:8; 99:5;106:8,17;108:19; 110:24;111:17;113:20; 114:10,13,15,16,21; 115:7;116:3,14; 118:11;120:10;124:15; 133:3;134:14,17; 150:18;152:5;156:12; 163:1;164:2;167:7,24; 169:23;170:5,14; 176:17,20;177:1; 180:9,22;181:23,24; 182:16;183:18,20; 187:21;189:5,15,16,19, 20,20;190:1,1;195:8, 10;200:9;203:15; 207:8;215:5;216:10, 24;217:12;218:18,19; 219:18;223:3;224:18; 227:20;231:22;233:2, 6;234:17,18;235:3; 236:8,24 looked (36) 17:5;18:3;27:14; 32:7;47:22;53:23; 56:22;71:21;73:10; 78:16,16,18;81:18; 82:2,14;88:12;89:15, 17,18;93:18;95:12; 102:7,10,13;109:11;</p>	<p>115:13;118:13;120:2; 133:8;151:9;160:10; 161:3;179:8,11; 212:24;221:3 looking (64) 18:18;19:15;21:17; 36:7,11,12;40:20,20, 20;43:4;54:24;56:10; 60:1;62:2;69:6,7; 70:11;72:22;73:16; 81:5;82:4;84:22;85:13; 90:3;91:12;93:17; 96:20;98:9;102:9; 103:22;105:5;112:3; 121:8;142:19;145:15; 149:1;154:21;155:11, 12,17;156:10;157:5; 161:16;168:1;172:24; 175:16;182:5,6; 186:17;187:18;190:4; 201:22;203:15;210:2; 211:12;214:21;217:10; 218:21;219:22,22; 225:7;233:11,11,19 looks (8) 38:22;39:11,18,20; 56:24;141:1;155:13; 224:2 Loomis (2) 1:24;238:4 Los (1) 2:23 lose (1) 55:13 lost (1) 214:9 lot (38) 15:22;16:4,16;17:8, 11;18:1,2,3,21,23;24:5; 25:21;29:3;33:7;38:1; 54:20;58:2;62:15; 63:23;68:7;75:2,18; 81:18;87:15;88:11; 90:2;95:9;98:14;106:1; 118:17;130:16;146:1; 159:3;160:10;161:24; 162:1;196:11;218:2 love (1) 209:20 lovely (1) 230:8 low (19) 36:18;37:17;38:1,9; 39:11;69:12;214:15, 24,24;227:6;229:6; 234:6,18,19,21,22,22; 235:3,4 Lower (92) 5:6,15,20;6:11;10:1, 10,17;14:13;19:10,17; 20:19;21:14,15,23; 27:13;31:9;42:2,9,14; 45:9;47:11,18,23;48:7,</p>	<p>14,21,21;49:2,21;50:5, 5;53:3;58:18;59:2; 81:5;86:6,8;87:8,12; 89:8,10,18;90:7,9,12; 91:9;95:18,23;96:21; 97:4,8,23;99:8;103:19; 104:15;107:23;110:1; 118:15;123:3;134:12; 135:9,10,15,18,24; 136:10,16;139:21; 140:11;148:22;149:6, 10,23;150:2,15,17; 157:6;159:17;160:24; 163:19;164:18;165:2; 171:2;177:4;189:9; 205:16,20;214:20; 220:4;221:2;227:5; 234:12 lowering (1) 162:20 Ltd (1) 2:16 Luke (1) 126:18 lunch (6) 9:2,3;86:24;125:24; 137:7,13 LWRFS (3) 172:22;173:8;205:2</p>	<p>manage (1) 136:15 managed (3) 98:8;109:2;207:7 management (5) 6:11;108:3;137:3; 199:18;200:12 managing (2) 85:22;97:8 man-made (3) 145:13,22,24 manner (3) 8:13;26:14;200:16 many (6) 11:19;14:22;18:4; 32:23;115:13;149:9 map (40) 15:22;19:9;21:2; 31:19,21;34:18;35:9, 12;37:8,9,11;39:5,14, 22;40:7,8,18,23;41:12; 42:19;45:13;47:8;48:3; 55:24;89:23;140:9; 143:1;144:8,20; 151:13;175:15,17; 192:13;194:10;207:14; 226:17;227:2,21; 235:24;236:4 mapped (3) 133:19,20;235:22 mapping (3) 14:19;133:20;175:14 maps (5) 17:14;43:23;48:2,8; 139:8 March (1) 160:16 mark (4) 126:13;230:3,10,24 marked (5) 12:23;27:4;230:7,18, 22 marking (1) 230:18 married (1) 151:12 mass (3) 88:12;167:23,24 matching (1) 89:1 material (9) 21:8;28:21;36:18; 38:2,10;180:19; 234:18,20,22 materials (2) 7:23;28:19 math (1) 167:15 MATTER (7) 1:7;5:6;12:8;100:6, 15;138:5;238:10 matters (5) 6:17;8:17;50:23;</p>
M				
<p>MacKenzie (1) 159:11 Madam (3) 13:6;45:19;126:21 magnetic (2) 29:21;33:15 magnetics (1) 32:9 magnetotellurics (4) 29:19;30:6;31:23; 32:10 main (6) 47:4;203:18;210:7; 214:24;232:14,14 maintain (2) 165:2;230:21 maintained (4) 138:10,14;230:16,21 maintains (1) 48:10 major (3) 54:16;127:19;148:12 majority (1) 29:15 makes (5) 39:20;41:19;71:7; 203:24;204:2 making (7) 6:10;28:24;33:14; 126:9;132:12;157:17; 177:15</p>				

<p>67:7;98:13 Maxey-Eaken (1) 88:14 Maxi (7) 150:12;151:4,10; 165:23;166:8,10,15 may (39) 7:16;9:3;10:9;15:21, 23;16:8,9,10;23:12; 27:15,15;34:10;61:12; 67:4;73:7;76:16;79:3; 81:1,1;83:24;86:5,19, 20,20;90:20;92:3; 99:19;100:6;103:9,16, 16;106:20;123:24; 139:4,8;140:23;173:7; 225:20;230:23 maybe (24) 9:2,18;46:4;47:19, 19;60:18,21,22;61:10; 68:5;87:16;110:5; 129:9;132:2;142:15; 152:18;156:5;170:9; 188:14;200:8;211:21; 219:13;222:22;232:22 McDonald (2) 172:4,8 MD (1) 35:4 Mead (1) 19:5 Meadow (5) 89:8,10;90:9,13; 95:23 mean (30) 50:8;51:4,22;53:4; 54:17;64:9;70:8;80:15; 90:9;96:24;108:1; 112:1;116:5;120:4; 121:4;130:24;132:22; 166:5,22;180:3; 182:18;185:5;197:3; 200:6;207:11;214:18; 215:8,19;216:16; 221:24 meaning (2) 36:18;64:20 means (4) 30:1,2;129:5;228:4 meant (2) 166:24;230:24 measurable (1) 159:1 measure (7) 29:4,20,21;30:9,14; 31:14;168:3 measured (4) 32:4;62:13;64:5; 206:14 measurement (2) 33:19;223:3 measurements (6) 28:24;33:14;36:17;</p>	<p>147:15;152:22;157:23 measuring (5) 29:11;30:3,6;223:5,5 mechanism (2) 180:4,5 mechanisms (1) 179:1 medium (1) 40:4 meeting (1) 161:2 meetings (1) 14:15 magnetotellurics (1) 29:17 Melissa (1) 5:17 melt (1) 168:19 members (6) 11:4,7;12:16;13:5, 22;15:1 memory (1) 210:2 mentioned (13) 21:18;22:13;25:14; 27:21;47:15;73:10,21; 79:18;90:4;103:14; 133:7;145:22;211:9 met (1) 14:24 metal (2) 31:5,6 meters (1) 36:14 method (8) 22:15;29:9,19;30:17; 32:11;55:19;151:11; 167:3 methodology (3) 128:13;150:18; 166:10 methods (6) 29:3,10,14;128:8; 166:16;167:21 metric (5) 55:14;169:24;223:6, 8,9 mic (4) 140:22;191:19; 192:6;193:4 Michel (2) 1:24;238:4 MICHELLE (3) 1:4,2,2;5:8 Michelle (2) 2:8;5:18 microphone (2) 187:1;194:21 mics (1) 192:9 mid-'70s (1) 30:18</p>	<p>middle (10) 20:2;34:13;37:13; 39:24;40:24;41:8; 45:18;113:15;185:12; 220:1 might (26) 29:6;31:3;44:22; 53:24;60:5;76:18; 87:13;90:23;120:18; 129:21;133:14;139:18; 152:17;158:11;164:11; 165:16;167:23;168:1, 17;176:17,20,20; 204:13;218:7;220:7; 233:14 mile (2) 34:10,10 miles (11) 33:17;42:9;56:3,7, 15,23;57:1,3;58:1,2; 103:21 MILLER (6) 126:18,18;127:6,13; 132:5;190:23 million (7) 24:4,10,17;25:4,4,6, 13 millions (1) 24:5 mimics (1) 189:14 mind (3) 96:18;192:22;231:4 minds (1) 102:8 mine (1) 42:20 minerals (3) 30:21;32:12;33:7 minimum (4) 69:20;70:1;71:2; 124:18 mining (1) 32:24 minute (5) 57:24;58:3;201:21; 232:7;233:8 minutes (14) 7:6;9:2,3,10;83:20; 99:15;116:23;123:8, 10;125:23;126:5; 190:21;191:14;223:20 mislocated (1) 139:20 misplaced (1) 40:2 Miss (6) 76:16;92:4;99:9,17; 120:21;208:3 missed (1) 97:12 misses (1) 129:20</p>	<p>missing (5) 55:6;70:17;72:16; 131:16;224:2 mix (1) 180:19 mixed (1) 169:16 mixing (1) 89:1 Moapa (22) 3:9;10:10;21:15; 34:16;89:18;95:18; 110:20;111:12;123:14, 17;137:9;138:20,21; 152:10,14;160:18,22; 165:17;171:15;191:5; 199:6,12 model (39) 9:24;15:11;16:1; 18:10;23:7,9,10,14; 28:2;36:16;71:10; 80:22,22;83:1;85:5; 91:21;92:15;94:7; 98:22;105:16;121:17; 125:10;128:20;131:19; 160:23,23;165:21,23, 24;166:5,12;167:8; 179:14;180:23;196:6; 202:10;209:22;233:6, 18 modeling (1) 121:5 models (7) 18:13;92:9;93:4; 121:5;130:15;131:20; 151:10 modern (2) 92:3;151:12 modification (1) 142:21 modifications (1) 144:7 modified (2) 19:6;148:3 Molly (2) 12:3;47:17 M-O-L-L-Y (1) 12:3 moment (1) 208:22 MONDAY (2) 5:1;138:1 money (1) 33:6 monitored (1) 153:8 monitoring (9) 14:20;70:11;73:15, 19;114:16,19;116:18; 201:24;202:1 month (2) 52:8,9 monthly (7)</p>	<p>52:1,4;53:10;63:17; 64:6;69:2;127:19 months (4) 52:6,9;53:11;161:3 MORAN (24) 11:17,17;53:20;54:3, 5,7;59:11;120:21,24; 127:9,11;153:12,13; 170:14;171:5;182:5; 187:4,10,11;210:4; 211:16;214:11;224:14, 17 M-O-R-A-N (1) 11:18 more (43) 14:12;17:12;20:9; 21:6;22:7;24:16;26:1, 22;30:22,22;31:22; 34:14;37:17;42:3; 44:13;48:22;52:8; 54:21;58:2;82:1;83:16; 93:10;103:14;112:16, 16;121:17;130:16,16; 131:10,12;133:7; 151:12;156:5;169:6,6; 171:24;173:20;187:9; 188:13;199:5;205:10; 212:1;227:7 morning (17) 5:5;6:17;9:7,11; 11:13,17;22:3;28:11, 13;85:2;101:3;132:9; 181:11;202:18;226:8, 17;229:18 Morrison (10) 4:8;152:13,13;155:5, 7;161:9;199:8,11,12; 224:22 most (13) 8:19;30:20;32:1,17; 34:20;82:15;92:3,10; 102:1;107:1;123:18; 220:17;236:19 mostly (2) 36:9;48:8 motor (1) 30:3 Mountain (2) 197:20,21 mountainous (2) 48:24;210:10 mountains (7) 25:8;89:20;90:10,13; 104:5;209:19;221:9 move (28) 17:23;22:7;23:1,22; 35:14;42:5;58:12,16; 59:21;61:4;70:10,10; 78:15;80:8;82:6;85:2; 100:19;129:21;130:18; 136:17;138:19;142:4, 6;144:1,5;195:12; 220:4;229:20</p>
--	---	--	---	---

<p>moved (2) 41:13;148:3</p> <p>movement (19) 10:14;14:13;17:3,17, 20;22:11;53:14,20; 58:10;59:19;78:11; 83:4;85:5;98:21;99:7; 106:21;232:12,12; 233:20</p> <p>moves (4) 15:14;17:20;58:5; 222:11</p> <p>moving (7) 46:8;75:15;78:19; 81:4;85:7;86:3;97:10</p> <p>MS-5 (1) 79:2</p> <p>MT (2) 32:9,10</p> <p>much (41) 29:7,14;31:22;43:23; 58:8;65:16;72:13;74:4; 79:1;87:6;90:19,20; 95:12,18;102:15; 103:17;109:24;111:9; 116:19;137:4,11; 148:14,20;149:7; 152:20;163:18;181:2; 185:6,8;202:3;203:13; 204:15;206:9;207:8,9, 10;209:4;221:11; 227:14;237:16,20</p> <p>MUDDY (81) 1:12;11:3;22:23; 61:15;64:1,3;68:7; 69:1,4,24;70:12;71:11, 18;72:7;73:17;74:3; 76:4;77:19;78:6,14; 79:20;82:16;84:20; 89:11;90:21;94:15; 97:16,19;106:21; 109:6,8,9,10,13,15; 110:18,21;111:12,16, 24;112:1,17,23; 114:17;119:24;120:7, 13;124:6,13;139:18; 140:6;141:15,16,20; 142:1,8,8,11;147:11, 11;149:8,11,17;155:9; 164:1,8;175:5;177:8, 11;179:20;185:7; 188:4;192:15,15; 205:14;208:13;221:7; 222:4;223:1,4,14</p> <p>multi (1) 165:4</p> <p>multiple (5) 178:4;187:17; 198:12,13;223:6</p> <p>MX- (1) 114:15</p> <p>MX-4 (20) 62:3,3,6;63:14;64:8;</p>	<p>73:16,21,21;74:10,15, 20;75:3,24;114:18; 115:14;116:5;117:11; 183:7;189:14;193:11</p> <p>MX-5 (42) 45:14;56:1;62:4; 71:17;72:10;73:17,22; 74:6,8,11,14,17,21; 75:1,7,7;76:4;78:1; 79:8;81:11;82:8;84:19; 113:14;114:15;122:5; 134:2;142:11;162:24; 163:3;175:3;184:8,10, 11,11;185:4,15,21; 187:14,24;188:1; 221:7;231:22</p> <p>MX-5's (1) 79:4</p> <p>MX-6 (6) 186:18,20;187:3,20; 225:20;226:1</p> <p>myself (1) 147:20</p>	<p>16:23;73:3;97:11; 131:14,16;164:8; 168:5;221:5</p> <p>necessary (2) 6:15;231:1</p> <p>need (14) 8:2;13:13;19:23; 81:24;95:16,23;96:20; 103:19;108:6;136:14; 176:22;177:1;214:10; 236:5</p> <p>needed (5) 34:8;55:4;100:17,18; 149:21</p> <p>needs (6) 18:12;55:8;96:9; 98:3;102:13;152:20</p> <p>negative (1) 227:5</p> <p>neither (2) 128:24;129:16</p> <p>NEVADA (25) 1:1;2:17;5:1;13:7; 19:2;48:4;92:11;106:5; 127:21;138:1;140:14; 141:11;160:18;172:15; 179:3;191:7,21; 193:23;200:24;208:8, 19;238:1,7,8,17</p> <p>new (18) 10:3,18;17:5;77:8; 88:9;93:17;95:13; 96:19;98:17;99:4; 102:9;143:21;160:13, 20;161:7;169:7; 170:17,19</p> <p>newer (1) 25:2</p> <p>next (30) 32:16;34:17;45:6,6; 56:13,19,24;57:5,19; 61:11;73:20;82:11; 93:15;99:12;114:20; 132:7;137:8;138:20; 140:13;152:10;159:6; 162:3;172:1,15;177:8, 16;181:3;201:5;208:4; 218:22</p> <p>nice (4) 39:9;44:21;57:5; 130:24</p> <p>nicely (2) 37:13;228:23</p> <p>near (1) 157:14</p> <p>NOAA (2) 48:10;49:9</p> <p>nob (4) 39:20;40:8,9;41:4</p> <p>Nodded (1) 145:7</p> <p>noise (8) 38:19;145:13;146:1,</p>	<p>7,15,17;214:16;216:8</p> <p>noisy (2) 147:3,7</p> <p>nominal (2) 117:23;233:13</p> <p>none (5) 149:3;191:6;204:23; 208:8,18</p> <p>nonequilibrium (1) 54:14</p> <p>Non-equilibrium (1) 130:9</p> <p>non-linear (1) 112:20</p> <p>noon (1) 137:7</p> <p>Nope (1) 208:17</p> <p>nor (1) 222:18</p> <p>Norm (1) 28:8</p> <p>normal (25) 22:8,8;24:23,24; 25:2,5,14;37:1;53:5,7; 83:2;96:13;104:23; 105:1;117:24;140:10; 163:21;232:10,20; 233:3,12,14,15;234:5; 235:16</p> <p>normally (1) 194:8</p> <p>Norman (1) 11:22</p> <p>north (25) 19:4;21:10;35:21,21; 40:20;43:4;44:17,18; 71:16;72:8,10;78:22; 79:9;80:8;162:4,6; 175:21,23,24;178:10; 184:4;201:7;212:10; 213:20;231:23</p> <p>north/south (2) 194:5;204:8</p> <p>northeast (2) 41:19;175:24</p> <p>northeast/southwest (1) 176:6</p> <p>northern (15) 33:24;81:7;84:20; 139:18;176:1;180:9, 14,18;184:6,17,21; 185:7,14;197:3;203:11</p> <p>northward (1) 180:17</p> <p>northwest/southeast (2) 174:23;175:8</p> <p>northwestern (2) 70:12;77:18</p> <p>nose (8) 33:24;35:4;37:15; 39:8,10;41:20;43:20; 44:4</p>	<p>note (2) 52:20;53:9</p> <p>noted (4) 50:19;67:10;76:15; 77:11</p> <p>notes (2) 238:7,14</p> <p>notice (5) 36:20;39:14;100:9, 10;171:11</p> <p>nowhere (1) 39:24</p> <p>Number (29) 12:9;14:6;15:20; 27:4;76:20;84:2;91:12; 93:23;94:20;103:4,7; 104:17;106:9;113:9; 114:24;115:3;122:13; 125:6,7,19;144:23; 145:2,9;156:22; 188:17;214:14;216:18; 218:14;224:4</p> <p>numbers (10) 36:9;84:14;93:8,10; 112:8;149:19;166:7; 171:8,10;214:13</p> <p>numerical (3) 121:5;130:15;131:20</p> <p>NV (5) 2:24;42:18;181:3,6; 238:22</p>
N				
<p>nap (2) 199:13,24</p> <p>name (17) 5:8;9:7;11:13,14,17, 18,22;12:3;52:13; 101:3;126:8,18; 141:10;172:18;181:5; 186:11;226:11</p> <p>named (1) 146:2</p> <p>names (3) 11:12;87:17;88:1</p> <p>narrow (3) 34:7;44:9;139:4</p> <p>National (11) 3:14;32:17,20;48:5; 49:11;122:14,18; 132:7,11;160:20; 190:24</p> <p>NATURAL (3) 1:2;133:18;238:9</p> <p>naturally (2) 30:9;32:4</p> <p>nature (1) 8:4</p> <p>NCA (1) 3:7</p> <p>near (11) 22:1,4;45:18;64:3,3; 80:11;120:12;146:5; 216:7;220:19;234:9</p> <p>nearby (5) 74:24;116:18; 119:14,14;211:21</p> <p>nearest (1) 171:10</p> <p>necessarily (8)</p>	<p>nailed (1) 199:13,24</p> <p>name (17) 5:8;9:7;11:13,14,17, 18,22;12:3;52:13; 101:3;126:8,18; 141:10;172:18;181:5; 186:11;226:11</p> <p>named (1) 146:2</p> <p>names (3) 11:12;87:17;88:1</p> <p>narrow (3) 34:7;44:9;139:4</p> <p>National (11) 3:14;32:17,20;48:5; 49:11;122:14,18; 132:7,11;160:20; 190:24</p> <p>NATURAL (3) 1:2;133:18;238:9</p> <p>naturally (2) 30:9;32:4</p> <p>nature (1) 8:4</p> <p>NCA (1) 3:7</p> <p>near (11) 22:1,4;45:18;64:3,3; 80:11;120:12;146:5; 216:7;220:19;234:9</p> <p>nearby (5) 74:24;116:18; 119:14,14;211:21</p> <p>nearest (1) 171:10</p> <p>necessarily (8)</p>	<p>new (18) 10:3,18;17:5;77:8; 88:9;93:17;95:13; 96:19;98:17;99:4; 102:9;143:21;160:13, 20;161:7;169:7; 170:17,19</p> <p>newer (1) 25:2</p> <p>next (30) 32:16;34:17;45:6,6; 56:13,19,24;57:5,19; 61:11;73:20;82:11; 93:15;99:12;114:20; 132:7;137:8;138:20; 140:13;152:10;159:6; 162:3;172:1,15;177:8, 16;181:3;201:5;208:4; 218:22</p> <p>nice (4) 39:9;44:21;57:5; 130:24</p> <p>nicely (2) 37:13;228:23</p> <p>near (1) 157:14</p> <p>NOAA (2) 48:10;49:9</p> <p>nob (4) 39:20;40:8,9;41:4</p> <p>Nodded (1) 145:7</p> <p>noise (8) 38:19;145:13;146:1,</p>	<p>no (5) 149:3;191:6;204:23; 208:8,18</p> <p>nonequilibrium (1) 54:14</p> <p>Non-equilibrium (1) 130:9</p> <p>non-linear (1) 112:20</p> <p>noon (1) 137:7</p> <p>Nope (1) 208:17</p> <p>nor (1) 222:18</p> <p>Norm (1) 28:8</p> <p>normal (25) 22:8,8;24:23,24; 25:2,5,14;37:1;53:5,7; 83:2;96:13;104:23; 105:1;117:24;140:10; 163:21;232:10,20; 233:3,12,14,15;234:5; 235:16</p> <p>normally (1) 194:8</p> <p>Norman (1) 11:22</p> <p>north (25) 19:4;21:10;35:21,21; 40:20;43:4;44:17,18; 71:16;72:8,10;78:22; 79:9;80:8;162:4,6; 175:21,23,24;178:10; 184:4;201:7;212:10; 213:20;231:23</p> <p>north/south (2) 194:5;204:8</p> <p>northeast (2) 41:19;175:24</p> <p>northeast/southwest (1) 176:6</p> <p>northern (15) 33:24;81:7;84:20; 139:18;176:1;180:9, 14,18;184:6,17,21; 185:7,14;197:3;203:11</p> <p>northward (1) 180:17</p> <p>northwest/southeast (2) 174:23;175:8</p> <p>northwestern (2) 70:12;77:18</p> <p>nose (8) 33:24;35:4;37:15; 39:8,10;41:20;43:20; 44:4</p>	<p>no (5) 149:3;191:6;204:23; 208:8,18</p> <p>nonequilibrium (1) 54:14</p> <p>Non-equilibrium (1) 130:9</p> <p>non-linear (1) 112:20</p> <p>noon (1) 137:7</p> <p>Nope (1) 208:17</p> <p>nor (1) 222:18</p> <p>Norm (1) 28:8</p> <p>normal (25) 22:8,8;24:23,24; 25:2,5,14;37:1;53:5,7; 83:2;96:13;104:23; 105:1;117:24;140:10; 163:21;232:10,20; 233:3,12,14,15;234:5; 235:16</p> <p>normally (1) 194:8</p> <p>Norman (1) 11:22</p> <p>north (25) 19:4;21:10;35:21,21; 40:20;43:4;44:17,18; 71:16;72:8,10;78:22; 79:9;80:8;162:4,6; 175:21,23,24;178:10; 184:4;201:7;212:10; 213:20;231:23</p> <p>north/south (2) 194:5;204:8</p> <p>northeast (2) 41:19;175:24</p> <p>northeast/southwest (1) 176:6</p> <p>northern (15) 33:24;81:7;84:20; 139:18;176:1;180:9, 14,18;184:6,17,21; 185:7,14;197:3;203:11</p> <p>northward (1) 180:17</p> <p>northwest/southeast (2) 174:23;175:8</p> <p>northwestern (2) 70:12;77:18</p> <p>nose (8) 33:24;35:4;37:15; 39:8,10;41:20;43:20; 44:4</p>
O				
<p>o (2) 5:2;138:2</p> <p>object (4) 64:21;65:21;76:9; 215:17</p> <p>objection (7) 50:14,18;67:10; 76:14;77:9,10;138:6</p> <p>observation (15) 56:3,8,18,23;57:1,4, 14,21;58:1;59:10; 67:16;78:18;116:17; 119:15;131:4</p> <p>observations (12) 11:5,9;59:16,21; 74:10;84:6,8;95:13; 101:18;103:18;105:5; 202:19</p> <p>observe (2) 27:19;202:21</p> <p>observed (4) 71:3;73:11,12;203:8</p> <p>obvious (1) 85:11</p> <p>obviously (2) 65:21;211:17</p> <p>occur (21) 23:12;25:10;60:2; 81:1;82:20;87:6,24;</p>	<p>o (2) 5:2;138:2</p> <p>object (4) 64:21;65:21;76:9; 215:17</p> <p>objection (7) 50:14,18;67:10; 76:14;77:9,10;138:6</p> <p>observation (15) 56:3,8,18,23;57:1,4, 14,21;58:1;59:10; 67:16;78:18;116:17; 119:15;131:4</p> <p>observations (12) 11:5,9;59:16,21; 74:10;84:6,8;95:13; 101:18;103:18;105:5; 202:19</p> <p>observe (2) 27:19;202:21</p> <p>observed (4) 71:3;73:11,12;203:8</p> <p>obvious (1) 85:11</p> <p>obviously (2) 65:21;211:17</p> <p>occur (21) 23:12;25:10;60:2; 81:1;82:20;87:6,24;</p>	<p>o (2) 5:2;138:2</p> <p>object (4) 64:21;65:21;76:9; 215:17</p> <p>objection (7) 50:14,18;67:10; 76:14;77:9,10;138:6</p> <p>observation (15) 56:3,8,18,23;57:1,4, 14,21;58:1;59:10; 67:16;78:18;116:17; 119:15;131:4</p> <p>observations (12) 11:5,9;59:16,21; 74:10;84:6,8;95:13; 101:18;103:18;105:5; 202:19</p> <p>observe (2) 27:19;202:21</p> <p>observed (4) 71:3;73:11,12;203:8</p> <p>obvious (1) 85:11</p> <p>obviously (2) 65:21;211:17</p> <p>occur (21) 23:12;25:10;60:2; 81:1;82:20;87:6,24;</p>	<p>o (2) 5:2;138:2</p> <p>object (4) 64:21;65:21;76:9; 215:17</p> <p>objection (7) 50:14,18;67:10; 76:14;77:9,10;138:6</p> <p>observation (15) 56:3,8,18,23;57:1,4, 14,21;58:1;59:10; 67:16;78:18;116:17; 119:15;131:4</p> <p>observations (12) 11:5,9;59:16,21; 74:10;84:6,8;95:13; 101:18;103:18;105:5; 202:19</p> <p>observe (2) 27:19;202:21</p> <p>observed (4) 71:3;73:11,12;203:8</p> <p>obvious (1) 85:11</p> <p>obviously (2) 65:21;211:17</p> <p>occur (21) 23:12;25:10;60:2; 81:1;82:20;87:6,24;</p>	

<p>89:10;98:5;104:4; 108:17;112:21;136:17; 163:18;165:10;183:19; 195:19;207:24;222:18; 223:17;235:17</p> <p>occurred (7) 25:9,13;45:11;70:22; 79:24;116:15;204:17</p> <p>occurrence (12) 10:14;14:12;17:3,17; 22:11;25:19;27:2; 53:20;58:6;59:19;83:4; 85:5</p> <p>occurring (20) 30:9;32:4;53:7,22; 68:12;70:23;71:20; 80:24;82:5;90:8;91:22; 108:16;113:13,21,22; 161:17;189:16;204:8, 15,17</p> <p>occurs (15) 15:14;23:11;51:12; 53:11;58:5;69:24;71:1; 107:18;170:18,19; 178:18;179:3;180:17; 187:18;206:16</p> <p>Oceanic (2) 48:5;49:11</p> <p>O'Connor (1) 2:18</p> <p>October (5) 72:21,21;157:24; 158:10,13</p> <p>off (11) 38:13;43:12;91:22; 111:13,20;163:2; 164:12;168:20;192:6; 210:2;223:19</p> <p>offend (1) 192:21</p> <p>offer (3) 65:6,22;67:6</p> <p>offered (5) 64:22;65:8;66:8,9,18</p> <p>office (13) 5:14;6:2;7:4,23; 53:21;85:3;88:7;99:18; 106:5;118:8;125:7; 126:19;132:10</p> <p>OFFICER (101) 1:4;2:7;5:4,9;13:6,9, 14;42:16,17,22;43:14; 45:19;46:3;50:18; 52:11,13,20;60:10,24; 61:12;65:7,14,24;66:7, 19;67:9;76:6,14;77:10, 13;83:13,18,22;99:14, 20;100:1,5,21;123:6, 11;125:22;126:23; 127:2;132:6;137:6; 138:4;140:13,21; 141:1,5;152:6,10; 155:5;159:6;162:3,7;</p>	<p>172:1,14;177:8,13; 181:3;186:7,10,24; 190:13,24;191:3,11,18; 192:8,17;193:1,18,22; 194:20;198:8,10,21; 199:1,4,9;201:5,9; 207:1,17,21;208:4,8, 11,15,18,21;212:2; 223:18,23;224:8; 229:22;230:5,13; 231:2;237:11</p> <p>offices (2) 8:24;11:24</p> <p>offset (5) 115:20;214:22; 215:2;235:17;236:21</p> <p>often (3) 36:24;42:10;210:13</p> <p>oil (1) 33:7</p> <p>old (4) 24:5;90:2;169:16; 210:19</p> <p>older (7) 21:11;23:21,21;24:4; 25:1;151:13;169:4</p> <p>omission (1) 224:6</p> <p>once (4) 31:10;34:9,10; 199:11</p> <p>one (115) 5:13;7:8;9:18;14:24; 15:11;27:16;29:4,14; 31:10;34:6;35:15; 36:10,10;38:13;39:7, 14;41:17;44:7,16; 45:15;46:24;47:14,14, 16,16;48:13;50:4,52:8; 55:6;60:14;62:5;67:18, 18;68:8;72:18,19; 74:10;86:14,15,24; 87:7,16,17;93:8;100:5; 103:17;104:7;116:1; 118:24;119:1,11; 120:18;122:19;129:21; 133:10;140:24;141:5; 142:3,16;143:4,10,11; 145:2;147:23;150:8; 151:15,16;153:23; 154:17;159:15;162:12; 163:13,16;170:5; 171:14;179:8;182:23; 188:13,21;192:9,24; 198:1;199:8;200:6,8; 204:4;205:2;207:4; 208:21;209:4,9,24; 212:23;213:3;214:2,9; 217:21;218:14;220:24; 223:5;224:1,14; 225:16,19;226:10,18; 227:23;230:9;231:12, 16;233:4,12,13,14;</p>	<p>237:5</p> <p>ones (4) 47:4;114:23;136:24; 175:12</p> <p>one's (1) 217:21</p> <p>one-to-one (1) 141:24</p> <p>online (1) 127:22</p> <p>only (25) 28:3;30:6;34:4; 56:16,24;57:24;61:4; 63:24;90:6;102:7; 107:12,23;118:4; 139:14,15;149:22; 150:20;161:7;170:9; 187:18;198:1;204:11, 21;210:21;232:8</p> <p>onto (3) 34:18;40:18;228:13</p> <p>open (9) 7:17;9:5;55:11; 152:8;186:8;190:16; 226:10,19,20</p> <p>opine (1) 164:14</p> <p>opined (1) 221:14</p> <p>opinion (12) 15:13;16:21;50:17; 104:14;105:3;120:20; 136:6;150:1;209:18; 220:14;221:24;225:13</p> <p>opinions (2) 15:4;16:18</p> <p>opportunities (1) 212:5</p> <p>opportunity (9) 6:24;8:13,18;9:21; 16:15;95:12;159:22; 180:18;222:16</p> <p>opposed (1) 128:19</p> <p>opposite (1) 122:6</p> <p>orange (2) 111:11;227:10</p> <p>orange-pink (1) 115:11</p> <p>Order (55) 5:7;6:1;9:23;10:8, 11;12:10;14:10,10,23; 15:9,9,24;17:4;18:7, 10;19:14;22:19;23:15; 28:1,5;53:18;60:2; 67:16;68:3;73:23;74:7; 78:22;88:16;94:4,21; 95:7,15;96:3,5,10; 98:12;100:12,17; 101:13;103:21;106:13; 113:23;124:1;130:1; 136:16,16;138:18;</p>	<p>148:22,24;149:1,2; 176:16;189:2;190:18; 194:9</p> <p>Oregon (1) 92:18</p> <p>organize (1) 106:12</p> <p>organized (1) 106:18</p> <p>orientation (4) 34:14;44:15,17; 237:6</p> <p>orientations (1) 226:3</p> <p>oriented (2) 34:14;35:21</p> <p>origin (1) 168:11</p> <p>original (1) 224:3</p> <p>originally (1) 14:9</p> <p>originated (1) 177:23</p> <p>others (10) 15:13;17:10;22:17; 88:10;114:6;125:13; 140:9;145:2;175:18; 212:23</p> <p>Otherwise (1) 40:12</p> <p>ourselves (5) 71:22;81:19;106:2; 209:23;210:1</p> <p>out (89) 5:14;7:19;8:16; 14:18,20;17:5,6,18; 18:19;21:1;22:19; 29:18;30:3,15;31:3; 32:9;33:18;34:9,19; 37:17;38:18,22;39:4, 24;40:5;41:13;44:2,6, 12,14;45:3,17;51:7; 54:21;55:17;58:16,19, 20;59:5;68:10;72:19; 74:6;76:17;80:2;82:1; 84:11;86:24;87:5,16; 88:8,10,15;91:14; 93:24;94:1,18;98:16, 17,17;114:5;119:1; 120:5;121:20;122:7; 129:11;133:5;147:24; 148:9;165:5;168:6; 170:8,16;185:22; 189:1,7;197:19; 205:19;207:14;210:20; 214:22;218:1,3;226:2, 9,16;228:10,21; 233:23;235:14</p> <p>outcrop (2) 37:4;44:21</p> <p>outcrops (1) 21:2</p>	<p>outer (1) 92:13</p> <p>outflow (31) 10:17;23:13;80:10; 89:16,17,19,23;90:18; 91:3,5,13;93:23,24; 94:14,14,18;95:3,18; 97:4;98:1;104:5;171:8; 197:22;205:15;206:4, 8,9,15,19;207:14; 222:14</p> <p>outflows (1) 173:11</p> <p>outline (1) 16:24</p> <p>outlined (3) 87:7;90:5;129:13</p> <p>outside (2) 140:8;223:12</p> <p>ovals (2) 227:22;228:2</p> <p>over (42) 16:5,6,6;17:13; 34:11,21;35:5,8;36:22; 37:4,14,16;39:10;50:9; 51:17;53:5;56:2,7,11; 60:18;62:11;65:15; 69:8;92:20;109:3; 111:5,22;116:9,9,13; 156:17,20;161:22; 168:16,17;170:16,23; 173:20;175:9;192:5; 221:13;227:16</p> <p>overall (4) 91:1;101:21;161:18; 167:7</p> <p>overestimated (1) 204:12</p> <p>overlapped (1) 227:24</p> <p>overlay (5) 34:18;63:9;64:9; 139:16;228:5</p> <p>overview (2) 18:15;103:3</p> <p>own (7) 30:15;32:5;46:14; 85:4;125:10;150:20; 221:11</p>
P				
<p>Pacific (5) 172:2,4,6,8;208:5</p> <p>pack (1) 34:5</p> <p>Page (37) 17:12;78:24;122:3; 135:22;142:18;145:12; 154:18,22;155:6,7,12, 18;157:4,5,11,17,23; 172:22;173:5;174:4, 18,19;181:18;201:18,</p>				

<p>19;214:3;216:15; 217:4;218:22;224:3,4, 5,23;225:5,7,8;231:11</p> <p>pages (1) 238:13</p> <p>Pahrnagat (12) 34:15;41:19;48:13; 49:22;50:6;81:7;89:5; 94:9;95:22;136:9,21; 200:18</p> <p>paint (1) 33:9</p> <p>Paiute (4) 137:9;138:20,22; 160:19</p> <p>paleo (1) 168:21</p> <p>Paleozoic (3) 24:6;229:5;234:9</p> <p>Paleozoics (1) 229:3</p> <p>PALMER (21) 12:3,3;47:17,19,21; 48:1;49:5,13;51:2,19; 52:23;53:12;62:8; 63:10;92:4,7;133:7; 151:6,8;166:1,4</p> <p>P-A-L-M-E-R (1) 12:4</p> <p>Palmer's (1) 50:22</p> <p>PANEL (18) 4:2;9:24;10:6;11:4, 7;13:11;16:15;101:5; 126:1;140:2;141:10; 159:10;172:3,19; 177:12;186:13;212:13, 14</p> <p>panelists (2) 11:10;16:12</p> <p>panels (1) 215:20</p> <p>paper (1) 214:10</p> <p>papers (1) 166:16</p> <p>paragraph (3) 155:8;173:6;225:8</p> <p>Parallel (7) 35:12,15;69:22; 143:9,18;202:22; 231:24</p> <p>parameters (7) 53:19;93:4;128:23; 129:2,13,17,18</p> <p>paren (1) 214:6</p> <p>Park (10) 3:14;122:14,18; 125:2;132:7,11; 160:20;190:24;191:4; 213:12</p> <p>part (37)</p>	<p>9:17,18;30:24;35:17; 42:13;47:10;51:13; 61:16;65:5;66:11,15, 17;74:11;75:9;80:10; 99:10,12;101:10,12; 107:24;108:1;112:18; 114:17;123:18;125:21; 136:24;139:18;150:5, 9;153:5;165:17; 168:14;176:1;180:14; 203:18;210:7;219:5</p> <p>partially (1) 165:23</p> <p>participant (1) 126:1</p> <p>participants (6) 7:6,12,17;66:20; 100:4;126:14</p> <p>participate (1) 14:14</p> <p>participating (1) 172:11</p> <p>particular (11) 36:21;47:5;50:23; 63:12;67:7;77:1;78:20; 105:22;106:23;121:6; 131:3</p> <p>particularly (1) 32:11</p> <p>parties (10) 14:2;15:18;101:13; 106:14;126:13;138:9, 13,17;190:21;191:12</p> <p>parts (2) 123:3;165:14</p> <p>party (2) 8:16;173:15</p> <p>pass (1) 221:8</p> <p>passed (1) 226:16</p> <p>past (5) 32:7;62:10;103:16; 105:18;168:11</p> <p>paths (7) 10:4;27:4,7;123:2; 163:22,24;221:6</p> <p>pathways (7) 26:12,18;96:14; 98:19;104:12;105:2, 118:2</p> <p>Patrick (4) 52:15;76:8;162:11; 201:14</p> <p>pattern (1) 161:18</p> <p>Paul (4) 13:7;141:10;191:20; 212:8</p> <p>Paulina (1) 172:7</p> <p>PDF (1) 201:19</p>	<p>peak (8) 22:5;24:15;69:15,15, 19,24;71:1,9</p> <p>peaked (1) 210:17</p> <p>Pederson (21) 54:11;55:2;56:4; 57:14;157:20,20,23,24; 158:1,3,6,10,12,14,18, 21;163:10;225:1,1,10, 11</p> <p>peer (2) 33:3,9</p> <p>peer-reviewed (1) 33:3</p> <p>pending (1) 148:18</p> <p>penetrating (1) 55:10</p> <p>people (6) 133:12;162:14; 198:13,13;199:2; 237:15</p> <p>per (28) 10:15,16,19;31:13; 49:24;52:8;56:2,6,14; 57:24;58:3;93:6,11,11; 108:10;122:23;123:5; 125:1;132:17,22,23; 134:22;136:16;164:19, 22;165:1;189:8,11</p> <p>perceived (1) 8:15</p> <p>percent (6) 55:12;109:8,15; 167:16,17;237:1</p> <p>perched (4) 210:9,9,10;211:9</p> <p>perennial (8) 148:21,23;149:6,7,9, 20,22;150:2</p> <p>Perfect (1) 61:8</p> <p>perfectly (2) 37:1;228:20</p> <p>perform (4) 14:16;15:2;17:18; 28:6</p> <p>performed (7) 28:10;88:8;106:2; 150:19;159:24;160:16, 16</p> <p>performing (1) 98:18</p> <p>perhaps (2) 162:16;230:10</p> <p>period (28) 7:7;8:11;24:6;50:3, 9;51:13,14,15,23;53:6; 63:18;67:23;68:11; 69:16;70:17;71:1; 73:23;77:23;80:16; 116:10;124:2;156:20;</p>	<p>161:22;183:17;190:10; 202:22;210:24;218:2</p> <p>periods (4) 69:8;124:16;190:2,5</p> <p>permeabilities (1) 26:12</p> <p>permeability (1) 210:14</p> <p>permeable (3) 25:23;133:23;134:1</p> <p>perpendicular (4) 26:14,21;118:3,5</p> <p>person (1) 162:16</p> <p>perspective (6) 37:10;40:19;43:4; 91:1;131:17;235:21</p> <p>Peterson (7) 3:4;4:9;159:9,10; 162:2;199:15;201:7</p> <p>photo (2) 236:11,17</p> <p>photographs (1) 168:2</p> <p>photos (2) 45:14;231:14</p> <p>phreatophytic (2) 164:12;204:15</p> <p>physical (6) 29:12;31:1;88:3; 97:13;99:6;229:11</p> <p>picked (1) 202:16</p> <p>picture (4) 19:24;125:12;164:3; 218:18</p> <p>piece (1) 55:6</p> <p>pieces (5) 9:13;55:7;65:2; 130:16;167:1</p> <p>pink (3) 21:10;50:2;63:17</p> <p>pipelines (2) 29:7;145:24</p> <p>place (8) 5:5;14:15;45:5; 86:24;98:5;205:1,2; 228:16</p> <p>placed (2) 35:23;40:12</p> <p>placement (1) 226:3</p> <p>places (5) 87:18,19;88:3;90:4; 187:19</p> <p>plan (3) 7:22;9:10;236:4</p> <p>planet (1) 30:11</p> <p>planning (4) 86:9;88:18;100:19; 173:14</p>	<p>plastic (1) 21:12</p> <p>plate (1) 226:18</p> <p>plates (1) 31:6</p> <p>plausible (1) 96:3</p> <p>play (2) 96:7;162:12</p> <p>plays (4) 85:17,18,18;120:14</p> <p>please (38) 11:11;14:7;16:12; 18:18;28:15;44:24; 51:2;52:13,14;54:6; 56:13,20;67:13;84:3; 95:6,8;101:8,22;106:9; 108:13,21;110:11; 113:10;114:24;118:12; 119:20;122:13;123:12; 125:6;126:15;144:24; 181:17;186:10;187:9; 188:18;194:21;224:14; 226:13</p> <p>pleasing (1) 229:10</p> <p>Pleistocene (1) 168:12</p> <p>plot (4) 36:8;40:18;80:14; 219:24</p> <p>plunge (1) 220:2</p> <p>plunges (1) 38:10</p> <p>plunging (1) 180:16</p> <p>plus (3) 6:7;33:9;42:7</p> <p>pm (4) 137:12;138:1; 223:18;237:22</p> <p>pocket (2) 211:19;213:4</p> <p>point (37) 21:1;22:21;43:10; 48:12;51:7;56:3,8,18, 23;57:1,4,14,21;58:1; 59:10;64:23;66:8; 72:19;85:8;98:16; 104:17;110:8;114:5; 119:1,8,9;133:3; 173:16;189:1;202:8, 12,16;214:21;219:2; 223:3,3;229:20</p> <p>pointed (2) 80:2;226:2</p> <p>pointer (6) 42:18;45:2;214:9; 233:22;234:4;235:10</p> <p>pointing (2) 45:3;233:23</p>
--	--	---	---	--

<p>points (4) 33:19;84:10;105:22; 229:12</p> <p>polarity (2) 31:10,13</p> <p>policy (1) 6:11</p> <p>PORTION (8) 1:9;21:13;61:16; 72:9;77:18;82:17,21; 180:9</p> <p>portions (1) 83:9</p> <p>position (3) 199:13;200:1;219:7</p> <p>possible (6) 140:16,23;169:5,11, 22;213:23</p> <p>post (1) 190:7</p> <p>posters (1) 230:8</p> <p>potential (2) 55:14;169:24</p> <p>potentially (2) 131:16;169:22</p> <p>pour (2) 58:7,8</p> <p>power (1) 29:8</p> <p>PowerPoint (9) 76:24;87:22;140:17, 19;142:16;144:23; 214:3;230:15,21</p> <p>PowerPoints (6) 76:18,21;138:7,8,10; 140:24</p> <p>practice (1) 237:14</p> <p>pre-1169 (1) 190:6</p> <p>precip (8) 64:6;88:13;162:1; 168:2;210:22;211:1; 212:1;213:16</p> <p>precipitation (42) 47:11;48:20;49:1,19, 19,22,24;50:2,13; 51:16;52:1,5,7,9;53:3, 11;62:7,9,12,17,21; 63:16,17,19;64:10; 92:5,9,14,14,22;93:2; 94:2;150:11;151:4,12, 13;152:1,2;166:14; 179:4;212:20;213:21</p> <p>precise (1) 111:2</p> <p>predevelopment (12) 90:23,24;94:23;97:3; 111:2,15;149:17; 167:11;171:2;172:21; 204:13,21</p> <p>preferred (8) 26:12,17;27:4,7; 96:14;104:12;105:2; 118:1</p> <p>prehearing (1) 100:9</p> <p>prehistorical (1) 170:24</p> <p>preliminary (4) 5:22;138:5;218:8,20</p> <p>prepare (4) 12:13;13:2,18;15:19</p> <p>prepared (15) 12:14;13:3,4,18,21, 22;15:5,7,16,23;60:11; 93:14;101:17;172:9; 192:4</p> <p>present (25) 16:12,15,21;29:2; 38:4;60:5;63:8;64:16; 68:2;79:13;80:20; 88:17,17;102:2,5; 112:8;128:2;140:7; 156:16,17;171:19; 172:18;189:21;226:9; 238:7</p> <p>presentation (28) 6:21;9:6,11,12,13, 15;16:1;61:18;65:15; 67:3;78:22;87:22; 91:10;98:15;99:10,12, 15,19;104:24;115:16; 126:6;159:13;161:3; 186:19,19;188:14; 224:3;231:12</p> <p>presentations (5) 65:11;99:21;230:3, 15,22</p> <p>presented (27) 15:15;16:24;17:10; 21:20;65:3;66:20;77:4; 90:23;98:6,23;109:4; 110:2,15;111:18; 112:4,13;121:8; 125:17;130:5;140:7; 160:22;166:7;171:23; 173:15;196:4;230:14, 20</p> <p>presenting (2) 21:20;115:14</p> <p>presents (1) 173:7</p> <p>pretty (8) 70:6;87:15;111:1; 116:16,19;131:5; 154:1;227:14</p> <p>prevent (2) 174:9,10</p> <p>prevention (1) 232:12</p> <p>previous (13) 49:18;51:21;52:16, 18;94:16,18,24,24; 95:1;96:24;103:9;</p> <p>123:4;188:20</p> <p>previously (5) 66:23;114:23; 188:22;189:19;218:23</p> <p>primarily (3) 53:11;219:22;232:18</p> <p>primary (3) 215:9,15;216:3</p> <p>prime (12) 20:9;21:19,24;23:1; 144:19;145:3;215:16; 216:18;219:3,4,7,18</p> <p>principal (1) 11:14</p> <p>principles (1) 53:15</p> <p>printed (1) 219:23</p> <p>prior (14) 60:2;62:22,23;66:3; 67:16,21;68:3,14; 70:21;72:4,24;143:21; 144:3;191:12</p> <p>prioritize (1) 127:7</p> <p>PRISM (6) 92:12,14,16;150:12; 151:3;152:2</p> <p>private (1) 32:24</p> <p>privilege (1) 215:19</p> <p>probably (12) 9:1;13:10;35:17; 38:15;44:3;54:9; 121:22;129:6;182:10; 192:9;204:14;220:19</p> <p>problem (2) 61:5;132:1</p> <p>problems (5) 38:20;46:17,20,21; 147:3</p> <p>procedural (1) 6:17</p> <p>procedures (1) 237:14</p> <p>proceed (3) 83:24;223:21;224:9</p> <p>proceeded (1) 14:14</p> <p>proceeding (5) 5:23;6:6,6;7:1;44:23</p> <p>proceedings (5) 5:7;6:14;8:21; 159:23;237:22</p> <p>process (2) 95:14;173:14</p> <p>processes (1) 25:12</p> <p>produce (1) 92:18</p> <p>produced (2) 76:19;77:3</p> <p>production (10) 14:21;27:12,13; 109:2;113:4,23; 114:13;116:19;117:10; 222:8</p> <p>productivities (1) 26:20</p> <p>professional (2) 5:19;11:16</p> <p>proffered (1) 66:21</p> <p>profile (3) 227:10;234:11; 236:22</p> <p>program (1) 132:1</p> <p>project (1) 228:13</p> <p>projected (1) 84:2</p> <p>projector (1) 18:20</p> <p>promoted (1) 163:17</p> <p>promptly (2) 83:19;137:12</p> <p>propagates (1) 56:10</p> <p>proper (1) 215:21</p> <p>properly (1) 217:22</p> <p>properties (6) 29:12;54:18;99:6; 105:6;121:23;229:11</p> <p>proprietary (1) 33:5</p> <p>provenance (1) 168:11</p> <p>provide (26) 6:16;7:2;8:19;15:9, 12;18:11;28:1;66:24; 91:15,24;94:21;95:12; 96:6;102:12;165:18; 168:6,9;171:20,22; 173:19;176:16;193:2; 200:24;207:6;221:4; 222:16</p> <p>provided (15) 7:3,12;17:8;67:2; 77:3;99:4,21;101:16; 102:7;108:15;125:11, 13;133:11;160:18; 173:6</p> <p>provides (3) 15:10;26:11;125:12</p> <p>providing (3) 5:24;46:22;107:21</p> <p>proximity (1) 142:23</p> <p>public (2) 14:15;128:1</p> <p>publications (1) 128:3</p> <p>publicly (3) 8:2;127:22;128:2</p> <p>published (3) 20:10;90:12;92:16</p> <p>pull (4) 24:22;26:1;148:9; 226:13</p> <p>pulled (1) 24:21</p> <p>pulling (1) 26:7</p> <p>pulse (1) 58:16</p> <p>pump (23) 27:9;59:2;74:6,12; 96:11;116:11;152:23; 153:9;154:17;155:14; 156:3,7;160:14;164:8; 165:19;171:17;185:6, 8;202:1,6;204:4;205:2; 206:23</p> <p>pumpage (3) 182:10;187:15;188:8</p> <p>pumped (19) 55:16;86:6;96:23; 102:16;104:15;106:20; 107:2;108:9;110:1; 118:15;123:24;147:9, 16;178:12;195:3; 197:1,9;205:8,24</p> <p>pumping (175) 10:20;14:11;27:16; 54:9,17,24;55:2,4,18; 56:1,2,5,6,11,14,14; 57:1,11,20,24;58:2; 59:9;62:4,17;68:12,14, 24;69:1,2,4,15,15,19, 24;70:3,3,4,21;71:1,9, 11,18,19;72:4,7,24; 73:24;74:3,8;75:1; 76:1;78:1,1,13;79:1,4, 8,20,21,24;80:3,6; 81:12;82:9,16;85:18; 86:21,21;96:21;97:8, 13,14,15,17,22,23; 98:4,5,8,24;99:1,8; 103:17;104:7,7;105:7; 106:21;108:16,16; 109:19;110:2,4,6; 113:19,21,22;115:8,8, 9,9,10;119:13,14,23; 120:6,9,12,14;121:3,9, 10,11,18;123:3;124:1, 21,21;125:4,18; 127:19;130:1,21; 131:2;141:15,24; 142:1,7,10;154:20; 155:9;156:9,11;157:6, 8;163:17,18;164:5,18; 165:7,7,10,13,14,20; 170:19;181:23;184:15; 185:4,21;186:4;</p>
--

187:14,17,18,20,21,21; 188:1,6;189:4,16; 192:13,14;193:11; 195:19;196:14,22; 197:22;202:16;203:24; 204:2;205:4;206:11; 207:12,24;225:12	156:14;235:20	read (11) 44:23;100:16; 111:13,20;112:3; 145:8;180:3;185:11, 11;205:12;214:13	22;122:13;123:8,13, 21;154:23;157:4,11; 159:13,18;160:2; 181:18;184:2;188:15; 223:21;224:23;225:5; 226:8,13,15,16;229:17; 234:2,12	18;108:7;120:11; 189:20
punctuated (1) 64:14	quote (1) 108:23	reading (2) 104:19;188:20	recall (4) 44:13;113:5;161:12; 225:2	red (10) 26:2;36:19;50:1; 73:18;111:11;131:11; 189:6;214:15;234:22; 235:3
purge (2) 81:23;213:3	quoted (1) 133:21	real (6) 138:5;148:9;154:15; 157:3;209:21;210:24	receive (1) 212:1	REDIRECT (6) 4:2;9:10;123:10; 139:11;224:11,12
purpose (9) 5:24;6:7;21:20; 68:11;114:11;128:13; 149:5;175:18;190:15	R	realistic (2) 46:12,22	received (2) 218:4;224:3	reds (1) 37:18
purposes (16) 19:3;64:23;65:7; 66:10,22;74:18;94:4; 115:16;126:2,9,12; 138:16;230:10,14,16; 233:22	radiates (1) 38:19	realize (1) 61:19	recent (6) 92:10;106:1;161:23; 168:11,23,24	reduced (1) 158:18
pursuant (4) 7:20;138:17;152:22; 153:8	rainfall (11) 62:11;63:1,6,22; 64:12,15;161:21; 179:3;183:22;211:3,5	really (113) 8:18;15:11,13;16:16, 23;17:1,4,8,13,17; 18:11,24;19:20;20:21; 22:13,18;23:19;24:19, 21;25:7,7,21;26:24; 40:24;43:10,22;46:19, 19;53:19;55:21,22; 59:23,24;61:17,23; 67:19;69:23;70:17; 72:6,22;74:20;79:19; 80:11,12;81:24;82:16; 83:3;84:11,12,14,14, 16,22;85:5,8,9,16; 88:14;90:15;91:22; 95:9,11;97:15,17,17; 98:3,16,21;99:3; 102:16;103:15;104:13, 13;105:9,14,15,16; 107:1,4,17;108:14,14; 109:11;111:8;114:7; 116:2,13;118:18; 119:11,12;120:5; 121:13;124:22;148:11; 163:16;165:11,18; 168:6,14;172:19; 190:2;195:16;199:12, 24;200:9;210:17; 211:2;218:1;221:3; 222:7,15;233:8;235:13	recess (3) 83:21;137:13;223:22	reduces (1) 70:4
push (3) 25:21,21;84:10	rally (1) 18:22	recharge (81) 10:4,19;11:1;23:12; 55:9,22;57:8;78:8; 86:13;88:13;89:13; 90:5,8,8,12;91:18,19, 22;92:5,9;93:1,14,22, 23;94:11,13;97:5; 116:8,12;122:9; 124:21;132:16,24; 134:12;135:3,11,16,18; 136:4;150:6,8,11,20, 21;151:1,3,5,10,19,21, 22;166:2,14,24;167:9, 24;169:2,7,9,14,15,21; 170:6,12,15,22;177:22; 178:3,9,17;179:1,6; 180:17;197:6;209:18; 211:4,5,19,20,24;213:7	recently (1) 96:23	reduction (5) 111:24;206:14,15; 222:13,14
pushing (2) 24:11,12	ran (5) 33:13;35:2,5;131:23; 226:8	recognize (1) 50:22	recess (3) 83:21;137:13;223:22	referred (3) 66:12;117:14;118:22
put (30) 20:17;22:23;23:9,9; 30:3,15;34:9;37:19,20; 40:10;41:5;47:2;57:7; 59:7;61:1;76:23;85:4; 90:16;93:8;122:12,13; 144:24;173:16;192:18; 197:4;207:10;216:20; 217:1;222:8;228:10	ranch (1) 150:21	recommend (1) 96:3	recharge (81) 10:4,19;11:1;23:12; 55:9,22;57:8;78:8; 86:13;88:13;89:13; 90:5,8,8,12;91:18,19, 22;92:5,9;93:1,14,22, 23;94:11,13;97:5; 116:8,12;122:9; 124:21;132:16,24; 134:12;135:3,11,16,18; 136:4;150:6,8,11,20, 21;151:1,3,5,10,19,21, 22;166:2,14,24;167:9, 24;169:2,7,9,14,15,21; 170:6,12,15,22;177:22; 178:3,9,17;179:1,6; 180:17;197:6;209:18; 211:4,5,19,20,24;213:7	reference (6) 12:23;45:20,23; 61:24;88:1;151:16
puts (2) 42:4;131:3	range (47) 10:19;11:1;21:5,7; 22:2,5;24:20;30:7; 34:1;35:5;39:8,11; 41:20;43:8,21;44:4; 81:13;90:9;91:18,20, 23;92:6;93:5,14;97:6; 105:12;112:13;132:17; 133:1;151:21,22; 157:13,14;166:2; 167:6;168:21;169:18; 177:23;178:4,5,6,21; 180:15,18;210:21; 232:3;234:7	record (49) 5:5;7:2;11:12;50:3,4, 9,10;51:23;52:14,16; 53:6;56:20;63:18; 64:21;65:5,17,20; 66:12,15,17;67:4,5,23; 70:17;76:9;77:5,23; 83:23;124:16;126:9; 138:9,11;156:20; 162:10,12;172:9; 190:10;191:20;193:3, 20;198:12,12;209:2; 212:8;223:19,24; 230:4;231:6;233:22	referred (3) 66:12;117:14;118:22	refer (8) 50:8;110:9;114:22; 143:3;157:10,11; 201:18;230:24
putting (4) 102:20;193:3; 227:14;235:14	raster (1) 92:13	reason (9) 34:23;97:21;139:17; 171:1;187:13;213:4; 235:21;236:5,22	recharge (81) 10:4,19;11:1;23:12; 55:9,22;57:8;78:8; 86:13;88:13;89:13; 90:5,8,8,12;91:18,19, 22;92:5,9;93:1,14,22, 23;94:11,13;97:5; 116:8,12;122:9; 124:21;132:16,24; 134:12;135:3,11,16,18; 136:4;150:6,8,11,20, 21;151:1,3,5,10,19,21, 22;166:2,14,24;167:9, 24;169:2,7,9,14,15,21; 170:6,12,15,22;177:22; 178:3,9,17;179:1,6; 180:17;197:6;209:18; 211:4,5,19,20,24;213:7	referring (13) 57:16,17;60:7;64:19; 83:10;85:24;113:9; 122:2;133:4;143:20; 154:23;172:20;175:15
Q	rate (6) 54:17;55:4;56:1; 120:12;170:1;235:4	reasonable (4) 89:22;146:11,22; 147:1	recharge (81) 10:4,19;11:1;23:12; 55:9,22;57:8;78:8; 86:13;88:13;89:13; 90:5,8,8,12;91:18,19, 22;92:5,9;93:1,14,22, 23;94:11,13;97:5; 116:8,12;122:9; 124:21;132:16,24; 134:12;135:3,11,16,18; 136:4;150:6,8,11,20, 21;151:1,3,5,10,19,21, 22;166:2,14,24;167:9, 24;169:2,7,9,14,15,21; 170:6,12,15,22;177:22; 178:3,9,17;179:1,6; 180:17;197:6;209:18; 211:4,5,19,20,24;213:7	reflect (3) 117:13;212:16,19
quadrant (3) 195:19,23;196:1	rates (8) 27:12,13;59:9; 124:12,17,19,19; 167:24	reasons (5) 29:14;72:18;102:16; 108:18;213:3	recharge (81) 10:4,19;11:1;23:12; 55:9,22;57:8;78:8; 86:13;88:13;89:13; 90:5,8,8,12;91:18,19, 22;92:5,9;93:1,14,22, 23;94:11,13;97:5; 116:8,12;122:9; 124:21;132:16,24; 134:12;135:3,11,16,18; 136:4;150:6,8,11,20, 21;151:1,3,5,10,19,21, 22;166:2,14,24;167:9, 24;169:2,7,9,14,15,21; 170:6,12,15,22;177:22; 178:3,9,17;179:1,6; 180:17;197:6;209:18; 211:4,5,19,20,24;213:7	reflected (3) 66:2;103:3;143:1
quantify (1) 86:16	Rather (4) 88:10;115:24; 222:15;232:24	rebuttal (54) 6:2;9:16;12:24; 13:18,24;15:17;99:19, 21;100:8;101:6;102:6; 103:2,3,6;104:16; 106:8,12;108:21,22; 110:9;113:9;114:22, 24;115:3;117:1,7; 118:11,21;119:20,21,	recharge (81) 10:4,19;11:1;23:12; 55:9,22;57:8;78:8; 86:13;88:13;89:13; 90:5,8,8,12;91:18,19, 22;92:5,9;93:1,14,22, 23;94:11,13;97:5; 116:8,12;122:9; 124:21;132:16,24; 134:12;135:3,11,16,18; 136:4;150:6,8,11,20, 21;151:1,3,5,10,19,21, 22;166:2,14,24;167:9, 24;169:2,7,9,14,15,21; 170:6,12,15,22;177:22; 178:3,9,17;179:1,6; 180:17;197:6;209:18; 211:4,5,19,20,24;213:7	reflecting (2) 213:6,24
quantity (6) 86:5;96:22;106:20; 108:9;109:24;223:14	reach (1) 124:18	recovery (11) 75:22,23;76:2;78:2; 81:10;106:19;107:15,	recharge (81) 10:4,19;11:1;23:12; 55:9,22;57:8;78:8; 86:13;88:13;89:13; 90:5,8,8,12;91:18,19, 22;92:5,9;93:1,14,22, 23;94:11,13;97:5; 116:8,12;122:9; 124:21;132:16,24; 134:12;135:3,11,16,18; 136:4;150:6,8,11,20, 21;151:1,3,5,10,19,21, 22;166:2,14,24;167:9, 24;169:2,7,9,14,15,21; 170:6,12,15,22;177:22; 178:3,9,17;179:1,6; 180:17;197:6;209:18; 211:4,5,19,20,24;213:7	reflects (5) 68:20;117:17; 155:13;161:24;175:17
quarter (5) 39:23;181:24; 182:11,14,15	reached (2) 119:3;170:17		recharge (81) 10:4,19;11:1;23:12; 55:9,22;57:8;78:8; 86:13;88:13;89:13; 90:5,8,8,12;91:18,19, 22;92:5,9;93:1,14,22, 23;94:11,13;97:5; 116:8,12;122:9; 124:21;132:16,24; 134:12;135:3,11,16,18; 136:4;150:6,8,11,20, 21;151:1,3,5,10,19,21, 22;166:2,14,24;167:9, 24;169:2,7,9,14,15,21; 170:6,12,15,22;177:22; 178:3,9,17;179:1,6; 180:17;197:6;209:18; 211:4,5,19,20,24;213:7	refuge (3) 15:1;49:23;50:6
quick (6) 61:13;100:5;138:5; 148:9;153:11;214:2	reaches (1) 211:22		recharge (81) 10:4,19;11:1;23:12; 55:9,22;57:8;78:8; 86:13;88:13;89:13; 90:5,8,8,12;91:18,19, 22;92:5,9;93:1,14,22, 23;94:11,13;97:5; 116:8,12;122:9; 124:21;132:16,24; 134:12;135:3,11,16,18; 136:4;150:6,8,11,20, 21;151:1,3,5,10,19,21, 22;166:2,14,24;167:9, 24;169:2,7,9,14,15,21; 170:6,12,15,22;177:22; 178:3,9,17;179:1,6; 180:17;197:6;209:18; 211:4,5,19,20,24;213:7	regard (4) 64:18;101:5;104:16; 107:10
quickly (2) 58:12;157:3	react (2) 119:17;189:12		recharge (81) 10:4,19;11:1;23:12; 55:9,22;57:8;78:8; 86:13;88:13;89:13; 90:5,8,8,12;91:18,19, 22;92:5,9;93:1,14,22, 23;94:11,13;97:5; 116:8,12;122:9; 124:21;132:16,24; 134:12;135:3,11,16,18; 136:4;150:6,8,11,20, 21;151:1,3,5,10,19,21, 22;166:2,14,24;167:9, 24;169:2,7,9,14,15,21; 170:6,12,15,22;177:22; 178:3,9,17;179:1,6; 180:17;197:6;209:18; 211:4,5,19,20,24;213:7	regarding (15) 10:3;11:5;12:19; 14:1;68:3;86:4;99:10; 106:15;124:10;128:12; 159:16;160:3,20; 161:9;224:23
quite (9) 5:15;39:13,16;47:6; 52:17;116:5;146:1;	reaction (1) 63:2		recharge (81) 10:4,19;11:1;23:12; 55:9,22;57:8;78:8; 86:13;88:13;89:13; 90:5,8,8,12;91:18,19, 22;92:5,9;93:1,14,22, 23;94:11,13;97:5; 116:8,12;122:9; 124:21;132:16,24; 134:12;135:3,11,16,18; 136:4;150:6,8,11,20, 21;151:1,3,5,10,19,21, 22;166:2,14,24;167:9, 24;169:2,7,9,14,15,21; 170:6,12,15,22;177:22; 178:3,9,17;179:1,6; 180:17;197:6;209:18; 211:4,5,19,20,24;213:7	regards (2) 92:5;138:7
	reacts (1) 74:15		recharge (81) 10:4,19;11:1;23:12; 55:9,22;57:8;78:8; 86:13;88:13;89:13; 90:5,8,8,12;91:18,19, 22;92:5,9;93:1,14,22, 23;94:11,13;97:5; 116:8,12;122:9; 124:21;132:16,24; 134:12;135:3,11,16,18; 136:4;150:6,8,11,20, 21;151:1,3,5,10,19,21, 22;166:2,14,24;167:9, 24;169:2,7,9,14,15,21; 170:6,12,15,22;177:22; 178:3,9,17;179:1,6; 180:17;197:6;209:18; 211:4,5,19,20,24;213:7	region (1) 160:24
			recharge (81) 10:4,19;11:1;23:12; 55:9,22;57:8;78:8; 86:13;88:13;89:13; 90:5,8,8,12;91:18,19, 22;92:5,9;93:1,14,22, 23;94:11,13;97:5; 116:8,12;122:9; 124:21;132:16,24; 134:12;135:3,11,16,18; 136:4;150:6,8,11,20, 21;151:1,3,5,10,19,21, 22;166:2,14,24;167:9, 24;169:2,7,9,14,15,21; 170:6,12,15,22;177:22; 178:3,9,17;179:1,6; 180:17;197:6;209:18; 211:4,5,19,20,24;213:7	regional (19) 19:1;88:5,9;89:5,6,6,

7,9,13,22;90:6;95:21; 135:18;136:18,22; 167:4;178:9;213:6,16	relatively (4) 119:4;121:24;124:3; 209:15	15;109:4;110:16,16; 112:5,5;113:3,5,11; 118:13;121:12;122:3, 15,19,19;123:14,18; 130:13,20,23;134:8,10, 23,24;135:7,22; 141:19;142:15,17,18; 144:3;145:2,8;146:4, 21;148:2;151:15,23; 152:5,18;153:5,7; 154:18,23;155:1; 157:4,11;163:1; 165:22;172:10,21,22; 174:5,17,22;177:3; 186:17;187:7;200:21; 201:19,20;206:17; 209:8;216:13;217:12, 14;218:3,13,21;219:5, 8;224:23;225:5; 226:11,20;229:7	researching (1) 209:5 reserve (2) 9:10;123:8 reserved (3) 7:13;149:10,21 resistive (2) 228:7;232:6 resistivities (9) 29:6;37:3;38:9;39:9, 12;40:13;42:3;44:10; 220:5 resistivity (50) 28:18,18,22,24;29:1, 4,9,13,14,23;31:15; 33:19;36:15,17,18,24; 37:13,16,18;38:2; 39:16,21;40:11;41:1,1, 9,24;42:9,15;44:11,21; 146:5,14;147:10,14,18; 214:5,7,14,15;215:6,7; 218:15;219:4,6; 229:14;234:18,22; 235:4,9 resolution (2) 30:22;34:8 resolve (2) 131:12;132:3 RESOURCES (19) 1:2,3;5:10;10:10; 16:17;85:23;86:11,16; 87:5;95:16,17;103:12; 107:22;119:17,17; 136:14,17;165:8;238:9 Resources' (1) 127:22 respect (14) 6:11;60:6;62:1; 100:12;101:7,9,18; 107:8,14;113:3; 118:21,22;124:21; 209:6 respective (2) 50:4,10 respond (4) 151:6;165:5;166:1; 221:1 responded (1) 106:14 responding (2) 115:15;234:1 response (43) 15:8;63:2,21,22; 64:13;68:6;69:7,7,9; 70:4;71:22;73:2,3; 74:19;75:5,6,7,8,23; 77:20;79:3,7,17,20,21; 80:12,13,14;82:8; 85:14;110:6;113:17; 116:14;154:19;155:9, 22;161:21;165:4; 185:4;203:1;206:2,3; 225:19	responses (2) 9:23;95:7 responsive (4) 8:9;74:20;113:14; 133:15 responsiveness (1) 80:5 rest (2) 37:6;140:11 restart (1) 113:14 restate (1) 128:15 result (7) 24:19;36:6;146:7; 162:20;164:7;229:10, 16 resulting (1) 222:19 results (18) 14:10,11;33:3,5; 36:5;37:11;41:16; 46:11,12;47:8;111:24; 131:1;164:11;218:4,6, 8,20;229:1 retrieve (2) 58:16;59:1 review (20) 47:11,17;76:12; 101:15;102:24;106:4; 133:5;134:14;140:8,9; 148:24;149:15;153:5; 159:23;160:5;161:2; 173:17;176:18,19; 185:3 reviewed (16) 33:9,9;49:1;53:21; 66:13;88:11,12;92:8; 93:10;101:9,12; 120:21;122:18;123:17; 153:7;226:7 reviewing (3) 10:11;130:20;161:6 right (149) 14:5;22:4;31:2; 34:10,13;35:4,10,14, 15,15;36:14;37:13; 39:9,17;40:9;43:5; 44:11;45:4,9,11;48:3; 60:14;62:13,14,19,20; 64:6;67:11;69:22; 70:13;71:4;79:23;81:6; 83:10;85:24;92:7; 106:8,10,11;108:22,24; 111:6,13;112:15; 115:1,22;117:3; 132:24;134:4;136:7; 137:6;141:7,20; 143:11,14,17;144:10, 21;145:5,12;146:8,9, 11,12,23;147:8;149:4, 23;150:3,6,9;153:20; 155:3;156:9,12;
7,9,13,22;90:6;95:21; 135:18;136:18,22; 167:4;178:9;213:6,16	regionally (2) 212:20;213:20 registered (2) 11:15;12:4 regressions (1) 92:15 REICH (100) 11:13,14;12:7,11; 13:17,20;14:7;15:19; 16:11;18:17;20:13; 21:16;23:5;25:14;27:3; 47:10,13;53:13,17; 59:12,14;60:13,17,21; 61:4,9,15;64:18;67:13; 77:15;83:10;84:2; 85:24;86:3;91:17; 93:12;101:8,11; 122:15,17;123:12,16; 124:24;132:19;139:7, 10;141:14,17;145:2, 18;148:1,5;151:21; 152:24;154:16;155:16; 159:5,15,20;162:15,22; 167:10;171:18;172:23; 178:2;181:10;182:6; 186:22;187:2,5; 188:16,19;192:3; 193:1,5;194:1;197:15; 198:7;200:5;207:17, 20;208:1;209:10; 210:5;214:6,12;216:2, 4,13;217:23;218:17; 220:21;224:14,22; 225:3;231:19,20; 233:21;234:1;237:10 R-E-I-C-H (1) 11:14 reiterate (1) 6:4 relate (2) 70:3;78:13 related (2) 110:16;224:24 relates (2) 62:14;166:14 relating (1) 77:16 relation (1) 127:14 relationship (14) 23:1;25:18;55:3; 62:6;78:5;110:10; 111:7;112:14,15,20; 164:15;209:13;211:6; 226:2 relationships (1) 97:13 relative (6) 57:20;115:24; 130:21;131:3,23;226:3	released (1) 58:24 relevant (1) 98:13 reliable (1) 120:19 relied (6) 19:7;25:16;53:16; 88:10;106:1;138:15 relies (1) 31:22 relying (4) 88:18;145:19; 215:15;216:3 remained (3) 74:12;80:19;124:3 remaining (3) 7:15;152:7;222:1 remark (1) 107:20 remarkable (2) 62:10;116:17 remarks (2) 5:22;106:15 remember (6) 71:5;90:22;167:21; 168:15;189:7;226:11 remind (2) 5:23;114:11 reminder (1) 8:21 removing (1) 165:1 Reno (2) 12:1,1 repair (1) 74:18 repaired (1) 12:15 repeat (3) 68:18;101:24;142:2 repeated (1) 51:20 rephrase (3) 135:4;154:3;202:13 replaced (1) 169:12 replica (1) 235:11 report (124) 9:14,16;12:10,13,13, 15,18,24;13:2,2,4,18, 23,24;14:1;15:7,15,16, 17,18,21,23;16:3,7; 18:23;22:17;31:21,21, 22;52:17,19;64:22,24; 76:21;88:18,20,23; 89:3,17;90:16;93:9; 99:11;100:7,8,17; 101:6;107:11;108:8, 15;109:4;110:16,16; 112:5,5;113:3,5,11; 118:13;121:12;122:3, 15,19,19;123:14,18; 130:13,20,23;134:8,10, 23,24;135:7,22; 141:19;142:15,17,18; 144:3;145:2,8;146:4, 21;148:2;151:15,23; 152:5,18;153:5,7; 154:18,23;155:1; 157:4,11;163:1; 165:22;172:10,21,22; 174:5,17,22;177:3; 186:17;187:7;200:21; 201:19,20;206:17; 209:8;216:13;217:12, 14;218:3,13,21;219:5, 8;224:23;225:5; 226:11,20;229:7 Reported (3) 1:24;74:8;127:20 reporter (4) 49:6,9;198:12;238:4 reports (36) 6:2,2,22;9:21;11:5; 15:6,17;18:8;65:2; 76:23;89:2;100:14; 101:13,16,18;102:6,10; 103:2;105:24;106:4; 118:7;130:4;133:5,8; 138:12,16;140:9; 154:10,15;161:4,6; 171:23;181:19;213:11; 224:16;226:19 represent (15) 69:18;71:18;73:24; 74:2;102:8;129:1,16; 132:11;141:11;152:14; 154:5;172:12;181:6; 232:17;234:10 representation (1) 110:15 representative (1) 188:2 represented (3) 21:10;153:21;225:23 representing (4) 159:11;162:5,11; 177:17 represents (6) 68:11;73:22;142:21; 231:16;232:24,24 reproduce (1) 131:17 Republic (3) 172:2,5,8 require (1) 50:17 requirements (1) 7:21 research (2) 88:8;92:18		

157:19;158:5,8,14,17, 24;161:16,17;163:10; 169:24;170:2,7;171:6, 12;174:6;178:20; 180:1,2;182:3,9;183:2; 185:2,10,16;188:1,5; 192:12;193:11,13,16; 195:6;198:20;199:3, 11;203:16;204:10; 208:4,22;211:7;212:2, 13,14;213:23,24;215:3, 10,13,17;216:23;217:5, 19,20;219:2,16;220:3, 11,15,17;221:16,19; 223:2,10,23;227:15,16, 19,23,24;228:11;229:5, 12;235:3,6;237:11	road (1) 210:19 Robison (20) 2:19,20;4:4;42:21; 60:16,20;61:7;65:12; 99:17,23;100:3,24; 101:2,3;123:6,9,12; 125:20;224:7;237:21 robust (1) 7:2 rock (14) 28:21;54:1;99:6; 108:17;179:4,17; 226:24;227:4,6;228:7; 229:1,4,5,15 rocks (4) 21:12;24:13;220:12, 12 rocky (1) 210:19 role (5) 85:17,18,18;96:8; 120:14 room (4) 7:24;8:3;65:13; 162:14 roughly (4) 10:15;121:11;147:6; 220:1 round (2) 171:11;201:16 rounding (1) 135:8 Rowley (44) 20:10;21:20;22:16, 17;25:17;26:10;27:22; 31:20;34:18;35:9,12; 37:8,19;39:5,22;40:18, 23;41:3,12;42:4,7; 43:11,24;44:5,18; 45:10;46:24;47:1,5,8; 83:2;105:10;133:21; 142:21;143:1;144:5,8; 148:3,8,9;175:17,18; 194:6;195:13 Rowley's (4) 40:7,8;140:9;143:24 RPR (1) 1:24 ruling (4) 65:18;67:11;148:15, 16 run (6) 28:16,17;109:3; 174:20;175:8;194:5 running (10) 34:2,3;35:10;40:23; 144:9;175:12,24; 194:13;195:24;231:23 runoff (6) 88:13;94:3;179:5,5, 7;211:6 runs (9)	41:17;143:3,18; 176:1,2,5,6;210:22; 227:16 rush (1) 217:24 S S1 (1) 227:11 S2 (1) 227:11 S3 (1) 227:11 S4 (1) 227:11 salient (3) 6:1;9:22;10:6 same (66) 13:5,22;29:22;35:6, 6;45:16;55:23;57:23; 58:20;63:10,11,20; 64:2,10;70:14,19;72:3, 16;75:2,18,19;77:19; 82:7;85:8;88:23;89:16; 93:21;94:17;113:12; 115:20;116:7,20; 121:24,24;136:20; 155:18;156:10;157:17, 23;158:15,21;166:12, 19;182:5,23;183:10, 17;189:17;198:13; 212:24;217:13;218:21, 24;219:5,20;227:12; 234:11;235:5,11,23; 236:5;237:1,5,9,14; 238:10 sample (1) 54:1 Sandia (1) 32:19 Sarah (1) 172:7 saturated (2) 55:11;58:11 saw (17) 41:7,7;44:13,18; 64:8;72:1,1;84:18,19; 107:1;124:17;153:4,5; 179:12;227:20,20; 235:5 saying (15) 75:19;100:17,18; 143:9;146:24;153:6; 154:6,9;169:4;184:17; 185:18;196:23;197:1; 206:19;232:6 scale (3) 115:20;166:24;202:4 scene (1) 54:15 schedule (1) 9:19	scheduling (1) 138:18 Schreck (1) 2:22 Schroeder (11) 3:11,13;4:11;162:5, 6;177:17,17,20;181:1; 201:8;208:17 scientific (3) 15:12;16:5;31:18 scope (3) 6:6,10;167:5 screen (13) 14:7;18:20;19:15; 20:21;38:14;55:11; 62:2;72:20;84:3; 140:17;145:15;217:10, 13 screens (1) 36:13 seasonal (15) 69:6;71:22;72:4,17; 73:1,3;75:5;76:1;79:4, 19,21;80:6,12;82:7,22 seasonality (1) 203:5 seatings (1) 230:12 second (13) 9:15,18;31:10,13; 52:18;59:24;69:21; 107:15;114:4;129:7; 164:22;182:15;225:17 secondary (2) 35:13;44:7 seconds (1) 134:18 secret (1) 33:4 Section (30) 2:7,10;5:12,18,19; 20:7,8;21:3,4,19,21,24; 23:1;24:2;36:5;42:2,8, 14,19;43:5,9;109:5; 142:3;146:6,14;195:9, 10;215:3;226:17;235:4 sections (3) 17:15;235:23;236:1 security (1) 8:4 sedimentary (1) 21:12 sediments (2) 234:10;235:18 seeing (14) 41:11;43:3;71:22; 73:1,3;183:22;191:6; 208:8,15,18;211:19; 229:11,13,15 seem (1) 183:18 seemed (1) 46:22	seems (2) 75:22;129:8 segments (1) 60:1 seismic (2) 29:11;32:9 selected (1) 92:9 sell (1) 32:21 senior (9) 11:19;12:4;108:24; 222:21,22,23,24;223:8, 13 sense (8) 39:18,20;71:7;81:10; 106:12;112:19;185:20; 224:21 sent (1) 76:17 sentence (3) 135:5;155:8;225:9 SEPTEMBER (4) 5:1;138:1;238:6,18 sequence (1) 234:24 sequences (1) 23:20 series (10) 20:13;120:19;130:5; 160:6;174:22;175:8; 194:14;195:11;224:19; 232:16 SeriesSEE (25) 54:22;120:22,24; 121:4,9,12,20;122:7; 127:9,11,12,14,18; 128:1,6,12,14,23,24; 129:13,14,24;130:10; 131:15,24 seriously (1) 17:5 serve (2) 129:1,16 Service (22) 3:14;15:2;54:23; 118:9;122:3,14,18; 125:3;126:3,20; 127:15;132:7,11; 160:19,20;190:19; 191:1,4,4;213:12,13; 237:19 Service's (1) 131:15 SESSION (2) 5:1;138:1 set (6) 5:6;6:1;30:3;125:8; 151:4;166:18 sets (4) 20:11;46:14;151:12; 168:9 seven (5)
--	---	---	--	--

6:19;69:8;109:8,15; 191:13 seven-foot (2) 203:18,20 several (3) 32:19,19;92:9 shade (2) 36:17,18 shaded (1) 68:10 shades (1) 219:23 shading (1) 36:15 Shakes (1) 208:20 shallow (1) 31:11 shallower (2) 58:15,23 shape (4) 55:17;58:21;113:13; 235:11 share (1) 192:9 Sharp (1) 2:19 sheep (27) 10:19;11:1;21:5,7; 22:2;81:13;90:9;91:18, 19,20,23;92:6;93:14; 97:6;132:17;133:1; 150:21;151:21,22; 166:2;167:6;177:23; 178:4,5,21;180:18; 209:19 sheet (2) 126:14,15 shift (1) 203:23 shifted (2) 47:1,6 short (9) 18:15;25:11,12;89:3; 102:14;142:6;218:2; 228:12,19 shorter (1) 51:11 shorthand (2) 12:9,23 shortly (1) 199:20 show (44) 18:24;19:12,19,21; 23:5;33:21;36:4;40:16; 41:15;43:18,22;46:9, 12;49:16,18;51:4,23; 53:5;61:11;67:14;68:2; 77:22;79:12;84:14; 108:19;110:12;114:3, 19;115:20;118:21; 136:8;147:22;154:19; 155:9;156:2;172:21;	174:1,5;175:14,19,20; 192:16;197:17;216:7 showed (10) 53:4,6,10;67:21; 105:2;121:8,17; 130:22;185:3;186:2 showing (24) 41:24;48:3,12,13; 49:19,21;50:2;52:1,4; 64:4;69:2,3;73:18; 78:21,24;87:10,21; 115:17;173:10;214:10; 217:4;226:22;227:21; 233:7 shown (36) 14:7;21:12;35:9,22; 36:10;39:5,19;44:7; 45:4,11;48:7;51:19,24; 69:16;71:13,15;72:2, 10;74:23;75:16;94:5; 95:4,17;110:21; 115:19;123:4;151:11; 173:6;176:13,24; 180:13;196:6;216:22; 217:3;233:17;234:19 shows (23) 33:22;40:8;41:21; 43:3;54:6;55:24;57:20; 60:11;63:12;68:6;84:3; 93:9;110:14;111:19; 115:3;116:2;122:4; 131:2;160:11;167:13; 171:6;175:21;176:2; 13;189:6;215:2;216:8; 226:10;231:13 shut (3) 74:14,17;79:4 shutdown (3) 74:15;79:7;113:14 shuts (1) 75:8 side (64) 26:5;30:11;36:11,14, 14;38:6,7,9,12;39:12; 40:7;41:4;44:5;65:12; 68:16,18;73:2;80:1,4; 81:12;82:23;84:19; 104:6;113:22,22; 114:2,9;144:11;147:9, 23;164:5;176:3,4; 178:3,8,12,22;179:18; 180:20;181:20;183:4, 8;189:4,17;192:14; 193:13,17;196:5; 204:8,16;205:5,21; 209:6;210:20;211:17; 214:7;215:1;220:24; 221:16;232:1,4; 233:17;234:15;236:2 sides (3) 26:7;38:8;117:19 sidetracked (1) 54:11	signal (4) 30:2,4;32:3;202:16 signals (3) 30:10;32:4;202:11 signature (6) 10:13;17:24;70:7; 76:1;96:8;124:8 signed (1) 126:15 significance (4) 117:7,9,13;164:22 significant (2) 41:5;52:7 significantly (1) 47:1 sign-in (2) 126:14,15 similar (18) 39:11;40:17;54:1; 81:9;94:8;107:18; 124:12;125:3;130:17; 135:19;163:12;183:23; 200:16;202:24;220:22; 224:19;236:21;237:1 similarities (2) 63:23;115:4 similarity (1) 64:7 Similarly (3) 58:22;82:22;116:5 simple (9) 54:20;55:8;57:19; 121:16,19;131:18,22; 154:1;187:22 simplified (4) 55:19;56:10;121:7; 122:8 simplifying (1) 154:4 simply (1) 54:24 simulate (3) 57:7,8,9 single (2) 48:12;236:3 singular (1) 201:11 sit (1) 67:22 site (5) 27:16,17;145:16,16; 219:20 sites (1) 154:21 sitting (1) 217:2 size (2) 167:5;227:18 sketch (1) 30:24 skip (1) 127:8 slicing (1)	167:1 slide (162) 14:6;16:11;18:17,18, 19,24;20:16,18,19; 21:16,18;22:12;23:4; 27:4;28:14;30:24; 31:17;32:16,16;33:10, 20,20;34:1,17,17;36:3, 21;37:7;39:6;40:15; 41:15;43:2,3,17;45:9, 18,20,22;46:8,8,10,10; 47:21;48:2;49:13,15, 18;51:18,19,21;52:23, 23;54:5;56:13,19,21, 22,24;57:5,16,17,19; 59:12,13,15;61:11; 62:3;63:12;67:13,14; 68:5,5;69:16;71:13,16, 16;73:9,20,21,21; 74:23;75:16;77:15,21; 79:24;81:4;82:11; 83:11;84:2,3;86:1,2,3; 90:1,1;91:17;92:24; 94:5,6;95:4,8,9,18; 97:1;98:10,14;103:3,7; 104:16,19;105:22; 106:9,11,17,24;108:20, 21,22;110:9,13,14; 113:9;114:10,11,20,21, 24;115:3;117:1,4,7; 118:11,21;119:19,20, 21,22;122:13;123:13, 21,21;144:23;159:13; 160:3;181:17;184:1; 186:18;187:3,5; 188:14;224:4;225:17; 226:12,13,14,15; 229:18;230:3;232:21; 233:9;234:12;235:11 slides (19) 20:14,14;45:23; 64:19;65:1,5;66:2; 83:16;96:24;99:18,21; 114:22;188:20;225:16, 18;226:8,10,10;234:19 slide's (1) 52:16 slideshow (1) 216:16 slight (5) 116:11;120:11; 182:19;183:11,13 slightly (3) 94:6;171:7,16 slope (5) 51:5,6,12;189:21; 227:8 slopes (1) 92:15 slow (1) 22:12 small (10) 35:2;37:4;48:2;63:5;	182:16,18,21,24;183:1; 209:15 SNWA (13) 2:16;88:18;94:20; 107:10,11,21;113:1,18; 134:7,10;150:15; 161:2;177:3 SNWA's (5) 107:8;113:3;172:22; 201:18,19 software (1) 92:23 solar (1) 30:11 solely (1) 187:14 Solicitor (2) 126:19;132:10 solid (5) 37:20;63:14;68:22, 23;120:3 solution (2) 54:9,13 solve (4) 55:6;121:2;130:19; 131:1 somebody (1) 220:7 someone (1) 162:17 someplace (2) 35:24;220:6 something's (1) 206:12 Sometimes (3) 30:5;34:7;162:13 somewhat (9) 68:1;73:12;88:23; 123:20,22;128:6; 154:12;171:11;183:16 somewhere (4) 57:12;59:5;223:12; 234:7 sorry (34) 42:20;45:4;51:15; 54:11;56:20;81:6;91:4; 114:18;117:17;119:21; 123:17;126:23;142:2, 3,17;148:2;150:23; 151:16;153:2;157:15; 163:5,6;164:21; 174:19;187:5;188:15, 20;194:11;196:21; 203:3,4;204:7;208:2; 219:20 sort (18) 33:23,23;34:15;35:3, 13,18;36:21;37:8,16; 40:4;43:19;45:18;50:1; 129:19;130:12;131:11; 132:12;145:23 sought (1) 100:7
--	---	---	---	--

<p>sound (1) 163:10</p> <p>sounded (1) 128:5</p> <p>Sounds (2) 123:11;129:23</p> <p>source (10) 22:15;29:16;30:1,15, 15;31:2;55:10;66:4; 67:2;136:22</p> <p>sources (1) 89:14</p> <p>south (3) 81:11;184:4,12</p> <p>southeast (2) 34:16;175:3</p> <p>Southern (31) 13:7;48:9;52:2; 61:16;63:19;106:5; 140:14;141:11;160:18; 176:3,4;184:6,10,18, 24;185:1,15,16;191:7, 21;193:23;195:18,20, 22,24;196:10,16,24; 198:2,3;226:17</p> <p>southwest (1) 41:18</p> <p>space (2) 58:7,8</p> <p>spaces (2) 28:21,22</p> <p>spacing (2) 33:13;34:6</p> <p>spare (1) 101:23</p> <p>spatial (5) 92:11,13,19,21;93:1</p> <p>speak (2) 49:5;126:11</p> <p>SPEAKER (3) 126:21,24;127:4</p> <p>speaking (2) 56:21;77:15</p> <p>special (1) 210:15</p> <p>specific (10) 32:13;33:18;46:23; 73:16;89:21;98:13; 113:18;153:1;179:24; 194:4</p> <p>specifically (8) 20:1;21:23;33:12; 95:10;145:15;185:9; 186:18;224:24</p> <p>specify (1) 123:23</p> <p>speculate (1) 209:17</p> <p>speculative (1) 169:9</p> <p>spelled (1) 11:23</p> <p>spelling (1)</p>	<p>11:11</p> <p>spent (2) 59:17;209:4</p> <p>spirit (1) 190:15</p> <p>spread (1) 202:11</p> <p>spreadsheet (1) 120:24</p> <p>Spring (106) 16:2;33:11,12,23,24; 55:1,2;57:14;61:14,15; 62:5;63:24;64:1;69:4, 4,12;70:13,22;71:23; 72:14;73:24;74:3;78:6, 19;79:22;80:10,11; 81:2;83:9;86:14;90:8; 93:19;94:1,4,13,22; 97:18;98:24;99:1; 104:5;117:19;119:3, 14;124:2,6,13,21,22; 132:17;133:1;140:5,6, 142:11;151:1;157:23; 158:13;159:1;160:9; 163:14;164:1,6,7; 165:3;170:10;176:5,9; 177:22;178:8;179:19; 180:10;184:4,6,7,10, 13,22,24;185:21,23; 186:2;187:14,22; 188:8;192:14;196:14, 18,22;200:18,19; 202:20,23,24;204:11, 19;205:9;206:1;210:7; 211:21,22;212:11; 213:16,20;221:23; 225:10;227:13;233:1</p> <p>SPRINGS (178) 1:12;6:18;9:5,8;10:5, 20;11:1,3;22:24;27:8, 10;38:17;54:10,12; 56:4;64:3;68:7,12,15; 69:1;70:1,12;71:12,17, 18,20;72:8,10,24;73:2, 8,18;76:4;77:19;78:6, 13,14;79:20;81:8; 82:17,18,23;89:7,11; 90:21;93:16;94:15; 95:3;97:16;101:4; 105:8;109:6,10,12,13, 16,17;110:17,18,21,22, 23;111:3,20,24;112:1, 10;114:17;115:8; 119:24;120:7,13; 124:14;134:16,17,22; 135:2,8,15,17,23; 136:20;139:14,16,18, 19;141:15;142:1,8,8, 12;147:12;150:19,20; 152:19,22;154:19; 155:9,10;156:9,19; 157:20,24;158:13,14, 18,21;159:16,18;160:3,</p>	<p>9;163:10,23;164:1,9, 23;165:15;171:15; 174:1,6,11,15,20; 175:5,6,12,13;176:1,3, 5,11,24;179:20;184:4, 18,18,18;185:1,7,13, 15,15,16,22;188:4; 192:15;196:5;198:19; 199:13,16,17,19,19,21, 22;200:2,2,4,4,12,14, 15,18;201:24;202:21; 203:11,11;204:3,9; 205:3,21;206:24; 209:6;223:21;225:1,1, 10,11</p> <p>square (1) 103:21</p> <p>squared (1) 189:8</p> <p>squiggly (1) 120:1</p> <p>S's (1) 121:22</p> <p>stable (1) 80:19</p> <p>staff (12) 5:9;7:14;8:8;15:10; 18:2;61:19;186:8; 224:15;225:19;231:4; 237:12,17</p> <p>staffed (1) 5:14</p> <p>stake (1) 113:15</p> <p>stakeholders (1) 11:6</p> <p>stakes (1) 31:6</p> <p>staking (1) 113:15</p> <p>stall (1) 8:15</p> <p>stand (1) 211:7</p> <p>standard (2) 70:6;222:20</p> <p>standing (1) 216:2</p> <p>stands (3) 29:16;49:10;92:14</p> <p>start (21) 22:1;23:15;77:24; 78:1,2,7,21;83:19; 85:19;101:8;125:24; 126:7;137:12;158:1; 162:18;171:9;173:14; 175:22;186:12;189:11; 211:6</p> <p>started (6) 24:5;25:4,10;27:22; 32:14;224:1</p> <p>starting (6) 6:17;17:1;19:4;</p>	<p>140:20;158:9;190:10</p> <p>starts (4) 51:9;52:3;169:17; 216:24</p> <p>STATE (93) 1:1;2:4;5:10,11,24; 7:2,13;8:8,19;9:20; 10:2,7,8;11:16;12:19; 14:3;15:9;18:11;19:7, 11;28:1;48:4;50:19; 52:13;60:23;65:4; 66:23,24;67:4,4,5,11; 86:4;88:17;92:11,18; 95:7;96:4;98:13;99:18; 100:9,11,13;101:24; 103:10;105:18;106:5; 107:12;109:23;110:6; 118:8;123:24;125:7,9, 16;126:8;129:8; 136:13,13;146:4; 148:14,21;149:19; 157:5;160:14;164:17; 168:7;170:17,19; 171:2,3,4,7;173:4,14; 176:16;177:10;184:3; 186:10;196:13;197:17; 200:8,24;206:18; 207:6,9;221:2;222:7; 224:15;225:19;230:6; 237:17;238:1</p> <p>stated (20) 66:23;100:10; 136:11,12;149:12; 153:15;154:19;156:22; 163:1;164:4;165:22; 181:10;199:17,21; 204:18;205:18;206:10; 212:21;213:8;222:7</p> <p>statement (7) 113:11;129:5; 135:14;154:21;173:9; 198:16;205:12</p> <p>statements (1) 66:3</p> <p>statement's (1) 154:22</p> <p>States (9) 48:6;92:20;118:8; 126:2;134:10;184:5; 190:19;205:13;237:18</p> <p>stating (4) 11:11;123:22; 184:19;185:16</p> <p>station (19) 33:13;34:4,9;36:9; 40:3;41:2,14;46:15; 48:12;49:23;50:6,10; 146:7,10,20;210:23; 211:1;220:3;228:14</p> <p>stations (9) 38:16;39:2;48:18,20; 49:1,3;53:6;146:17; 228:21</p>	<p>status (4) 106:18,19;107:14; 108:6</p> <p>stay (2) 54:23;198:17</p> <p>stays (1) 38:13</p> <p>steady (6) 156:6;170:17,19; 171:3,4,7</p> <p>steady-state (4) 119:2;123:20,22; 124:11</p> <p>steep (2) 160:12;228:11</p> <p>steeper (1) 227:8</p> <p>stenotype (2) 238:7,14</p> <p>step (2) 16:20;68:9</p> <p>Stephen (1) 11:14</p> <p>steps (1) 67:18</p> <p>Steptoe (3) 178:6,6;210:21</p> <p>Stetson (5) 11:15,19;12:5,16; 14:9</p> <p>Steve (4) 92:8;177:10,14; 231:20</p> <p>still (13) 58:20;74:8;75:20,24; 82:4,4;85:13;122:7; 129:19;158:11;185:22; 199:5;225:13</p> <p>stone (1) 81:23</p> <p>stop (1) 194:18</p> <p>stopped (1) 44:8</p> <p>storage (14) 55:5,13,16;57:23; 58:6,7,9,17,21,22,23, 24;59:2;129:2</p> <p>storativity (2) 58:7,9</p> <p>storms (1) 30:11</p> <p>straight (3) 50:1;74:16;120:3</p> <p>straightforward (1) 131:5</p> <p>stratosphere (1) 30:12</p> <p>stream (1) 62:24</p> <p>streamflow (2) 102:20;119:4</p> <p>stress (1)</p>
---	--	---	---	---

124:5 stresses (2) 99:5;189:12 strict (1) 200:1 Strike (1) 219:13 strongly (1) 190:2 struck (2) 119:12;120:5 structural (36) 10:23;80:1;83:7; 96:17;98:20;104:9,20; 105:12;107:6;117:18; 118:4;124:8;133:19; 23;134:1,3,5,6;144:11; 163:21,22;179:22; 181:11;194:15,19,23, 24;195:1,2,6,13;232:4, 9,24;233:16;235:16 structure (18) 17:2,16;20:11;21:22; 43:13;96:12;106:9; 146:8;193:14;195:11; 196:15;198:17;235:19, 24;236:2,3,6;237:2 structures (12) 10:13;17:23;42:12; 96:13;160:21;211:11; 231:9,10,13,16;232:17; 236:20 studies (4) 88:10,11,12;95:1 study (4) 10:3;94:21;127:20, 21 stuff (2) 39:16;221:9 sub (1) 165:16 subjected (1) 103:10 submit (2) 125:21;219:12 submittal (4) 15:21;101:14; 186:17;218:5 submitted (16) 11:5;14:2;15:20; 18:8;78:4;100:18; 101:13;103:10;106:4; 118:7;138:12,17; 161:4;213:12;218:8; 219:5 subparallel (3) 174:23;175:4,8 subsequent (2) 6:14;202:5 subset (1) 29:19 substantial (1) 200:3	substitute (2) 138:12,16 subsurface (11) 10:16;28:24;29:4,12; 31:19;58:13;97:4; 197:22;206:4;226:24; 229:12 sudden (1) 220:2 suddenly (1) 46:16 sufficient (1) 147:18 suggest (3) 87:3;169:17;170:12 suggested (3) 105:10;206:17;220:5 suggesting (2) 143:6;206:20 suggestion (1) 122:22 suggests (1) 177:24 suite (1) 31:14 suited (2) 120:18;162:17 Sullivan (2) 2:5;5:11 summarily (1) 230:21 summarization (2) 66:1;76:21 summarize (10) 11:4;18:14;52:24; 61:10;77:7;82:10;91:2; 95:7;101:9;200:7 summarized (5) 22:17;46:11;47:8; 89:24;134:21 summarizes (1) 43:19 summarizing (1) 84:8 summary (21) 6:1;12:18;14:1; 20:15,16;49:9;57:19; 59:15;65:1,8;84:6; 87:22;95:6,9;101:21; 102:14;103:11;106:10, 24;107:15;108:23 summer (1) 69:13 sums (1) 57:15 supervising (1) 5:18 supply (3) 58:17;211:10;213:3 support (17) 11:20;80:22;82:24; 94:7;96:14,14;98:24; 102:8,11;105:3;	108:15;113:24,24; 123:3;219:7,8;225:9 supported (2) 79:19;199:18 supportive (1) 6:3 supports (9) 71:11;98:21;105:16; 114:8;155:11;160:2; 164:16;179:6;226:7 suppose (1) 130:22 sure (26) 9:4;88:2;115:17; 126:15;132:12;135:6; 138:8;140:22;141:3; 154:15;155:17;156:1, 14;157:17;162:14; 169:10;171:12;172:19; 178:15;185:10;191:18; 194:2;215:24;231:10, 15;237:1 surface (20) 21:2;23:23;29:5; 35:1,24;36:8;37:5; 40:23;55:14;86:14,21; 94:1;97:18;98:2;139:4; 163:7;205:14;206:24; 220:19;222:24 surrounding (1) 213:16 survey (23) 12:2;22:22;28:10,15, 18;30:16;31:18;32:13; 33:13,21,22;34:20; 36:6;46:11,13;83:3; 98:18;139:14;160:16; 226:6;227:10;229:8; 233:7 surveys (4) 31:12;32:8,9,19 sustainability (1) 173:8 sustainable (2) 150:17;165:10 sustainably (1) 205:19 swear (2) 126:22;127:1 switch (1) 16:11 sworn (2) 13:8,11 Sylvia (1) 172:3 SYSTEM (101) 1:8;5:7,16,21;6:12; 10:1,3,4,9,14,17,21; 14:13;19:13,18;20:3, 20;21:14,14,23;24:18; 32:2;47:12,19,23;48:7, 14,21;49:2;53:3;55:15; 85:6;86:6,8;87:9,12;	89:22,23;90:7;91:9; 92:22;96:1,2,21;97:4,9, 19,24;99:8;103:20; 104:15;107:3,23; 110:1;118:16,19; 123:4;124:7,23; 125:13;134:12;135:10, 16,19,24;136:11,16,18; 137:1;139:21;140:11; 148:22;149:7,10,23; 150:3,16,17;154:2,6, 10,11;157:7;159:17; 163:19;164:19;165:2; 169:4,7,17;171:3; 176:2,4;177:4;202:11; 205:16,20;206:6; 211:4;221:2;222:11 systems (1) 32:19	T table (20) 65:12,15;93:9;99:23; 100:2;110:15,16; 111:17;134:21;162:21; 163:13;172:21;173:1, 2,6,10,11,13;176:13,24 tables (1) 176:13 Taggart (75) 2:16,16;4:7;13:6,7, 10;45:19,21;46:1,3,5; 50:14;64:21;65:17; 66:14,17,19;67:8,9; 77:5,11,12;140:16,20, 21,23;141:3,7,9,10; 152:6,9;191:7,10,15, 16,20,21;192:2,8,10, 11,17,20;193:4,6,18, 21;194:3,17,20,22; 197:14,16;198:6,9,10, 14,15,22,23;199:3; 207:3,16;212:3,7,8; 216:1,9,15,21;217:3,8; 218:12;220:10 Taggart's (1) 175:22 talk (42) 17:16,19,22;18:9,16, 23;20:1,6;21:5,9;22:3, 5;23:15;53:19;56:5; 61:18;80:4,4;86:12,12, 13;87:17,18,21;88:1,5; 89:12,13;91:14;92:4; 157:19,23;163:16,20, 20;165:9;183:21; 195:7;197:5,5;210:12, 13 talked (26) 53:13;63:1;75:2,5; 76:17;79:5;81:5;85:12; 95:10;116:7;133:18;	134:7;152:19;161:20; 165:6;171:15;193:14; 194:13,15;196:3; 209:24;212:9;214:19; 216:8;235:16,20 talking (25) 19:14;20:13;23:6; 43:21,21;59:17;84:5; 91:21;98:22;104:22; 136:5;137:1;143:4; 144:17;145:4;165:13; 166:2;176:8;179:24; 182:18;202:19;206:5; 209:14;212:10;215:20 talks (3) 76:20;77:1,2 targets (1) 34:6 tasked (1) 14:8 TDS (2) 28:23;29:2 team (4) 12:16;13:5,22;161:2 team's (2) 14:1;47:10 technical (2) 15:12,21 technicalities (1) 210:12 technically (1) 17:12 techniques (4) 22:19;92:3;128:8; 133:9 Technologies (1) 172:5 tectonics (8) 22:9;24:8,9,10,20,20, 22;105:1 television (1) 162:13 telling (1) 226:24 tells (2) 51:16;209:14 temperature (1) 28:23 temporal (1) 113:19 temporarily (1) 192:6 ten (6) 32:7;83:16,19; 116:23;170:20;223:20 tend (4) 23:8;25:22,24;26:18 tends (1) 26:14 ten-minute (3) 7:9;83:14,19 tenth (1) 36:10
--	--	--	---	---	--

ten-year (2) 51:13,15	234:23	tiller (1) 38:21	64:5;69:11,15;71:2; 80:10;106:18;111:14; 120:1;163:2;220:12	174:23;189:22; 213:21;231:23;232:1; 233:13,13,14
terms (16) 9:9,12;22:10;24:2; 86:15;87:11,24;88:4,4; 90:4,18;93:21;94:8,14; 230:2;233:20	thickening (1) 235:6	tilted (1) 37:8	topic (1) 162:18	trends (5) 50:12,13;51:8,12; 53:5
test (22) 10:11;11:20;27:9; 67:17;68:4;74:4,7; 84:9,11;96:5,11; 105:20,23;113:14; 116:10;121:11;160:14; 171:17;187:21;189:3; 202:1,6	thickens (1) 38:10	Tim (2) 2:18;5:10	topographic (2) 43:23;227:7	Tribe (2) 137:9;191:5
tested (1) 189:7	thickness (3) 55:9,11;58:11	timely (1) 138:13	total (18) 6:19;49:24;52:4; 91:3,4,4,5,13;95:2,3; 99:1,7;109:1;187:14; 205:13,15;206:3,18	tributaries (1) 135:9
testified (9) 132:13,15;139:3; 178:20;202:18;203:5; 213:2;214:17;218:23	thinking (1) 227:12	timer (1) 152:15	touch (1) 22:10	tributary (3) 134:11,14;135:19
testify (3) 12:1;174:8;199:22	third (9) 35:19;42:12,13; 104:17;110:8;173:5,5; 182:10,14	times (4) 27:21;31:13;58:11; 115:13	Toward (1) 176:7	tried (2) 71:21;106:11
testifying (3) 117:5;131:14;219:6	thoroughly (1) 212:22	tiny (1) 37:15	towards (26) 19:5;21:13,14;34:16, 16;36:18,19,21;37:2; 38:11,15;40:4;41:23; 60:23;61:7;73:17;82:6; 94:18;175:23;176:5,8; 180:10,12;181:10; 203:21;227:5	trips (1) 14:24
testimony (17) 6:3;11:20;50:19; 135:20;136:12;141:14; 143:24;164:5;181:11, 18;185:5;195:3,4; 196:13;198:16;206:11; 212:21	Thought (13) 36:20;39:14;55:7,19; 122:7;130:15;131:22; 140:20;146:21;153:8; 207:18;219:4;224:2	titled (1) 226:18	trace (1) 228:5	trouble (1) 198:24
testing (7) 152:23;153:9; 154:17;155:14;156:3, 7;181:23	thought (3) 152:17;163:6;174:13	today (75) 5:9;6:19,19,21;7:8, 20,24;9:3,22;11:21; 16:13,21;18:6,16;19:3, 13,19;20:1,8;21:6; 22:10;24:3,19;25:8; 28:8;42:20;62:15;67:3; 68:1,2,13;70:9;73:14; 79:23;81:17;82:3,14; 85:12;90:24;91:21,23; 94:4;95:10;96:7,9; 97:22;98:7;99:5; 115:13;116:7;124:8; 125:8,11,17;126:10,16; 140:7,7;163:17;185:6; 186:19;190:11;200:24; 204:12,14,18;206:11; 210:12;211:7;213:8; 219:16;222:7,10; 230:9;232:4	track (1) 50:9	true (11) 12:18;13:24;115:17; 132:21;134:2;139:6; 162:19;171:16;219:9; 237:9;238:13
tests (8) 14:11;18:7;67:21; 73:13,23;130:1;190:7, 7	thousand (4) 40:21;95:1;103:21; 146:6	today's (1) 237:13	trade-off (1) 207:11	truly (1) 67:19
Texas (1) 172:7	thousand-acre-feet (1) 204:20	together (22) 13:22;16:16;20:4,17; 23:9;25:22;57:7,15; 59:7;61:10;75:14; 76:23;85:4;90:17;91:3; 102:21,22;136:4; 173:16;188:5;190:1; 235:14	transcribed (1) 238:10	try (3) 24:1;211:6;224:20
Thanks (3) 77:12;159:3;188:12	thousand-square-mile (1) 103:22	tomorrow (3) 237:14,18,19	transcript (2) 44:23;238:12	trying (7) 6:4;34:24;115:23; 119:16;127:7;129:12; 165:4
Theis (26) 53:23;54:8,13,24; 56:9;57:5;59:7;120:22; 121:1,7;122:8;127:12; 128:23;129:14;130:8, 8,14;153:11,21;154:1, 12;187:10,16,22; 224:16,18	three (17) 6:20;9:11;33:13,18, 21,22;41:11;113:12; 123:7,10;161:3; 172:10;181:24;190:21; 224:10;226:9;227:24	took (6) 14:15;17:4;55:24; 86:7;187:21;238:7	transcription (1) 238:14	T's (1) 121:22
theme (1) 62:16	throughout (15) 14:21;48:18;83:4; 85:6,11,16;124:8; 140:3,10;156:7;157:6; 179:2;206:10;221:6; 223:4	toolt (7) 30:19;31:19;33:2; 87:4;121:6;128:19; 154:1	transcripts (1) 66:12	Tucson (1) 11:24
themes (1) 163:16	thrust (9) 22:3,5;24:11,15; 25:2,14,21;140:10; 234:6	tools (1) 86:10	transfer (1) 160:23	turn (6) 18:17;122:14; 123:12,21;186:24; 225:15
theoretically (1) 30:18	thrusts (2) 24:11,14	top (25) 19:19;21:4;22:2; 23:19;24:13;36:7;37:9; 45:15;49:19;50:4;51:8, 10,20;62:19;63:14;	transform (2) 128:23;129:14	turned (1) 25:9
thereafter (2) 199:20;238:10	thunderstorms (1) 46:18	top (25) 19:19;21:4;22:2; 23:19;24:13;36:7;37:9; 45:15;49:19;50:4;51:8, 10,20;62:19;63:14;	transforms (2) 128:23;129:14	Turning (5) 14:6;26:6;52:23; 59:12;98:10
therefore (1) 154:7	thus (1) 99:15	took (6) 14:15;17:4;55:24; 86:7;187:21;238:7	transmissivities (2) 26:19;105:6	twisted (1) 129:8
thick (1)	tie (1) 233:18	toolt (7) 30:19;31:19;33:2; 87:4;121:6;128:19; 154:1	transmissivity (7) 55:5;57:23;58:6,10; 129:2;189:7,10	twisting (1) 26:7

2,17,22,22;220:24; 226:9;227:23,23,24; 229:1,11;235:22 two-year (3) 56:1;113:13;121:10 type (15) 26:23;31:18;42:11; 75:23;77:19;114:8; 160:7;166:12;189:23; 195:11,15;203:7; 206:16;213:6;234:13 types (4) 6:13;22:7;87:8; 229:1 typewriting (1) 238:10 typically (4) 48:22;130:15;234:5, 7 typo (2) 119:5;155:3 typographical (1) 217:20	219:1 unless (2) 64:22,23 unlimited (1) 186:4 unmistakable (1) 113:16 unrealistic (2) 38:22,23 unreliable (1) 131:16 unusual (2) 46:18;146:5 up (121) 7:17;8:3;9:5;11:24; 12:1;14:7;18:10;19:4; 20:11;22:2;23:22;25:8; 35:2,14;36:16;37:11, 13;39:17;40:24;41:4, 18;43:22;44:5,6,7,11, 15,19;46:14;48:23; 49:5;51:24;60:21,22; 63:3;69:3;70:3;74:16; 75:9,11;79:13;81:17; 87:6;88:18;93:1,5; 94:3;95:1,8;99:1; 100:4;104:24;111:22; 116:11;122:13;125:3; 133:8;135:8;137:8; 138:20;140:17;141:2; 144:24;145:15;152:7, 8,10;157:5,18;159:14; 163:1;165:19;167:1; 169:17;173:15;180:10, 12,19;182:19,21,24; 183:1,11,14;184:2; 186:8;190:6,16; 194:12;195:12;201:15; 202:16;207:10;209:9, 12;210:16,19,20; 211:17,20;212:10,10, 13;213:21;214:10; 215:7;217:10,13; 220:19;226:13;227:14, 15,19,23;228:20;229:1, 9;231:9;232:23; 233:15;237:8 updated (1) 94:2 upgradient (9) 48:14;70:10;71:15, 15;72:12,14;78:17,19; 79:10 upon (10) 48:17;50:20;121:2; 138:15;139:24;145:19; 148:7;173:20;215:15; 216:3 upper (11) 30:12;31:2;45:22; 48:3;66:2;81:4;111:10, 10;114:17;146:6; 212:13	upstream (3) 71:14;170:1;186:4 uptick (1) 78:2 up-to-date (1) 92:3 upward (2) 51:12;80:17 upwards (3) 91:8;123:5;189:23 use (44) 18:24;22:15,19;29:3, 5,10,14;30:8;31:15; 32:2,18,22;33:1;67:15; 86:10,16;87:23;88:17, 22;91:7;92:2,19;110:9, 20;125:9;129:13; 130:14;138:7;142:15; 143:24;151:11;152:1, 4;153:23;165:20; 169:3;176:16;191:18; 192:4;193:4;194:21; 214:10;224:19;237:16 used (43) 10:9;27:19,19;30:20; 32:11;47:18;49:8;53:2; 54:22;68:21;81:3; 88:19;90:18;92:12,21; 93:1,15;94:2,17;95:16; 97:7;98:24;102:4; 121:21,22,23;125:7,18, 19;133:9;139:11; 150:14;151:3,4;173:7, 18,22;188:3,8;194:9; 222:8;230:10,11 useful (1) 28:19 uses (1) 150:8 USGS (13) 32:1,19,23;37:9; 121:2;127:24;128:3,8, 11;151:15;226:10,18; 227:9 using (17) 45:2;90:3,16;92:10; 96:2;99:3;127:18; 150:11;160:23;166:9; 167:21,23;187:13,22; 193:4;233:22;234:4 utility (1) 154:12	48:13,23;61:14,16; 62:5;64:1;68:12,15; 70:13,22;71:17,20,23; 72:10,14,24;73:2,8; 74:1,3;78:6,13,19; 79:22;80:10,11;81:3,8, 12;82:7,18,23;83:9; 89:5;90:9;93:16,20; 94:1,4,13,19,22;95:4, 18,23;98:24;99:1; 117:19;123:14,17; 132:17;133:1;135:17; 139:14,16,19;140:6,14; 141:12;142:11;150:19, 20;151:1;152:11,14, 22;154:20;155:10; 159:16,18;160:3,9,9; 163:23;164:1,6; 165:14,17;171:15,16; 174:1,6,20;175:5,12, 13;176:2,3,5,11;177:9, 11,22;178:8;179:19; 184:4,5,6,7,10,18,19, 22,24;185:1,15,21,22, 23;186:2;187:14; 188:8;191:8,22; 192:14;196:5,14,18,22; 197:20;198:19;199:6, 12,14,17,19,19,23; 200:2,2,4,12,15,15,18, 18,19;201:24;202:20, 23;203:11;204:3,9,11, 19;205:22;208:13; 210:7;211:17,18; 212:11;213:16,20; 227:14;233:1;235:17 valleys (4) 31:24;87:19;160:12; 173:23 value (6) 50:20;57:23;123:1; 132:22;151:5,23 values (8) 26:19;37:18;89:15; 90:16;91:15;97:7; 122:1;167:19 variability (7) 79:4;85:9;103:13; 118:19,20;120:2;203:7 variation (8) 69:10;70:2,19,20,23; 72:4,17;80:6 variations (1) 168:4 variety (2) 33:15;92:18 various (1) 173:22 vast (1) 29:15 Vegas (10) 5:14;8:23;61:2; 140:14;141:12;162:4,	6;191:8,21;201:7 vegetation (1) 164:12 velocity (1) 214:24 venture (1) 234:13 verbal (1) 193:2 verified (3) 100:17,18;228:9 verify (4) 28:5;186:20;228:22, 22 versus (5) 38:7;103:17;141:24; 187:17;227:20 vertical (12) 69:17,18,20,21,22; 71:1,3;186:1;214:22; 215:2;234:9,15 VH-4 (3) 56:4;72:1;121:11 via (2) 8:22;138:6 vicinity (2) 120:12;146:17 Vidler (4) 159:7,12;199:16; 201:6 view (7) 28:2;43:19;60:19; 102:13;103:24;171:20; 236:4 viewed (4) 8:22;61:1;115:4; 154:10 viewing (1) 61:2 views (1) 102:9 Village (1) 15:22 vine (1) 51:12 virtually (1) 228:20 visible (1) 43:22 vision (1) 168:20 visited (4) 14:18,18,20;210:16 voir (1) 50:21 volcanic (1) 21:9 volcanics (3) 38:4;229:3,6 volume (1) 187:20
U				
um-hum (6) 49:7;178:16;180:11, 21;220:18;221:17 UMVM-1 (17) 70:11,11,23;71:12; 72:2;73:16;75:17,18, 23;76:5;77:16,17; 84:21;114:17;115:15; 116:6;189:14 under (3) 94:23;204:13;222:8 understood (4) 132:12,15;203:9; 231:15 undetected (1) 139:20 unfortunate (1) 79:12 Unfortunately (5) 33:6;67:22;70:16; 210:24;218:3 uniform (1) 55:9 unique (1) 82:1 unit (4) 35:6;122:24;125:5; 199:18 United (6) 48:6;92:20;118:8; 126:2;190:19;237:18 units (6) 19:1,22;20:22;23:2, 18;168:8 University (1) 92:18 unknown (1)				
V				
		valid (9) 31:19;46:12,22; 146:8,20;151:11; 173:2,12;177:3 VALLEY (169) 1:10,11;3:9;10:10, 20;11:1;16:2;27:8,10; 33:11,24;38:11;44:3;		

W	<p>232:12;233:4;238:9 waters (1) 169:6 way (27) 35:19;39:23;61:1,7; 74:6;78:21;96:3; 108:19;110:12;121:20; 131:5;136:7,20;165:5; 169:3;175:23;176:8; 180:22;187:16;203:17; 208:3;211:16,24; 227:3;233:13,14;237:8 ways (5) 39:17;47:6;96:15; 118:2;188:18 weakly (4) 38:12;44:13;47:3,3 weather (2) 46:18,20 website (3) 8:22;127:22;128:9 wedge (1) 235:6 weight (2) 66:24;131:8 weighted (1) 131:8 well-accepted (1) 33:3 well-defined (1) 41:9 well-established (1) 33:2 wells (71) 10:13;14:20,21; 26:20;27:8,10,11,13; 54:24;57:7,11,20;59:9; 60:7;61:21,24;67:15; 70:18;73:15,19;78:18, 18;80:7;81:21;84:18; 85:12;97:14,16,17; 105:7,7;113:4,12,19, 20,23;114:1,3,12,13, 16,16,19;116:17,18,19; 117:10;119:15,24; 120:7;121:9;122:10; 127:19;131:4,8; 153:24;154:17,17; 164:4;188:3,17; 189:12;190:7;202:23; 203:1,8;210:7;212:24; 224:21;225:22;226:3 weren't (2) 65:5;226:9 west (78) 11:2;35:10;37:21; 38:6,12,15;39:1,22; 40:2,5,11,12;41:2,13, 22;43:4;44:14,17,18; 47:1,6;80:1,3;81:12; 109:6,12,17;110:17,22, 23;111:3,20;112:10; 113:22;114:2,9;</p>	<p>117:19;144:1,6,11; 145:14,20;146:5,14,19; 147:2,4,9;164:23; 165:15;178:21;179:15, 18;180:5,20;181:20; 183:4;189:4,17; 192:14;194:18,23; 195:1,2;196:1,15; 198:17;205:21;209:6; 213:21;214:7;220:9; 221:16;228:14;231:23; 234:23;235:20;236:2 western (18) 10:24;39:19,23; 40:22,23;41:13;42:12; 47:5;82:22;83:8;92:19; 104:6;178:8,12;196:5; 205:5;216:7;236:19 wet (9) 62:24;64:13;80:16; 107:24;108:4,4,5,5; 124:16 wetter (1) 53:7 wetting (5) 51:5,11;53:5;70:15; 161:20 what's (33) 20:24;29:1;35:17; 37:19,19;52:17;55:4; 57:5;62:10;72:16; 74:20;79:15;80:11; 82:15;90:23;95:19; 107:16;116:13;130:24; 147:22;154:5;157:14; 161:14,17;167:6; 171:8;195:18,20,22; 197:3;210:8;211:8,18 WHITE (67) 1:8;5:6,15,20;6:12; 10:1,17;14:13;19:13, 17,18;20:2,19;21:14, 23;33:9;47:11,19,23; 48:7,14,21;49:2;53:3; 86:6,8;87:9,12;90:7; 91:9;96:21;97:4,9,23; 99:8;103:20;104:15; 107:23;110:1;118:15; 123:3;134:12;135:10, 15,18,24;136:11,16; 139:21;140:11;148:22; 149:6,10,23;150:2,15, 17;157:6;159:17; 163:19;164:19;165:2; 171:2;177:4;205:16, 20;221:2 whole (7) 31:14;42:2,7;90:3; 160:21;164:2,3 who's (3) 5:13,14;28:8 wider (1) 71:6</p>	<p>wildlife (18) 15:1,2;49:23;50:6; 54:23;118:8,13;122:3; 125:2;126:3,20; 127:15;131:15;160:19; 190:19;191:4;213:12; 237:19 Williams (1) 172:7 willing (1) 207:10 Wilson (2) 5:10;61:8 winter (1) 53:11 wintertime (1) 69:12 wire (2) 31:3;46:16 wise (2) 16:20;68:9 wish (6) 5:22;44:22;67:22; 214:13;217:13;229:7 withdraw (4) 171:21,22;197:14; 198:6 withdrawn (1) 222:8 WITHIN (26) 1:8;10:4,14,19,20; 19:15;21:22;27:8,8; 48:8;54:10;58:5;61:14; 73:7;97:23;127:19,19; 134:2;153:16;154:15; 167:6;194:24;196:22, 23;205:2;238:9 without (20) 50:16;60:22;131:12; 147:11;161:6;163:13; 166:9;178:13;185:7; 192:15;195:20;196:1; 197:2,9;206:24; 221:22,23;222:4; 223:13,13 Witness (6) 13:11;50:15;126:22; 127:1,2;137:5 witnesses (6) 8:6,8,14;13:8;50:21; 172:13 wonder (1) 60:17 wonderful (1) 33:5 wondering (1) 60:4 word (1) 103:15 wording (1) 141:21 words (1) 233:24</p>	<p>work (13) 10:1,23;15:5;18:21; 29:15;32:1;41:16; 47:10;78:21;140:6; 147:24;175:23;226:6 worked (2) 17:6;23:8 working (3) 12:16;17:13;211:4 works (8) 5:15;33:18;59:8; 117:21;122:12;125:14; 187:16;192:12 world (1) 37:8 worried (2) 47:4;175:11 worry (1) 141:6 wrap (2) 18:10,13 writes (1) 192:22 write-up (1) 174:21 written (2) 29:18;105:24 wrong (2) 139:13;187:3</p>
			X	
			XD (1) 151:16	
			Y	
			year (32) 10:2,15,16,19,23; 14:24;16:8,9,10;49:20, 22,24;50:3;56:2,7,14; 93:6,11,11;108:10; 122:23;123:5;125:1,3; 132:18,22,23;134:22; 160:16;164:19;165:1; 169:15 years (35) 11:19;16:5,6;17:14; 18:4;24:4,5,10,17;25:4, 6,13;30:22;32:6,7,14; 56:7,14;69:8;108:4,4,5, 5;116:13;168:16,17,18, 24;170:20,20,21; 173:20;188:2,2;189:24 yellow (3) 21:8;73:22;115:9 yellows (1) 37:18 Yep (2) 143:16;155:20 yield (10) 58:8;148:21,23; 149:6,7,9,21,23;150:2,	

17 younger (1) 23:22	1:00 (1) 137:12 10 (14) 25:3,6;27:4;113:9; 142:15,18;145:1; 148:1,2;186:18; 217:12,14;219:4,15 10,000-acre-feet (1) 112:7 10:30 (2) 7:9;83:14 100 (3) 4:4;170:21;237:1 11 (7) 28:14;114:10,10,11; 196:7;218:18,19 11- (1) 97:2 11,000 (1) 215:5 11,000-acre-feet (1) 206:23 11,900-acre-feet (2) 97:2;206:21 11.5 (4) 56:3,15,23;58:2 11:59 (1) 137:13 1169 (24) 10:11;14:10;18:7; 60:2,2;67:16;68:4; 73:11,13,23;74:7;96:5, 11;105:19,23;130:1; 152:22;153:9;154:17; 155:14;156:3,7; 160:14;189:2 12 (7) 4:3;31:17;114:21,24; 115:3;133:8;168:24 12,000 (1) 168:16 12,000-acre-feet (1) 10:15 1200-acre-feet (1) 167:14 13 (13) 15:21;32:16;46:4; 78:1;105:24;117:1; 216:10,13,15;217:3,10; 225:16,16 13,000 (1) 189:8 13,000-acre-feet (1) 149:22 13.8 (1) 33:17 130,000 (1) 189:10 1303 (19) 5:7;6:1;9:23;10:7,8; 12:10;14:23;15:9; 19:14;95:7,15;96:3; 98:12;101:13;106:13;	124:1;136:13,16;168:8 132 (1) 4:5 139 (1) 4:6 14 (7) 7:6;33:10;117:7; 126:5;161:22;181:18; 188:14 14,000-acre-feet (1) 93:11 14,5 (1) 125:2 14,500-acre-feet (1) 122:23 140 (2) 24:10,17 141,192 (1) 4:7 1442-acre-feet (1) 120:8 15 (9) 33:20;64:16,16,16; 112:2,6;118:11; 125:23;159:13 15,000 (1) 168:24 1500 (6) 38:24;39:4;41:14; 145:16;220:7;228:14 152 (1) 4:8 159 (1) 4:9 16 (5) 12:24;34:17;118:21; 173:7;174:4 1600 (2) 32:8,9 162,201 (1) 4:10 16th (2) 15:16;218:5 17 (8) 36:3;64:16;119:19, 20,21,22;144:23;214:3 17,000-acre-feet (1) 196:7 172 (1) 4:12 177 (1) 4:11 18 (1) 37:7 1800 (1) 57:24 181 (1) 4:13 1811 (1) 163:9 1813 (2) 163:3,7 186 (1)	4:14 1874.5 (1) 156:4 1895 (2) 48:11,20 19 (2) 39:6;122:13 19,700-acre-feet (2) 10:16;97:3 1900 (3) 38:16;93:11;217:1 1935 (1) 54:15 1945 (1) 51:9 1964 (1) 48:15 1967 (1) 51:14 1975 (1) 51:10 1981 (1) 152:3 1985 (1) 51:14 1994 (1) 92:17 1998 (9) 52:3,8,9;53:7;62:10, 22,23,23;69:3	52:10;53:8;156:10; 209:15 2006 (7) 53:10;157:5,13,24; 158:9,17;161:22 2007 (6) 88:18;90:16;94:20; 134:22;172:22;177:3 2009 (2) 157:6,13 200-foot (1) 228:17 2010 (11) 52:10;53:8;63:5,6; 64:15;108:5;116:11, 12;152:3;157:8,14 2011 (12) 72:21;74:5,17;75:7; 79:6,17;116:15;148:8; 181:24;182:11,14; 183:10 2012 (10) 74:5,17;75:8;79:6; 105:24;128:2,4; 182:23;183:13,19 2013 (24) 18:8;64:14;74:7,11; 75:10,10,20;79:2,3; 80:18;116:10;120:6; 122:2;127:18;129:24; 130:3,13;157:8,14; 158:9,10,13,18;161:22 2014 (5) 53:10;80:18;120:6; 189:21;202:7 2015 (5) 63:8;80:19;119:3,6; 120:8 2017 (11) 10:22;18:22;20:10; 31:21;105:11;119:5,6, 6;120:8;142:22;175:18 2018 (3) 14:9,15;52:4 2019 (13) 5:1;12:2,10,24; 14:16;15:21,21,23; 33:12;69:3;138:1; 238:6,18 209,232 (1) 4:15 20-year (1) 51:14 21 (2) 41:15;187:3 210 (1) 1:9 2100 (1) 146:7 215 (1) 1:10 217 (1) 1:11
Z				
zero (3) 33:23;111:4,5 zone (11) 26:2,18;42:15;93:2; 134:6;145:21;181:20; 195:14,14;212:1;220:6 zones (8) 26:1,5,11,20;34:7; 42:10;93:1;139:3 Zonge (8) 11:23;12:16;17:6; 28:6;159:24;218:5,6,9				
0			2	
0.07 (1) 158:22 0.23 (1) 158:18 0.24 (1) 158:22 0.7 (2) 122:5;158:14 0.74 (1) 57:14 00420 (1) 226:19 01 (1) 158:19 04 (6) 63:1,22;64:13; 107:19;108:5;161:21 04-'05 (2) 80:16;85:15 05 (10) 63:1,2,22;64:13; 107:19;108:5;116:8; 156:16,17;161:21 06 (1) 64:14			2 (11) 12:23;15:6;16:11; 46:1;68:22;100:7; 167:16,17;172:15; 229:20;230:1 2,000 (11) 38:24;39:4;48:22; 146:18,18,20,24;147:2, 6;216:24;219:20 2,000-acre (2) 157:10,12 2.5 (4) 56:7;57:1,3;58:1 2.7 (1) 111:23 20 (7) 17:14;25:4;30:22; 31:22;40:15;78:1; 210:3 20,000 (1) 57:13 200 (3) 33:14,14;219:20 2000 (10) 40:3;41:2,14;124:17; 134:7;182:17;216:18; 226:20;227:9;228:14 2004 (2) 52:10;53:7 2005 (4)	
1				
1 (18) 12:9;14:6;15:6;39:1; 76:11,11;100:7; 158:10,13;167:16,17; 172:15,20;188:17,22; 229:20,24;238:13 1,000 (3) 38:24;40:11;216:20 1,000-acre-feet (2) 204:11,14 1.12 (3) 111:19,22,23 1.2 (1) 122:5				

<p>218 (1) 1:12</p> <p>219 (1) 1:13</p> <p>22 (7) 43:2,3;226:13,14,15; 234:2,12</p> <p>22,400 (1) 94:9</p> <p>224 (1) 4:3</p> <p>23 (10) 5:1;43:17;138:1; 158:2;186:18;187:4,5; 216:15;217:4;225:17</p> <p>2300 (1) 220:7</p> <p>237 (1) 238:13</p> <p>24 (5) 46:8,9,10;158:6; 231:11</p> <p>24,100-acre-feet (1) 94:10</p> <p>24th (2) 238:6,17</p> <p>25 (3) 47:21;123:13;184:1</p> <p>25,000 (1) 221:21</p> <p>25,000-acre-feet (4) 205:8,24;222:1; 223:11</p> <p>2500 (2) 38:16;220:3</p> <p>26 (5) 49:13;51:21;99:15; 123:21;142:18</p> <p>27 (1) 51:18</p> <p>2700 (1) 120:9</p> <p>28 (1) 52:23</p> <p>289 (1) 56:17</p> <p>29 (1) 54:5</p> <p>29th (2) 76:17;218:19</p>	<p>3.2 (3) 112:11;164:22;165:3</p> <p>3.82 (5) 111:1,2,6,23;112:10</p> <p>3:00 (2) 212:3;223:18</p> <p>3:36 (1) 237:22</p> <p>30 (6) 9:10;17:14;44:18; 56:22;123:8;231:23</p> <p>30,000 (3) 57:13;220:23;221:14</p> <p>30,000-acre-feet (13) 91:8;123:5;125:4; 150:2;164:18;165:1, 19;205:19;206:20; 220:21,23;222:18,19</p> <p>300 (2) 62:3;73:22</p> <p>30000 (1) 205:16</p> <p>30th (1) 44:17</p> <p>30-year (1) 51:9</p> <p>31 (2) 15:21;56:24</p> <p>31st (1) 16:8</p> <p>32 (6) 57:17;157:4,5,11; 225:5,7</p> <p>3200 (1) 58:3</p> <p>32000-acre-feet (1) 205:14</p> <p>3300 (4) 145:16;146:10,14,22</p> <p>34 (3) 59:12,13,15</p> <p>34,348-acre-feet (1) 132:23</p> <p>35 (2) 62:3;112:4</p> <p>350 (1) 32:10</p> <p>36 (1) 63:12</p> <p>360 (1) 32:10</p> <p>369 (1) 33:18</p> <p>37 (1) 64:19</p> <p>37,000-acre-feet (2) 149:16,21</p> <p>37,800 (1) 94:15</p> <p>38 (3) 32:14;64:19,20</p> <p>39 (3) 67:13,14,15</p>	<p>3D (1) 40:19</p> <p>3rd (12) 13:23;15:7,15,18; 93:9;135:22;151:15; 153:5,7;174:22; 201:19,20</p> <hr/> <p style="text-align: center;">4</p> <hr/> <p>4 (15) 15:20;20:14;48:9; 49:20;50:5;51:22;52:2; 53:2;63:19;103:7; 104:17,19;114:1; 188:17,23</p> <p>4- (3) 72:21;108:10;124:24</p> <p>4,000 (4) 31:4;109:2;112:8,13</p> <p>4,000-acre-feet (1) 221:13</p> <p>4,190-acre-feet (1) 134:11</p> <p>4,200 (1) 135:8</p> <p>4,200-acre-feet (1) 134:22</p> <p>4:30 (2) 7:16,18</p> <p>40 (5) 68:5,6;203:15,16,22</p> <p>40,000 (1) 168:17</p> <p>41 (2) 71:13;172:22</p> <p>42 (3) 71:16,16;174:4</p> <p>4200-acre-feet (7) 94:10;174:1,5; 176:14,24;200:3,20</p> <p>43 (2) 72:22;173:5</p> <p>44 (1) 73:9</p> <p>45 (2) 73:21,21</p> <p>46 (2) 57:4;74:23</p> <p>47 (4) 32:6;75:16,17;77:15</p> <p>48 (3) 77:21;155:6,7</p> <p>49 (4) 78:20;154:18,22; 155:2</p> <hr/> <p style="text-align: center;">5</p> <hr/> <p>5 (8) 20:14;76:20;106:9, 11;155:12,18;189:24; 232:21</p>	<p>5,000 (3) 31:4;48:22;221:15</p> <p>5,000-acre-feet (1) 147:9</p> <p>5,200-acre-feet (1) 205:7</p> <p>5,217-acre-feet (2) 56:2,14</p> <p>5,280-acre-feet (6) 10:18;97:5;99:2; 132:17;177:22;204:4</p> <p>5:00 (1) 7:20</p> <p>50 (4) 78:24;111:15; 170:20;203:22</p> <p>50,000 (1) 168:18</p> <p>50,000-acre-feet (2) 149:5,20</p> <p>50.2 (2) 111:14;112:3</p> <p>500 (4) 24:4,5;25:13;40:11</p> <p>51 (1) 79:10</p> <p>52 (1) 79:24</p> <p>52- (1) 97:5</p> <p>520-acre-feet (1) 132:21</p> <p>5280 (10) 93:5;94:13;150:21; 196:21,22,22;197:6,10; 198:9,17</p> <p>5280-acre-feet (4) 196:14;197:2,8; 205:20</p> <p>5288 (1) 192:13</p> <p>54 (3) 81:4;201:18,19</p> <p>55 (3) 83:11,12;135:22</p> <p>55,980-acre-feet (1) 95:4</p> <p>56 (2) 84:2,3</p> <p>5-6 (2) 201:20,22</p> <p>57 (2) 86:1,2</p> <p>58 (4) 86:3;157:22;158:4, 11</p> <p>59 (4) 87:10;157:22; 158:11,12</p> <hr/> <p style="text-align: center;">6</p> <hr/> <p>6 (6)</p>	<p>20:14,15,16;189:24; 209:15;232:21</p> <p>6,000 (2) 112:9,13</p> <p>6,000-acre-feet (3) 108:10;109:2;125:1</p> <p>6.2.4 (2) 109:5;110:2</p> <p>60 (6) 9:3;35:21;90:1,1; 210:4,5</p> <p>60-foot (1) 210:6</p> <p>60's (1) 88:14</p> <p>61 (2) 91:17;224:4</p> <p>62 (3) 96:24;224:4,5</p> <p>62,200-acre-feet (1) 91:4</p> <p>62,210-acre-feet (1) 91:5</p> <p>6255 (5) 14:10;148:15,17; 149:12,14</p> <p>63,630 (1) 91:6</p> <p>64 (4) 94:5,6;95:4;96:24</p> <p>65 (2) 95:8,9</p> <p>6500 (1) 157:13</p> <p>66 (1) 98:10</p> <hr/> <p style="text-align: center;">7</p> <hr/> <p>7 (5) 20:18,19;134:8; 145:12;232:21</p> <p>7,000 (1) 157:13</p> <p>7,000-acre-feet (1) 157:7</p> <p>700 (4) 214:14;215:5; 216:19,20</p> <p>7380-acre-feet (1) 93:6</p> <p>7500 (1) 157:14</p> <hr/> <p style="text-align: center;">8</p> <hr/> <p>8 (12) 21:16,18;108:20,21, 22;110:9;172:21; 173:6,11,13;176:13,24</p> <p>8,192 (2) 31:12,13</p> <p>80s (1)</p>
3				
<p>3 (14) 12:10;18:17,18,19; 20:14;81:6;86:4;103:4; 114:1;176:23;177:1; 188:17,23;224:23</p> <p>3,000 (5) 48:23;146:18;147:6; 214:19,20</p> <p>3,000-acre-feet (2) 56:6;206:8</p>				

30:19				
9				
9 (9) 23:4;110:13,14; 134:21;174:18,19,19, 19;175:16				
9,000-acre-feet (1) 157:9				
93 (3) 143:8,10,12				
9318 (1) 125:1				
98 (4) 63:21;64:12;85:15; 108:5				
99 (1) 124:17				

In The Matter Of:

*DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES*

*Vol. II
September 24, 2019*

*Capitol Reporters
123 W. Nye Lane, Ste 107

Carson City, Nevada 89706*

Original File 9-24-19a.m.VolumeIIfinalSE_1.txt
Min-U-Script® with Word Index

SE ROA 53053

JA_17450

Page 239

1 STATE OF NEVADA
 2 DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
 3 DIVISION OF WATER RESOURCES
 4 BEFORE MICHELINE N. FAIRBANK, HEARING OFFICER
 5
 6
 7 IN THE MATTER OF THE ADMINISTRATION
 8 AND MANAGEMENT OF THE LOWER
 9 WHITE RIVER FLOW SYSTEM WITHIN
 10 COYOTE SPRING VALLEY HYDROGRAPHIC
 11 BASIN (210), A PORTION OF BLACK
 12 MOUNTAIN'S AREA HYDROGRAPHIC
 13 BASIN (215), GARNET VALLEY
 14 HYDROGRAPHIC BASIN (216), HIDDEN
 15 VALLEY HYDROGRAPHIC BASIN (217),
 16 CALIFORNIA WASH HYDROGRAPHIC BASIN
 17 (218), AND MUDDY RIVER SPRINGS AREA
 18 (AKA UPPER MOAPA VALLEY HYDROGRAPHIC
 19 BASIN (219)).
 20
 21
 22
 23
 24

14 TRANSCRIPT OF PROCEEDINGS
 15 PUBLIC HEARING
 16 HEARING ON ORDER 1303
 17 VOLUME II
 18 (A.M. SESSION, PAGES 239-379)
 19 TUESDAY, SEPTEMBER 24, 2019
 20
 21
 22
 23
 24 Reported by: Michel Loomis, RPR

Page 241

1 APPEARANCES:
 2 For Lincoln County
 3 Water District
 4 -and-
 5 Vidler Water Company: Allison MacKenzie
 6 By: Karen Peterson, Esq.
 7 Carson City, Nevada
 8
 9 For Moapa Band of Paiutes: Beth Baldwin, Esq.
 10
 11 For NCA: Alex Flangas, Esq.
 12 Reno, Nevada
 13
 14 For Moapa Valley
 15 Water District: Greg Morrison, Esq.
 16
 17 For Bedroc: Schroeder Law
 18 By: Laura Schroeder, Esq.
 19
 20 For City of North Las Vegas: Schroeder Law
 21 By: Laura Schroeder, Esq.
 22 For National Park Service: Karen Glasgow
 23 For Center for Biologic
 24 Diversity: Patrick Donnelly

Page 240

1 APPEARANCES:
 2 Micheline N. Fairbank,
 3 Hearing Officer
 4
 5 Tim Wilson,
 6 Acting State Engineer
 7 Adam Sullivan,
 8 Deputy State Engineer
 9
 10 Melissa Flatley,
 11 Chief of the Hearing Officer Section
 12 Michelle Barnes,
 13 Supervising Professional Engineer
 14
 15 Levi Kryder,
 16 Chief of the Hydrology Section
 17 Jon Benedict,
 18 Hydrologist
 19
 20 Christi Cooper,
 21 Geologist
 22 Bridget Bliss,
 23 Basin Engineer
 24
 25 For SNWA: Taggart & Taggart, Ltd.
 26 By: Paul G. Taggart, Esq.
 27 Carson City, Nevada
 28 -and-
 29 Tim O'Connor, Esq.
 30 For CSI: Robison, Belaustegui, Sharp
 31 & Low
 32 By: Kent R. Robison, Esq.
 33 Reno, Nevada
 34
 35 For CSI: Brownstein Hyatt Farber Schreck
 36 By: Brad Herrema, Esq.
 37 Los Angeles, California
 38 For NV Energy: Justina Caviglia, Esq.

Page 242

1 INDEX
 2 THE PANEL: DIRECT CROSS REDIRECT EXAMINATION
 3 By Mr. MILLER: 245
 4 By Mr. Herrema: 324
 5 By Ms. Glasgow: 336
 6 By Ms. Baldwin: 337
 7 By Mr. Taggart: 349
 8 By Mr. Morrison: 360
 9 By Ms. Peterson: 366
 10
 11 EXHIBITS: MARKED ADMITTED
 12 5 247
 13 7 247
 14
 15
 16
 17
 18
 19
 20
 21
 22
 23
 24

Page 243

1 CARSON CITY, NEVADA, TUESDAY, SEPTEMBER 24, 2019, A.M. SESSION
2 -o0o-
3
4 HEARING OFFICER FAIRBANK: Good morning. We'll
5 go ahead and go back on the record, and this is the second day
6 of the hearing in the administration of Lower White River Flow
7 System hearing on Order 1303. We'll go ahead and get started
8 this morning with the U.S. Fish and Wildlife Service.
9 But just before we get going, again, just to
10 reiterate, this is an opportunity for the participants to go
11 ahead and present their salient conclusions and point us in
12 the direction of the evidence that supports those conclusions,
13 and yesterday I thought was a very -- went well.
14 And so keep it in that path that we've been
15 proceeding. And we appreciate everybody being succinct and
16 making, you know, efficient use of their time. So with that,
17 we'll go ahead and turn it over.
18 MR. MILLER: Hello to everybody, and good
19 morning. My name is Luke Miller. I'm with the Department of
20 the Interiors, Office of the Solicitor and I'm here on behalf
21 of the Fish and Wildlife Service.
22 Today is our special day to bring forward our
23 authors and experts who took part of drafting the reports on
24 behalf of Fish and Wildlife Service that were filed with the

Page 244

1 State Engineer in response to Order 1303.
2 As you'll note, we have three authors. They each
3 took part in drafting a specific section, a distinct section
4 of the primary report filed on July 3rd, and we have one
5 author who filed the rebuttal or drafted the rebuttal in
6 whole.
7 They will each be providing today a summarization
8 presentation that is distinct and precise to their particular
9 section, and so hopefully you'll get it mixed up and see their
10 own styles as well.
11 The reports, themselves, the Fish Wildlife
12 Service believes are very robust, well rounded, rational,
13 reasonable presentations of good information. They are solid
14 and dense, so they took your recommendation to heart and they
15 are trying their hardest to focus on the salient points and
16 conclusions, and just trying to put some good useful
17 information in front of you folks today so we can have a good
18 discussion.
19 To that end, I'll just go ahead and have them
20 introduce themselves, maybe we can start on the far end, get
21 your name and spell your last name for the record and just
22 tell them what you do.
23 MS. BRAUMILLER: Yeah, Sue Braumiller. I'm a
24 groundwater hydrologist. The last name is spelled

Page 245

1 B-R-A-U-M-I-L-L-E-R, and I authored sections 1.1 through 1.5
2 and 1.7.
3 MR. MAYER: Hello, I'm Tim Mayer, that's
4 M-A-Y-E-R. I'm a supervisor hydrologist of the water
5 resources branch in the regional office of the U.S. Fish and
6 Wildlife in Portland, Oregon and I think that's it.
7 DR. SCHWEMM: My name is Mike Schwemm,
8 S-C-H-W-E-M-M, and I'm the Senior Fish Biologist for the
9 Southern Nevada Fish and Wildlife Service office in Las Vegas,
10 and I coordinate recovery efforts for the Moapa Dace.
11 HEARING OFFICER FAIRBANK: Okay.
12 MR. MILLER: Oh, just, we'll --
13 HEARING OFFICER FAIRBANK: And so at this point
14 in time, we can go ahead and have the witnesses sworn in.
15 MR. MILLER: Yeah, that's a great idea. Sorry
16 about that.
17 (The Panel sworn.)
18 DIRECT EXAMINATION
19 BY MR. MILLER:
20 Q. I would note just for the record that these three
21 individuals were qualified in this proceeding as experts in
22 their respective fields. And I'll go ahead and ask them now.
23 Sue, just starting down there with you -- I'm
24 sorry, Ms. Braumiller, can you verify that you're familiar

Page 246

1 with Fish and Wildlife Service Exhibit 5, the report titled,
2 "issues related to conjunctive managements of the Lower White
3 River Flow System," filed July 3rd, 2019?
4 ANSWERS BY MS. BRAUMILLER:
5 A. Yes, um-hum.
6 Q. And can you attest that you personally prepared
7 any part or parts thereof?
8 A. Oh, yes.
9 Q. Can you identify those one more time?
10 A. Yeah, sections 1.1 through 1.5 and 1.7.
11 Q. Okay. Mr. Mayer, same question for you. Are you
12 familiar with the Fish and Wildlife Service Exhibit 5, the
13 report filed July 3rd?
14 ANSWERS BY MR. MAYER:
15 A. Yes, I am.
16 Q. And can you attest that you personally prepared
17 any part or parts thereof?
18 A. Yes, I prepared Section 1.6.
19 Q. All right. And, Mr. Schwemm, same question to
20 you. Are you familiar with Fish and Wildlife Service
21 Exhibit 5, the report filed July 3rd?
22 ANSWERS BY MR. SCHWEMM:
23 A. Yes.
24 Q. And can you attest that you personally prepared

Page 247

1 any parts or parts thereof?
2 A. Yes, I prepared the entirety of Section 2.
3 Q. Okay. And, Mr. Mayer, I'm going to come back to
4 you since you are extra authored here. Are you familiar with
5 Fish and Wildlife Service Exhibit 7, titled "rebuttal to water
6 level decline in the LWRFS managing or sustainable groundwater
7 development," and that was filed August 16th, 2019?
8 A. Yes.
9 Q. And can you attest that you personally prepared
10 any part or the whole part of that report?
11 A. Yes, I prepared the whole report.
12 Q. Thank you. I don't know if the format was for me
13 to wait until the end or -- if not, I'll probably just go
14 ahead and ask that these be admitted into evidence.
15 HEARING OFFICER FAIRBANK: They will be admitted.
16 MR. MILLER: Thank you.
17 (Exhibit 5 admitted into evidence.)
18 (Exhibit 7 admitted into evidence.)
19 MR. MILLER: So for our summarization
20 presentations today, the Fish and Wildlife Service has opted
21 to do a very narrative format style presentation for their
22 direct testimony. And with that, I believe I will just go
23 ahead and turn it over to Ms. Braumiller will start.
24 MS. BRAUMILLER: Sure. And there are handouts

Page 248

1 over there on the left and they are my summary presentation
2 slides and appended to those are a fairly large number of
3 backup slides that I brought to assist me in answering
4 questions, so I'm not fumbling through the report.
5 There are just a couple of slides that I
6 accidentally left out of the package, but I can bring those
7 tomorrow if you're interested.
8 Do you think that's about as bright as it's going
9 to get?
10 HEARING OFFICER FAIRBANK: I think it will get
11 better as it warms up.
12 MS. BRAUMILLER: Oh, okay. That's fine. Well, I
13 will go ahead. My sections of the report are very simply an
14 interpretation of geologic and hydrologic data leading to
15 responses, my responses to the questions posed in Order 1303.
16 So what I'm going to present are my salient
17 findings, hopefully just enough additional explanatory
18 material to provide context and they are as follows:
19 They're -- I'm going to present them in the order
20 in which I developed them because, in general, they followed
21 one another. So I think that's the most logical way to
22 present them.
23 I began by doing a literature search, probably by
24 no means a complete literature search. But it was a pretty

Page 249

1 earnest literature search in an effort to enumerate the
2 sources of water in the Muddy River, from the Muddy River
3 Springs to uppermost floor of Moapa Valley below which the
4 river is oozing all the way to Overton.
5 In some cases, I found that sources were
6 hypothesized, but hadn't been definitively demonstrated in the
7 past, and I think I have identified definitively some of those
8 sources. They are -- and most of this, we -- we already know.
9 The immediate sources of water in the Muddy River
10 are, of course, Muddy River Springs, the surface discharges,
11 seepage from alluvial aquifers into the river in the Muddy
12 River Springs area in California Wash, and of course,
13 intermittent runoff and precipitation in the river.
14 The Muddy River Springs, in turn, as we all know,
15 are almost entirely derived from regional carbonate aquifer.
16 The sources of water in the alluvium adjacent to the Muddy
17 River Springs area and California Wash are infiltration of the
18 surface discharges and some surface seepage from the springs
19 in the Muddy River Springs area, the carbonate aquifer
20 underlying Muddy River Springs and California Wash.
21 Alluvial inflows from basins bordering the Muddy
22 River Springs area in California Wash, I found, or concluded
23 that those included Lower Meadow Valley Wash and maybe Coyote
24 Spring Valley.

Page 250

1 And lastly recharge of local precipitation to
2 alluvium probably to Pahrnatag Wash from -- in Muddy River
3 Springs area and Lower Meadow Valley Wash.
4 So most of that we already knew, but some of
5 those sources, I think I was able to confirm -- oh, I'm not
6 clicking in the right place. There we go.
7 In the process of confirming some of those
8 sources of water in the Muddy River, I also demonstrated, I
9 believe, that hydraulic connections exist between the alluvial
10 aquifers of the Muddy River Springs area and California Wash
11 and the underlying regional carbonate rock aquifer.
12 Oh, I didn't put that in the right place. Oh,
13 boy. I should have brought my bifocals. Okay. Here we go.
14 And the hydraulic connections also exist between the alluvial
15 aquifers, Lower Meadow Valley Wash and the Muddy River Springs
16 area between Lower Meadow Valley Wash and California Wash and
17 between the Muddy Springs area and California Wash.
18 Second, I endeavored to clarify the DOI 2013
19 SeriesSEE Curve-fitting analysis of the Order 1169 pumping
20 test and those findings since they are foundational to the
21 identification of six basins and parts of basins under --
22 unclaimed by a portion of the regional carbonate rock aquifer
23 possessing exceptionally high field scale transmissivity.
24 Those five plus basins being the Muddy River

Page 251

1 Springs area, most of Coyote Spring Valley, Hidden Valley,
2 Garnet Valley, most of California Wash, and the northwest part
3 of Black Mountains area.
4 The basis for identifying the five-plus basins
5 and that really occurred what, six years ago, was the
6 development -- really the isolation of a remarkably uniform
7 1.5 to 1.6 drawdown in the regional carbonate aquifer due to
8 the MX-5 test pumping as of the end of the Order 1169 test.
9 That drawdown isolated using SeriesSEE analysis.
10 Of course, you know, we didn't analyze all of the
11 water level records for monitor carbonate -- carbonate
12 monitoring wells in the entire study area, but just did that
13 for a select number of wells, far flung across the study area.
14 And it -- I'll show you in a minute where those five wells
15 were located.
16 At any rate, I'll just skip to this slide. This
17 is really hard to see. So MX-5, if you can see this, is the
18 triangle in the middle. All right. About three miles north
19 of MX-5 is CSV-6 in Coyote Spring Valley. It's -- it -- I
20 think that was one point -- these are all between 1.5 and
21 1.6 feet of MX-5 induced drawdown.
22 So three miles north of MX-5 and CSV-6, we see
23 this 1.5 to 1.6 feet drawdown. Nine miles south of MX-5 in
24 CSV-2, also in Coyote Spring Valley, again, we isolated 1.5

Page 252

1 to 1.6 feet of MX-5 induced drawdown.
2 27 miles south of MX-5 in Garnet Valley at GB-1,
3 we, again, saw 1.5 to 1.6 feet of MX-5 induced drawdown, and
4 15 miles southeast of MX-5 in California Wash, in M-1, we saw
5 the same thing. And nine miles east of MX-5 at SCSV-2 in
6 Muddy River Springs area, we saw the same thing.
7 So -- oh, yeah, okay. So, I mean, this looks
8 like a very small area on the screen, but it was a really
9 expansive area of near uniform drawdown.
10 Clearly, it's a drawdown cone, it can't be
11 anything else. But it was remarkably uniform, 1.5 to 1.6 feet
12 of MX-5 induced drawdown over a very large area.
13 So in order to identify the five-plus basins, we
14 then -- or I then interpreted that because it is a drawdown,
15 flat or not. It must extend to -- at least to the nearest
16 likely no flow boundaries and that is how we came up with the
17 identification of five-plus basins that we did.
18 Okay. And that area, that portion of the
19 regional carbonate aquifer based on a SeriesSEE analysis of
20 2013 of the pumping test, that area that possesses
21 exceptionally high field scale transmissivity is something on
22 the order of 1,050 square feet -- miles rather, miles, and as
23 much as 24 miles from west to east and 60 miles from north to
24 south. So I would deem that result, you know, foundational

Page 253

1 to -- well, it was a starting place for where we're at right
2 now.
3 Third, I concluded that the alluvium aquifers of,
4 at a minimum, those five plus basins and the underlying
5 carbonate rock aquifer function for all practical purposes as
6 one groundwater basin as the source of the Muddy River Springs
7 and Muddy River.
8 That conclusion based on my earlier findings,
9 that the five-plus basins are underlined by a portion of
10 regional carbonate aquifer possessing exceptionally high field
11 state of transmissivity, and I mean, you know, the carbonate
12 rock province of the Great Basin.
13 Secondly, the hydraulic connections that I think
14 I've demonstrated exist between the alluvial aquifers of the
15 Muddy River Springs area and California Wash and the
16 underlying regional carbonate aquifer.
17 And lastly, that the alluvial aquifers of the
18 Muddy River Springs area, California Wash, and Lower Meadow
19 Valley Wash are, themselves, in hydraulic connection.
20 Okay. So fourth, yeah, I propose that Kane
21 Springs Valley should be considered for incorporation in Lower
22 White River Flow System pending clarification of the
23 completion of the existing carbonate wells in Kane Springs
24 Valley KMW-1 and KPW-1, relative to the Kane Springs Wash

Page 254

1 Fault. That is still not clear to me. I'm not sure whether
2 they would be completed on the -- it would be the northwest
3 side or perhaps through the fault. They're very deep wells.
4 And also pending, the acquisition is sufficient
5 hydraulic data to determine whether the hydraulic connection
6 that I believe I've demonstrated to exist between carbonates
7 in southern most Kane Springs Valley and central Coyote
8 Springs Valley is limited to one side or occurs on both sides
9 in the Kane Springs Wash Fault as I just said a moment ago.
10 And I'll just mention here that contrary to a
11 2007 ruling, I think it was 5712 -- yeah, it was 5712, that I
12 believe I've demonstrated that although the transmissivity of
13 the carbonates between central Coyote Spring Valley, I'm
14 thinking like CSV-6, might be the most northern extent and
15 southern most Kane Springs Valley.
16 That although the transmissivity of the
17 carbonates is clearly much lower than this chunk of the
18 carbonate aquifer that just possesses exceptionally high field
19 scale transmissivity.
20 It is still transmissive as evidenced by the fact
21 that you can see the same -- at least temporally, you can see
22 the same variations in water level pre-order 1169 pumping test
23 at CSV-6 as you do in CSMV-4.
24 And, in fact, you can see it in KMW-1, and during

Page 255

1 the pumping test, you see the same response, not the same
2 magnitude, but the same timing in the central Coyote Spring
3 Valley, in CSVM-4 in northern Coyote Spring Valley, and in
4 KMW-1.
5 So there is a hydraulic connection, the
6 transmissivity is just lower in that chunk of the carbonates
7 than in this very large area possessing exceptionally high
8 transmissivity.
9 So let's see. So, you know, I think that more
10 information is needed, but there's plenty of evidence that it
11 should be investigated and considered.
12 And, you know, as a consequence, I propose a 3-
13 to 4-month multi-well pumping test in KPW-1, which is needed,
14 but not necessarily going to be sufficient to clarify the
15 effects of carbonate pumping in Kane Springs Valley and Coyote
16 Spring -- you know what I'm trying to say, Coyote Spring
17 Valley, and its effect -- the effect of pumping Kane Springs
18 Valley on the remainder of the Lower White River Flow System.
19 Depending on what the completion of KPW-1 is and KMW-1
20 relative to Kane Springs fault, that's really key. We
21 don't -- we've got to note that.
22 Five, you know, I conclude that the effects of
23 carbonate pumping in northern Coyote Spring Valley or
24 southwestern Kane Springs Valley within a wedge of the

Page 256

1 carbonate aquifer that is situated northwest of the Kane
2 Springs Wash Fault and east of a north striking fault, normal
3 fault, passing near CSVM-3 are currently unknown.
4 It's basically that chunk of the -- that chunk of
5 the carbonates that is north or northwest of Kane Springs Wash
6 Fault. You know, I think we just don't know what would happen
7 if we moved carbonate pumping into the wedge, I would say, of
8 the aquifer.
9 And, you know, I mean, on -- you know, based
10 on -- if possible that this wedge of the carbonate aquifer is
11 also compartmentalized by the Delamar Thrust Fault, then maybe
12 gouge in the river's fault zone, unknown at this time.
13 And as such, because I know that's been
14 considered, you know, I propose a 3- to 4-month multi-well
15 pumping test in CSVM-3 to clarify the potential effects of
16 moving carbonate pumping into this wedge, northern wedge of
17 the carbonate aquifer, northern part of either Coyote Spring
18 Valley or actually southwestern Kane Springs Valley is also
19 part of that area.
20 What is to determine the effect of pumping within
21 that wedge of the carbonates on groundwater levels in central
22 Coyote Spring Valley and the remainder of the Lower White
23 River Flow System, including the springs when they're flowing,
24 of course.

Page 257

1 Six, I've concluded that the Kane Springs Wash
2 Fault must be permeable over much of central Coyote Spring
3 Valley. And I can go into this one, if I'm asked about, just
4 based on water budget and secondarily, geologic
5 considerations.
6 Seven, I think that Lower Meadow Valley Wash
7 should be considered for incorporation in the Lower White
8 River Flow System, given the potential for hydraulic
9 connection between the portion of the regional carbonate
10 aquifer underlying Lower Valley Meadow Wash, which I
11 understand is poorly known, but apparently is there somewhere.
12 And that underlying northern and central Coyote
13 Springs Valley, the Muddy River Springs area, and California
14 Wash based on geologic considerations. The potential is there
15 and -- but pending hydraulic confirmation following the
16 installation of adequate carbonate wells in Lower Meadow
17 Valley Wash of which I don't think there were any at present,
18 and collection of sufficient hydraulic data to confirm a
19 hydraulic connection between the carbonates being used Lower
20 Meadow Valley Wash and these other five-plus basins, et
21 cetera.
22 And that is a correction from our July report --
23 well, it's a clarification really, and we did submit that as
24 this slide as some -- as an additional exhibit. I think we

Page 258

1 submitted four of these slides as exhibits just to be sure,
2 because it was not stated that way in my original report.
3 But I would note that, at a minimum, the alluvial
4 aquifer of Lower Meadow Valley Wash, I believe I demonstrated
5 to be a source of water in the alluvium adjacent to the river
6 in California Wash, plus a source of water in the Muddy River.
7 So for that reason, if for no other reason, I
8 would advocate that it does impact water, the amount -- it
9 does impact the Muddy River and California Wash to some
10 degree. And for that reason, Lower Valley Wash should be
11 considered, to some capacity, to be part of the Lower White
12 River Flow System.
13 Okay. Eight, I identified climate signals and I
14 did this very simply, just inspection of hydrographs, nothing
15 statistical. I'm not trying to infer any statistical
16 significance here, et cetera.
17 But I endeavored to identify climate signals in
18 Lower White River Flow System groundwater levels and spring
19 and spring flows in response to the 2004, 2005 and somewhat
20 lesser, but still 2010, 2011 wet conditions for the limited
21 purpose of characterizing the timing of those wet period
22 responses of ground water levels and spring and stream flow
23 relative to changes in the climatic conditions in the Nevada
24 climate division 4, which includes the Lower White River Flow

Page 259

1 System basins, the original five-plus basins, plus Kane
2 Springs Valley, and Lower Meadow Valley Wash that I also
3 proposed be considered. Those are all Nevada climate division
4 4 and -- I'm kind of rambling here. Okay. Sorry.
5 Characterizing the timing of the wet period
6 responses in the groundwater levels and spring stream flows in
7 the Lower White River Flow System relative to climatic changes
8 and climactic conditions in division 4 and division 3, which
9 are -- includes the basins that are immediate up gradient of
10 the Lower White River Flow System basins and are the primary
11 source of water in the Lower White River Flow System -- Lower
12 White River Flow System.
13 And I -- I undertook this because I think that
14 understanding the timing of the responses of groundwater
15 levels and spring and spring flows in the Lower White River
16 Flow System, the timing of those responses relative to the
17 changes in climactic conditions are necessary, but also
18 probably not sufficient to determine how climatic conditions
19 are influencing groundwater levels and springs, spring flows,
20 and the availability of water in the Lower White River Flow
21 System.
22 And what I found or I believe I see, just based
23 on simple inspection of the hydrographs, again, is that
24 climate signals, really wet period signals in groundwater

Page 260

1 levels and spring stream, you know, in flows at the Moapa Gage
2 are detectible in carbonate water levels records basically
3 throughout the five-plus basins in the alluvial water levels,
4 in the Muddy River Springs area, in the hydrographs, water
5 level records for Pederson and probably also Plummer springs,
6 and the Muddy River Springs area, and arguably flows in the
7 Muddy River and Moapa Gage all within about one year, which I
8 thought was interesting.
9 In contrast, I looked at the water level record
10 for both Baldwin Spring and I don't see those wet period
11 responses in that record and I really don't know why.
12 But what I thought was very interesting and
13 important because of big Muddy Spring is -- let's see, what is
14 it? It's about seven CFS, it's a big spring and it's a
15 significant component of the spring discharge to the river.
16 The Big Muddy Spring flows gradually increased
17 and then decreased over about 12 years from 1995 to 2007 as
18 that's a pattern not seen in division 4 or 3, Palmer drought
19 of severity index trends since about 1977 to 1989 for 18 years
20 prior, which I thought was very interesting. And I have a
21 theory about that.
22 Nine, I identified the physical locations and
23 conditions on the boundaries of the five-plus basins, Kane
24 Springs Valley, and Lower Valley Meadow Wash consistent with

Page 261

1 my earlier findings and using available geologic and
2 hydrologic data, beginning with inflow boundaries. And the
3 first and most prominent one, of course, is Pahrnagat Sheer
4 Zone, which is a constant inflow boundary between Pahrnagat
5 and northern Coyote Spring Valleys. I believe for the
6 foreseeable future, two reasons, that is pretty clear this is
7 a constant inflow boundary.
8 One, there is a potential for hydraulic
9 resistance across a sheer zone based on geologic
10 considerations, the three, I believe, slip falls that are the
11 Pahrnagat shoot zone. So, you know, water basically piles up
12 in Pahrnagat Valley behind the sheer zone.
13 And secondly, I estimate that a minimum of
14 1200 -- a minimum of a 1200-foot difference in head exists in
15 the carbonate aquifer across this portion of the sheer zone.
16 That's a very large head difference, and
17 consequently, I believe that -- I think it's pretty -- it's
18 not -- it's pretty clear it changes on the order of many tens
19 of feet in carbonate water levels in either Pahrnagat and/or
20 Coyote Spring Valleys, have no significant effect on the
21 hydraulic gradient or basin groundwater flow across the sheer
22 zone into the Coyote Spring Valley.
23 So it is -- you know, for all practical purposes,
24 very conservatively you could say, it is basically a constant

Page 262

1 inflow boundary. And it appears to be on the order of about
2 49,500-acre-feet per year based on the most recent water
3 budget analyses I've looked at was using -- that is -- those
4 were the water budgets developed by SNWA as part of their
5 conceptual model for their CCRP model. Okay. So that was
6 2009.
7 Anyway, the other inflow boundary, I believe, is
8 a variable inflow boundary between -- this is at the top of
9 the Lower Meadow Valley Wash between Panaca Valley and Lower
10 Meadow Valley Wash, given the potential for hydraulic
11 conductivity through Lake Patterson and Panaca Valleys into
12 Lower Meadow Valley Wash, all within the Meadow Valley Flow
13 System based on geologic considerations. There's a continuity
14 of carbonates and other permeable units.
15 And secondly, based on the available water
16 budgets, again, they were SNWA's water budgets from their CCRP
17 conceptual model, they concluded that there is water flowing
18 from Panaca Valley into Lower Meadow Valley Wash based on
19 those water budget analyses and variable -- a variable inflow
20 boundary, given that, you know, the groundwater level data is
21 pretty sparse in Panaca Valley.
22 But, you know, I found at least a couple records,
23 well records, water level records where you could see
24 long-term variations in groundwater levels up gradient of

Page 263

1 Lower Meadow Valley Wash and Panaca Valley. It wasn't
2 seasonal, it was longer than that. So I believe that to be a
3 variable inflow boundary to the Lower White River Flow System.
4 And, again, based on SNWA's water budget analyses
5 for their conceptual model for the CCRP model, it appears to
6 be, you know, something on the order of 4700-acre-feet per
7 year.
8 Next, I evaluated the potential for no-flow
9 boundaries in the vicinity of the five-plus basins, Kane
10 Springs Valley, Lower Meadow Valley Wash, you know, using
11 geologic and hydrologic data that showed these -- well, okay.
12 I'm babbling here.
13 The no-flow boundaries -- luckily no-flow
14 boundaries were either coincidence with topographic that is
15 for groundwater divides, coincidence with flow lines inferred
16 from groundwater level data, or the locations where -- based
17 on -- I made extensive use actually of HNL 2006, geologic
18 cross-sections, and also, wherever possible, a 3D
19 hydrogeologic framework model developed by SNWA to support the
20 develop of CCRP numerical model.
21 Using those two sources, I attempted to locate
22 places for the full sequence of Paleozoic carbonates are
23 juxtaposed with low permeability rocks. Those being
24 potential. Okay. I've lost my -- yeah, anyway, creating the

Page 264

1 potential for no-flow conditions. I lost it again.
2 Okay. Confirmed by groundwater level data where
3 it's available. It's pretty sparse, but where it was
4 available, and also it -- including the propagation of pumping
5 induced drawdown or lack thereof across some of these geologic
6 discontinuities.
7 And, you know, in summary, what I see is that the
8 available geologic and hydrologic data support that a large
9 number of no-flow segments can be identified in the vicinity
10 of the five-plus basins, Kane Springs Valley, and Lower Valley
11 Meadow Wash, which largely define the aerial extent of what I
12 propose would be considered at least as the Lower White River
13 Flow System.
14 Ten, without going into the details until I'm
15 asked about them, in which case we can talk about it. Ten, I
16 wanted to know that whereas some ground outflow may occur
17 across the Glendale and Muddy Mountain thrusts from Lower
18 Meadow Valley Wash and California Wash into lower Moapa Valley
19 and/or the Black Mountain area, that the rate of outflow is
20 poorly known. It's uncertain. To date, it's based on
21 Darcy-flux approximations and/or basin scale water budget
22 analyses.
23 But more importantly, what I believe that that
24 outflow to the extent that it occurs to lower Moapa Valley and

Page 265

1 Black Mountain areas beyond the five-plus basins is unlikely
2 to change significantly as a result of water management within
3 the Lower White River Flow System in view of a 250-foot drop
4 in carbonate water levels that is documented from west to east
5 across the Glendale thrust.
6 That is from Lower Meadow Valley Wash to Lower
7 Moapa Valley and a 100 to 150-foot drop in ground waters that
8 is documented from west to east across the Muddy Mountain
9 thrust, that is from California Wash to Lower Moapa Valley and
10 Black Mountains area.
11 So, you know, although, you know, it may exist
12 and it's not entirely clear what the rate of outflow is to
13 Lower Moapa Valley or perhaps Black Mountains area, you would
14 have to have -- it seems high unlikely that you would have
15 sufficient change in head within the carbonates of Lower White
16 River Flow System basins, or specifically California Wash,
17 sufficient to change that gradient significantly.
18 And likewise, it seems unlikely that you get a
19 really -- you know, I guess the 150 to 200-foot difference in
20 head, it seems unlikely that you would get a large enough
21 change in head of the Lower Moapa Valley side of these two
22 thrusts to, again, change that gradient and that rate of
23 outflow significantly.
24 So although it may exist, I'm not terribly

Page 266

1 concerned that management within Lower White River Flow System
2 is going to affect it, outflow to Lower Moapa Valley.
3 11, so in summary -- some summary, you know, I
4 would propose revisions to the aerial extent of the Lower
5 White River Flow System to include the following eight basins
6 and parts of basins: The Muddy River Springs area, most of
7 Coyote Spring Valley, Hidden Valley, Garnet Valley, most of
8 California Wash, the northwest part of Black Mountains area,
9 those being the original five-plus basins, plus Kane Springs
10 Valley and Lower Meadow Valley Wash, pending, you know, the
11 acquisition of the information that I mentioned earlier.
12 And that's really, really hard to see, but as you
13 can see, that would be a significantly larger area than what
14 has been proposed by others and what we recognize right now.
15 So I'll just give that to you for your consideration.
16 12, you know, I conclude that knowledge of the
17 relative transmissivities, storativities and hydraulic
18 diffusivities of the carbonate and alluvial aquifers of the
19 Lower White River Flow System are sufficient to address the
20 remaining questions posed in Order 1303.
21 We don't -- you know, we don't need, you know,
22 sophisticated estimates. We know that the carbonate aquifer
23 had -- possesses high field scale transmissivity. All, of it
24 compared to the alluvium, limited storativity and high, but

Page 267

1 finite, hydraulic diffusivity.
2 The alluvial aquifers of Muddy River Springs area
3 and California Washburns are lower in transmissivity, higher
4 in storativity and possess lower hydraulic diffusivity than
5 the carbonate aquifer.
6 And I believe that's really all we need to know
7 in order to answer the rest of the questions posed in Order
8 1303, such as, what are the effects of moving alluvial pumping
9 into carbonates or carbonate pumping into alluvium.
10 13, based on all those previous findings, I
11 developed a hydrogeologic conceptual model of Lower White
12 River Flow System as a basis for addressing the remaining
13 questions posed in the order.
14 And just generally, they -- it includes the
15 effects of carbonate pumping. The effects of alluvial pumping
16 within the Lower White River Flow System. The effects of
17 constant inflow at the Pahrnagat Sheer Zone. The effects of
18 variable inflow of at the north end of Lower Meadow Valley
19 Wash.
20 The causes of climate signals in groundwater
21 levels and spring and spring flows in the Lower White River
22 Flow System. The effects of decreased local recharge, local
23 recharge or inflow to Lower Meadow Valley Wash due to changes
24 in climatic conditions. The effects of changes in groundwater

Page 268

1 availability up gradient of the Lower White River Flow System
2 basins due to development, time lags and the manifestation of
3 pumping impacts and recovery, and lastly, the source of the
4 Muddy River Spring, I have a hypothesis.
5 14, you know, I conclude the following about the
6 sustainable levels of pumping in the Lower White River Flow
7 System. Just an initial observation, carbonate and alluvial
8 aquifers in the Lower White River Flow System are generally in
9 good hydraulic connection, therefore, total carbonate and
10 alluvial pumping must be used to establish a sustainable level
11 of pumping. The total pumping, carbonate and alluvium.
12 Secondly, I observe, at least in my opinion, that
13 there are too many outstanding questions regarding the
14 hydrology and hydrogeology of the system to construct a
15 numerical model at this time that will be useful in predicting
16 the sustainable yield.
17 So I believe that the average rate of combined
18 carbonate and alluvial pumping in 2015, '16, and '17, that was
19 9318-acre-feet per year or so, is the best initial estimate of
20 a sustainable yield of Lower White River Flower System
21 available at this time.
22 That is excluding rates of alluvium pumping that
23 is currently -- that's occurring in Lower Meadow Valley Wash
24 as that has not been inventoried as far as I can tell.

Page 269

1 Oops, I lost the place again.
2 That's assuming that flows in the Muddy River in
3 2015 through 2017 were sufficient to meet senior decreed water
4 rights in the river, which, you know, is a domain in the State
5 Engineer's office. I won't pretend to know that for certain.
6 And as I presented in my report and I -- you
7 know, it's not here in detail in my summary presentation, but
8 I do believe this to be conservative, but not overly
9 conservative initial estimate of the sustainable level of
10 total carbonate alluvial pumping in the system, if only
11 because we know that pumping -- I can't bring it on the top of
12 my head. It was like 10,000 something acre-feet per year was
13 the total -- average total carbonate alluvial pumping during
14 Order 1169 pumping test.
15 And when the test -- you know, when the test
16 pumping ceased, the system was nowhere close to the
17 equilibrium state as evidenced by the fact that the spring
18 flows at Pederson and the Plummer Springs -- let's just say
19 Pederson Springs because they're more accurately monitored,
20 were in an undiminished state of decline and paralleled by
21 changes in water level, in carbonate monitor well EH-4 is the
22 closest monitor well, undiminished state of decline.
23 So the system was nowhere close to new steady
24 state when the pumping test ended. So we know the 10,000,

Page 270

1 whatever it was, acre-feet per year was a total carbonate
2 alluvial pumping during the test average is probably too much.
3 We estimated that the Pederson, one of the
4 Pederson Springs would have stopped flowing if it had
5 continued. So that is too much.
6 And I think we know from what we observed in
7 2015, '16 and '17, that assuming that the amount of water
8 flowing down the river was sufficient to meet the senior
9 decreed rights on a river, that the spring flows were pretty
10 steady, the flow on the river was reasonably steady. It seems
11 like a pretty safe bet and I don't know how we're going to
12 know any better than that right now.
13 I also have a -- probably suggest an alternative
14 approach. He's not here, so I've included it in my report,
15 and he suggests that it may be possible to create a simple
16 empirical model that can be used to project a level of
17 combined pumping at a sustainable yield that will allow senior
18 decreed water rights on the river to be met. And that would
19 involve, if this can be done -- I'm not clicking again here,
20 okay -- oh, here we go.
21 Yeah, what that would involve is if you could
22 estimate what the total carbonate alluvial pumping was in the
23 Lower White River Flow System basins, going back, you know,
24 20 years and just make an X/Y plot, that against -- I don't

Page 271

1 know if it would be flow to Moapa Gage, flow in the Glendale
2 Gage, or maybe you'd have to look at both of them, but you
3 could create a simple empirical relationship based on data,
4 okay, that relates the rate of total carbonate and alluvial
5 pumping versus what you saw going down the river at the Moapa
6 Gage or the Glendale Gage or both of them. You could then
7 pick off of that graph, okay, the level of total pumping that
8 allows enough water to go down the river at the Moapa Gage or
9 Glendale Gage.

10 And if you created such an X/Y plot using data
11 that goes back, say, 20 years, you would also capture the
12 effects of changes in climate, at least within that record.
13 So it would have that benefit as well.

14 So I would suggest that be the next step. That,
15 of course, would have to be updated periodically, but like I
16 said, that kind of empirical model -- because I think -- you
17 know -- it's -- we don't know enough to build a numerical
18 model that can predict sustainable yield yet. That's what I
19 think.

20 That kind of empirical model would have the
21 advantage of accounting for climatic -- variations in climatic
22 conditions at least in the past years. And regardless of what
23 method is used, I do think that sustainable yield is going to
24 have to be updated periodically to reflect changes in the

Page 272

1 available of water within the system due to changes in
2 climatic conditions or groundwater development up gradient of
3 the Lower White River Flow System, which at least at the top
4 of Lower Meadow Valley Wash could affect rates of inflow to
5 the basins. So I don't see this as being a static number.

6 15, I thought about the effects of moving
7 carbonate and alluvial pumping within the Lower White River
8 Flow System and this is my conclusion.

9 Carbonate pumping, total carbonate pumping should
10 not be increased in exchange for reductions in alluvial
11 pumping, even if total pumping is maintained at a sustainably
12 overall level, since the Muddy River Springs, at least the
13 Refuge Springs are derived almost entirely from the carbonate
14 aquifer.

15 And existing carbonate pumping should not be
16 moved closer to any of the springs or the river, which could
17 reduce the lag time and the development impacts to the springs
18 or the river, possibly before the impacts can be detected
19 based on periodic data collection processing, because that
20 does take time.

21 And with respect to alluvial pumping, I don't
22 believe that it should be increased in exchange for reductions
23 in carbonate pumping, even if total pumping is maintained at a
24 sustainable overall level since, in addition to springs, the

Page 273

1 remainder of water in the river comes from alluvium in the
2 Muddy River Springs area and California Wash, and that
3 existing alluvial pumping in the vicinity of the river should
4 not be moved closer to the river, pretty obvious, because that
5 could reduce the time lag in development impacts to the river
6 possibly before the impacts can be detected based on periodic
7 data collection and processing.

8 And lastly, I enumerated -- it's probably -- it's
9 not a complete list, but I enumerated some obvious unresolved
10 technical questions, which I identified through my analysis
11 regarding the hydrogeology for Lower White River Flow System,
12 unresolved technical questions that I think are relevant to
13 the development of an effective conjunctive water management
14 program and eventually, you know, hopefully we can address.
15 And that is it.

16 MR. MILLER: All right. Thank you,
17 Ms. Braumiller. I think we're going to have to swap seats so
18 Tim Mayer can put up his presentation.

19 MR. MAYER: Okay. I'm Tim Mayer, and I'm going
20 to be talking about Section 1.6 of the report that was
21 submitted in July, we go to the slide view. So the title of
22 that section is, "groundwater and spring discharge
23 relationships in the Muddy River Springs area and their
24 importance to the trigger levels in the 2006 MOA."

Page 274

1 And basically we've all heard how Pederson Spring
2 on the refuge is the highest, most sensitive spring in the
3 system. And so I'm going to take a couple slides here and
4 explain why that is just for those of you who haven't heard
5 this before.

6 I think most of the people have seen these slides
7 and heard this. This is our theoretical understanding of
8 groundwater and spring discharge in relationship to the Muddy
9 River Springs area.

10 So the springs are derived from the regional
11 carbonate aquifer and that aquifer is confined and is under
12 pressure. And so the potentiometric surface elevation of the
13 aquifer rises above the land surface elevation in the Muddy
14 River Springs area and that results in spring flow.

15 And because of the high transmissivity of the
16 aquifer in this area, that potentiometric surface elevation is
17 fairly consistent and uniform throughout the Muddy River
18 Springs area. But the elevation of the springs, themselves,
19 in the Muddy River Springs area varies quite a bit, by 70 feet
20 or more.

21 So what this means is you have a range of
22 hydraulic head differential driving the spring flow of the
23 individual springs in this area. And by hydraulic head
24 differential, that's simply the difference between the

Page 275

1 potentiometric surface elevation and the land surface
2 elevation of the spring.
3 So if I can direct your attention to the higher
4 elevation spring on the slide here on the left-hand side, and
5 we have a potentiometric surface elevation at that site of
6 1,817 feet. We have a spring orifice with an elevation of
7 1,807 feet. So we have ten feet of difference between the
8 potentiometric surface elevation and the spring elevation at
9 that higher elevation spring.
10 So our hydraulic head differential is ten feet.
11 If you move over to the right-hand side part of the slide and
12 you look at the lower elevation spring, that spring is in
13 elevation of 1,797 feet. All right.
14 Potentiometric surface elevation is uniform
15 throughout this whole area, so it's still at 1,817 feet. So
16 we have a hydraulic head differential at this spring of
17 20 feet. So the important part here is that we have a range
18 of hydraulic head differentials at individual springs.
19 Now, why that is important is if you impose a
20 drawdown, if you vary the level of the potentiometric surface
21 elevation, say, through pumping or climate or whatever, so
22 I've imposed a hypothetical five-foot decrease in the
23 potentiometric surface elevation of the regional aquifer.
24 So now that potentiometric surface, it was at

Page 276

1 1,817 feet, now it's at 1,812 feet. So if you look at the
2 hydraulic head differential at the higher elevation spring on
3 the left now, that went from an initial value of ten feet to a
4 new value of five feet.
5 We have a 50 percent reduction in the hydraulic
6 head differential at that spring. If you look at the lower
7 elevation spring on the right, we had an initial hydraulic
8 head differential of 20 feet, now we have a new hydraulic head
9 differential of 15 feet, so we have a 25 percent reduction at
10 that spring.
11 So we have 50 percent at the highest elevation
12 spring, 25 percent at the lower elevation spring, and we --
13 because of Darcy's Law, we expect that the reduction in spring
14 flow is going to be proportional to the reduction in hydraulic
15 head differential, a change in hydraulic head.
16 So that means we would expect a 50 percent
17 reduction in spring flow at the highest spring and only a
18 25 percent reduction in the spring flow at the lower elevation
19 spring.
20 So that's why our highest elevation springs are
21 the most sensitive to changes in water level elevations, at
22 least that's our theory anyway. So this section is really an
23 update of an analysis that we did of looking at groundwater
24 and spring discharge relationships and the changes in flow and

Page 277

1 the changes in head at several different sites in the Muddy
2 River Springs area. And we did that in the Order 1169 report
3 that the Department of Interior submitted in 2013. So this is
4 an update of that order.
5 This is a map showing the monitoring sites that
6 we looked at, the refuge boundary is shown in purple here.
7 There are five sites that we looked at that are on or close to
8 the refuge. Those are the Apgar Spring -- I mean, the Jones
9 Spring, the Pederson Spring, Pederson East Spring, the Warm
10 Springs West flume and then the Iverson flume.
11 Now, we didn't look at Baldwin Spring, but we did
12 in 2013, but we didn't do it in this update. There were some
13 funny things in the record there and we didn't look at Big
14 Muddy Spring.
15 Big Muddy is the lowest elevation spring, it's
16 the least sensitive, and we did not see any relationship when
17 we looked at that in 2013. So we didn't look at that spring
18 in this analysis here.
19 And then the -- just for reference, the
20 monitoring well that I'm talking about, this is the carbonate
21 monitoring well just south of the refuge, that's CH-4, and
22 that's the well that we're using to represent the
23 potentiometric surface elevation in the aquifer.
24 So I'm just going to walk you through one figure.

Page 278

1 This is the top plot from Figure 19 in our report and this is
2 showing the average monthly flow at Pederson Spring, which is
3 the highest elevation spring versus the average monthly water
4 elevation at EH-4. And this is for the period from 2004 to
5 2019.
6 So we've got discharge on the Y axis and the
7 range of water elevations in EH-4 on the X axis. And you can
8 see, we have a really good relationship between spring
9 discharge and groundwater elevation here.
10 So what happens is the groundwater effects the
11 springs there very clearly. We have an R-squared of about
12 .97, that says that 97 percent of the variability in monthly
13 discharge at the Pederson Spring is described by monthly
14 groundwater elevations and EH-4. So that's really good.
15 So as I said, this was the most sensitive spring.
16 And if you look at the coefficient or the slope of this line
17 of this relationship, it's .05 CFS. That equates to about
18 19 percent of the maximum flow per foot of drawdown.
19 So, in other words, for every foot of drawdown
20 that you get in EH-4, you lose 18 percent of the flow relative
21 to the maximum flow. And that's the highest relative decline
22 that we found in our analysis of the five sites that we looked
23 at. So it makes sense. It's supposed to be the most
24 sensitive spring, it looks like it is the most sensitive

Page 279

1 spring.

2 And then since we know the potentiometric surface
3 elevation at the maximum water level here and at the minimum
4 groundwater level, and we know the elevation of the spring
5 orifice, we could estimate the reduction in head differential
6 just like I did on the illustration that I just showed you.

7 So we did that and we estimated that the
8 reduction in head should be or was about minus 72 percent. So
9 we had a change -- that much of a change in head differential
10 over this range of water elevations. And we compare that to
11 what we measured in terms of reduction of flow and we see that
12 we have very good agreement, 73 percent reduction in flow.

13 So that says that this spring is behaving pretty
14 much exactly as we theorized that it should, and that it is
15 the most sensitive spring in the system.

16 So this is just a table summarizing our results
17 from the analysis of the five sites that we looked at, and the
18 five sites are listed here in the first column on the left.
19 Pederson Spring, Pederson East Spring, Warm Springs West,
20 Jones Springs, Iverson Springs -- or Iverson Flume. I should
21 say this is Table 1 in our report.

22 And these springs are ordered from high elevation
23 to low elevation, so from high sensitivity to low sensitivity
24 if they follow our theory.

Page 280

1 And we've got the type of monitoring site here in
2 the next column from the left. Some of these are spring
3 monitoring sites, they're monitoring the outflow from the
4 individual springs.

5 Some of these are flow monitoring sites and
6 they're monitoring the collective discharge from a lot of
7 different springs. And then we have the elevation here or the
8 range of elevations depending on the site.

9 We have the R-squared value, I said was .97 for
10 Pederson. You can see we get worse R-squares as we go to less
11 sensitive springs. We don't have as much descriptive power in
12 each water level elevations. We don't do as good a job
13 explaining water elevation -- or water discharge changes at
14 these lower elevation sites.

15 Then we have a slope coefficient, that's the
16 slope of the line with key value associated with that
17 coefficient.

18 And then over here, we have the changes that
19 observed discharge that we measure over the range of water
20 level elevations. And in the following column, the furthest
21 column on the right, we have what we estimate was the change
22 in head.

23 So these should agree pretty closely and then
24 there's some variability, but they're fairly close. And they

Page 281

1 are ordered from, you know, steepest or greatest decline to
2 less decline. So it looks like these springs are behaving as
3 we think they should, according to the theory that we
4 developed. And this says that the Pederson Spring and those
5 higher elevations springs are the most sensitive, and that if
6 you protect those, you're going to protect the other springs
7 in the system.

8 So, in conclusion, I've shown you that
9 groundwater levels and spring discharge are really closely
10 related, especially at these higher elevation springs. If you
11 limit pumping in the Lower White River Flow System, you're
12 going to maintain groundwater levels and you'll protect the
13 spring flow.

14 I didn't talk much about this in the presentation
15 here, but there are triggers on the Warm Springs West flume.
16 Those triggers protect or measure the flow from the highest
17 elevation springs, Pederson, the Pederson East, a number of
18 other springs there. So those triggers are established to
19 protect the flows on that use in the refuge, the Pederson --
20 the Pederson that has most sensitive springs.

21 So if we protect those springs, then we believe
22 that you'll protect all the other springs in the MRSA as well.
23 And that's all I have to say.

24 MR. MILLER: All right. We'll switch seats one

Page 282

1 more time and let Mr. Schwemm sit over there. And after
2 Mr. Schwemm's presentation, if you could let me know if the
3 timing is such you'd like to take a break and then we'll have
4 one more substantive presentation for the rebuttal report.

5 DR. SCHWEMM: All right. My name is Michael
6 Schwemm and I'm going to be talking about Section 2 of the
7 report, which deals with sort of the direct implications of
8 the biology and springs for the Moapa Dace. So for this talk,
9 I'm going to briefly go over a few elements that correspond to
10 the sections straight out of the report.

11 So basically of the report that was divided up
12 into these sections and I pulled out a number of salient
13 features, not all of them, but ones that were important that I
14 wanted to highlight here today.

15 It looks like we got the automatic timer on. So
16 basically I'm going to cover elements of background biology of
17 the Moapa Dace and some of the peculiarities that make it a
18 really interesting species, and that led into a number of
19 anthropogenic impacts and conservation actions that we've done
20 on the Moapa Valley Refuge over the years, and that's kind of
21 naturally led into the importance of cone activity and
22 fragmentation and how that might affect the biology of the
23 species.

24 And then that kind of -- after that is a

Page 283

1 discussion of spring flow and habitat needs, and for this
2 section, I want to highlight one of the papers that I believe
3 provides the best information in terms of this relationship.
4 And then I'll briefly touch on the -- our current
5 and historical abundance of Moapa Dace and then I have a
6 summary slide at the end. So I think it's only about 17
7 slides after the title slides. That's good news.
8 So starting off with where it is, I didn't think
9 we had covered it already, but I wanted to just highlight a
10 couple elements of the system that are important. So just
11 starting at the very course of scale, I did have this one
12 image here that isn't found in our report. It's just a map of
13 the southern U.S., but this one here on the left is.
14 But as I mentioned or discussed in the report
15 that the Muddy River Springs is part of a larger river system.
16 Historically, in pluvial times, it was part of the pluvial
17 White River, which is basically drainage that runs all the way
18 down from the White River to -- through Pahrangat down into
19 what's called the Muddy River and the original arm of Lake
20 Mead. And that area here is shown in this little diagram I
21 made.
22 But basically, at present, the Muddy River
23 Springs provide a substantial water in the system currently.
24 So that's -- makes it a really important sort of legacy of

Page 284

1 water in the system from a biogeographic standpoint, which is
2 why animals occur where they do. And that's an important --
3 I'll cover that in a minute.
4 On the left here is a diagram of the streams.
5 The colored sections just represent areas that we identify as
6 recovery units and we can communicate effectively. So the
7 numbers just identify specific segments.
8 But as Tim just talked about previously, here's
9 Pederson right here, here's Plummer Spring. This is Aparcar.
10 This green area here shows the majority of the refuge and
11 these are some -- and then there's this -- kind of another
12 branch here that's made up by the north fork and south fork
13 that comes down, and this is the main stem down here.
14 So the Gage that Tim was talking about is right
15 here on the Pederson stream, right at the refuge boundary, the
16 Warm Springs West Gage.
17 MR. MILLER: Mr. Schwemm, just to remember, try
18 to be specific with your descriptions since it doesn't come
19 through with the pointer.
20 DR. SCHWEMM: Okay. So the system that we're
21 talking about, the Muddy River, because as I mentioned that
22 it's part of this historical drainage, there's a number of
23 endemic species that live there. And the one we're the most
24 concerned with is the Moapa Dace because it's endangered. But

Page 285

1 it shares its habitat with a couple other fish, a couple
2 snails and bugs.
3 So -- but overall what this system is
4 characterized why it's unique from a biological standpoint is
5 that Moapa Dace and others were sort of stranded in this
6 little pocket of water that the Muddy River Springs area since
7 the end of the Pleistocene. So as Holocene warming began,
8 these fish were kind of stuck up there. And with the case of
9 Moapa Dace, there's no other fish in genus Moapa.
10 So what that means is there are no really similar
11 minnows. All of its very close relatives are extinct and it
12 represents a unique component of the biodiversity of the
13 system. So given that it's rare from, you know, a
14 biogeographic standpoint, it also has some really interesting
15 features about this species.
16 The first one is that it's thermophilic. That
17 means that it likes hot water and for a minnow, this is way on
18 the high end. So this species occurs from 32 to 26 degrees
19 Celsius. That's about 90 or so on the top end. And spawning
20 occurs at the very highest temperatures, 30 to 32. So it
21 really likes hot water.
22 It's a small fish that's about 120-millimeter
23 fork length with -- when it was sort of described in the '90's
24 and -- oh, crap. That's about -- that's less than five inches

Page 286

1 and it's left to live about four years or so.
2 But I'll come back to this at the minute -- or in
3 a minute later in the slides that it's actually a little
4 smaller now and probably only living a couple of years now.
5 We have a little different age structure than was what we
6 thought we had in the '90's.
7 A typical -- or typical threats of the species
8 are those that affect most of the desert southwest, which is
9 outright habitat change and then the effects of predatory
10 invasive species, both fish and otherwise, and the
11 availability of in-stream flow.
12 So you can touch -- boil down to rest of desert
13 fishes of those three big ones. We don't have issues --
14 serious issues with pollution and stuff that we have as you
15 move farther east in other systems typically.
16 So given all of this unique status that we've
17 known about Moapa Dace for a long, it was listed as endangered
18 kind of -- as kind of the first wave of fishes that came after
19 the establishment of the Preservation Act in '66.
20 So it was right after that and it's one of the
21 earliest fish to receive some protection. And it only occurs
22 in the sort of upper mile or so habitat of the springs because
23 it likes hot water. So as you go downstream, you're not going
24 to find this in the cooler water areas or at least below 26.

Page 287

1 So you're limited in that range.
 2 But there's -- I'm going to talk a lot about
 3 movement within that range in the subsequent slides. But at
 4 present, we have about 1500 animals, which is considerably
 5 better from the 500 animals that we had in the recent past.
 6 So we're pretty pleased with that at the moment, but we still
 7 have quite a ways to go.
 8 So given this rarity of the fish, it was
 9 important that a refuge was established for the Moapa Dace and
 10 just as an -- it's kind of an aside is that, you know, the
 11 wildlife refuge typically established for -- for waterfowl and
 12 wetland areas, and this probably was the only refuge
 13 established for a minnow. It's that unique in its biology
 14 that it warranted such an entire refuge based on this habitat.
 15 So it's really unique.
 16 Early efforts on the refuge involved removing
 17 palm trees and trying to get stream habitat back to what it
 18 was naturally. And basically Plummer and Pederson were
 19 characterized by chlorinated swimming pools in which the
 20 stream was completely obliterated and similarly Apcar was
 21 taken all for municipal water supply.
 22 So these springs had to be almost completely
 23 recreated and fish had to be moved around on the refuge and --
 24 or off the refuge back onto those habitats. So it's really an

Page 288

1 effort of extensive habitat recovery.
 2 And similarly, when we do these sorts of
 3 renovations, we're trying to make habitat that's more amenable
 4 to Moapa Dace and less so to the invasive aquatic species like
 5 mollies and Mosquitofish and Tilapia that really have posed
 6 significant threats to the species and we've done a lot to
 7 mitigate these.
 8 And on the refuge, more recently, we've really
 9 been thinking critically about what types of habitat we need
 10 the most benefit of the Dace, you know, how can we, you know,
 11 mitigate the effects of endangered -- of invasive species on
 12 the system and protect in-stream flow requirements. And the
 13 Fish and Wildlife Service has done this from a couple of
 14 previous agreements that I'll talk about.
 15 What -- I guess probably what has -- what makes
 16 the species most interesting are a number of complex
 17 biological requirements that are really, really unique, but,
 18 however, they've also posed significant challenges to the
 19 recovery of the Moapa Dace and I want to highlight some of
 20 those here.
 21 The first one is that the stream habitat where
 22 these fish occur varies with life stage, and specifically
 23 young fish feeding on really small stuff in slow moving pools.
 24 And as they get larger, they grow a little bit and become --

Page 289

1 at juvenile stages, they drift downstream. This was shown by
 2 a lot of the early work of others that worked in the -- at the
 3 refuge. And then you typically find large fish in faster
 4 moving and deeper parts of the water.
 5 And not only do they -- does the habitat vary by
 6 life stage, but it's also really interesting that the fish,
 7 even within their own lifetime, they vary where they are in
 8 the stream by their behavior.
 9 And this is key and the adults are known to only
 10 spawn in the highest temperatures at the spring head that's
 11 about 30, 32 degrees, and yet they were found and typically
 12 feeding gross likely downstream. And this -- this is typical
 13 of even larger fish, kind of grow better due to, you know,
 14 metabolic concerns as they go downstream.
 15 So the implication of these sort of complex
 16 biology is that Dace are continually moving upstream and
 17 downstream in the system on -- you know, daily, seasonally
 18 quite often because these fish are spawning year round, yet
 19 they feed in cooler water, at least historically. So we have
 20 a lot of issues with migration to deal with.
 21 And I wanted to bring up one slide here, this is
 22 from the Warm Springs stewardship plan. And what I want to
 23 highlight here, it's just a nice diagram of the temperature of
 24 the spring heads. So you can see how the spring heads are hot

Page 290

1 here, indicated by the red and as it goes through the blue,
 2 yellow, green as the streams cool down.
 3 So what this means from Moapa Dace is that
 4 they're having to swim back and forth between the hottest
 5 spring areas of the spring head and downstream all the time
 6 and really highlight the importance of conductivity.
 7 So what we've done for the conservation in Moapa
 8 Dace is kind of -- we've taken this three-part approach. And
 9 the first was to restore all types of habitat, because we know
 10 we need up at the spring head and we know we need slightly
 11 downstream.
 12 And we've done this by trying to remove barriers
 13 and constructing habitat that's amenable to the species. And
 14 simultaneously, though, we've done a ton of work on trying to
 15 mitigate the effects of cretation and non-native fish like
 16 Mosquitofish and Molly and the chemical removal of Tilapia
 17 from the entire system. And we think we have a pretty good
 18 handle on this now.
 19 Just recently, we've come -- finished the entire
 20 system, treated the entire system of the Muddy River for
 21 non-native fishes over the course of the last decade or so.
 22 And the last point is maintaining in-stream flow,
 23 and as I pointed out, it's -- we need to maintain these
 24 habitat -- specific areas of the habitat and the connectivity

Page 291

1 between them. And this has been accomplished through
2 voluntary curtailment of groundwater pumping through a couple
3 of Fish and Wildlife Service agreements.
4 In 2006, one was the MOA that we mentioned
5 already that looks at Muddy River Springs area, Coyote Springs
6 Valley. And the second agreement, which is the amended
7 stipulation with Lincoln County, Vidler that dealt with Kane
8 Springs. And so just to highlight some important aspects of
9 the MOA is that it brought together the main water users in
10 the area to actively protecting spring flow in the Moapa Dace.
11 And part of this was to establish a system where
12 we would all meet monthly and discuss the needs and how they
13 are changing so that we could have this sort of adapting
14 management approach that has really been successful.
15 And then this included explicit financial
16 agreements from all the parties to fund recovery actions of
17 research that have made a difference, as you'll see, in the --
18 when we get to the current abundance slide.
19 Also, in there was these mandatory annual
20 discussions of hydrology where we would discuss the pumping
21 data that occurred only last year and how the triggers and the
22 Dace are doing. And, of course, the important main in-stream
23 flow triggers, which is the voluntarily curtailment of surface
24 and groundwater.

Page 292

1 And my report dealt only with the biology and not
2 with other elements of these agreements, but I wanted to just
3 highlight the triggers here just to show the -- what they are.
4 And these are several exhibits and so I wanted to highlight
5 that the -- it's 3.29 CFS or below 3.2 CFS, is where the first
6 trigger in the MOA. And in the amended stipulation, it's
7 3.15. So they're approximately similar in where voluntary
8 curtailment would occur.
9 So given that, you know, we have this, you know,
10 this species that we know uses different parts of habitat and
11 is likely sensitive to flow based on these habitat needs, I
12 want to highlight one specific paper, in particular, that
13 really shows -- provides the best evidence of how spring flow
14 and Dace habitat, their relationship of those features. And I
15 want to walk through this particular paper.
16 So what this -- what the authors did is they
17 identified Dace habitat based on typical snorkel surveys and
18 they measured habitat characteristics. And then what they did
19 with this information is they wanted to ask, you know, what
20 are the important variables for Dace, and they did this using
21 logistic regression and model selection approach that used a
22 presence/absence model and the -- and typical stream
23 characteristics that you go out and measure like water depth,
24 velocity, the sub-stream and the stream lithology which is

Page 293

1 these -- which is sort of the shape, whether it's a glide or a
2 riffle or a run type of habitat.
3 And then the second was to use this information,
4 these variables that were important to develop a simulation
5 that showed -- a model that showed when you actually changed
6 the flow, how is that going to affect the amount of habitat
7 that's available for Moapa Dace.
8 So starting with the first part, this is the part
9 that developed a model for the number of variables and what
10 variables they were. And there's a lot of text on here and a
11 lot of stuff, and I don't want to get bogged down. I just
12 wanted to cut and paste the direct figures from the exhibit
13 unaltered.
14 But what I wanted to highlight is these are
15 models here on the left, 1 through 13, and they included a
16 bunch of univariant and multivariant models that -- virtually
17 every one that they could and then they used the AIC, which is
18 a model selection approach to choose the variables that best
19 fit the data.
20 And typically with AIC modeling, models that have
21 a delta AIC score of less than two is considered to be good
22 models. So that limits us right here at the first two models.
23 So they ranked them in the table convenient for us. So we're
24 only concerned with these top two models. And within these

Page 294

1 models, the variables that were important were depth,
2 velocity, and the substrate, which is like cobble, sand, rock,
3 so forth. And the other -- and a variable FRD which is that
4 complex stream variable.
5 So given that these were the top models, the
6 authors chose model 2 among them to carry forward the -- these
7 sorts of important variables, depth, velocity and substrate
8 to -- into the model simulation for flow.
9 So specifically what the authors wanted to ask is
10 to address the question, how does habitat change in response
11 to flow. And what they did to answer this question is they
12 simulated 10, 20 and 30 percent increases and decreases of
13 stream flow and they used this software, River 2D, to
14 calculate how the amount of habitat that would be available at
15 those flow rates. And they did this with Apcar, Pederson and
16 Plummer.
17 So here's a slide showing a cut and paste of the
18 data from the Hatten paper and there's two panels, A and B,
19 and I'll sort of walk through what's on these panels and what
20 they mean. So there's three colors on each panel. Those
21 correspond to Plummer, Pederson and Apcar respectively.
22 Starting with the top panel, I'm going to point
23 to the Y axis here. This is the amount of habitat per meter.
24 So you can about this as an assessment of habitat. And then

Page 295

1 across the bottom are the different categories of flow.
2 So in the middle column here, this is start --
3 this is base flow right here. And then to the left would be
4 at 10 percent, at 20 percent, at 30 percent increase or
5 conversely a 10, 20 percent decrease in flow.
6 So as you can see, it's really obvious that
7 there's a really nice pattern in the amount of habitat and
8 then it's going down with decrease in flow. So whether you
9 increase it, it goes up or decrease it, it goes down. And
10 it's particularly clear on the descending limb. So as you get
11 10, 20 or 30 percent, you can see it's a really nice
12 relationship.
13 Similarly, another way that the authors chose to
14 graph this information to explain it a little differently was
15 how habitat would change from what you had originally. And
16 this is the same data, but it's formatted in a way that shows
17 you the change in habitat on the Y. So it's either plus
18 habitat or minus habitat as you go to the different flow.
19 And here, you see that same pattern. But I
20 wanted to highlight that -- so when you reduce the flow at 10,
21 20 or 30 percent, and I'm pointing to those bar graphs, you
22 can see that, in all cases, in all streams that they looked
23 at, at all levels, that every time you reduced the habitat,
24 you see a consequent reduction in the habitat in those

Page 296

1 particular streams. And, in fact, it's really prevalent in
2 Plummer, which is a pretty small one.
3 So the conclusions are that flow and habitat are
4 proportional in this system and that any reduction in flow
5 results in the decrease of the amount of habitat available for
6 Moapa Dace. And given that's -- given it's endangered
7 species, habitat is a premium.
8 So now I want to move on to talk a little bit
9 about what the -- what we have currently in the system right
10 now. This graph here shows abundance on the Y. I'm pointing
11 to that and time across the bottom.
12 And this is Moapa Dace over time and you can see
13 that this is about 2005 and '6. This is when that MOA was
14 established and you can see the number -- you can see the
15 increase in Moapa Dace in this diagram.
16 I didn't particularly identify specific features,
17 but there's been so much habitat recovery going on since we've
18 hit this really low, about 500 animals. This was when we had
19 lots of invasive species. We had lots of Tilapia in the
20 system. There's been, you know, fires, there's been a lot of
21 recovery actions and things that have happened that result --
22 that all play into the amount of Dace that we see.
23 So it's complicated into attribute different
24 features to exact to, you know, one particular recovery action

Page 297

1 or another because they're all kind of happening concurrently.
2 But it's important to note that we have the stable population
3 of about 1500 most recently and we had a low of about 500
4 animals in their recent past.
5 Historically, it's fluctuated a lot from all the
6 way up to in the high 3,000's at some point in time. But the
7 system is dynamic in that stream reaches change and habitat
8 changes, the effects of invasive species changes and so forth.
9 So it's hard to pin down exactly what response is happening at
10 what time.
11 So here is the same data and obviously these
12 numbers are really small. I don't want anyone to read any of
13 them. I just want to point out that we have the number of
14 this stream reach. As I pointed out, there's a number
15 assigned to each part of the stream along the -- on the
16 left-hand side of this table, rather, and I just want to
17 highlight that the bottom section of the table has all the
18 zeros.
19 And those sections of the stream correspond --
20 the zero sections is that the north fork and south fork and
21 the main stem river here, that we don't seem to have a lot of
22 fish in that we used to historically, and that all the fish
23 that we're counting now, basically are on the southern part of
24 the system.

Page 298

1 This is the Warm Springs natural area that's
2 received a lot of recovery actions and, of course, the refuge
3 that's received a lot of recovery actions. I'm pointing to
4 the refuge and the southern portion of the Muddy River Springs
5 area here.
6 So, with that, I want to summarize it up and wrap
7 it up. Basically, we have this really interesting species
8 that's a unique component of the biological diversity of the
9 area given that it's a relic species and it's hot and it's a
10 minnow and it uses cold temperature or slightly -- or hot
11 temperatures, rather, and slightly cooler. And the
12 implications are this fish is moving around and needing both
13 sufficient discharge for deep water, as we noted, but it also
14 needs all these kind of habitat concurrently.
15 And the ability for the fish to move back and
16 forth among them is really paramount here and that's a little
17 bit unique as far as fish go. This is an interesting species
18 that has some challenges for us.
19 So recent estimates have shown Moapa Dace size
20 has fluctuated a lot, but we have some protection in place
21 that we've not hit the triggers. And the triggers at this
22 point now are 32 and 315 respectively, and I think they have
23 been useful in -- and particularly MOA in protecting the Dace.
24 However, with the caveat that, you know, we only

Page 299

1 have about 1500 Dace right now and as the Hatten, et al paper
2 showed that increasing flow, even just 10, 20, 30 percent
3 would result in a consequent increase in habitat, which would
4 be reflected in Dace.
5 So it's important to remember that any decrease
6 in flow is probably going to result in a decrease in habitat
7 and could potentially harm the Dace. That's it. Thanks.
8 HEARING OFFICER FAIRBANK: So we have about
9 another half-hour until we would take a break.
10 MR. MILLER: Okay.
11 HEARING OFFICER FAIRBANK: If you want to keep
12 going.
13 MR. MILLER: What did we say, 30, 40 minutes?
14 MR. MAYER: My presentation is probably 30 --
15 probably 45 minutes maybe, 30 to 45 minutes. So we can start
16 it and there is a place where I could break.
17 HEARING OFFICER FAIRBANK: If that works for you.
18 MR. MAYER: Yeah, sure.
19 HEARING OFFICER FAIRBANK: Let's do that.
20 MR. MAYER: Okay. I'm Tim Mayer again. I was
21 the primary author of our 1303 rebuttal report. That rebuttal
22 report really focused on the Moapa Band of Paiutes Order 1303
23 report, their initial report, and it really focused on the
24 main argument in that report that there is long-term drought

Page 300

1 in this region and that this has affected well levels and
2 spring flows in the Lower White River Flow System and will
3 continue to do so in the future.
4 So I don't mean to unfairly single out the
5 Moapas. They were not the only one that made this argument.
6 There are several other parties that did, too, but they were
7 the main proponents of this argument. So I'm focused on their
8 report.
9 So the first thing I did in my report is I
10 presented this figure, which is Figure 1, and this is the
11 monthly water level record for the carbonate monitoring well
12 EH-4 from 1987 to 2019.
13 This is the well that's just south of the refuge
14 that I showed you in my previous presentation and it's one of
15 the longer records that we have of carbonate monitoring wells
16 in this area.
17 And if we look at this figure just real quickly,
18 it looks like we have about a ten-year period of fairly stable
19 water level records in the beginning of the record there.
20 We have a decline that starts somewhere around
21 1997 or '98, continues to 2005, then we had widely recognized
22 wet year response to what was an extraordinarily wet year in
23 2005. That response continued for a couple years.
24 Then we continued to decline again. The decline

Page 301

1 steepens around 2011, beginning with the -- corresponding with
2 the aquifer test. That continues until about 2013, the
3 aquifer test and then the levels come back up somewhat. They
4 don't come back up to the levels prior to 2010, but they seem
5 fairly stable for the last few years or so.
6 So the main question is: How much of this that
7 we see in this record is attributable to climate and how much
8 is attributable to pumping?
9 So what I did in my report, the first thing I did
10 was I looked at some of the climate data for this area. And I
11 was a little surprised not to see climate data in the Moapas
12 report. But they didn't include any, so I looked at climate
13 Division 3 and Division 4.
14 We heard about climate division data yesterday
15 from CSI that's available from the National Atmospheric and --
16 Oceanic and Atmospheric Administration, NOAA, and it's
17 available all over the country.
18 I'm focused on Division 4, which is extreme
19 southern Nevada. It's just the southern tip of Nevada and
20 overlays the Lower White River Flow System as it's currently
21 defined.
22 And then I also looked at Division 3, which is
23 just north of the Lower White River Flow System in what is
24 believed to be the area of recharge for the flow system. And

Page 302

1 I looked at both precip data and Palmer Drought Severity Index
2 data or PDSI.
3 Now, these are Figures 2 and Figure 4 from the
4 rebuttal report. This is monthly precipitation totals in
5 climate Division 3 on the top plot and Division 4 on the
6 bottom plot. And this is for period 1990 to 2019.
7 And what you see when you look at this, there's
8 the monthly precipitation totals plotted and then there's a
9 moving average, a 12-month moving average, which just helps to
10 identify the pattern of the data.
11 And what you see is quite a bit of variability,
12 especially in the first half of the record. You'll see wet
13 years, you see dry periods, less of that in the second half of
14 the record. And, in fact, you may see a little bit of an
15 increase if you look at the moving averages in monthly
16 precipitation in the second half of the record.
17 What we don't see and what I was specifically
18 looking for is some kind of long-term drying trend or drought
19 here. I see dry periods, but they're sandwiched between wet
20 periods and so forth. I don't see any consistent long-term
21 drying trend in these precipitation data.
22 Next, I looked at drought indices data for the
23 Palmer Drought Severity Index. This is, again, Division 3 on
24 the top plot, Division 4 on the bottom plot. The same period

Page 303

1 of record, 1990 to 2019.

2 I also looked at Palmer Hydrologic Drought Index
3 for Division 4 and that's plotted on the bottom plot there
4 along with the PDSI. There was very little difference so I
5 really didn't do much with that except plot it.

6 But, again, here, what we see if we look -- step
7 back and look at this, first of all, let me explain what the
8 Palmer Drought Severity Index is in terms of units. It's a
9 standardized index. And so what that means is zero, a value
10 of zero on the index represents average conditions. It's
11 neither dry, it's neither wet. And the units of the drought
12 index can be thought of as standard deviations.

13 So if you have a value of one, that means that
14 you are one standard deviation wetter than the average
15 conditions. All right. And a value of negative one, you're
16 one standard deviation drier than average conditions.

17 And so Palmer defined negative 3 or 3 standard
18 deviations drier than average as severe drought, okay? And
19 correspondingly, he defined positive 3 or a 3 standard
20 deviations wetter than average as severe wet conditions. So
21 that gives you some idea of the relative value of what you're
22 looking at here in these plots.

23 So we see -- we go from severe drought to severe
24 wet, back to severe drought, severe wet. Bounce around a lot,

Page 304

1 more so in the first half of the record, but then the second
2 half of the record. But, again, we don't see any kind of
3 long-term drying trend or drought in these data.

4 And even in the second half of the record, which
5 looks a little bit drier, you still have some wet periods in
6 there, some average or wet periods, especially one around
7 the -- in the aquifer test, the time of the aquifer test.

8 And then I will note that both divisions showed
9 that it's become severely wet in the last year or so. So
10 things have gotten wet. We don't see that kind of similar
11 recovery or that similar trend in the water level data or the
12 spring flow data.

13 So next, I looked at well hydrographs for basins
14 that were close to or adjacent to the Lower White River Flow
15 System, but basins where there's little or no pumping. This
16 includes Dry Lake Valley and Delamar Valley.

17 Delamar Valley is tributary to Coyote Spring
18 Valley and the Lower White River Flow System and Dry Lake
19 Valley is just north of Delamar Valley and tributary to
20 Delamar Valley. And then I also looked at Tule Desert, and
21 this basin is just east of the Lower Meadow Valley Wash and
22 the Kane Springs area.

23 So presumably all these basins are responding to
24 the same climate signal as what's happening in the Lower White

Page 305

1 River Flow System. There's no reason to believe that there's
2 different climate down in the Lower White River Flow System
3 from these basins. And these basins have little or no
4 pumping, as I say, so the well hydrographs in these basins
5 should represent the climate response.

6 So this is the -- this is four monitoring wells
7 monitored by SNWA and Dry Lake Valley for the period 2008 or
8 2010 to 2019. And if you look at these levels, the top plot,
9 let's see, on the left there, is stable.

10 The top right plot shows a slight decline and
11 then the bottom two plots here show slight increases. So
12 certainly no consistent decline in these water levels in this
13 basin.

14 Next, I dropped down to Delamar basin, which is,
15 as I said, adjacent to Coyote Spring Valley, just north of it.
16 And here we see two water levels, the top left plot and the
17 bottom plot are stable, and then the top right plot shows a
18 decline, but that really doesn't start until about 2015 or so.
19 So it doesn't look like a strong drought signal in these water
20 levels either.

21 Next, I looked at 13 monitoring wells in Tule
22 Desert. Now, in the report, I only graphed these four, but I
23 did discuss all 13 and I included them as exhibits, which I'll
24 get to when I get to the next slide. But these four were

Page 306

1 graphed in the report and you can see here that three of the
2 wells show increases in water levels and one is stable.

3 And there's some funny things that happen in the
4 first part of the record in all these wells, I think maybe
5 there was adjustment in the elevations or measuring points or
6 something. But if you look beyond that, basically three of
7 the four wells are increasing over this period from 2007 to
8 2019.

9 Next, this is six more of the 13 wells in Tule
10 Desert for the same period and all six of these wells show
11 increases in water levels. And then finally these are the --
12 and I'm sorry, if I back up there, if you're looking for these
13 graphs, these are exhibits down here in the lower left-hand
14 corner.

15 These were not in the report, these six
16 monitoring wells and neither were these last three on the left
17 part of the slide. And those are exhibits, again, listed down
18 in the lower left-hand corner presentation. But, again, these
19 are three -- the last three of the 13 monitoring wells that I
20 looked at, and you see increases in water levels in all these
21 wells in addition. So certainly no drought signal in this
22 basin either.

23 And then finally I looked at -- in the report,
24 Figure 9, looked at the water levels in CSVN-5, which is the

Page 307

1 well we were discussing yesterday with Coyote Spring
2 investment. They had a graph of this too and showed same
3 figure, same period of record from 2003 to 2019. Basically
4 that well has increased over time and may be stabilized in the
5 last few years there. So no drought signal in that well
6 either. And that's in a part of Coyote Spring basin that is
7 believed to be unaffected by pumping, so that should be
8 reflecting climate as well.

9 So my point with this is that there's no evidence
10 that long-term drought or drying in the region exists or has
11 affected water levels in this area. So I want to go back to
12 the slide that I just showed you before, the hydrograph for
13 CSVM-5, and I want to focus on this right here.

14 This is the wet year response to what I said was
15 an extraordinarily wet year in 2005. We see that CSVM-5, we
16 see that in almost all the carbonate monitoring wells in the
17 Lower White River Flow System and even outside of the -- that
18 system, we see it in other wells.

19 We certainly see it in EH-4 and this is a graph
20 that was presented in our DOI 1169 report in 2013. This shows
21 EH-4 water levels in red here and then the water year
22 precipitation in Division 4. And I'm just singling this out
23 to look at the wet year and dry year response in this figure
24 here, which I discussed in the report.

Page 308

1 So if we look at the wet years, particularly
2 2005, in 1992 and '93, we had back-to-back wet years in '92
3 and '93 and we see a little bit of a response there in the
4 water levels. In 2005, a really wet year, the wettest one on
5 record, and we see a really big response in water levels in
6 EH-4.

7 So what you don't see is any kind of
8 corresponding response to dry years. Let me back up here. I
9 also looked at '95, you may see a little bump up there, and
10 '98, they were fairly wet years, not quite as wet, and they
11 weren't back-to-back wet years. But you may see some increase
12 there, too. The '98 response may be obscured because of the
13 climate trend started that year.

14 So what you don't see is the corresponding
15 response to dry years in this record. So if you look back at
16 1989, that was a really dry year, look at the water levels
17 there, really no change in the pattern before or after that or
18 during that dry year. You look at '96, that was even drier,
19 again, really no change in response to that dry year.

20 And then 2002, which is exceptionally dry. We
21 had declining water levels through that whole 1998 to 2004
22 period, but we don't see any change in the slope of the
23 decline related to that dry year in 2002. But we seem to have
24 a response to wet years, but not to dry years.

Page 309

1 One other thing I want to point out about this
2 record, just kind of a side note is that, you know, why are we
3 looking at climate and water levels? I would have looked at
4 this first ten years of record here because that's a period
5 where we had very little carbonate pumping, and yet we had a
6 lot of variability of water, increased precipitation there.

7 And so if you wanted to try to illustrate the
8 relationship between water levels and precipitation, that's a
9 great record, a great opportunity to do it, and I'm -- I say
10 I'm a little disappointed that no one did that.

11 So getting back to my previous point, we saw a
12 response to the wet years. We didn't see a response in dry
13 years. So should a water level response to extremely wet
14 years imply a proportionate response or sensitivity to
15 extremely dry years. And I would say, and we discussed this
16 in our paper in 2008, listed as an exhibit there in the lower
17 left-hand corner, that the answer to that is no.

18 The relationship between precipitation and
19 recharge is nonlinear, especially in arid systems, which means
20 that the system is much more sensitive to wet years than to
21 dry years. And the reason for that is that a much greater
22 fraction of precipitation becomes recharge in wet years
23 compared to dry years.

24 So if you think about rain or snow hitting the

Page 310

1 ground and what happens to that precipitation once it hits the
2 ground. Well, it can be consumed by evapotranspiration in
3 plants and evaporation from the soil. It can go to meet soil
4 moisture demand or it can go to recharge the aquifer. But it
5 usually meets those first two components first. It meets
6 evapotranspiration and it meets soil moisture and it satisfies
7 those requirements first before it gets down to the aquifer.

8 So in a dry year, after it satisfies those first
9 two requirements, there's just not much water left over to
10 recharge the aquifer. But in a wet year, the capacity of
11 plants to transpire and evaporate water and the soil to take
12 up moisture, that's limited. There's only so much they can do
13 with that.

14 So there's a much greater fraction of the
15 precipitation that's available to get down to recharge the
16 aquifer in a wet year. And so that's why aquifers are so much
17 sensitive -- more sensitive to wet years than dry years. So
18 that's the physical explanation and we see that in the data,
19 too. So I think that this is a pretty good place to stop if
20 you want.

21 HEARING OFFICER FAIRBANK: That sounds like a
22 good plan. Let's go ahead and take a ten-minute break.
23 (Recess.)
24 HEARING OFFICER FAIRBANK: All right. Let's go

Page 311

1 ahead and go back on the record, and you can continue on with
2 your presentation.

3 MR. MAYER: Okay. Tim Mayer again and I'm
4 finishing up the discussion of the rebuttal report.

5 So I'm going to switch gears here and I'm going
6 to start to look at a critical review -- more of a critical
7 review of the report that I reviewed of the Moapa's 1303
8 report.

9 But let me say again that I'm not singling them
10 out, because a lot of the points that I'm raising with their
11 report, I see in other reports that have been entered into the
12 record here, too. So these are general points, just kind of
13 using Moapa as an example.

14 This is Figure 3 from Appendix 2 in the Moapas
15 1303 report. And this figure represents the annual EH-4 water
16 levels as derived by the authors from the annual base flow of
17 the north fork, Virgin River, Utah. And in their own words,
18 they're using the base flow of the north fork Virgin River as
19 a climate proxy, okay? So something to represent climate.

20 And what they have here, they have water levels
21 on the X axis, time on the Y -- or the X axis, I'm sorry,
22 water levels on the Y axis. And then they have in blue, the
23 water level record from the Gage 4 and those are water level
24 elevations and then they have an orange kind of on top of

Page 312

1 that.

2 The training, what they call the training test
3 data set, and I interpret that to mean that they derived that
4 training set from the base flows of the north fork of the
5 Virgin River. And then they -- if I'm interpreting the graph
6 right, they hind cast the water level record back through time
7 using the base flow of the north fork of the Virgin River.

8 So I want to make a couple points about this
9 figure. First of all, I question why you would use a climate
10 proxy, especially one in a different state when you have
11 climate data as we've seen readily available, locally and
12 regionally. So I question the need for a climate proxy.

13 The second point I'd like to make on this figure
14 is -- and this is common to so many of the reports that we've
15 seen. This is a time series plot. That means that time is on
16 the X axis, and in this case, they're plotting these two
17 variables parallel in time and trying to establish a
18 relationship between those two variables.

19 The time series plot is not the best graph to
20 establish a relationship between two variables. If you want
21 to demonstrate a relationship, the best way to do it is to
22 plot one variable versus the other in an X/Y plot. I think
23 the technical people will know what I mean here.

24 So, for instance, when I showed you Pederson

Page 313

1 discharge in the Gage 4 water levels, I didn't plot the two in
2 time to show that they varied together and all that stuff. I
3 plotted one against the other, Y versus X and that's an X/Y
4 plot. And that's the most effective way to evaluate the
5 quality of a relationship.

6 So I would like to encourage everybody, if you're
7 trying to demonstrate a relationship, started using X/Y plots.
8 Do not use time series plots to demonstrate relationships. We
9 looked at a lot of time series plots yesterday in the
10 presentation from CSI. And they were trying to demonstrate a
11 relationship between -- I think it was cumulative departure of
12 the mean and the water levels and stuff. Over time, again,
13 it's just easier to see that if you plot water level versus
14 cumulative departure from the mean. So in an X/Y plot. So
15 that's a second point I wanted to make about this.

16 And the third point I would make about this
17 figure, and this is specific to this figure and this report,
18 is that there wasn't a lot of information on how they derived
19 this, I didn't feel. There wasn't enough information and I
20 plotted in the slide, my Figure 1, which is the EH-4 water
21 levels and then I derived monthly base flow for the north fork
22 of the Virgin River from 1970 to 2020. And I lined the X axis
23 up so the times would be -- you know, would correspond.

24 I look at these graphs -- I didn't look at this

Page 314

1 that closely, but I look at the graphs and I just question how
2 you got the relationship we see there in EH-4 graph from the
3 bottom plot. I don't see any similar kind of decline at any
4 point in time like that.

5 So the points I want to make about this are,
6 first of all, I would avoid the use of climate proxies when
7 climate data are readily available. The problem with the
8 climate proxy is there are questions about, was the site
9 affected by the divergence, was it affected by adjacent
10 groundwater pumping, has there been changes in the measurement
11 location or method or something that would flow -- affect the
12 flow record.

13 Again, we have climate data available and climate
14 proxies were used -- you know, there were several kind of
15 climate proxies that were used in this report, so I would have
16 avoided those.

17 The second point is the point I made earlier
18 about time series plots. I think we should avoid the use of
19 time series plots when we're trying to illustrate the
20 relationship between two variables and we should stick with
21 X/Y plots.

22 So then I want to address some statistical
23 questions and problems in the Moapa's report, and again, I'll
24 emphasize that these were not unique to the Moapa's report. I

Page 315

1 see these same issues and some of these same problems in other
2 people's statistics.
3 The first issue is model and variable selection
4 and there was very little information in this report on how
5 variables were selected in -- for regression analysis. And so
6 they had a regression -- they had a number of regression
7 analyses and those had multiple variables, as many as 27 in
8 one case that I recall.
9 And so model and variable selection, how you
10 choose the variables in your model that explain your -- the
11 variable that you're trying to explain is very important.
12 It's a very important issue.
13 Now, it's so important there are automated tools
14 to help you do this objectively. There's the AIC, that's the
15 Akaike information criteria. That's one tool to diagnose
16 model selection. There's also step-wise procedures you can
17 use that add variables, that take variables out and do that
18 iteratively until you arrive at the optimum model.
19 What you want to do is you don't want to under
20 fit the data, you don't want to over fit the data. You want
21 the most parsimonious model, that is the model with the fewest
22 variables that can describe the data because everything -- if
23 you start adding a lot of variables, then you get into a lot
24 of other issues, some of which I'm going to talk about here.

Page 316

1 You start over fitting the data in the model.
2 So the next issue I saw in this report, and I've
3 seen this in other reports to be fair, is the statistical
4 significance of regression coefficients or I should say the
5 non-significance. That was the issue.
6 So when you do a regression, you're trying to
7 establish a relationship between explanatory variable, say,
8 pumping or climate and a dependent variable, say water level,
9 and that relationship is quantified through a coefficient in
10 the regression. All right.
11 So the larger the coefficient in absolute terms,
12 it can be negative or positive, but the larger the
13 coefficient, the more impact that explanatory variable has on
14 the dependent variable.
15 And every coefficient in the regression -- for
16 every explanatory variable, you have a coefficient and every
17 coefficient has a P value associated with it. And that P
18 value is the probability of getting the value of the
19 coefficient that you've got in regression when the true value
20 is actually zero.
21 Okay. So the null hypothesis of regression
22 analysis is that the regression coefficient is zero. That
23 means there's no relationship between explanatory and the
24 independent variable. And what you're doing with this

Page 317

1 hypothesis testing, this P value is you're testing that.
2 You want to be able to reject the null hypothesis
3 and the way you do that is with a really low P value. And
4 traditionally we said that P values less than .05 are
5 statistically significant, that indicates statistical
6 significance. All right.
7 And so many of the regression coefficients that I
8 saw in this report and in other reports had P values that were
9 not even close to .05. They were much higher. I should say
10 P values go from a value of zero to one. So .05 is on the
11 lower end of the P value.
12 So this is just one example. This is output from
13 table that was in the report in the Appendix 2. This is EH-4
14 water levels versus 16 years of north fork Virgin River base
15 flows. So the regression is trying to establish a
16 relationship between the EH-4 water levels looking at the
17 current year base flow and the previous 15 years of base flow
18 in the north fork of the Virgin River.
19 And the first column here on the left indicate
20 that in this table, those are the 16 variables. LV-1 through
21 LV-16. The second column on the left is the value of the
22 regression coefficient itself. Okay. And we're testing that,
23 that's the value that we're testing.
24 We're saying, is that really truly different from

Page 318

1 zero. And this P value here on the furthest column on the
2 right, that is telling us what the P value is, how likely is
3 it that that value is truly different from zero.
4 And if we look at the ones I've highlighted
5 there, I've highlighted 12 of the 16 variables and none of
6 those are less than .05, which would indicate that they're
7 statistically significant and statistically different from
8 zero.
9 So -- and the R software here, the asterisks that
10 are behind some of the ones that are statistically
11 significant, the -- our software actually indicates which ones
12 are statistically significant for the user.
13 So this is a problem. I think 12 of these
14 variables probably should not have been included in the
15 regression. So this is more output. This is from a
16 regression of EH-4 water levels versus 13 weeks of Arrow
17 Canyon well pumping.
18 So trying to relate the weekly water level, I
19 think it's the weekly water level, and the EH-4 with the
20 current pumping for the week at Arrow Canyon well and the
21 12 weeks prior.
22 And, again, you have like zero through like 12,
23 on the left-hand column, those -- that represents the 12 weeks
24 of pumping -- or 13 weeks of pumping, sorry. And then they

Page 319

1 have the regression coefficients, the values here in the
2 second from the left column.
3 And then you have the P values in the middle
4 there, and I've highlighted those. And you can see that 12 of
5 the 13 are not statistically significant, so again, they
6 should probably not have been included in this regression. It
7 looks to be over fitted.
8 So this was not an issue I saw addressed in this
9 report and I didn't see it addressed in other people's reports
10 either.
11 So another issue that I raised -- that raised
12 questions with me is the issue of multicollinearity and what
13 that is, is that's the correlation of explanatory variables
14 with each other.
15 So in a regression analysis, the assumption is
16 that every explanatory variable in that regression is
17 independent of others. And when you -- when they're not, when
18 they're correlated, then you have multicollinearity and you
19 have problems, you have regression coefficients that are
20 unrealistically large. They can be unstable. So if you make
21 a change in the data, they vary wildly in values.
22 They -- the statistical significance can be
23 inflated, so you -- it looks like they're statistically
24 significant, but they're not. And then also, finally, the

Page 320

1 sign of the regression coefficient cannot make physical sense.
2 So what I mean by that is the positive and the
3 negative sign. So if you have a regression between a
4 precipitation and water levels, you expect that when
5 precipitation goes up, water levels are going to go up, right?
6 So that's -- that would be a positive coefficient. That sign
7 would be positive.
8 If you get a negative for some -- you know, you
9 have a lot of correlating explanatory variables, you're likely
10 to get a negative sign on that coefficient for precipitation
11 just because it's trying to balance something else that's
12 already accounting for the variability.
13 So when you have a bunch of variables that are
14 correlated, that's a problem. And I think that this was a
15 problem in the authors's report because they made a comment on
16 page 44 in their report, they were discussing their two
17 climate model, and they said, "the significance of over half,
18 17 of the 27 regression coefficients being negative in the
19 combined models and not understood."
20 So I'm assuming that they probably expected
21 positive coefficients, and in this case, they were looking at
22 base flows and water levels. So you expect as base flow goes
23 up, water levels should go up. They should be all positive.
24 The fact that they were negative probably

Page 321

1 indicates problems with multicollinearity in this regression.
2 And again, they probably had more variables than they should
3 have in this regression.
4 So the final issue that I questioned in the
5 report was autocorrelation. So this is a little different
6 from multicollinearity in that this is correlation of the
7 dependent variable, the variable you're trying to explain.
8 The dependent variable with itself.
9 So sometimes we -- say, for instance, we're
10 looking at water levels in EH-4 on a weekly basis. Chances
11 are that the water level from the previous week probably
12 explains some of the water level that we see in the current
13 week, right?
14 There's some information in that previous
15 measurement that would explain a lot of the information in the
16 current measurement. So they're correlated. This is called
17 autocorrelation. And the problem with this is you have N
18 observation -- N number of observations, but you don't have N
19 number of independent observations. They're not all
20 independent.
21 So what this does is it inflates the statistical
22 significance too, and accept that these statistical
23 significance that you see is probably worse than what it
24 appears.

Page 322

1 There are ways to account for autocorrelation,
2 there are ways to diagnose multicollinearity and account for
3 that, too. So I would have liked to have seen a discussion of
4 these issues in the report, and in all reports that there are
5 any kind of regression analysis.
6 I'd like to see them address these issues and
7 explain better in model and variable selection and address the
8 significance of regression of coefficients and considerable to
9 collinearity and autocorrelation and that kind of thing.
10 So I think that that is, yeah, the end of the
11 slide. So I'm going to go back and I'm going to conclude the
12 whole rebuttal report, okay, kind of wrap up here.
13 So I believe that there's no credible evidence
14 that drought exists or has affected water levels in the Lower
15 White River Flow System. The only water level response to
16 climate that I observed in the wells in the Lower White River
17 Flow System is response to extremely wet years. I didn't see
18 a response to dry years.
19 So even if there is a drought, the question is:
20 Does it really affect anything as far as water levels go? And
21 then the analysis presented in the Moapa's 13303 report
22 requires more information on methods and results. The authors
23 either neglected or were not aware of many of the assumptions
24 and proper procedures of a regression model. And that's it.

Page 323

1 MR. MILLER: So that should conclude the Fish and
2 Wildlife Services direct summarization presentation testimony.
3 And if it is still allowable, I think we're ahead of schedule
4 in the sense of our allotted time. I would still like to
5 reserve maybe 30 minutes for redirect.
6 HEARING OFFICER FAIRBANK: Certainly. You have
7 about 50 minutes left, so you can reserve that time for
8 redirect and you can use as much or little as you like.
9 So we'll go ahead and get prepared for
10 cross-examination. And cross-examination, we had a couple of
11 parties that stated that they were not going to be
12 participating in cross-examination today.
13 So I've adjusted the amount of time allotted to
14 the various participants who have indicated or have not
15 indicated that they would not be participating in
16 cross-examination.
17 So based upon that, the parties will be allowed
18 16 minutes and then similarly, as yesterday, if there's
19 additional time remaining after the State Engineer staff has
20 an opportunity to ask questions, then we'll reopen that time
21 frame up again on a limited basis to participants to follow up
22 with additional questions that they may not have sufficient
23 time within that first allotment of time or such.
24 So we'll go ahead and start the timer with

Page 324

1 16 minutes and we'll begin with Coyote Spring Investments.
2 CROSS-EXAMINATION
3 MR. HERREMA: Good morning. My name is Brad
4 Herrema and I represent Coyote Spring Investment in this
5 proceeding and I have just a handful of questions for you.
6 I'd like to start with Ms. Braumiller. You
7 conducted a SeriesSEE analysis, did you not?
8 ANSWERS BY MS. BRAUMILLER:
9 A. Actually, I did not conduct the SeriesSEE
10 analysis that's in our DOI 2013 report. Keith Halford, who is
11 the author of SeriesSEE, conducted that analysis in 2013. It
12 was a pretty new code at the time.
13 It had only been published in 2012, and frankly,
14 I think Keith was the only one that was proficient in it
15 enough at that time to analyze all the data. We were working
16 on a pretty tight timetable.
17 So he graciously volunteered to the other DOI
18 agencies to perform that himself. He did it at my desk and
19 tutored me in SeriesSEE and we walked through it together for
20 about 11 hours. But he actually performed the SeriesSEE
21 analysis.
22 Q. So you're familiar with the SeriesSEE analysis?
23 A. I am. I'm very familiar with it. But I wanted
24 to be clear that I did not perform it in 2013.

Page 325

1 Q. And have you relied on that SeriesSEE analysis
2 for your conclusions in your current report?
3 A. Some of them. Okay. I think it clearly
4 established this area of exceptionally high field scale
5 transmissivity in the carbonate aquifer underlying those
6 five-plus basins. So I -- it's a -- it is a very important
7 conclusion.
8 Q. Okay.
9 A. One of many.
10 Q. Did that SeriesSEE analysis account for
11 groundwater recharge?
12 A. No, it did not.
13 Q. Are faults or boundaries accounted for in that
14 SeriesSEE analysis?
15 A. No. No, Keith did not. I'm not even sure it's
16 possible. We -- a few of us have discussed this. It might be
17 possible to use image wells in the SeriesSEE Curve-fitting
18 analysis to account for no-flow boundaries, but he did not
19 choose to do that and it's not clear to me at this time as
20 even possible using SeriesSEE.
21 So -- but the reason he did not choose to do
22 that, if this is helpful, is the purpose was to -- you know,
23 there was a lot of pumping going on within the study area for
24 water supply, right, at the time of the study. And it was

Page 326

1 pumping at MX-5. That was the test pumping. That was really
2 the test.
3 So the purpose of that SeriesSEE analysis was to
4 try to isolate the MX-5 induced drawdown from all that
5 drawdown induced by all the other ongoing water supply
6 pumping, and just look at how aerially extensive the drawdown
7 create by the MX-5 test pumping was or was not. The
8 surprising part was that it was incredibly uniform over a very
9 large area. That was unexpected.
10 Q. Did the analysis account for varying levels, I
11 guess, of transmissivity and storability?
12 A. No, that's not how SeriesSEE works. Okay.
13 There's no question that this fractured rock aquifer is
14 heterogenous, no question about that. Okay. So SeriesSEE is
15 a Curve-fitting tool, a Curve-fitting tool, right?
16 So, you know, I mean, in the simplest terms, the
17 assumption is, is that there's a collection of pumping and
18 non-pumping stresses and non-pumping stresses and
19 environmental stresses that influence water levels in a well.
20 And they're each approximated by analytical
21 expression and those analytical expressions, every one of them
22 has a coefficient and they are jointly optimized. In the end,
23 you have a collection of analytical approximations that
24 represent the effect of each of those either pumping or

Page 327

1 non-pumping stresses on the water levels that you observed in
2 the well, right?
3 So what did you just ask me? I'm so sorry.
4 Q. I'll move on to the next question.
5 A. Yeah, that's fine. Sorry.
6 Q. Following the 2013 SeriesSEE analysis, did you
7 check your results with available post-test data in
8 preparation for -- of the July report that you prepared?
9 A. Yeah, did I cross check? I'm sorry. That
10 doesn't quite make sense to me.
11 Q. Did you use any post-test data to check your --
12 the results of that SeriesSEE analysis in preparation of the
13 July report?
14 A. No, that wouldn't have been relevant. The
15 purpose of the SeriesSEE analysis was to look at how extensive
16 the drawdown was created by the MX-5 test pumping. And the --
17 and it proved to be very extensive and it proved to be
18 remarkably uniform.
19 The implication being that that chunk of the
20 carbonate aquifer possesses exceptional high field skill
21 transmissivity. So there wasn't anything in particular that I
22 needed to clarify about that result.
23 Q. Okay.
24 A. Right. So, no, I didn't.

Page 328

1 Q. Yeah. Could the same unprocessed data produce a
2 different result in that SeriesSEE analysis?
3 A. Would a different set? I wouldn't expect it --
4 Q. No. Was it the same unprocessed data?
5 A. The same -- oh, the original input data to the
6 SeriesSEE analysis?
7 Q. Yeah.
8 A. What, if someone repeated it or if there was a
9 whole new data set -- I'm sorry, from the big pumping test
10 which -- I'm sorry --
11 Q. No, the same unprocessed data, perhaps if the
12 amounts were adjusted a little bit, would that produce a
13 different result?
14 A. Well, it's a Curve-fitting tool and so the
15 results of the Curve-fitting are a collection of -- it is
16 certainly an approximation and an estimate, but the trend in
17 the results were so clear that, yeah, if you repeated
18 Curve-fitting to the original Order 1169 pumping test data,
19 you -- I absolutely believe that you would come up with the
20 same result.
21 Would you get the exact same estimates of the
22 MX-5 drawdown at every single well? It would probably be
23 somewhat different because it's a Curve-fitting process,
24 right?

Page 329

1 But you would -- I have no doubt that the results
2 were so remarkable, the drawdown was so expansive and it was
3 so surprisingly uniform, you know, that I have no doubt you
4 would show that same thing there.
5 Q. Thank you. Could I change gears to talk about
6 the boundary of the Lower White River Flow System?
7 A. Sure.
8 Q. In your conclusions, you identified a number of
9 tasks that you would do to confirm your conclusion about the
10 best boundary for the Lower White River Flow System?
11 A. Um-hum.
12 Q. Is that correct?
13 A. Yeah, with respect to considering Kane Springs
14 Valley for inclusion in the system.
15 Q. And so pump tests as well?
16 A. And Lower Meadow Valley Wash both, right.
17 Q. Okay. And you also discussed the possible
18 construction of I think what you refer to as an empirical
19 model that, in my words, might -- you might be able to back
20 out the total of pumping that could sustainability occur.
21 Do you recall that as well?
22 A. Yeah, absolutely. Right.
23 Q. Okay. One of the caveats that you had on the
24 9,318-acre-feet per year number in your presentation was that

Page 330

1 that assumed that flows in the Muddy River during that period
2 were sufficient to meet senior water rights.
3 Do you recall that?
4 A. Yes, and --
5 Q. Do you have -- I'm sorry.
6 A. No, go ahead.
7 Q. Do you have an opinion as to what quantity of
8 water is necessary to satisfy those?
9 A. I -- this is a demand on the State Engineer's
10 office and I do remember a table that was assembled and
11 distributed in one of our Lower White River Flow System
12 working group meetings.
13 You know, I wouldn't pretend to have a handle on
14 what the total senior decreed water rights are on a river or
15 how they're distributed on a river. So I didn't attempt to
16 evaluate that. I said, assuming that what happened in 2015 to
17 '17 was enough water, I think that total pumping during that
18 period is the right starting place.
19 Q. Okay.
20 A. Yeah.
21 Q. Are you familiar with the MOA?
22 A. MOA.
23 Q. 2006 MOA that was discussed?
24 A. Um-hum, yes.

Page 331

1 Q. Would the trigger levels that are in that MOA,
2 would that be something that might be a mechanism that could
3 satisfy the Fish and Wildlife Services concerns about the
4 spring flows?
5 A. Yeah. So I cannot speak for the whole agency,
6 okay? But from my perspective as a groundwater hydrologist, I
7 would tell you this: They provide a level of protection that
8 we've never had before and we have now and I think that's
9 great.
10 But at the time that the MOA trigger levels were
11 developed, we didn't know as much about how the system works
12 as we do now. So I think it is important and obviously it
13 exists and it's going to continue to exist, and that's very
14 important. But it's not sufficient in and of itself in my
15 opinion.
16 Q. I'd like to move to Mr. Mayer if that's okay.
17 Mr. Mayer, I'm going to ask you the same question
18 I asked Ms. Braumiller. Do you have an opinion on what
19 quantity of water is necessary to satisfy the Muddy River
20 rights?
21 ANSWERS BY MR. MAYER:
22 A. No, I don't have an opinion on that.
23 Q. And your second conclusion on your conclusions
24 five was that the trigger levels in the -- for Warm Springs

Page 332

1 West flows established in the 2006 MOA are still valid and
2 important for protecting the Pederson Unit Springs; is that
3 correct?
4 A. Yes.
5 Q. All right. I'd like to shift gears to a couple
6 questions on your rebuttal of the Moapa Band of Paiute Tribe
7 report?
8 A. Okay.
9 Q. The data that you showed in your rebuttal
10 presentation regarding precipitation records you reviewed,
11 what was the period of that record; do you recall?
12 A. Well, I showed you two periods. I showed you
13 1990 to 2019 and then I also showed, on a later graph, I had
14 data from 1987 to 2013.
15 Q. Did you consider precipitation data at the NOAA
16 division for -- or NOAA division for precipitation data from
17 1895 to 1990 when assessing whether or not there are bad
18 droughts or current drought condition?
19 A. Yes, I looked at the -- I downloaded all those
20 data.
21 Q. And did those have any effect on your -- or
22 impact your analysis?
23 A. No.
24 Q. And why is that?

Page 333

1 A. Because there was no effect.
2 Q. Okay. Did you review the location of faults,
3 recharge areas or discharge areas when assessing the
4 hydrographs that you looked at?
5 A. No, I didn't.
6 Q. Would you expect that faults or recharge areas,
7 other structural barriers might affect the hydrographs?
8 A. I would admit that they would probably affect
9 some of them. I wouldn't expect them to affect all of them,
10 though.
11 Q. Okay. Did you review any of the well driller
12 logs for the wells that you looked at in terms of total depth
13 or perforation zone?
14 A. No, I reviewed the aquifers that they were in,
15 but that's it.
16 Q. Do you think that depth of the well perforation
17 zones, those type of things you would see in a driller's log,
18 that they might affect the groundwater level response?
19 A. Yes.
20 Q. Is it Dr. Schwemm?
21 ANSWERS BY DR. SCHWEMM:
22 A. Yes.
23 Q. Okay. Dr. Schwemm, a couple questions for you on
24 the Dace. What is the greatest threat to the Dace immediately

Page 334

1 downstream of Pederson Springs?
2 A. Immediately downstream? Well, it's a mix of
3 immediately downstream of Pederson Springs. Most of the
4 habitat that I believe this is from EH-5 on the diagram, and
5 if you want, we can pull it up.
6 But I think that area that has undergone
7 extensive -- at least at the transition point from the refuge
8 to the Warm Springs natural area, that's undergone a lot of
9 habitat restoration at this point and doesn't have the level
10 of non-natives.
11 So in that particular stretch flow, I think, is
12 probably the most important, maintaining flow. And -- but it
13 depends -- it shifts because their shifting relative
14 contribution of invasive species and flow and the quality of
15 the habitat.
16 Q. What about barriers to the passage?
17 A. Oh, yes, there is a barrier below, right at the
18 refuge boundary to the Warm Springs area. There's a
19 relevant -- the old -- the Gage that's installed there is
20 relatively old and it has a drop associated. We think it made
21 it difficult for Dace to get up and down there very easily.
22 And we target that as something on the near
23 horizon, to sort of increase the level below the Gage or
24 change the Gage to a newer model, that there wouldn't be an --

Page 335

1 as great of a small waterfall sort of barrier there.
2 Q. What is keeping that work from going forward?
3 A. It's just been an ongoing project because the
4 Gage -- there's -- because the Gage is used for the MOA,
5 there's just been a lot of discussions and meetings that have
6 to take place and have taken place over what it takes to get a
7 new Gage that would read accurately.
8 And in this case, our goal for moving forward is
9 to place another Gage on there and make sure that they read
10 the same. And then after that, we could remove the old Gage
11 and leave the new Gage in there that would be a more modern
12 style that would hopefully have less of an impact to
13 migration.
14 Q. And do you have a time frame for when that might
15 be done?
16 A. Not really. We're hoping the next couple of
17 years. So I guess I do have a time frame, but exactly when
18 that happens and getting the funding in place and getting all
19 the asterisks to line up.
20 Q. Are there other barriers to fish passage in the
21 vicinity of the Warm Springs Gage?
22 A. Yeah, there's a number of -- or one that we
23 just -- were just addressing in the last few weeks to months,
24 and that was one on the -- what we call the refuge stream,

Page 336

1 which is down -- a little bit downstream of the Plummer and
2 Pederson, where they come together.
3 But it's a -- so, yes, we have one barrier that
4 we fixed and as -- because it's a dynamic system with flows
5 changing and, you know, erosion happens.
6 So we end up with having parts of habitat that we
7 don't think are the very best for Dace. So we target those
8 areas first as they appear and work our way to improving all
9 the habitat in the system.
10 MR. HERREMA: Thank you.
11 HEARING OFFICER FAIRBANK: Next will be National
12 Park Service.
13 CROSS-EXAMINATION
14 MS. GLASGOW: Good morning. Hi, I'm Karen
15 Glasgow with the Department of Interior Office the Solicitor
16 and I represent the National Park Service.
17 Good morning. I have one question for you,
18 Mr. Mayer. You talked about looking at the levels of EH-4.
19 ANSWERS BY MR. MAYER:
20 A. (Nodded head.)
21 Q. What caused the reduction in EH-4 water levels in
22 approximately 1998, I think it was? Was it pumping or was it
23 climate in your opinion?
24 A. I think it was pumping. You see, on this graph

Page 337

1 here, there was a period of stable water levels until about
2 1998 and then there was a decline. That decline coincides
3 with an increase in Arrow Canyon pumping, approximately a
4 four-fold increase, I think we said in our 1169 report. So
5 that's -- I believe that to be pumping related.
6 MS. GLASGOW: Thank you. No further questions.
7 HEARING OFFICER FAIRBANK: Next is the Moapa Band
8 of Paiute Indians.
9 MS. BALDWIN: Thanks. Beth Baldwin for the Moapa
10 Band, along with Debbie Leonard, local counsel.
11 CROSS-EXAMINATION
12 BY MS. BALDWIN:
13 Q. And these questions are for the whole panel
14 mostly. Are your opinions the official position of the Fish
15 and Wildlife Service?
16 ANSWERS BY MS. BRAUMILLER:
17 A. Well, I think that has to be the case, right? We
18 did submit our report from the U.S. Fish and Wildlife Service,
19 so yeah, um-hum.
20 Q. Is that true for all of you?
21 MR. MAYER: Yes.
22 DR. SCHWEMM: Yes.
23 BY MS. BALDWIN:
24 Q. Did you discuss the opinions expressed in your

Page 338

1 reports with anyone else at the Service before submitting your
2 reports?
3 ANSWERS BY MS. BRAUMILLER:
4 A. I did not.
5 DR. SCHWEMM: Not officially.
6 MR. MAYER: Did we discuss -- is the question,
7 did we discuss opinions?
8 BY MS. BALDWIN:
9 Q. (Nodded head.)
10 A. Yes, with other Fish and Wildlife Service staff,
11 I did.
12 Q. Did anyone from any other agencies like
13 Reclamation or BLM provide technical review or comments on
14 your reports?
15 ANSWERS BY MS. BRAUMILLER:
16 A. The National Park Service did provide some
17 comments on my sections of the report, but I did not utilize
18 them.
19 Q. Are you familiar with Fish and Wildlife Service
20 policies on information quality and peer review?
21 A. Not in detail, no.
22 Q. And I saw nods from --
23 MR. MAYER: Yes.
24 DR. SCHWEMM: Yes.

Page 339

1 BY MS. BALDWIN:
2 Q. Did you adhere to those policies with regards to
3 your reports?
4 DR. SCHWEMM: Yes.
5 ANSWERS BY MS. BRAUMILLER:
6 A. I certainly think so. All the data sources that
7 I utilized are thoroughly cited. They're public, they're
8 published, et cetera. So I assume so, yes.
9 Q. Did you obtain any outside peer review from other
10 third parties?
11 A. Only we had review from the National Park
12 Service, and as I said, I didn't implement any of those
13 proposed changes. And other than that, no.
14 MR. MAYER: I think the Park Service looked at my
15 report, but they -- I believe they didn't give me any comments
16 on it.
17 BY MS. BALDWIN:
18 Q. What is the services interest in this proceeding?
19 Why are you here?
20 ANSWERS BY MS. BRAUMILLER:
21 A. I'm very happy to answer that. The State
22 Engineer's office asked for technical input and I was happy to
23 give it, and that is really the truth.
24 You know, the springs are such a significant

Page 340

1 component of water flowing down the Muddy River that, you
2 know, the reality is they'll be protected by default if an
3 effective conjunctive water management program can be
4 developed.
5 Q. So it's part of your role in implementing the
6 Endangered Species Act?
7 A. No, what I'm trying to say is that -- that's
8 obviously -- it's obviously -- it's obvious it's to the
9 benefit of the Dace for an effective conjunctive water
10 management program to be developed. That's obvious.
11 But my purpose was the State Engineer's office
12 asked for technical input and I endeavored to help and that's
13 it.
14 Q. That answer applies to all the rest?
15 DR. SCHWEMM: Absolutely.
16 MR. MAYER: I'll say that the mission of our
17 water resources branch in the regional office is to protect
18 the water resources of the Fish and Wildlife Service and
19 that's primarily on national wildlife refuges. So we're here
20 because -- or I'm here because of that.
21 BY MS. BALDWIN:
22 Q. Mr. Mayer, you said you're not -- you were not
23 targeting the Tribe unfairly by submitting a rebuttal
24 addressing only their report; correct?

Page 341

1 ANSWERS BY MR. MAYER:
2 A. What I meant -- if I said that, it's true. I
3 don't remember exactly what I said, but I --
4 Q. I'm paraphrasing.
5 A. Okay. I meant the criticism that I have and the
6 comments I have apply more generally to everyone, not just the
7 Moapa.
8 Q. Okay. Do you recall sending an e-mail to Katie
9 Johnson on July 16th, 2019?
10 A. I sent him several emails, but I recall that.
11 Q. This is the e-mail where you asked to see his
12 files relating to his analysis of the climate impacts?
13 A. I do recall asking him several times for the
14 files that he cited in his report.
15 Q. Okay. And for the record, Mr. Criedter and
16 Mr. Sullivan from the State Engineer's office were copied on
17 that e-mail. Do you remember what you said in that e-mail,
18 other than asking for the files?
19 A. No.
20 Q. Well, I'm going to read from it, quote, "I have
21 to warn you that it's not going to look good and you will have
22 a lot of explaining to do to the State Engineer if you aren't
23 willing to share your results. I will make a point of this in
24 my review, Tim," end quote. Does that sound accurate?

Page 342

1 A. It does and I think I did say that in my report.
2 I said -- in the rebuttal report, I said there was no data
3 files, although they were cited in the report, they weren't
4 made available to me. So I did make a point of it.
5 Q. Thank you.
6 A. And so I still believe it doesn't look good. I
7 believe we should share data.
8 Q. It's okay. It was a yes/no question. So turning
9 to the SeriesSEE, did you -- how did you get the values for
10 the aquifer parameters that were used in the Theis
11 transformation?
12 ANSWERS BY MS. BRAUMILLER:
13 A. A very common misunderstanding. They are fitting
14 coefficient.
15 Q. Right.
16 A. So they're not intended to be or function as
17 estimates of aqua parameters. And -- but the fitting
18 coefficients are arrived at through -- there's a joint
19 optimization of the fitting coefficients in whole series of
20 analytical approximations, describing all the stresses that
21 the SeriesSEE analysts believes are having a significant
22 effect on the water level record that you're trying to
23 interpret. And it's -- you want to know how they're
24 optimized?

Page 343

1 Q. Well, I'm just curious. So in order to do the
2 Theis transform that you described, you have to assign some
3 value to, T, transmissivity, and S, storativity?
4 A. Yeah, that's a good question. We don't --
5 they're not assigned.
6 Q. Okay.
7 A. They're joint -- they're not really optimized.
8 We don't know what they are and, first of all, they're not
9 aquifer parameters or it's not an attempt to estimate aqua
10 parameters.
11 They're just fitting coefficients and they are
12 jointly optimized, all the coefficients for each of these
13 numerous analytical approximations for pumping and all these
14 different pumping centers -- yeah, okay.
15 Q. But where do the numbers come from?
16 A. Well, they're -- they start out -- you have to
17 give it some initial values like any parameter estimation
18 process or any other thing. Give us some initial value.
19 And then the code includes routines for trying to
20 optimize all the coefficients simultaneously to get the best
21 fit of all your water level records. And it's a couple
22 utilities that are -- were written by John Dougherty for PEST,
23 it's -- let me find it.
24 Q. I don't need all the details because I can read

Page 344

1 the paper.
2 A. Okay. Yeah.
3 Q. I'm just -- you know, when you come up with
4 these -- these --
5 A. Yeah.
6 Q. You're -- are you -- you're inferring some high
7 level of transmissivity from the model in some way. We're
8 just curious where the numbers are coming from?
9 A. Well, yeah, the exceptionally high field scale
10 transmissivity is inferred, not from the optimized values in
11 the fitting coefficients in the SeriesSEE Curve-fitting
12 process, but by the result, the result being that there was a
13 really remarkable uniformity of drawdown of a very large area
14 of the carbonate aquifer.
15 And that can only have happened, that could only
16 happen if you have exceptionally high field scale
17 transmissivity. It can't happen any other way.
18 Q. Okay. If we have more time later, we can talk
19 about it.
20 A. Okay.
21 Q. So do you agree with Mr. Mayer's conclusions
22 about a lack of a long-term drought in the region?
23 A. Well, we have very different backgrounds and I
24 don't have Tim's background in multiple regression analyses.

Page 345

1 So I have not endeavored to -- it's really not a -- it's not
2 the kind of thing that groundwater hydrologists usually do.
3 So I have not critiqued Tim's analyses. That's something he's
4 quite good at.
5 Q. Is it correct that when the Service did the
6 original SeriesSEE analysis in 2013, it never tried to remove
7 climate-based fluctuations from the hydrographs because there
8 was no reference wells to use?
9 A. No, that's not the case. I mean, I would say
10 I -- it's difficult to come up with a reference well. Okay?
11 Q. Well, I'm looking at Page 9 of Nevada State
12 Engineer Exhibit Number 256, your 2015 report?
13 A. Yeah, yeah.
14 Q. And that's what it says?
15 A. Yeah, happy to explain why things like barometric
16 pressure fluctuations, bird ties, none of those things were
17 incorporated in this Curve-fitting because the purpose was --
18 because the most significant drivers of changes in groundwater
19 levels were pumping, okay? And the goal of the analysis was
20 to see how aerially expansive the drawdown due to the MX-5
21 test pumping was.
22 So the goal -- the purpose of the SeriesSEE
23 analysis was to separate out the drawdown create by the MX-5
24 test pumping from that induced by all the other ongoing water

Page 346

1 supply pumping and study area of which there was a lot, all
2 right? That was the goal.
3 And the assumption is, and I think it's a good
4 one, that the effects of certainly barometric pressure
5 fluctuations, bird ties were very small compared to the
6 effects of pumping by changes in water levels. And at even
7 groundwater recharge, you know, over two years is still going
8 to impact water levels in wells, no question, okay.
9 But that's still relatively small impact on water
10 levels in the wells compared to the pumping. So, you know, it
11 was a simplest SeriesSEE analysis possible to answer the
12 questions that the SeriesSEE analysis was done.
13 Q. Okay. Looking at your initial report for this
14 proceeding, you said you did a simple analysis hydrographs to
15 try and come up with some relationship between climate effects
16 and what you were seeing in the wells?
17 A. Well, not a relationship. I --
18 Q. You were just looking to see if you could see
19 anything that would be a climate --
20 A. Well, no, I was after something specific.
21 Q. Okay.
22 A. Okay.
23 Q. And you identified in your -- your best guess is
24 that there appears to be a one-year lag between wet years and

Page 347

1 when?
2 A. All those --
3 Q. Where the water level increased?
4 A. Within one year.
5 Q. Okay.
6 A. You can see the effects of those -- the 2004,
7 2005 and 2010 to 2011, in some cases. You can see the effects
8 of those particularly wet periods in groundwater levels in the
9 carbonate aquifer over pretty much the entire five-plus basin
10 area. You know, if -- CSVM-5 is an interesting exception, but
11 I think I know why. But it's not fair. Okay.
12 Q. Okay.
13 A. But at any rate, my purpose, I wasn't trying to
14 come up with a relationship. I just believe that if we're
15 going to get a handle on how climate is affecting groundwater
16 levels from the spring flows, the first thing you have to do
17 is get a handle on what is -- you know, what's the time lag
18 between the change in climate, wet seasons and showing up in
19 the groundwater levels in the spring flows.
20 And that will give you somewhere to start when
21 you're trying to figure out how is it an affecting groundwater
22 and springs and springs flows, right? And so with that and
23 only that purpose, okay, I just use simple visual inspection
24 of the hydrographs, the Palmer Drought Severity Index versus

Page 348

1 groundwater level spring flows and stream flows, and noticed
2 that it's not one year, but it's within one year.
3 Q. That'll be it.
4 A. Yeah, that was it. Yeah.
5 Q. Okay. Mr. Mayer, when you looked at the
6 hydrographs in Dry Lake, Delamar and Tule Desert, did you
7 consider whether water levels are responding to any delayed
8 climate signal?
9 ANSWERS BY MR. MAYER:
10 A. No, I didn't.
11 Q. Is that something that you have done previously
12 in your work?
13 A. Yes, I've looked at climate responses before.
14 Q. And did you reach any conclusions?
15 A. It -- well, it was a different study. I mean,
16 yeah, I -- yes.
17 Q. So you have identified climate lag?
18 A. I have identified lags in climate responses, yes.
19 MS. BALDWIN: I don't have any more at this time.
20 But if there is additional time later. Hold on a second. One
21 question.
22 BY MS. BALDWIN:
23 Q. Mr. Mayer, you looked at 20 hydrographs in those
24 adjacent basins, Tule Desert and Dry Lake and Delamar. Were

Page 349

1 those all the wells in those basins or did you just pick
2 certain ones?
3 A. I just picked what were designated as monitoring
4 wells by SNWA or by Vidler, so --
5 Q. Thank you.
6 HEARING OFFICER FAIRBANK: Next is SNWA, Las
7 Vegas Valley Water District.
8 CROSS-EXAMINATION
9 MR. TAGGART: Good morning. My name is Paul
10 Taggart. I represent the Southern Nevada Water Authority and
11 the Las Vegas Valley Water District, and I want to start with
12 a few questions for Mr. Mayer.
13 How many years have you been analyzing issues
14 regarding hydrogeology in the Lower White River Flow System?
15 ANSWERS BY MR. MAYER:
16 A. Well, I've been working down here since about
17 1997.
18 Q. Okay. And I have a few questions about -- just
19 some quick historic questions about the role of the Fish and
20 Wildlife Service.
21 Initially, the Fish and Wildlife Service, did it
22 file protests against the water right applications in the
23 Coyote Spring Valley?
24 A. Yes.

Page 350

1 Q. Okay. And were you present during the hearings
2 in 2001 on the CSI applications?
3 A. Yes, I was.
4 Q. Okay. At that time in 2001, did you have a
5 similar opinion than you have today regarding the impact of
6 pumping in Coyote Spring Valley on the Muddy River Springs?
7 A. Yes, I did. Yeah, I believe so.
8 Q. And were you involved in recommending that a pump
9 test occur?
10 A. It's possible. It was a long time ago, but I
11 could have been.
12 Q. Okay. And I'm wondering, did the pump test --
13 I'm sorry, the pumping test that was ordered by Order 1169,
14 did that pumping test validate your understanding of the
15 system in 2001?
16 A. I think it did, yeah.
17 Q. And did you review the State Engineer's rulings
18 that came out after the pump test and after the reports were
19 submitted by all the parties? And I want to say this was
20 2013, 2012, somewhere in that range.
21 A. Yes, I reviewed those reports.
22 Q. Okay. And do you agree with the findings of the
23 State Engineer made in those rulings regarding the effect of
24 Coyote Spring carbonate pumping on the Muddy River Springs?

Page 351

1 A. Yes.
2 Q. You mentioned in some previous answers that the
3 Fish and Wildlife Service owns a water right in the Muddy
4 River Springs area. Could you describe that water right?
5 A. Yeah, we have a water right. It's measured at
6 Warm Springs West and it's essentially -- it's for wildlife.
7 It's essentially an in-stream flow right. So it's on the
8 refuge.
9 Q. And --
10 A. That's the Pederson reach of the springs.
11 Q. Okay. And did you say -- did you say what the
12 flow rate is in your opinion of that water right?
13 A. Well, that water right is 3.5, but I believe it
14 has a priority date of 1991. So it's fairly junior.
15 Q. Okay. Now, was the MOA that's been described --
16 and you understand what I mean when I talk about the MOA?
17 A. Um-hum, yes.
18 Q. Was the MOA executed, in part, to address
19 potential impacts to that water right or do you know?
20 A. It was designed, established to protect that
21 reach of stream. The trigger levels are actually below the
22 water rights. So in a way it doesn't protect the full water
23 right, but it still protects the stream.
24 Q. Okay. And do you have an understanding whether

Page 352

1 the MOA was completed in order to allow the 1169 pump test,
2 itself, to occur?
3 A. Yes, it was.
4 Q. Um-hum. I have a couple questions for
5 Ms. Braumiller, and they have to do with a couple points you
6 made in your presentation.
7 And you identified a -- what I wrote down as a
8 Kane Spring or maybe a Kane Spring wedge?
9 ANSWERS BY MS. BRAUMILLER:
10 A. Fault.
11 Q. And I was wondering where that's located in the
12 Kane Springs area. I wasn't exactly sure.
13 A. Yeah, yeah, I didn't -- I didn't refer to as a
14 Kane Springs wedge. But it's a portion of the carbonates.
15 Some of it lies in southwestern Kane Springs Valley, some of
16 it in northern Coyote Springs Valley. But it's between the
17 Kane Springs wash fault and a normal fault that -- normal
18 trend and normal fault, the passages just by CSVM-3.
19 Q. Were you present during yesterday's testimony?
20 A. Yes.
21 Q. And were you present when there was discussion,
22 something we referred to as the highway fault?
23 A. Yes.
24 Q. And my simple question is: Does your opinion

Page 353

1 about this Kane Springs wedge, fault or whatever we're calling
2 it?
3 A. Yes.
4 Q. Does that somehow make it possible for, in your
5 opinion, CSI to pump water from the west side of that highway
6 fault without impacting the Muddy River Springs?
7 A. I can't say because it was never clear yesterday
8 what -- which of the faults were discussed or the Kane Springs
9 wash fault. So I'm not sure if the highway fault is the Kane
10 Springs wash fault. I was never clear about that yesterday.
11 Q. Okay. And do you have your PowerPoint?
12 A. I do.
13 Q. Available?
14 A. Got to switch.
15 Q. Okay. There was a -- yeah, there was a figure
16 with boundary for the proposed --
17 A. Um-hum.
18 Q. Your recommendation regarding the boundary for
19 the Lower White River Flow System?
20 A. Yes.
21 Q. Could you find that?
22 A. Yes.
23 Q. It was probably maybe 25 slides in. So where on
24 that figure is this area that you're talking about? And

Page 354

1 again, I don't want to misstate what you said. I just recall
2 you testifying about an area where it's unknown what occurred
3 there or something like that.
4 Maybe you want to restate your view on -- or I
5 don't want to misstate what your testimony was about. But I'm
6 just trying to clarify where it's located. That's all I'm
7 trying to do.
8 A. Oh, the wedge?
9 Q. Yes.
10 A. Oh, good. Okay. So -- oh, gosh, this is a
11 little hard to see. Let me look at it on my screen a little
12 bit there.
13 Okay. Okay. So that's the north trending normal
14 fault that passes right by CSVM-3. So I mean from there to
15 the Kane Springs wash fault, which is right there. So at --
16 there's also, you know, the Caldera Complex there. That's
17 just virtually impermeable for all practical purposes.
18 So south and southwest of the Caldera Complex,
19 west or northwest of the Kane Springs wash fault, and east of
20 this north trending normal fault that passes right by CSVM-3.
21 And I think CSVM-3 is completed within that kind of isolated
22 wedge of carbonate.
23 Q. Okay.
24 A. Yeah, um-hum. So there's never been any

Page 355

1 carbonate pumping in there and I don't know what the effect of
2 pumping in that wedge of the carbonates would be. I don't
3 think we have any data that we can use to anticipate that at
4 this point.
5 Q. Okay. Back to Mr. Mayer.
6 So yesterday there was some testimony about water
7 budgets being developed by Mr. Reich, and his view was that no
8 one else in the hearing room had developed water budgets and
9 that was something that he indicated as being significant in
10 his opinion.
11 My question to you is: Just having been involved
12 in this for decades, are we past the point of using water
13 budgets as a method of analysis and could you describe, in
14 your opinion, what you should -- you know, what you view the
15 role of water budgets when you have empirical data from a pump
16 test?
17 ANSWERS BY MR. MAYER:
18 A. Yeah, I think we are past the point where we need
19 a water budget because we show that there's water available.
20 You could define a perennial yield, but you could start to
21 pump that water as we've done here in this basin and this flow
22 system, and see the effects and impact springs and other
23 resources and rights. So I would agree that I'm not sure how
24 helpful the water budget is.

Page 356

1 Q. And given -- and in your opinion, do we have
2 empirical data from the pumping test that pumping in the Lower
3 White River Flow System impacts the Muddy River and the Muddy
4 River Springs?
5 A. Certainly, yes.
6 Q. And so would it be dangerous to make decisions
7 about groundwater availability based on water budgets when we
8 have that empirical data?
9 A. I think so.
10 Q. There was -- and I guess this is to you,
11 Ms. Braumiller.
12 So one of your conclusions or recommendations to
13 the State Engineer is the -- involves the 9318-acre-feet of
14 pumping that's existing, I think, in the basin's lower or
15 closest to the basins. Do you recall that opinion?
16 ANSWERS BY MS. BRAUMILLER:
17 A. Yep, um-hum.
18 Q. Okay. And is it accurate that that is a number
19 that's associated with actual pumping in 2015, 2016 and 2017?
20 A. Yes, actual total carbonate and alluvial pumping.
21 Q. Okay. And I want to ask you a question about
22 that and it's -- you see the binder over there on the -- I'll
23 get it for you, just a second.
24 So I'm going to just ask you and I think you just

Page 357

1 may have even alluded to it a little bit, is to ask you to
2 partition that 9318, if you will, between carbonate and
3 ground -- and alluvial. But do you see table -- are you
4 familiar with SNWA's report that's been marked as SNWA
5 Number 5, I believe?
6 A. No, I actually did not read the report.
7 Q. Okay. Well, then let me ask you -- or, no, let
8 me ask Mr. Mayer.
9 Are you familiar with the SNWA hydrology report?
10 MR. MAYER: Well, I read it, but just briefly. I
11 mean, I'm not sure I'm qualified --
12 MR. TAGGART: Okay.
13 MR. MAYER: -- I don't --
14 BY MR. TAGGART:
15 Q. Do you have Tables C-3 there in front of you?
16 ANSWERS BY MS. BRAUMILLER:
17 A. Yeah.
18 Q. Okay. And you're not familiar with this table?
19 A. No, I did not read your report.
20 Q. Okay.
21 A. I'm sorry.
22 Q. Well, let me just ask you this then. The table
23 says that it's showing Lower White River Flow System or LWRFSS
24 carbonate aquifer annual groundwater production?

Page 358

1 A. Okay.
2 Q. And over on the right-hand column, there's -- it
3 says "total"?
4 A. Um-hum.
5 Q. Do you see that?
6 A. Yeah, I see that, um-hum.
7 Q. And so in the years 2015, '16 and '17, would you
8 agree with me that this table indicates that there's been --
9 there was approximately 7500-acre-feet, give or take, there's
10 a range of 7144 to 7791-acre-feet of carbonate pumping?
11 A. Sure.
12 Q. Okay. And so that's the amount of carbonate
13 pumping that, in your recommendation, would be allowed as part
14 of that 9318 number?
15 A. Right.
16 Q. As a maximum?
17 A. Well, right.
18 Q. Okay.
19 A. Because I did also, just for simplicity, suggest
20 that carbonate alluvial pumping shouldn't be swapped.
21 Q. Okay.
22 A. That it just leads to too many questions about
23 alluvial pumping. If you just swapped out carbonate for are
24 now too close to the river, you know, et cetera, right? It's

Page 359

1 a pretty simplistic recommendation, but I think implemented,
2 so yeah.
3 Q. Okay. Now, in your report on page 37, I think is
4 where you describe this. And so on page 37 of your report on
5 the bottom of that page, there's a paragraph that begins
6 consequently assuming a flow rate of 30,550-acre-feet to the
7 Moapa Gage is sufficient to meet senior decreed rights.
8 So that -- and then you go on to say "the initial
9 threshold of combined carbonate and alluvial of 9318"?
10 A. Um-hum.
11 Q. And that -- this is the base of your
12 recommendation; right?
13 A. Yeah, I -- you know, I'm going from memory here
14 now. But I think 30,550-acre-feet per year was the average of
15 what was flowing through the Moapa Gage in 2015, '16, and '17.
16 And 9318-acre-feet per year is apparently what the total of
17 carbonate and alluvial pumping average in 2015, '16 and '17.
18 Q. So from a hydrologic standpoint?
19 A. Um-hum.
20 Q. If more than 30,550-acre-feet is required to meet
21 senior rights in the Muddy River?
22 A. Um-hum.
23 Q. Would you agree that the amount of pumping that
24 should be allowed from the carbonate system would have to be

Page 360

1 less than the 7500 number we just talked about?
2 A. Well, I think that might be a step too far, but I
3 would say that the total carbonate and alluvial pumping would
4 have to be somewhat less.
5 Q. That's correct. Just so the 9318 number?
6 A. Yeah.
7 Q. Would have to come down in relationship to how
8 much additional water would be needed to meet rights in the
9 river?
10 A. Correct.
11 Q. Okay.
12 MR. TAGGART: Is that me?
13 HEARING OFFICER FAIRBANK: That's you.
14 MR. TAGGART: Okay.
15 HEARING OFFICER FAIRBANK: Next will be the Moapa
16 Valley Water District.
17 CROSS-EXAMINATION
18 MR. MORRISON: Good morning, I'm Greg Morrison
19 and I represent Moapa Valley Water District. I just have a
20 couple of quick questions.
21 First, for Ms. Braumiller, now, you -- I'm going
22 to paraphrase here, so please let me know if I butcher this.
23 But I think what you said your analysis, you attempted to
24 define the scope of the management area by -- you started with

Page 361

1 the five-plus basins that you said indicated this clear
2 connectivity, and then you kind of expanded outward, looking
3 for low flow or even no-flow boundaries to help you define the
4 extent.
5 ANSWERS BY MS. BRAUMILLER:
6 A. Yeah. Yeah, so the drawdown in the five wells
7 that admittedly you couldn't hardly see on that plot, go
8 figure, but the drawdown cone was extremely flat in the area
9 of delineated by those five particular wells. Okay.
10 But it is a drawdown cone, flat or not, and
11 drawdown generally -- I mean, this is a homogeneous or
12 isotropic, sorry, aquifer decreases logarithmically with
13 distance.
14 So you can't go from 1.5 or 1.6 feet of drawdown
15 reduced by MX-5 to, you know, zero over distance. So, you
16 know, as a practical matter, I had, you know, other -- it made
17 sense to me to extend the area affected by MX-5 pumping to the
18 numerous likely no-flow boundaries.
19 Q. Great.
20 A. And that's how I defined the five-plus basins.
21 Q. So this -- and I'm glad this slide is still up
22 there. So you're showing your proposed extent there of the
23 Lower White River Flow System. Is it safe to assume, looking
24 at that, that you did not find any low flow boundary at the

Page 362

1 northern end of Coyote Springs Valley or the southern end of
2 Kane Springs Valley that would preclude you from including
3 them in your analysis in your area?
4 A. Yeah. You know, I'll go back to the 2007 ruling,
5 I think it was 5712. There was conclusion that there is a
6 very -- there's like a 50-, 75-foot difference in head between
7 CSVM-4 in northern Coyote Springs Valley.
8 And in a ruling, it was -- the exact location
9 where head -- or the carbonate aquifer was 50 to 75 feet less
10 than it is at CSVM-4, was not clearly defined. But the first
11 location at which I found those kinds of carbonate water
12 levels was in central Coyote Spring Valley in the area of
13 MX-5, CSVM-6, et cetera.
14 So it's very clear because there's a much larger
15 head difference between, say, CSVM-6 in Coyote Spring Valley
16 and CSVM-4 at the north end, just south Kane Springs Valley,
17 that the transmissivity of the carbonates is a whole lot less
18 than it is in this other area that is just exceptionally
19 high --
20 Q. Okay.
21 A. -- in field transmissivity. But --
22 Q. If I can just interrupt you for a second.
23 A. Yeah.
24 Q. You didn't find a low flow barrier that would

Page 363

1 exclude Kane Springs from this management area as you have it
2 included in your map up there?
3 A. Well, you could always hypothesize any number of
4 such things. But what I noted is that water level
5 fluctuations in CSVM-6 or MX-5, there's 4 or 5 wells in
6 central monitor -- carbonate wells in central Coyote Springs
7 Valley.
8 In any of those, you saw the same water level
9 fluctuations as CSVM-4. They were of different magnitude, but
10 there's clearly a hydraulic -- this is where -- don't touch
11 that thing.
12 This is where it does make a sense to look at
13 time series, right, as a hydrologist or hydrogeologist, okay?
14 So there's a clear hydraulic connection. It's just the
15 transmissivity is much less between central Coyote Spring
16 Valley and southern Kane Springs Valley, but it is still
17 transmissive.
18 Q. All right.
19 A. Right.
20 Q. Thanks.
21 A. Yeah.
22 Q. All right. And this generally is directed to
23 Mr. Mayer, but I think any or all of you might be qualified to
24 answer it. So if anyone feels more comfortable, please.

Page 364

1 You concluded that the triggers from the 2006
2 Memorandum of Understanding based on Warm Springs West flows,
3 those are valid and important for protecting the springs in
4 the Pederson Unit or the Pederson Unit?
5 ANSWERS BY MR. MAYER:
6 A. Yes, I concluded that.
7 Q. Okay. And you're familiar with the amended
8 stipulation between the Fish and Wildlife Service and Lincoln
9 County, Vidler? It's on the record as Fish and Wildlife
10 Service Exhibit 57.
11 A. Yes, I'm familiar with that.
12 Q. Does that agreement also have some trigger levels
13 based on Warm Springs West flows?
14 A. Yes, it does.
15 Q. Would you say that those trigger levels -- those
16 trigger levels are also valid and important to protect
17 Pederson Unit Springs?
18 A. Yes, I would agree, they are.
19 Q. All right. I want to dig a little deeper into
20 that stipulation with Lincoln Vidler. So that stipulation
21 requires the formation of a technical review team, TRT; is
22 that correct?
23 A. Yes. Is this more you, Sue or --
24 ANSWERS BY MS. BRAUMILLER:

Page 365

1 A. I think you're right.
2 MR. MAYER: Yeah, it was. Yeah --
3 ANSWERS BY MS. BRAUMILLER:
4 A. And that team was never formed and never met,
5 um-hum.
6 Q. That was my question. Great. Thank you.
7 When did it last meet is another. Has the
8 stipulation, to your knowledge, has it ever been modified or
9 cancelled according to its terms over the years?
10 ANSWERS BY MR. MAYER:
11 A. Well, it was -- there was a provision that
12 required a monitoring well in the northern part of Coyote
13 Spring Valley, two actually. One on Kane, one in Coyote
14 Spring, one --
15 ANSWERS BY MS. BRAUMILLER:
16 A. One on --
17 MR. MAYER: I can't remember. Yeah, anyway, so
18 that was modified. There was an agreement by the Fish and
19 Wildlife Service to allow -- was it CSVM-4 to still be
20 substituted?
21 MS. BRAUMILLER: I don't remember.
22 MR. MAYER: There was another well that was
23 drilled that was substituted by SNWA that was substituted for
24 the well that was required in the stipulation. But that was

Page 366

1 just the one well. There was never anything addressed as far
2 as the other wells as far as I know.
3 Q. So your knowledge then was one well was
4 substituted and the second one was never drilled?
5 A. As far as I know, yes.
6 Q. All right. Was there ever -- so there was never
7 any agreement obviously from the TRT that those monitoring
8 wells wouldn't be required because the TRT didn't meet?
9 ANSWERS BY MS. BRAUMILLER:
10 A. Never met.
11 MR. MORRISON: All right. That's all I have.
12 Thank you.
13 HEARING OFFICER FAIRBANK: And next up is Lincoln
14 County with Vidler Water Company.
15 CROSS-EXAMINATION
16 MS. PETERSON: Good morning, panel, Karen
17 Pederson representing Lincoln County Water District and Vidler
18 Water Company. And I just had a question for Dr. Schwemm.
19 Are you familiar with the biological opinion U.S.
20 Fish and Wildlife Exhibit 59?
21 ANSWERS BY MR. SCHWEMM:
22 A. Not really. I didn't really address the -- this
23 is Mike Schwemm. Not really. I didn't address the biological
24 opinion in my report. I just spoke of what the triggers

Page 367

1 themselves and the values that were in that amended
2 stipulation in relation to the Dace themselves. But I'm not
3 overly familiar with the biological opinion.
4 MS. PETERSON: May I approach the witness?
5 HEARING OFFICER FAIRBANK: Yes.
6 MS. PETERSON: Thank you.
7 I am going to hand you and your counsel a copy of
8 your Fish and Wildlife Exhibit 59, which is a biological
9 opinion, and if you could turn to page 37.
10 ANSWERS BY MR. SCHWEMM:
11 A. Okay.
12 Q. I hate to waste my time on this. I mean, I need
13 you to read it, not out loud, to yourself. But if you could
14 read quickly, that would be great.
15 A. Which section?
16 Q. I'm sorry, number three.
17 A. (Complies.) Okay.
18 Q. All right. And do you agree that in this
19 document, it's the Service's biological opinion that the
20 action, as proposed and analyzed -- and again, this is related
21 to the Kane Springs Valley groundwater development project in
22 Lincoln County; do you agree with that?
23 A. Well, I haven't reviewed this document. So it's
24 new to me in -- so I don't really know the entire -- the

Page 368

1 entirety of what's referred to in the document.
2 Q. Do you agree that paragraph 3 there on this page,
3 page 37 of what I'll represent to you is Fish and Wildlife
4 Service Exhibit 59, indicates that it's the Service's
5 biological opinion that the action, as proposed and analyzed,
6 is not likely to jeopardize the continued existence of the
7 endangered Moapa Dace?
8 A. Yeah, I can read that, but I don't really know
9 what was stated in the biological opinion because I did not
10 analyze that in my report.
11 Q. Do you think it was important to analyze the
12 biological opinion before you drafted your report?
13 A. It could have been and it was -- would have been
14 good background. But specifically what I wanted to address
15 was if there was a -- the change in flow and how that might
16 affect the species itself.
17 So I was just interested in the biological effect
18 of how flow changes would affect the species and not the
19 compliance issues because I did not address those in my
20 report.
21 Q. My next questions are directed to Ms. Braumiller.
22 ANSWERS BY MS. BRAUMILLER:
23 A. Um-hum.
24 Q. You were not qualified in this proceeding as a

Page 369

1 geologist, as an expert in the area of geology; is that
2 correct?
3 A. Yep. Right. Yes.
4 HEARING OFFICER FAIRBANK: Please turn your mic
5 on.
6 MS. BRAUMILLER: Oh, it's on actually. Okay.
7 Yes, no.
8 BY MS. PETERSON:
9 Q. And you were also not qualified as an expert in
10 the area of hydrogeology; is that correct?
11 A. No, I didn't ask to be qualified as a
12 hydrogeologist.
13 Q. Would you agree that you provided a lot of
14 opinions in your presentation that would be in the areas of
15 geology and hydrogeology?
16 A. Yes, and I asked to be qualified as a groundwater
17 hydrologist because I am a groundwater hydrologist by formal
18 training and work experience. And I have become a
19 hydrogeologist of a result of over 24 years of work. But I do
20 not have a geology degree and so I was very conservative about
21 that.
22 MS. PETERSON: And I just asked the State
23 Engineer and panel to take the appropriate -- take into
24 consideration that in offering the opinions today, that

Page 370

1 Ms. Braumiller is not qualified as an expert in geology or
2 hydrogeology.
3 HEARING OFFICER FAIRBANK: Thank you. We'll note
4 that.
5 BY MS. PETERSON:
6 Q. Do you agree, Ms. Braumiller, that the boundary
7 issue with regard to the Lower White River Flow System is a
8 structural geology issue?
9 A. We're trying to define the boundaries of a flow
10 system. So, in part, it's a geology issue; and in part, large
11 part, it is not.
12 Q. Would you agree, then, that structural geology of
13 the region controls the groundwater flow of this region?
14 A. It is. It's one factor influencing groundwater
15 flow in this region, one of several.
16 Q. Do you agree, as a hydrologist, that you're
17 making conclusions about where groundwater flows in this
18 region. But if you're structural geology is wrong, your
19 opinions could be wrong?
20 A. Well, but as I said, I have 24 years of work
21 experience doing groundwater hydrology that cannot be done
22 without also doing hydrogeology. So although I did not ask to
23 be officially qualified as a hydrogeologist out of, you know,
24 a sense of respect for the fact that I do not have a geology

Page 371

1 degree, I have been doing hydrogeology for 24 years.
2 Q. Would you agree, though, if your assumptions
3 about structural geology were wrong or if you had no
4 assumptions about geology in your flow analysis, that your
5 opinions could be wrong?
6 A. No, I don't, and here's the reason. Everywhere
7 where I cited the likely existence of geologic
8 discontinuities, I said subject to hydraulic confirmation.
9 And there is not everywhere, hydraulic confirmation for those
10 no-flow boundaries, if that's what you're specifically
11 referring to. But at many locations, there are.
12 And so my approach is to first look at geology,
13 look for geologic discontinuities that are very significant,
14 and then look for hydraulic confirmation. I don't believe you
15 can infer hydraulic connections or a lack thereof just based
16 on geology.
17 Q. Directing your attention to pages 15 and 16 of
18 your report, which is the Fish and Wildlife Exhibit 5?
19 A. Okay.
20 Q. You make some conclusions about 12 wells on those
21 pages, that they're in the carbonate; do you recall that?
22 A. Let's see. Wait a minute. Oh, there were
23 several -- there were 14, yeah, several of the carbonate wells
24 that were the water level records for some of the carbonate

Page 372

1 wells that were analyzed using SeriesSEE in 2013 are not part
2 of the regional aquifer. So maybe you have to clarify your
3 question a little bit.
4 Q. Well, directing your attention to the 12 wells
5 that you have on pages 15 and 16; do you see those?
6 A. I see there are -- there's 1, 2 -- yeah. Okay,
7 yeah, I see them.
8 Q. All right. You used a geologic map to determine
9 which geologic units the wells represent; is that correct?
10 A. Not only geologic maps, but also the well logs.
11 Q. You did look at the well logs?
12 A. Absolutely.
13 Q. Did you note that in your report?
14 A. I don't know. If you want me to read the text,
15 I'll do it right now. But I can tell you I looked at the well
16 logs and the geologic mapping, of course.
17 Q. For all the wells listed on pages 15 and 16?
18 A. Correct, um-hum. Right, um-hum.
19 Q. And then directing your attention to page 14 of
20 your report?
21 A. Um-hum.
22 Q. Exhibit 5?
23 A. Uh-huh, right.
24 Q. You talk about the parameters of the Theis

Page 373

1 transforms. Do you see that? It's in the third paragraph
2 down.
3 A. Um-hum.
4 Q. You're familiar with that sentence?
5 A. Which sentence are you talking about?
6 Q. It starts with "the parameters of the Theis
7 transforms as applied in SeriesSEE analysis"?
8 A. Yeah, okay.
9 Q. Do you see that?
10 A. Right, right.
11 Q. That they're not intended or -- to represent or
12 serve as estimates of aquifer parameters?
13 A. Correct, um-hum.
14 Q. Are you saying that the SeriesSEE analysis allows
15 you to ignore structural geology and well construction?
16 A. It doesn't take those things into account because
17 it's a Curve-fitting tool, Curve-fitting tool. You're fitting
18 analytical approximations of various stresses that account for
19 changes in water level in the well to document water level
20 records for wells. That's the nature of it.
21 Q. And would you agree -- and this might have been
22 asked already, so I apologize if it's a repeat. Would you
23 agree that the SeriesSEE analysis does not incorporate
24 recharge due to weather events, such as high precipitation in

Page 374

1 2005 or 2010?
2 A. It could be made to do that, but that is not the
3 way it was applied to interpret the Order 1169 pumping test,
4 because our purpose was to characterize the aerial extent of
5 the drawdown created by the test pumping.
6 And then secondarily, we were surprised to see
7 how uniform it was over such a large area. It was not the
8 purpose. This was pure application of SeriesSEE.
9 Q. Did the SeriesSEE analysis drawdown impacts
10 extend from the Order 1169 pumping to Kane Springs Valley,
11 which is about over 15 miles away?
12 A. You know, I don't believe KMW-1 was officially
13 one of the water monitoring wells for the Order 1169 study,
14 although there was monitoring. I found the hydrographs, of
15 course, in the State Engineer's data basis. And it was not
16 officially -- oh, I'm sorry, I'm getting to my point here.
17 It was not -- in fact, there was an explicit
18 decision in 2007 not to include it in the Order 1169 pumping
19 test. I know it was -- there was a decision not to include it
20 in the pumping test. I think it was based on the 2007 ruling
21 5217. But there is groundwater level data for KMW-1 through
22 the pumping tests and I think the monitoring started in about
23 2007 perhaps, something like that. So it's there, um-hum.
24 Q. Right. But I think I was asking you about -- and

Page 375

1 I believe you've stated that your SeriesSEE analysis, there
2 were no drawdown impacts that extended from the Order 1169
3 pumping to Kane Springs Valley; is that correct?
4 A. No. What I'm saying is that the SeriesSEE
5 analysis was only -- we only -- Keith Halford, okay, only
6 analyzed a select number of carbonate wells throughout the
7 Order 1169 study area because there were many, many monitor
8 carbonate wells.
9 So he selected carbonate wells from far flung
10 locations throughout the Order 1169 pumping test that were
11 also based on other considerations, water level records,
12 geologic mapping, well logs, et cetera, also believed to be
13 completed in the regional carbonate aquifer, some carbonate
14 wells that are apparently complete outside the carbonate
15 aquifer and some other geologic units.
16 But at any rate, he didn't happen to choose KMW-1
17 as one of the records that was analyzed. So it just wasn't
18 analyzed, um-hum.
19 Q. How come Mr. Halford is not here, testifying
20 today about the work he did?
21 A. Well, we refer to the 2013 DOI report, okay? We
22 refer to that. We cited it. I re-explained, verified the
23 SeriesSEE analysis in my report because it's so foundational
24 to the identification of the basins that it should be

Page 376

1 considered the Lower White River Flow System.
2 But we're not relitigating, as far as I know,
3 Keith Halford's Curve-fitting in 2013. The results, the
4 analysis that was done is described in the DOI 2013 report as
5 one of our exhibits. I cited it. The results and our
6 interpretation are also described and cited in our DOI 2013
7 report.
8 There is no need for Dr. Halford to be here,
9 although I think it would have been helpful. I would have
10 loved to heard him explain since he's the author of SeriesSEE,
11 what it is and is not because there does seem to be a lot of
12 confusion about that.
13 Q. Did you or Dr. Halford do any analysis of Kane
14 Springs pumping impacts on the Muddy River?
15 A. No. No, not --
16 Q. And are you aware of the amended stipulation?
17 You were answering questions about it. It's Fish and Wildlife
18 Exhibit 57, I believe, the amended stipulation in Kane Springs
19 with U.S. Fish and Wildlife and Lincoln County Water District
20 and Vidler?
21 A. I think that Tim Mayer responded to those
22 questions. And I do not have a lot of knowledge of amendments
23 to the original stipulation agreement.
24 Q. And are you aware, in that stipulation, that Fish

Page 377

1 and Wildlife asked the State Engineer not to include Kane
2 Springs in Order 1169?
3 A. I'm not terribly familiar with the original
4 stipulation or with any amendment to it.
5 Q. And then directing your attention to page 22 of
6 Exhibit 5?
7 A. Okay, um-hum. Sure.
8 Q. Where you want to --
9 MS. PETERSON: I'll be back.
10 HEARING OFFICER FAIRBANK: Actually if you want
11 to finish that one question and then we'll break after that.
12 BY MS. PETERSON:
13 Q. You're asking about the geophysical surveys for
14 the Kane Springs wells?
15 A. Well, I'm not asking about it. I'm just noting
16 that I reviewed a URS well completion report that included a
17 description of down hole surveys, including geophysical
18 surveys that were conducted in both KMW-1 AKVW-1, and that in
19 the interpretive material in that report, I saw no conclusions
20 about which or perhaps maybe both sides -- these are both very
21 deep wells completed over a large interval -- whether they
22 are -- the completion intervals span the Kane Springs Wash
23 Fault Zone or they're entirely limited to the northwest side
24 of the Kane Springs Wash Fault Zone.

Page 378

1 I saw no indication in your report that that was
2 interpreted from the geophysical surveys. And I just think
3 that's critical because when you look at hydraulic data from
4 either or both of those wells, we don't know what it means.
5 So I do think that that question needs to be cleared up.
6 MS. PETERSON: I will be back.
7 MS. BRAUMILLER: Okay. Thank you.
8 HEARING OFFICER FAIRBANK: All right. So we'll
9 go ahead and break for a lunch break. We will go ahead and
10 get back on record and return to our proceedings at 1:15. So
11 promptly at 1:15.
12 (Proceedings concluded at 12:09 p.m.)
13
14
15
16
17
18
19
20
21
22
23
24

1 STATE OF NEVADA)
2) ss.

3
4 CARSON CITY)

5 I, MICHEL LOOMIS, a Certified Court Reporter, do
6 hereby certify;

7 That on the 24th of September, 2019, in Carson
8 City, Nevada, I was present and took stenotype notes of the
9 hearing held before the Nevada Department of Conservation and
10 Natural Resources, Division of Water in the within entitled
11 matter, and thereafter transcribed the same into typewriting
12 as herein appears;

13 That the foregoing transcript, consisting of
14 pages 239 through 379 hereof, is a full, true and correct
15 transcription of my stenotype notes of said hearing to the
16 best of my ability.

17 Dated at Carson City, Nevada, this 25th day of
18 September, 2019.

19
20
21

MICHEL LOOMIS, RPR

22 NV CCR #228

23
24

#	actually (13) 256:18;263:17; 286:3;293:5;316:20; 318:11;324:9,20; 351:21;357:6;365:13; 369:6;377:10	286:8;293:6;314:11; 322:20;333:7,8,9,18; 368:16,18	allow (3) 270:17;352:1;365:19	315:5;316:22;319:15; 322:5,21;324:7,10,11, 21,22;325:1,10,14,18; 326:3,10;327:6,12,15; 328:2,6;332:22; 341:12;345:6,19,23; 346:11,12,14;355:13; 360:23;362:3;371:4; 373:7,14,23;374:9; 375:1,5,23;376:4,13
#228 (1) 379:22	Adam (1) 240:5	affected (6) 300:1;307:11;314:9, 9;322:14;361:17	allowable (1) 323:3	analysts (1) 342:21
A	adapting (1) 291:13	affecting (2) 347:15,21	allowed (3) 323:17;358:13; 359:24	analytical (6) 326:20,21,23; 342:20;343:13;373:18
ability (2) 298:15;379:15	address (11) 266:19;273:14; 294:10;314:22;322:6, 7;351:18;366:22,23; 368:14,19	again (29) 243:9;251:24;252:3; 259:23;262:16;263:4; 264:1;265:22;269:1; 270:19;299:20;300:24; 302:23;303:6;304:2; 306:17,18;308:19; 311:3,9;313:12; 314:13,23;318:22; 319:5;321:2;323:21; 354:1;367:20	allows (2) 271:8;373:14	analyze (4) 251:10;324:15; 368:10,11
able (3) 250:5;317:2;329:19	additional (6) 248:17;257:24; 323:19,22;348:20; 360:8	against (3) 270:24;313:3;349:22	alluded (1) 357:1	analyzed (6) 367:20;368:5;372:1; 375:6,17,18
above (1) 274:13	addressed (3) 319:8,9;366:1	age (1) 286:5	alluvial (31) 249:11,21;250:9,14; 253:14,17;258:3; 260:3;266:18;267:2,8, 15;268:7,10,18;269:10, 13;270:2,22;271:4; 272:7,10,21;273:3; 356:20;357:3;358:20, 23;359:9,17;360:3	analyzing (1) 349:13
absolute (1) 316:11	addressing (3) 267:12;335:23; 340:24	agencies (2) 324:18;338:12	alluvium (9) 249:16;250:2;253:3; 258:5;266:24;267:9; 268:11,22;273:1	and- (1) 241:3
absolutely (4) 328:19;329:22; 340:15;372:12	adequate (1) 257:16	agency (1) 331:5	almost (4) 249:15;272:13; 287:22;307:16	and/or (3) 261:19;264:19,21
abundance (3) 283:5;291:18;296:10	adhere (1) 339:2	ago (3) 251:5;254:9;350:10	along (3) 297:15;303:4;337:10	Angeles (1) 240:23
accept (1) 321:22	adjacent (6) 249:16;258:5; 304:14;305:15;314:9; 348:24	agree (17) 280:23;344:21; 350:22;355:23;358:8; 359:23;364:18;367:18, 22;368:2;369:13; 370:6,12,16;371:2; 373:21,23	alternative (1) 270:13	animals (5) 284:2;287:4,5; 296:18;297:4
accidentally (1) 248:6	adjusted (2) 323:13;328:12	agreements (4) 288:14;291:3,16; 292:2	although (8) 254:12,16;265:11, 24;342:3;370:22; 374:14;376:9	annual (4) 291:19;311:15,16; 357:24
accomplished (1) 291:1	adjustment (1) 306:5	ahead (18) 243:5,7,11,17; 244:19;245:14,22; 247:14,23;248:13; 310:22;311:1;323:3,9, 24;330:6;378:9,9	always (1) 363:3	anthropogenic (1) 282:19
according (2) 281:3;365:9	ADMINISTRATION (3) 239:7;243:6;301:16	agreements (4) 288:14;291:3,16; 292:2	amenable (2) 288:3;290:13	anticipate (1) 355:3
account (7) 322:1,2;325:10,18; 326:10;373:16,18	admit (1) 333:8	agreements (4) 288:14;291:3,16; 292:2	amended (6) 291:6;292:6;364:7; 367:1;376:16,18	Apcar (4) 284:9;287:20; 294:15,21
accounted (1) 325:13	ADMITTED (5) 242:11;247:14,15, 17,18	agreements (4) 288:14;291:3,16; 292:2	amendment (1) 377:4	Apgar (1) 277:8
accounting (2) 271:21;320:12	admittedly (1) 361:7	agreements (4) 288:14;291:3,16; 292:2	amendments (1) 376:22	apologize (1) 373:22
accurate (2) 341:24;356:18	adults (1) 289:9	agreements (4) 288:14;291:3,16; 292:2	among (2) 294:6;298:16	apparently (3) 257:11;359:16; 375:14
accurately (2) 269:19;335:7	advantage (1) 271:21	agreements (4) 288:14;291:3,16; 292:2	amount (11) 258:8;270:7;293:6; 294:14,23;295:7; 296:5,22;323:13; 358:12;359:23	appear (1) 336:8
acquisition (2) 254:4;266:11	advocate (1) 258:8	agreements (4) 288:14;291:3,16; 292:2	amounts (1) 328:12	APPEARANCES (2) 240:1;241:1
acre-feet (2) 269:12;270:1	aerial (3) 264:11;266:4;374:4	agreements (4) 288:14;291:3,16; 292:2	analyses (7) 262:3,19;263:4; 264:22;315:7;344:24; 345:3	appears (5) 262:1;263:5;321:24; 346:24;379:11
across (10) 251:13;261:9,15,21; 264:5,17;265:5,8; 295:1;296:11	aerially (2) 326:6;345:20	agreements (4) 288:14;291:3,16; 292:2	analysis (50) 250:19;251:9; 252:19;273:10;276:23; 277:18;278:22;279:17;	appended (1) 248:2
Act (2) 286:19;340:6	affect (13) 266:2;272:4;282:22;	agreements (4) 288:14;291:3,16; 292:2		Appendix (2) 311:14;317:13
Acting (1) 240:4		agreements (4) 288:14;291:3,16; 292:2		application (1) 374:8
action (3) 296:24;367:20;368:5		agreements (4) 288:14;291:3,16; 292:2		applications (2)
actions (5) 282:19;291:16; 296:21;298:2,3		agreements (4) 288:14;291:3,16; 292:2		
actively (1) 291:10		agreements (4) 288:14;291:3,16; 292:2		
activity (1) 282:21		agreements (4) 288:14;291:3,16; 292:2		
actual (2) 356:19,20		agreements (4) 288:14;291:3,16; 292:2		

349:22;350:2 applied (2) 373:7;374:3 applies (1) 340:14 apply (1) 341:6 appreciate (1) 243:15 approach (7) 270:14;290:8; 291:14;292:21;293:18; 367:4;371:12 appropriate (1) 369:23 approximated (1) 326:20 approximately (4) 292:7;336:22;337:3; 358:9 approximation (1) 328:16 approximations (5) 264:21;326:23; 342:20;343:13;373:18 aqua (2) 342:17;343:9 aquatic (1) 288:4 aquifer (48) 249:15,19;250:11, 22;251:7;252:19; 253:5,10,16;254:18; 256:1,8,10,17;257:10; 258:4;261:15;266:22; 267:5;272:14;274:11, 11,13,16;275:23; 277:23;301:2,3;304:7, 7;310:4,7,10,16;325:5; 326:13;327:20;342:10; 343:9;344:14;347:9; 357:24;361:12;362:9; 372:2;373:12;375:13, 15 aquifers (11) 249:11;250:10,15; 253:3,14,17;266:18; 267:2;268:8;310:16; 333:14 AREA (80) 239:12;249:12,17, 19,22;250:3,10,16,17; 251:1,3,12,13;252:6,8, 9,12,18,20;253:15,18; 255:7;256:19;257:13; 260:4,6;264:19; 265:10,13;266:6,8,13; 267:2;273:2,23;274:9, 14,16,18,19,23;275:15; 277:2;283:20;284:10; 285:6;291:5,10;298:1, 5,9;300:16;301:10,24; 304:22;307:11;325:4, 23;326:9;334:6,8,18; 344:13;346:1;347:10; 351:4;352:12;353:24; 354:2;360:24;361:8, 17;362:3,12,18;363:1; 369:1,10;374:7;375:7 areas (11) 265:1;284:5;286:24; 287:12;290:5,24; 333:3,3,6;336:8; 369:14 arguably (1) 260:6 argument (3) 299:24;300:5,7 arid (1) 309:19 arm (1) 283:19 around (6) 287:23;298:12; 300:20;301:1;303:24; 304:6 arrive (1) 315:18 arrived (1) 342:18 Arrow (3) 318:16,20;337:3 aside (1) 287:10 aspects (1) 291:8 assembled (1) 330:10 assessing (2) 332:17;333:3 assessment (1) 294:24 assign (1) 343:2 assigned (2) 297:15;343:5 assist (1) 248:3 associated (4) 280:16;316:17; 334:20;356:19 assume (2) 339:8;361:23 assumed (1) 330:1 assuming (5) 269:2;270:7;320:20; 330:16;359:6 assumption (3) 319:15;326:17;346:3 assumptions (3) 322:23;371:2,4 asterisks (2) 318:9;335:19 Atmospheric (2) 301:15,16	attempt (2) 330:15;343:9 attempted (2) 263:21;360:23 attention (5) 275:3;371:17;372:4, 19;377:5 attest (4) 246:6,16,24;247:9 attributable (2) 301:7,8 attribute (1) 296:23 August (1) 247:7 author (4) 244:5;299:21; 324:11;376:10 authored (2) 245:1;247:4 Authority (1) 349:10 authors (8) 243:23;244:2; 292:16;294:6,9; 295:13;311:16;322:22 authors's (1) 320:15 autocorrelation (4) 321:5,17;322:1,9 automated (1) 315:13 automatic (1) 282:15 availability (4) 259:20;268:1; 286:11;356:7 available (20) 261:1;262:15;264:3, 4,8;268:21;272:1; 293:7;294:14;296:5; 301:15,17;310:15; 312:11;314:7,13; 327:7;342:4;353:13; 355:19 average (15) 268:17;269:13; 270:2;278:2,3;302:9,9; 303:10,14,16,18,20; 304:6;359:14,17 averages (1) 302:15 avoid (2) 314:6,18 avoided (1) 314:16 aware (3) 322:23;376:16,24 away (1) 374:11 axis (8) 278:6,7;294:23; 311:21,21,22;312:16;	313:22 B babbling (1) 263:12 back (27) 243:5;247:3;270:23; 271:11;286:2;287:17, 24;290:4;298:15; 301:3,4;303:7,24; 306:12;307:11;308:8, 15;309:11;311:1; 312:6;322:11;329:19; 355:5;362:4;377:9; 378:6,10 background (3) 282:16;344:24; 368:14 backgrounds (1) 344:23 back-to-back (2) 308:2,11 backup (1) 248:3 bad (1) 332:17 balance (1) 320:11 Baldwin (13) 242:6;260:10; 277:11;337:9,9,12,23; 338:8;339:1,17; 340:21;348:19,22 Band (4) 299:22;332:6;337:7, 10 bar (1) 295:21 Barnes (1) 240:8 barometric (2) 345:15;346:4 barrier (4) 334:17;335:1;336:3; 362:24 barriers (4) 290:12;333:7; 334:16;335:20 base (12) 295:3;311:16,18; 312:4,7;313:21; 317:14,17,17;320:22, 22;359:11 based (28) 252:19;253:8;256:9; 257:4,14;259:22; 261:9;262:2,13,15,18; 263:4,16;264:20; 267:10;271:3;272:19; 273:6;287:14;292:11, 17;323:17;356:7; 364:2,13;371:15;	374:20;375:11 basically (14) 256:4;260:2;261:11, 24;274:1;282:11,16; 283:17,22;287:18; 297:23;298:7;306:6; 307:3 BASIN (15) 239:9,10,11,13; 253:6,12;261:21; 264:21;304:21;305:13, 14;306:22;307:6; 347:9;355:21 basins (39) 249:21;250:21,21, 24;251:4;252:13,17; 253:4,9;257:20;259:1, 1,9,10;260:3,23;263:9; 264:10;265:1,16; 266:5,6,9;268:2; 270:23;272:5;304:13, 15,23;305:3,3,4;325:6; 348:24;349:1;356:15; 361:1,20;375:24 basin's (1) 356:14 basis (5) 251:4;267:12; 321:10;323:21;374:15 become (3) 288:24;304:9;369:18 becomes (1) 309:22 Bedroc (1) 241:11 began (2) 248:23;285:7 begin (1) 324:1 beginning (3) 261:2;300:19;301:1 begins (1) 359:5 behalf (2) 243:20,24 behaving (2) 279:13;281:2 behavior (1) 289:8 behind (2) 261:12;318:10 Belaustegui (1) 240:19 believes (2) 244:12;342:21 below (6) 249:3;286:24;292:5; 334:17,23;351:21 Benedict (1) 240:11 benefit (3) 271:13;288:10;340:9 best (11)
--	--	---	---

268:19;283:3; 292:13;293:18;312:19, 21;329:10;336:7; 343:20;346:23;379:15 bet (1) 270:11 Beth (1) 337:9 better (5) 248:11;270:12; 287:5;289:13;322:7 beyond (2) 265:1;306:6 bifocals (1) 250:13 big (8) 260:13,14,16; 277:13,15;286:13; 308:5;328:9 binder (1) 356:22 biodiversity (1) 285:12 biogeographic (2) 284:1;285:14 Biologic (1) 241:15 biological (12) 285:4;288:17;298:8; 366:19,23;367:3,8,19; 368:5,9,12,17 Biologist (1) 245:8 biology (6) 282:8,16,22;287:13; 289:16;292:1 bird (2) 345:16;346:5 bit (13) 274:19;288:24; 296:8;298:17;302:11, 14;304:5;308:3; 328:12;336:1;354:12; 357:1;372:3 BLACK (7) 239:9;251:3;264:19; 265:1,10,13;266:8 Bliss (1) 240:14 BLM (1) 338:13 blue (2) 290:1;311:22 bogged (1) 293:11 boil (1) 286:12 bordering (1) 249:21 both (13) 254:8;260:10;271:2, 6;286:10;298:12; 302:1;304:8;329:16;	377:18,20,20;378:4 bottom (10) 295:1;296:11; 297:17;302:6,24; 303:3;305:11,17; 314:3;359:5 Bounce (1) 303:24 boundaries (12) 252:16;260:23; 261:2;263:9,13,14; 325:13,18;361:3,18; 370:9;371:10 boundary (16) 261:4,7;262:1,7,8, 20;263:3;277:6; 284:15;329:6,10; 334:18;353:16,18; 361:24;370:6 boy (1) 250:13 Brad (1) 324:3 branch (3) 245:5;284:12;340:17 BRAUMILLER (35) 244:23,23;245:24; 246:4;247:23,24; 248:12;273:17;324:6, 8;331:18;337:16; 338:3,15;339:5,20; 342:12;352:5,9; 356:11,16;357:16; 360:21;361:5;364:24; 365:3,15,21;366:9; 368:21,22;369:6; 370:1,6;378:7 B-R-A-U-M-I-L-L-E-R (1) 245:1 break (7) 282:3;299:9,16; 310:22;377:11;378:9,9 Bridget (1) 240:14 briefly (3) 282:9;283:4;357:10 bright (1) 248:8 bring (4) 243:22;248:6; 269:11;289:21 brought (3) 248:3;250:13;291:9 Brownstein (1) 240:22 budget (7) 257:4;262:3,19; 263:4;264:21;355:19, 24 budgets (8) 262:4,16,16;355:7,8, 13,15;356:7 bugs (1)	285:2 build (1) 271:17 bump (1) 308:9 bunch (2) 293:16;320:13 butcher (1) 360:22 C C-3 (1) 357:15 calculate (1) 294:14 Caldera (2) 354:16,18 California (21) 240:23;249:12,17, 20,22;250:10,16,17; 251:2;252:4;253:15, 18;257:13;258:6,9; 264:18;265:9,16; 266:8;267:3;273:2 call (2) 312:2;335:24 called (2) 283:19;321:16 calling (1) 353:1 came (3) 252:16;286:18; 350:18 can (68) 244:17,20;245:14, 24;246:6,9,16,24; 247:9;248:6;251:17; 254:21,21,24;257:3; 264:9,15;266:13; 268:24;270:16,19; 271:18;272:18;273:6, 14,18;275:3;278:7; 280:10;284:6;286:12; 288:10;289:24;294:24; 295:6,11,22;296:12,14, 14;299:15;303:12; 306:1;310:2,3,4,12; 311:1;315:16,22; 316:12;319:4,20,22; 323:7,8;334:5;340:3; 343:24;344:15,18; 347:6,7;355:3;362:22; 368:8;371:15;372:15 cancelled (1) 365:9 Canyon (3) 318:17,20;337:3 capacity (2) 258:11;310:10 capture (1) 271:11 carbonate (84)	249:15,19;250:11, 22;251:7,11,11; 252:19;253:5,10,11,16, 23;254:18;255:15,23; 256:1,7,10,16,17; 257:9,16;260:2; 261:15,19;265:4; 266:18,22;267:5,9,15; 268:7,9,11,18;269:10, 13,21;270:1,22;271:4; 272:7,9,9,13,15,23; 274:11;277:20;300:11, 15;307:16;309:5; 325:5;327:20;344:14; 347:9;350:24;354:22; 355:1;356:20;357:2, 24;358:10,12,20,23; 359:9,17,24;360:3; 362:9,11;363:6; 371:21,23,24;375:6,8, 9,13,13,14 carbonates (14) 254:6,13,17;255:6; 256:5,21;257:19; 262:14;263:22;265:15; 267:9;352:14;355:2; 362:17 carry (1) 294:6 Carson (5) 240:17;243:1;379:2, 6,17 case (8) 264:15;285:8; 312:16;315:8;320:21; 335:8;337:17;345:9 cases (3) 249:5;295:22;347:7 cast (1) 312:6 categories (1) 295:1 caused (1) 336:21 causes (1) 267:20 caveat (1) 298:24 caveats (1) 329:23 Caviglia (1) 240:24 CCR (1) 379:22 CCRP (4) 262:5,16;263:5,20 ceased (1) 269:16 Celsius (1) 285:19 Center (1) 241:15 centers (1)	343:14 central (10) 254:7,13;255:2; 256:21;257:2,12; 362:12;363:6,6,15 certain (2) 269:5;349:2 certainly (8) 305:12;306:21; 307:19;323:6;328:16; 339:6;346:4;356:5 Certified (1) 379:4 certify (1) 379:5 cetera (6) 257:21;258:16; 339:8;358:24;362:13; 375:12 CFS (4) 260:14;278:17; 292:5,5 CH-4 (1) 277:21 challenges (2) 288:18;298:18 Chances (1) 321:10 change (22) 265:2,15,17,21,22; 276:15;279:9,9; 280:21;286:9;294:10; 295:15,17;297:7; 308:17,19,22;319:21; 329:5;334:24;347:18; 368:15 changed (1) 293:5 changes (23) 258:23;259:7,17; 261:18;267:23,24; 269:21;271:12,24; 272:1;276:21,24; 277:1;280:13,18; 297:8,8;314:10; 339:13;345:18;346:6; 368:18;373:19 changing (2) 291:13;336:5 characteristics (2) 292:18,23 characterize (1) 374:4 characterized (2) 285:4;287:19 characterizing (2) 258:21;259:5 check (3) 327:7,9,11 chemical (1) 290:16 Chief (2) 240:7,10
--	--	---	--	---

chlorinated (1) 287:19	closer (2) 272:16;273:4	compartmentalized (1) 256:11	262:11;290:6	constant (4) 261:4,7,24;267:17
choose (5) 293:18;315:10; 325:19,21;375:16	closest (2) 269:22;356:15	complete (3) 248:24;273:9;375:14	cone (4) 252:10;282:21; 361:8,10	construct (1) 268:14
chose (2) 294:6;295:13	cobble (1) 294:2	completed (5) 254:2;352:1;354:21; 375:13;377:21	confined (1) 274:11	constraining (1) 290:13
chunk (5) 254:17;255:6;256:4, 4;327:19	code (2) 324:12;343:19	completely (2) 287:20,22	confirm (3) 250:5;257:18;329:9	construction (2) 329:18;373:15
cited (7) 339:7;341:14;342:3; 371:7;375:22;376:5,6	coefficient (17) 278:16;280:15,17; 316:9,11,13,15,16,17, 19,22;317:22;320:1,6, 10;326:22;342:14	completion (4) 253:23;255:19; 377:16,22	confirmation (4) 257:15;371:8,9,14	consumed (1) 310:2
City (5) 240:17;243:1;379:2, 7,17	coefficients (13) 316:4;317:7;319:1, 19;320:18,21;322:8; 342:18,19;343:11,12, 20;344:11	complex (5) 288:16;289:15; 294:4;354:16,18	Confirmed (1) 264:2	context (1) 248:18
clarification (2) 253:22;257:23	coincidence (2) 263:14,15	compliance (1) 368:19	confirming (1) 250:7	continually (1) 289:16
clarify (6) 250:18;255:14; 256:15;327:22;354:6; 372:2	coincides (1) 337:2	complicated (1) 296:23	confusion (1) 376:12	continue (3) 300:3;311:1;331:13
clear (13) 254:1;261:6,18; 265:12;295:10;324:24; 325:19;328:17;353:7, 10;361:1;362:14; 363:14	collective (1) 280:6	Complies (1) 367:17	conjunctive (4) 246:2;273:13;340:3, 9	continued (4) 270:5;300:23,24; 368:6
cleared (1) 378:5	collinearity (1) 322:9	component (4) 260:15;285:12; 298:8;340:1	connection (7) 253:19;254:5;255:5; 257:9,19;268:9;363:14	continues (2) 300:21;301:2
Clearly (6) 252:10;254:17; 278:11;325:3;362:10; 363:10	colored (1) 284:5	components (1) 310:5	connections (4) 250:9,14;253:13; 371:15	continuity (1) 262:13
clicking (2) 250:6;270:19	colors (1) 294:20	conceptual (4) 262:5,17;263:5; 267:11	connectivity (2) 290:24;361:2	contrary (1) 254:10
climactic (2) 259:8,17	column (11) 279:18;280:2,20,21; 295:2;317:19,21; 318:1,23;319:2;358:2	concerned (3) 266:1;284:24;293:24	consequence (1) 255:12	contrast (1) 260:9
climate (44) 258:13,17,24;259:3, 24;267:20;271:12; 275:21;301:7,10,11,12, 14;302:5;304:24; 305:2,5;307:8;308:13; 309:3;311:19,19; 312:9,11,12;314:6,7,8, 13,13,15;316:8; 320:17;322:16;336:23; 341:12;346:15,19; 347:15,18;348:8,13,17, 18	combined (4) 268:17;270:17; 320:19;359:9	concerns (2) 289:14;331:3	consequent (2) 295:24;299:3	contribution (1) 334:14
climate-based (1) 345:7	comfortable (1) 363:24	conclude (5) 255:22;266:16; 268:5;322:11;323:1	consequently (2) 261:17;359:6	controls (1) 370:13
climatic (7) 258:23;259:7,18; 267:24;271:21,21; 272:2	coming (1) 344:8	concluded (7) 249:22;253:3;257:1; 262:17;364:1,6;378:12	CONSERVATION (4) 239:2;282:19;290:7; 379:8	convenient (1) 293:23
close (8) 269:16,23;277:7; 280:24;285:11;304:14; 317:9;358:24	comment (1) 320:15	conclusion (7) 253:8;272:8;281:8; 325:7;329:9;331:23; 362:5	conservative (3) 269:8,9;369:20	conversely (1) 295:5
closely (3) 280:23;281:9;314:1	comments (4) 338:13,17;339:15; 341:6	conclusions (13) 243:11,12;244:16; 296:3;325:2;329:8; 331:23;344:21;348:14; 356:12;370:17;371:20; 377:19	conservatively (1) 261:24	cool (1) 290:2
	common (2) 312:14;342:13	concurrently (2) 297:1;298:14	consider (2) 332:15;348:7	cooler (3) 286:24;289:19; 298:11
	communicate (1) 284:6	condition (1) 332:18	considerable (1) 322:8	coordinate (1) 245:10
	Company (2) 366:14,18	conditions (14) 258:20,23;259:8,17, 18;260:23;264:1; 267:24;271:22;272:2; 303:10,15,16,20	considerably (1) 287:4	copied (1) 341:16
	compare (1) 279:10	conduct (1) 324:9	consideration (2) 266:15;369:24	copy (1) 367:7
	compared (4) 266:24;309:23; 346:5,10	conducted (3) 324:7,11;377:18	considerations (5) 257:5,14;261:10; 262:13;375:11	corner (3) 306:14,18;309:17
		conductivity (2)	considered (9) 253:21;255:11; 256:14;257:7;258:11; 259:3;264:12;293:21; 376:1	correction (1) 257:22
			consistent (4) 260:24;274:17; 302:20;305:12	correlated (3) 319:18;320:14; 321:16
			consisting (1) 379:12	correlating (1) 320:9
				correlation (2) 319:13;321:6
				correspond (4) 282:9;294:21; 297:19;313:23
				corresponding (3) 301:1;308:8,14
				correspondingly (1)

303:19 counsel (2) 337:10;367:7 counting (1) 297:23 country (1) 301:17 County (7) 241:2;291:7;364:9; 366:14,17;367:22; 376:19 couple (19) 248:5;262:22;274:3; 283:10;285:1,1;286:4; 288:13;291:2;300:23; 312:8;323:10;332:5; 333:23;335:16;343:21; 352:4,5;360:20 course (12) 249:10,12;251:10; 256:24;261:3;271:15; 283:11;290:21;291:22; 298:2;372:16;374:15 Court (1) 379:4 cover (2) 282:16;284:3 covered (1) 283:9 Coyote (38) 249:23;251:1,19,24; 254:7,13;255:2,3,15, 16,23;256:17,22;257:2, 12;261:5,20,22;266:7; 291:5;304:17;305:15; 307:1,6;324:1,4; 349:23;350:6,24; 352:16;362:1,7,12,15; 363:6,15;365:12,13 crap (1) 285:24 create (4) 270:15;271:3;326:7; 345:23 created (3) 271:10;327:16;374:5 creating (1) 263:24 credation (1) 290:15 credible (1) 322:13 Criedter (1) 341:15 criteria (1) 315:15 critical (3) 311:6,6;378:3 critically (1) 288:9 criticism (1) 341:5 critiqued (1)	345:3 CROSS (2) 242:2;327:9 cross-examination (10) 323:10,10,12,16; 324:2;336:13;337:11; 349:8;360:17;366:15 cross-sections (1) 263:18 CSI (6) 240:19,22;301:15; 313:10;350:2;353:5 CSMV-4 (1) 254:23 CSVM-2 (1) 251:24 CSVM-3 (6) 256:3,15;352:18; 354:14,20,21 CSVM-4 (6) 255:3;362:7,10,16; 363:9;365:19 CSVM-5 (4) 306:24;307:13,15; 347:10 CSVM-6 (7) 251:19,22;254:14, 23;362:13,15;363:5 cumulative (2) 313:11,14 curious (2) 343:1;344:8 current (8) 283:4;291:18; 317:17;318:20;321:12, 16;325:2;332:18 currently (5) 256:3;268:23; 283:23;296:9;301:20 curtailment (3) 291:2,23;292:8 Curve-fitting (13) 250:19;325:17; 326:15,15;328:14,15, 18,23;344:11;345:17; 373:17,17;376:3 cut (2) 293:12;294:17	289:17 dangerous (1) 356:6 Darcy-flux (1) 264:21 Darcy's (1) 276:13 data (63) 248:14;254:5; 257:18;261:2;262:20; 263:11,16;264:2,8; 271:3,10;272:19; 273:7;291:21;293:19; 294:18;295:16;297:11; 301:10,11,14;302:1,2, 10,21,22;304:3,11,12; 310:18;312:3,11; 314:7,13;315:20,20,22; 316:1;319:21;324:15; 327:7,11;328:1,4,5,9, 11,18;332:9,14,15,16, 20;339:6;342:2,7; 355:3,15;356:2,8; 374:15,21;378:3 date (2) 264:20;351:14 Dated (1) 379:17 day (3) 243:5,22;379:17 deal (1) 289:20 deals (1) 282:7 dealt (2) 291:7;292:1 Debbie (1) 337:10 decade (1) 290:21 decades (1) 355:12 decision (2) 374:18,19 decisions (1) 356:6 decline (16) 247:6;269:20,22; 278:21;281:1,2; 300:20,24,24;305:10, 12,18;308:23;314:3; 337:2,2 declining (1) 308:21 decrease (7) 275:22;295:5,8,9; 296:5;299:5,6 decreased (2) 260:17;267:22 decreases (2) 294:12;361:12 decreed (5) 269:3;270:9,18;	330:14;359:7 deem (1) 252:24 deep (3) 254:3;298:13;377:21 deeper (2) 289:4;364:19 default (1) 340:2 define (5) 264:11;355:20; 360:24;361:3;370:9 defined (5) 301:21;303:17,19; 361:20;362:10 definitively (2) 249:6,7 degree (3) 258:10;369:20;371:1 degrees (2) 285:18;289:11 Delamar (8) 256:11;304:16,17, 19,20;305:14;348:6,24 delayed (1) 348:7 delineated (1) 361:9 delta (1) 293:21 demand (2) 310:4;330:9 demonstrate (4) 312:21;313:7,8,10 demonstrated (6) 249:6;250:8;253:14; 254:6,12;258:4 dense (1) 244:14 DEPARTMENT (5) 239:2;243:19;277:3; 336:15;379:8 departure (2) 313:11,14 dependent (4) 316:8,14;321:7,8 Depending (2) 255:19;280:8 depends (1) 334:13 depth (5) 292:23;294:1,7; 333:12,16 derived (7) 249:15;272:13; 274:10;311:16;312:3; 313:18,21 descending (1) 295:10 describe (4) 315:22;351:4; 355:13;359:4 described (6)	278:13;285:23; 343:2;351:15;376:4,6 describing (1) 342:20 description (1) 377:17 descriptions (1) 284:18 descriptive (1) 280:11 desert (7) 286:8,12;304:20; 305:22;306:10;348:6, 24 designated (1) 349:3 designed (1) 351:20 desk (1) 324:18 detail (2) 269:7;338:21 details (2) 264:14;343:24 detected (2) 272:18;273:6 detectible (1) 260:2 determine (4) 254:5;256:20; 259:18;372:8 develop (2) 263:20;293:4 developed (11) 248:20;262:4; 263:19;267:11;281:4; 293:9;331:11;340:4, 10;355:7,8 development (8) 247:7;251:6;268:2; 272:2,17;273:5,13; 367:21 deviation (2) 303:14,16 deviations (3) 303:12,18,20 diagnose (2) 315:15;322:2 diagram (5) 283:20;284:4; 289:23;296:15;334:4 difference (9) 261:14,16;265:19; 274:24;275:7;291:17; 303:4;362:6,15 different (21) 277:1;280:7;286:5; 292:10;295:1,18; 296:23;305:2;312:10; 317:24;318:3,7;321:5; 328:2,3,13,23;343:14; 344:23;348:15;363:9 differential (11)
	D			
	Dace (37) 245:10;282:8,17; 283:5;284:24;285:5,9; 286:17;287:9;288:4, 10,19;289:16;290:3,8; 291:10,22;292:14,17, 20;293:7;296:6,12,15, 22;298:19,23;299:1,4, 7;333:24,24;334:21; 336:7;340:9;367:2; 368:7 daily (1)			

274:22,24;275:10, 16;276:2,6,8,9,15; 279:5,9 differentials (1) 275:18 differently (1) 295:14 difficult (2) 334:21;345:10 diffusivities (1) 266:18 diffusivity (2) 267:1,4 dig (1) 364:19 DIRECT (7) 242:2;245:18; 247:22;275:3;282:7; 293:12;323:2 directed (2) 363:22;368:21 Directing (4) 371:17;372:4,19; 377:5 direction (1) 243:12 disappointed (1) 309:10 discharge (14) 260:15;273:22; 274:8;276:24;278:6,9, 13;280:6,13,19;281:9; 298:13;313:1;333:3 discharges (2) 249:10,18 discontinuities (3) 264:6;371:8,13 discuss (6) 291:12,20;305:23; 337:24;338:6,7 discussed (7) 283:14;307:24; 309:15;325:16;329:17; 330:23;353:8 discussing (2) 307:1;320:16 discussion (5) 244:18;283:1;311:4; 322:3;352:21 discussions (2) 291:20;335:5 distance (2) 361:13,15 distinct (2) 244:3,8 distributed (2) 330:11,15 District (6) 349:7,11;360:16,19; 366:17;376:19 divergence (1) 314:9 diversity (1)	298:8 divided (1) 282:11 divides (1) 263:15 DIVISION (20) 239:3;258:24;259:3, 8,8;260:18;301:13,13, 14,18,22;302:5,5,23, 24;303:3;307:22; 332:16,16;379:9 divisions (1) 304:8 document (4) 367:19,23;368:1; 373:19 documented (2) 265:4,8 DOI (7) 250:18;307:20; 324:10,17;375:21; 376:4,6 domain (1) 269:4 done (13) 270:19;282:19; 288:6,13;290:7,12,14; 335:15;346:12;348:11; 355:21;370:21;376:4 doubt (2) 329:1,3 Dougherty (1) 343:22 down (28) 245:23;270:8;271:5, 8;283:18,18;284:13, 13;286:12;290:2; 293:11;295:8,9;297:9; 305:2,14;306:13,17; 310:7,15;334:21; 336:1;340:1;349:16; 352:7;360:7;373:2; 377:17 downloaded (1) 332:19 downstream (11) 286:23;289:1,12,14, 17;290:5,11;334:1,2,3; 336:1 DR (14) 245:7;282:5;284:20; 333:20,21,23;337:22; 338:5,24;339:4; 340:15;366:18;376:8, 13 drafted (2) 244:5;368:12 drafting (2) 243:23;244:3 drainage (2) 283:17;284:22 drawdown (31) 251:7,9,21,23;252:1,	3,9,10,12,14;264:5; 275:20;278:18,19; 326:4,5,6;327:16; 328:22;329:2;344:13; 345:20,23;361:6,8,10, 11,14;374:5,9;375:2 drier (4) 303:16,18;304:5; 308:18 drift (1) 289:1 drilled (2) 365:23;366:4 driller (1) 333:11 driller's (1) 333:17 drivers (1) 345:18 driving (1) 274:22 drop (3) 265:3,7;334:20 dropped (1) 305:14 drought (22) 260:18;299:24; 302:1,18,22,23;303:2, 8,11,18,23,24;304:3; 305:19;306:21;307:5, 10;322:14,19;332:18; 344:22;347:24 droughts (1) 332:18 dry (24) 302:13,19;303:11; 304:16,18;305:7; 307:23;308:8,15,16,18, 19,20,23,24;309:12,15, 21,23;310:8,17; 322:18;348:6,24 drying (4) 302:18,21;304:3; 307:10 due (7) 251:7;267:23;268:2; 272:1;289:13;345:20; 373:24 during (8) 254:24;269:13; 270:2;308:18;330:1, 17;350:1;352:19 dynamic (2) 297:7;336:4	287:16;289:2 earnest (1) 249:1 easier (1) 313:13 easily (1) 334:21 east (11) 252:5,23;256:2; 265:4,8;277:9;279:19; 281:17;286:15;304:21; 354:19 effect (11) 255:17,17;256:20; 261:20;326:24;332:21; 333:1;342:22;350:23; 355:1;368:17 effective (4) 273:13;313:4;340:3, 9 effectively (1) 284:6 effects (23) 255:15,22;256:15; 267:8,15,15,16,17,22, 24;271:12;272:6; 278:10;286:9;288:11; 290:15;297:8;346:4,6, 15;347:6,7;355:22 efficient (1) 243:16 effort (2) 249:1;288:1 efforts (2) 245:10;287:16 EH-4 (19) 269:21;278:4,7,14, 20;300:12;307:19,21; 308:6;311:15;313:20; 314:2;317:13,16; 318:16,19;321:10; 336:18,21 EH-5 (1) 334:4 Eight (2) 258:13;266:5 either (11) 256:17;261:19; 263:14;295:17;305:20; 306:22;307:6;319:10; 322:23;326:24;378:4 elements (4) 282:9,16;283:10; 292:2 elevation (37) 274:12,13,16,18; 275:1,2,4,5,6,8,8,9,12, 13,14,21,23;276:2,7, 11,12,18,20;277:15,23; 278:3,4,9;279:3,4,22, 23;280:7,13,14;281:10, 17 elevations (10)	276:21;278:7,14; 279:10;280:8,12,20; 281:5;306:5;311:24 else (4) 252:11;320:11; 338:1;355:8 e-mail (4) 341:8,11,17,17 emails (1) 341:10 emphasize (1) 314:24 empirical (8) 270:16;271:3,16,20; 329:18;355:15;356:2,8 encourage (1) 313:6 end (17) 244:19,20;247:13; 251:8;267:18;283:6; 285:7,18,19;317:11; 322:10;326:22;336:6; 341:24;362:1,1,16 endangered (6) 284:24;286:17; 288:11;296:6;340:6; 368:7 endeavored (4) 250:18;258:17; 340:12;345:1 ended (1) 269:24 endemic (1) 284:23 Energy (1) 240:24 Engineer (9) 240:4;244:1;323:19; 341:22;345:12;350:23; 356:13;369:23;377:1 Engineer's (7) 269:5;330:9;339:22; 340:11;341:16;350:17; 374:15 enough (7) 248:17;265:20; 271:8,17;313:19; 324:15;330:17 entered (1) 311:11 entire (7) 251:12;287:14; 290:17,19,20;347:9; 367:24 entirely (4) 249:15;265:12; 272:13;377:23 entirety (2) 247:2;368:1 entitled (1) 379:9 enumerate (1) 249:1
		E		
		earlier (4) 253:8;261:1;266:11; 314:17 earliest (1) 286:21 Early (2)		

enumerated (2) 273:8,9	everybody (3) 243:15,18;313:6	expanded (1) 361:2	296:1;302:14;320:24; 370:24;374:17	276:1,1,3,4,8,9;361:14; 362:9
environmental (1) 326:19	everyone (1) 341:6	expansive (3) 252:9;329:2;345:20	factor (1) 370:14	few (7) 282:9;301:5;307:5; 325:16;335:23;349:12, 18
equates (1) 278:17	Everywhere (2) 371:6,9	expect (7) 276:13,16;320:4,22; 328:3;333:6,9	fair (2) 316:3;347:11	fewest (1) 315:21
equilibrium (1) 269:17	evidence (8) 243:12;247:14,17, 18;255:10;292:13; 307:9;322:13	expected (1) 320:20	FAIRBANK (25) 239:4;240:2;243:4; 245:11,13;247:15; 248:10;299:8,11,17,19; 310:21,24;323:6; 336:11;337:7;349:6; 360:13,15;366:13; 367:5;369:4;370:3; 377:10;378:8	field (10) 250:23;252:21; 253:10;254:18;266:23; 325:4;327:20;344:9, 16;362:21
erosion (1) 336:5	evidenced (2) 254:20;269:17	experience (2) 369:18;370:21	falls (1) 261:10	fields (1) 245:22
especially (5) 281:10;302:12; 304:6;309:19;312:10	exact (3) 296:24;328:21;362:8	expert (3) 369:1,9;370:1	fairly (7) 248:2;274:17; 280:24;300:18;301:5; 308:10;351:14	figure (20) 277:24;278:1; 300:10,10,17;302:3; 306:24;307:3,23; 311:14,15;312:9,13; 313:17,17,20;347:21; 353:15,24;361:8
Esq (6) 240:18,20,24;241:4, 7,13	exactly (5) 279:14;297:9; 335:17;341:3;352:12	experts (2) 243:23;245:21	familiar (17) 245:24;246:12,20; 247:4;324:22,23; 330:21;338:19;357:4, 9,18;364:7,11;366:19; 367:3;373:4;377:3	figures (2) 293:12;302:3
essentially (2) 351:6,7	EXAMINATION (2) 242:2;245:18	explain (10) 274:4;295:14;303:7; 315:10,11;321:7,15; 322:7;345:15;376:10	far (11) 244:20;251:13; 268:24;298:17;322:20; 360:2;366:1,2,5;375:9; 376:2	file (1) 349:22
establish (6) 268:10;291:11; 312:17,20;316:7; 317:15	example (2) 311:13;317:12	explaining (2) 280:13;341:22	Farber (1) 240:22	filed (7) 243:24;244:4,5; 246:3,13,21;247:7
established (8) 281:18;287:9,11,13; 296:14;325:4;332:1; 351:20	except (1) 303:5	explains (1) 321:12	faster (1) 289:3	files (4) 341:12,14,18;342:3
establishment (1) 286:19	exception (1) 347:10	explanation (1) 310:18	Fault (27) 254:1,3,9;255:20; 256:2,2,3,6,11,12; 257:2;352:10,17,17,18, 22;353:1,6,9,9,10; 354:14,15,19,20; 377:23,24	final (1) 321:4
estimate (8) 261:13;268:19; 269:9;270:22;279:5; 280:21;328:16;343:9	exceptional (1) 327:20	explanatory (8) 248:17;316:7,13,16, 23;319:13,16;320:9	farther (1) 286:15	finally (3) 306:11,23;319:24
estimated (2) 270:3;279:7	exceptionally (10) 250:23;252:21; 253:10;254:18;255:7; 308:20;325:4;344:9, 16;362:18	explicit (2) 291:15;374:17	faults (4) 325:13;333:2,6; 353:8	financial (1) 291:15
estimates (5) 266:22;298:19; 328:21;342:17;373:12	exchange (2) 272:10,22	expressed (1) 337:24	features (5) 282:13;285:15; 292:14;296:16,24	find (6) 286:24;289:3; 343:23;353:21;361:24; 362:24
establishment (1) 286:19	exclude (1) 363:1	expression (1) 326:21	feed (1) 289:19	findings (6) 248:17;250:20; 253:8;261:1;267:10; 350:22
estimate (8) 261:13;268:19; 269:9;270:22;279:5; 280:21;328:16;343:9	excluding (1) 268:22	expressions (1) 326:21	feeding (2) 288:23;289:12	fine (2) 248:12;327:5
estimated (2) 270:3;279:7	executed (1) 351:18	extend (3) 252:15;361:17; 374:10	feel (1) 313:19	finish (1) 377:11
estimates (5) 266:22;298:19; 328:21;342:17;373:12	Exhibit (18) 246:1,12,21;247:5, 17,18;257:24;293:12; 309:16;345:12;364:10; 366:20;367:8;368:4; 371:18;372:22;376:18; 377:6	extended (1) 375:2	feels (1) 363:24	finished (1) 290:19
estimation (1) 343:17	EXHIBITS (7) 242:11;258:1;292:4; 305:23;306:13,17; 376:5	extensive (6) 263:17;288:1;326:6; 327:15,17;334:7	feet (23) 251:21,23;252:1,3, 11,22;261:19;274:19; 275:6,7,7,10,13,15,17;	finishing (1) 311:4
et (7) 257:20;258:16; 299:1;339:8;358:24; 362:13;375:12	exist (7) 250:9,14;253:14; 254:6;265:11,24; 331:13	extent (7) 254:14;264:11,24; 266:4;361:4,22;374:4		finite (1) 267:1
evaluate (2) 313:4;330:16	existence (2) 368:6;371:7	extinct (1) 285:11		fires (1) 296:20
evaluated (1) 263:8	existing (4) 253:23;272:15; 273:3;356:14	extra (1) 247:4		first (31) 261:3;279:18; 285:16;286:18;288:21; 290:9;292:5;293:8,22; 300:9;301:9;302:12; 303:7;304:1;306:4;
evaporate (1) 310:11	EXISTS (4) 261:14;307:10; 322:14;331:13	extraordinarily (2) 300:22;307:15		
evaporation (1) 310:3		extreme (1) 301:18		
evapotranspiration (2) 310:2,6		extremely (4) 309:13,15;322:17; 361:8		
even (15) 272:11,23;289:7,13; 299:2;304:4;307:17; 308:18;317:9;322:19; 325:15,20;346:6; 357:1;361:3				
events (1) 373:24		F		
eventually (1) 273:14		fact (8) 254:20,24;269:17;		

<p>309:4;310:5,5,7,8; 312:9;314:6;315:3; 317:19;323:23;336:8; 343:8;347:16;360:21; 362:10;371:12</p> <p>Fish (55) 243:8,21,24;244:11; 245:5,8,9;246:1,12,20; 247:5,20;285:1,8,9,22; 286:10,21;287:8,23; 288:13,22,23;289:3,6, 13,18;290:15;291:3; 297:22,22;298:12,15, 17;323:1;331:3; 335:20;337:14,18; 338:10,19;340:18; 349:19,21;351:3; 364:8,9;365:18; 366:20;367:8;368:3; 371:18;376:17,19,24</p> <p>fishes (3) 286:13,18;290:21</p> <p>fit (4) 293:19;315:20,20; 343:21</p> <p>fitted (1) 319:7</p> <p>fitting (7) 316:1;342:13,17,19; 343:11;344:11;373:17</p> <p>five (13) 250:24;251:14; 253:4;255:22;276:4; 277:7;278:22;279:17, 18;285:24;331:24; 361:6,9</p> <p>five-foot (1) 275:22</p> <p>five-plus (16) 251:4;252:13,17; 253:9;257:20;259:1; 260:3,23;263:9; 264:10;265:1;266:9; 325:6;347:9;361:1,20</p> <p>fixed (1) 336:4</p> <p>Flangas (1) 241:7</p> <p>flat (3) 252:15;361:8,10</p> <p>floor (1) 249:3</p> <p>FLOW (127) 239:8;243:6;246:3; 252:16;253:22;255:18; 256:23;257:8;258:12, 18,22,24;259:7,10,11, 12,16,20;261:21; 262:12;263:3,15; 264:13;265:3,16; 266:1,5,19;267:12,16, 22;268:1,6,8;270:10, 23;271:1,1;272:3,8;</p>	<p>273:11;274:14,22; 276:14,17,18,24;278:2, 18,20,21;279:11,12; 280:5;281:11,13,16; 283:1;286:11;288:12; 290:22;291:10,23; 292:11,13;293:6; 294:8,11,13,15;295:1, 3,5,8,18,20;296:3,4; 299:2,6;300:2;301:20, 23,24;304:12,14,18; 305:1,2;307:17; 311:16,18;312:7; 313:21;314:11,12; 317:17,17;320:22; 322:15,17;329:6,10; 330:11;334:11,12,14; 349:14;351:7,12; 353:19;355:21;356:3; 357:23;359:6;361:3, 23,24;362:24;368:15, 18;370:7,9,13,15; 371:4;376:1</p> <p>Flower (1) 268:20</p> <p>flowing (6) 256:23;262:17; 270:4,8;340:1;359:15</p> <p>flows (28) 258:19;259:6,15,19; 260:1,6,16;267:21; 269:2,18;270:9; 281:19;300:2;312:4; 317:15;320:22;330:1; 331:4;332:1;336:4; 347:16,19,22;348:1,1, 364:2,13;370:17</p> <p>fluctuated (2) 297:5;298:20</p> <p>fluctuations (5) 345:7,16;346:5; 363:5,9</p> <p>flume (4) 277:10,10;279:20; 281:15</p> <p>flung (2) 251:13;375:9</p> <p>focus (2) 244:15;307:13</p> <p>focused (4) 299:22,23;300:7; 301:18</p> <p>folks (1) 244:17</p> <p>follow (2) 279:24;323:21</p> <p>followed (1) 248:20</p> <p>following (5) 257:15;266:5;268:5; 280:20;327:6</p> <p>follows (1) 248:18</p>	<p>foot (2) 278:18,19</p> <p>foregoing (1) 379:12</p> <p>foreseeable (1) 261:6</p> <p>fork (12) 284:12,12;285:23; 297:20,20;311:17,18; 312:4,7;313:21; 317:14,18</p> <p>formal (1) 369:17</p> <p>format (2) 247:12,21</p> <p>formation (1) 364:21</p> <p>formatted (1) 295:16</p> <p>formed (1) 365:4</p> <p>forth (5) 290:4;294:3;297:8; 298:16;302:20</p> <p>forward (4) 243:22;294:6;335:2, 8</p> <p>found (9) 249:5,22;259:22; 262:22;278:22;283:12; 289:11;362:11;374:14</p> <p>foundational (3) 250:20;252:24; 375:23</p> <p>four (6) 258:1;286:1;305:6, 22,24;306:7</p> <p>four-fold (1) 337:4</p> <p>fourth (1) 253:20</p> <p>fraction (2) 309:22;310:14</p> <p>fractured (1) 326:13</p> <p>fragmentation (1) 282:22</p> <p>frame (3) 323:21;335:14,17</p> <p>framework (1) 263:19</p> <p>frankly (1) 324:13</p> <p>FRD (1) 294:3</p> <p>front (2) 244:17;357:15</p> <p>full (3) 263:22;351:22; 379:13</p> <p>fumbling (1) 248:4</p> <p>function (2)</p>	<p>253:5;342:16</p> <p>fund (1) 291:16</p> <p>funding (1) 335:18</p> <p>funny (2) 277:13;306:3</p> <p>further (1) 337:6</p> <p>furthest (2) 280:20;318:1</p> <p>future (2) 261:6;300:3</p>	<p>336:14,15;337:6</p> <p>Glendale (5) 264:17;265:5;271:1, 6,9</p> <p>glide (1) 293:1</p> <p>goal (4) 335:8;345:19,22; 346:2</p> <p>goes (6) 271:11;290:1;295:9, 9;320:5,22</p> <p>Good (28) 243:4,18;244:13,16, 17;268:9;278:8,14; 279:12;280:12;283:7; 290:17;293:21;310:19, 22;324:3;336:14,17; 341:21;342:6;343:4; 345:4;346:3;349:9; 354:10;360:18;366:16; 368:14</p> <p>gosh (1) 354:10</p> <p>gouge (1) 256:12</p> <p>graciously (1) 324:17</p> <p>gradient (7) 259:9;261:21; 262:24;265:17,22; 268:1;272:2</p> <p>gradually (1) 260:16</p> <p>graph (10) 271:7;295:14; 296:10;307:2,19; 312:5,19;314:2; 332:13;336:24</p> <p>graphed (2) 305:22;306:1</p> <p>graphs (4) 295:21;306:13; 313:24;314:1</p> <p>great (9) 245:15;253:12; 309:9,9;331:9;335:1; 361:19;365:6;367:14</p> <p>greater (2) 309:21;310:14</p> <p>greatest (2) 281:1;333:24</p> <p>green (2) 284:10;290:2</p> <p>Greg (1) 360:18</p> <p>gross (1) 289:12</p> <p>ground (6) 258:22;264:16; 265:7;310:1,2;357:3</p> <p>groundwater (51) 244:24;247:6;253:6;</p>
G				
			<p>Gage (24) 260:1,7;271:1,2,6,6, 8,9;284:14,16;311:23; 313:1;334:19,23,24; 335:4,4,7,9,10,11,21; 359:7,15</p> <p>GARNET (4) 239:10;251:2;252:2; 266:7</p> <p>GB-1 (1) 252:2</p> <p>gears (3) 311:5;329:5;332:5</p> <p>general (2) 248:20;311:12</p> <p>generally (5) 267:14;268:8;341:6; 361:11;363:22</p> <p>genus (1) 285:9</p> <p>geologic (18) 248:14;257:4,14; 261:1,9;262:13; 263:11,17;264:5,8; 371:7,13;372:8,9,10, 16;375:12,15</p> <p>Geologist (2) 240:13;369:1</p> <p>geology (14) 369:1,15,20;370:1,8, 10,12,18,24;371:3,4, 12,16;373:15</p> <p>geophysical (3) 377:13,17;378:2</p> <p>gets (1) 310:7</p> <p>given (12) 257:8;262:10,20; 285:13;286:16;287:8; 292:9;294:5;296:6,6; 298:9;356:1</p> <p>gives (1) 303:21</p> <p>glad (1) 361:21</p> <p>Glasgow (5) 241:14;242:5;</p>	

256:21;258:18;259:6, 14,19,24;261:21; 262:20,24;263:15,16; 264:2;267:20,24; 272:2;273:22;274:8; 276:23;278:9,10,14; 279:4;281:9,12;291:2, 24;314:10;325:11; 331:6;333:18;345:2, 18;346:7;347:8,15,19, 21;348:1;356:7; 357:24;367:21;369:16, 17;370:13,14,17,21; 374:21	297:1,9;304:24 happens (4) 278:10;310:1; 335:18;336:5 happy (3) 339:21,22;345:15 hard (4) 251:17;266:12; 297:9;354:11 hardest (1) 244:15 hardly (1) 361:7 harm (1) 299:7 hate (1) 367:12 Hatten (2) 294:18;299:1 head (30) 261:14,16;265:15, 20,21;269:12;274:22, 23;275:10,16,18;276:2, 6,8,8,15,15;277:1; 279:5,8,9;280:22; 289:10;290:5,10; 336:20;338:9;362:6,9, 15 heads (2) 289:24,24 heard (5) 274:1,4,7;301:14; 376:10 HEARING (30) 239:4;240:7;243:4,6, 7;245:11,13;247:15; 248:10;299:8,11,17,19; 310:21,24;323:6; 336:11;337:7;349:6; 355:8;360:13,15; 366:13;367:5;369:4; 370:3;377:10;378:8; 379:8,14 hearings (1) 350:1 heart (1) 244:14 held (1) 379:8 Hello (2) 243:18;245:3 help (3) 315:14;340:12;361:3 helpful (3) 325:22;355:24;376:9 helps (1) 302:9 hereby (1) 379:5 herein (1) 379:11 hereof (1) 379:13	here's (4) 284:8,9;294:17; 371:6 Herrema (4) 242:4;324:3,4; 336:10 heterogenous (1) 326:14 Hi (1) 336:14 Hidden (2) 251:1;266:7 high (20) 250:23;252:21; 253:10;254:18;255:7; 265:14;266:23,24; 274:15;279:22,23; 285:18;297:6;325:4; 327:20;344:6,9,16; 362:19;373:24 higher (7) 267:3;275:3,9;276:2; 281:5,10;317:9 highest (9) 274:2;276:11,17,20; 278:3,21;281:16; 285:20;289:10 highlight (13) 282:14;283:2,9; 288:19;289:23;290:6; 291:8;292:3,4,12; 293:14;295:20;297:17 highlighted (3) 318:4,5;319:4 highway (3) 352:22;353:5,9 himself (1) 324:18 hind (1) 312:6 historic (1) 349:19 historical (2) 283:5;284:22 Historically (4) 283:16;289:19; 297:5,22 hit (2) 296:18;298:21 hits (1) 310:1 hitting (1) 309:24 HNL (1) 263:17 Hold (1) 348:20 hole (1) 377:17 Holocene (1) 285:7 homogeneous (1) 361:11	hopefully (4) 244:9;248:17; 273:14;335:12 hoping (1) 335:16 horizon (1) 334:23 hot (6) 285:17,21;286:23; 289:24;298:9,10 hottest (1) 290:4 hours (1) 324:20 Hyatt (1) 240:22 hydraulic (36) 250:9,14;253:13,19; 254:5,5;255:5;257:8, 15,18,19;261:8,21; 262:10;266:17;267:1, 4;268:9;274:22,23; 275:10,16,18;276:2,5, 7,8,14,15;363:10,14; 371:8,9,14,15;378:3 hydrogeologic (2) 263:19;267:11 hydrogeologist (4) 363:13;369:12,19; 370:23 hydrogeology (8) 268:14;273:11; 349:14;369:10,15; 370:2,22;371:1 hydrograph (1) 307:12 HYDROGRAPHIC (1) 239:11 hydrographs (13) 258:14;259:23; 260:4;304:13;305:4; 333:4,7;345:7;346:14; 347:24;348:6,23; 374:14 hydrologic (6) 248:14;261:2; 263:11;264:8;303:2; 359:18 hydrologist (7) 244:24;245:4;331:6; 363:13;369:17,17; 370:16 hydrologists (1) 345:2 Hydrology (5) 240:10;268:14; 291:20;357:9;370:21 hypothesis (4) 268:4;316:21;317:1, 2 hypothesize (1) 363:3 hypothesized (1)	249:6 hypothetical (1) 275:22
H		I		
habitat (46) 283:1;285:1;286:9, 22;287:14,17;288:1,3, 9,21;289:5;290:9,13, 24,24;292:10,11,14,17, 18;293:2,6;294:10,14, 23,24;295:7,15,17,18, 18,23,24;296:3,5,7,17; 297:7;298:14;299:3,6; 334:4,9,15;336:6,9 habitats (1) 287:24 half (7) 302:12,13,16;304:1, 2,4;320:17 half-hour (1) 299:9 Halford (5) 324:10;375:5,19; 376:8,13 Halford's (1) 376:3 hand (1) 367:7 handful (1) 324:5 handle (4) 290:18;330:13; 347:15,17 handouts (1) 247:24 happen (5) 256:6;306:3;344:16, 17;375:16 happened (3) 296:21;330:16; 344:15 happening (3)			idea (2) 245:15;303:21 identification (3) 250:21;252:17; 375:24 identified (11) 249:7;258:13; 260:22;264:9;273:10; 292:17;329:8;346:23; 348:17,18;352:7 identify (7) 246:9;252:13; 258:17;284:5,7; 296:16;302:10 identifying (1) 251:4 ignore (1) 373:15 illustrate (2) 309:7;314:19 illustration (1) 279:6 image (2) 283:12;325:17 immediate (2) 249:9;259:9 immediately (3) 333:24;334:2,3 impact (9) 258:8,9;316:13; 332:22;335:12;346:8, 9;350:5;355:22 impacting (1) 353:6 impacts (12) 268:3;272:17,18; 273:5,6;282:19; 341:12;351:19;356:3; 374:9;375:2;376:14 impermeable (1) 354:17 implement (1) 339:12 implemented (1) 359:1 implementing (1) 340:5 implication (2) 289:15;327:19 implications (2) 282:7;298:12 imply (1) 309:14 importance (3) 273:24;282:21;290:6 important (27) 260:13;275:17,19;	

282:13;283:10,24; 284:2;287:9;291:8,22; 292:20;293:4;294:1,7; 297:2;299:5;315:11, 12,13;325:6;331:12, 14;332:2;334:12; 364:3,16;368:11	317:19;318:6 indicated (5) 290:1;323:14,15; 355:9;361:1 indicates (5) 317:5;318:11;321:1; 358:8;368:4 indication (1) 378:1 indices (1) 302:22 individual (3) 274:23;275:18;280:4 individuals (1) 245:21 induced (8) 251:21;252:1,3,12; 264:5;326:4,5;345:24 infer (2) 258:15;371:15 inferred (2) 263:15;344:10 inferring (1) 344:6 infiltration (1) 249:17 inflated (1) 319:23 inflates (1) 321:21 inflow (12) 261:2,4,7;262:1,7,8, 19;263:3;267:17,18, 23;272:4 inflows (1) 249:21 influence (1) 326:19 influencing (2) 259:19;370:14 information (16) 244:13,17;255:10; 266:11;283:3;292:19; 293:3;295:14;313:18, 19;315:4,15;321:14, 15;322:22;338:20 initial (10) 268:7,19;269:9; 276:3,7;299:23; 343:17,18;346:13; 359:8 Initially (1) 349:21 input (3) 328:5;339:22;340:12 inspection (3) 258:14;259:23; 347:23 installation (1) 257:16 installed (1) 334:19 instance (2)	312:24;321:9 in-stream (5) 286:11;288:12; 290:22;291:22;351:7 intended (2) 342:16;373:11 interest (1) 339:18 interested (2) 248:7;368:17 interesting (10) 260:8,12,20;282:18; 285:14;288:16;289:6; 298:7,17;347:10 Interior (2) 277:3;336:15 Interiors (1) 243:20 intermittent (1) 249:13 interpret (3) 312:3;342:23;374:3 interpretation (2) 248:14;376:6 interpreted (2) 252:14;378:2 interpreting (1) 312:5 interpretive (1) 377:19 interrupt (1) 362:22 interval (1) 377:21 intervals (1) 377:22 into (27) 247:14,17,18; 249:11;256:7,16; 257:3;261:22;262:11, 18;264:14,18;267:9,9; 282:12,18,21;283:18; 294:8;296:22,23; 311:11;315:23;364:19; 369:23;373:16;379:10 introduce (1) 244:20 invasive (6) 286:10;288:4,11; 296:19;297:8;334:14 inventoried (1) 268:24 investigated (1) 255:11 investment (2) 307:2;324:4 Investments (1) 324:1 involve (2) 270:19,21 involved (3) 287:16;350:8;355:11 involves (1)	356:13 isolate (1) 326:4 isolated (3) 251:9,24;354:21 isolation (1) 251:6 isotropic (1) 361:12 issue (11) 315:3,12;316:2,5; 319:8,11,12;321:4; 370:7,8,10 issues (10) 246:2;286:13,14; 289:20;315:1,2,4; 322:4,6;349:13;368:19 iteratively (1) 315:18 Iverson (3) 277:10;279:20,20	9;354:15,19;362:2,16; 363:1,16;365:13; 367:21;374:10;375:3; 376:13,18;377:1,14,22, 24 Karen (4) 241:4,14;336:14; 366:16 Katie (1) 341:8 keep (2) 243:14;299:11 keeping (1) 335:2 Keith (5) 324:10,14;325:15; 375:5;376:3 Kent (1) 240:20 key (3) 255:20;280:16;289:9 kind (29) 259:4;271:16,20; 282:20,24;284:11; 285:8;286:18,18; 287:10;289:13;290:8; 297:1;298:14;302:18; 304:2,10;308:7;309:2; 311:12,24;314:3,14; 322:5,9,12;345:2; 354:21;361:2 kinds (1) 362:11 KMW-1 (8) 253:24;254:24; 255:4,19;374:12,21; 375:16;377:18 knew (1) 250:4 knowledge (4) 266:16;365:8;366:3; 376:22 known (4) 257:11;264:20; 286:17;289:9 KPW-1 (3) 253:24;255:13,19
J				
<p>jeopardize (1) 368:6 job (1) 280:12 John (1) 343:22 Johnson (1) 341:9 joint (2) 342:18;343:7 jointly (2) 326:22;343:12 Jon (1) 240:11 Jones (2) 277:8;279:20 July (9) 244:4;246:3,13,21; 257:22;273:21;327:8, 13;341:9 junior (1) 351:14 Justina (1) 240:24 juvenile (1) 289:1 juxtaposed (1) 263:23</p>				
K				
<p>Kane (47) 253:20,23,24;254:7, 9,15;255:15,17,20,24; 256:1,5,18;257:1; 259:1;260:23;263:9; 264:10;266:9;291:7; 304:22;329:13;352:8, 8,12,14,15,17;353:1,8,</p>				
L				
<p>lack (3) 264:5;344:22;371:15 lag (5) 272:17;273:5; 346:24;347:17;348:17 lags (2) 268:2;348:18 Lake (7) 262:11;283:19; 304:16,18;305:7; 348:6,24 land (2) 274:13;275:1</p>				

large (13) 248:2;252:12;255:7; 261:16;264:8;265:20; 289:3;319:20;326:9; 344:13;370:10;374:7; 377:21	302:13;317:4;318:6; 335:12;360:1,4;362:9, 17;363:15	281:11	292:21	296:19,19
largely (1) 264:11	lesser (1) 258:20	limited (7) 254:8;258:20; 266:24;287:1;310:12; 323:21;377:23	logs (5) 333:12;372:10,11, 16;375:12	loud (1) 367:13
larger (7) 266:13;283:15; 288:24;289:13;316:11, 12;362:14	level (52) 247:6;251:11; 254:22;260:5,9; 262:20,23;263:16; 264:2;268:10;269:9, 21;270:16;271:7; 272:12,24;275:20; 276:21;279:3,4; 280:12,20;300:11,19; 304:11;309:13;311:23, 23;312:6;313:13; 316:8;318:18,19; 321:11,12;322:15; 331:7;333:18;334:9, 23;342:22;343:21; 344:7;347:3;348:1; 363:4,8;371:24; 373:19,19;374:21; 375:11	limits (1) 293:22	long (2) 286:17;350:10	loved (1) 376:10
Las (3) 245:9;349:6,11	levels (75) 256:21;258:18,22; 259:6,15,19;260:1,2,3; 261:19;262:24;265:4; 267:21;268:6;273:24; 281:9,12;295:23; 300:1;301:3,4;305:8, 12,16,20;306:2,11,20, 24;307:11,21;308:4,5, 16,21;309:3,8;311:16, 20,22;313:1,12,21; 317:14,16;318:16; 320:4,5,22,23;321:10; 322:14,20;326:10,19; 327:1;331:1,10,24; 336:18,21;337:1; 345:19;346:6,8,10; 347:8,16,19;348:7; 351:21;362:12;364:12, 15,16	Lincoln (8) 241:2;291:7;364:8, 20;366:13,17;367:22; 376:19	longer (2) 263:2;300:15	low (9) 263:23;279:23,23; 296:18;297:3;317:3; 361:3,24;362:24
last (12) 244:21,24;290:21, 22;291:21;301:5; 304:9;306:16,19; 307:5;335:23;365:7	lies (1) 352:15	line (3) 278:16;280:16; 335:19	long-term (7) 262:24;299:24; 302:18,20;304:3; 307:10;344:22	Lower (104) 243:6;246:2;249:23; 250:3,15,16;253:18,21; 254:17;255:6,18; 256:22;257:6,7,10,16, 19;258:4,10,11,18,24; 259:2,7,10,11,11,15, 20;260:24;262:9,9,12, 18;263:1,3,10;264:10, 12,17,18,24;265:3,6,6, 9,13,15,21;266:1,2,4, 10,19;267:3,4,11,16, 18,21,23;268:1,6,8,20, 23;270:23;272:3,4,7; 273:11;275:12;276:6, 12,18;280:14;281:11; 300:2;301:20,23; 304:14,18,21,24;305:2; 306:13,18;307:17; 309:16;317:11;322:14, 16;329:6,10,16; 330:11;349:14;353:19; 356:2,14;357:23; 361:23;370:7;376:1
lastly (4) 250:1;253:17;268:3; 273:8	life (2) 288:22;289:6	listed (5) 279:18;286:17; 306:17;309:16;372:17	look (37) 271:2;275:12;276:1, 6;277:11,13,17; 278:16;300:17;302:7, 15;303:6,7;305:8,19; 306:6;307:23;308:1, 15,16,18;311:6;313:24, 24;314:1;318:4;326:6; 327:15;341:21;342:6; 354:11;363:12;371:12, 13,14;372:11;378:3	looked (31) 260:9;262:3;277:6,7, 17;278:22;279:17; 295:22;301:10,12,22; 302:1,22;303:2; 304:13,20;305:21; 306:20,23,24;308:9; 309:3;313:9;332:19; 333:4,12;339:14; 348:5,13,23;372:15
later (4) 286:3;332:13; 344:18;348:20	lifetime (1) 289:7	lithology (1) 292:24	looking (14) 276:23;302:18; 303:22;306:12;309:3; 317:16;320:21;321:10; 336:18;345:11;346:13, 18;361:2,23	lowest (1) 277:15
Laura (1) 241:13	liked (1) 322:3	little (28) 283:20;285:6;286:3, 5;288:24;295:14; 296:8;298:16;301:11; 302:14;303:4;304:5, 15;305:3;308:3,9; 309:5,10;315:4;321:5; 323:8;328:12;336:1; 354:11,11;357:1; 364:19;372:3	looks (9) 252:7;278:24;281:2; 282:15;291:5;300:18; 304:5;319:7,23	Ltd (1) 240:16
Law (2) 241:11;276:13	likely (8) 252:16;289:12; 292:11;318:2;320:9; 361:18;368:6;371:7	live (2) 284:23;286:1	Loomis (2) 239:24;379:4	luckily (1) 263:13
leading (1) 248:14	likes (3) 285:17,21;286:23	living (1) 286:4	Los (1) 240:23	Luke (1) 243:19
leads (1) 358:22	likewise (1) 265:18	local (4) 250:1;267:22,22; 337:10	lose (1) 278:20	lunch (1) 378:9
least (14) 252:15;254:21; 262:22;264:12;268:12; 271:12,22;272:3,12; 276:22;277:16;286:24; 289:19;334:7	limb (1) 295:10	located (3) 251:15;352:11;354:6	lost (3) 263:24;264:1;269:1	LV-1 (1) 317:20
leave (1) 335:11	limit (1)	location (4) 314:11;333:2;362:8, 11	lot (31) 280:6;287:2;288:6; 289:2,20;293:10,11; 296:20;297:5,21; 298:2,3,20;303:24; 309:6;311:10;313:9, 18;315:23,23;320:9; 321:15;325:23;334:8; 335:5;341:22;346:1; 362:17;369:13;376:11, 22	LV-16 (1) 317:21
led (2) 282:18,21		log (1) 333:17	lots (2)	LWRFS (2) 247:6;357:23
left (18) 248:1,6;276:3; 279:18;280:2;283:13; 284:4;286:1;293:15; 295:3;305:9,16; 306:16;310:9;317:19, 21;319:2;323:7		logarithmically (1) 361:12		M
left-hand (6) 275:4;297:16; 306:13,18;309:17; 318:23		logical (1) 248:21		M-1 (1) 252:4
legacy (1) 283:24		logistic (1)		magnitude (2) 255:2;363:9
length (1) 285:23				main (7) 284:13;291:9,22; 297:21;299:24;300:7; 301:6
Leonard (1) 337:10				maintain (2) 281:12;290:23
less (14) 280:10;281:2; 285:24;288:4;293:21;				maintained (2)

<p>272:11,23 maintaining (2) 290:22;334:12 majority (1) 284:10 makes (3) 278:23;283:24; 288:15 making (2) 243:16;370:17 management (8) 265:2;266:1;273:13; 291:14;340:3,10; 360:24;363:1 managements (1) 246:2 managing (1) 247:6 mandatory (1) 291:19 manifestation (1) 268:2 many (12) 261:18;268:13; 312:14;315:7;317:7; 322:23;325:9;349:13; 358:22;371:11;375:7,7 map (4) 277:5;283:12;363:2; 372:8 mapping (2) 372:16;375:12 maps (1) 372:10 MARKED (2) 242:11;357:4 material (2) 248:18;377:19 MATTER (3) 239:7;361:16;379:10 maximum (4) 278:18,21;279:3; 358:16 may (12) 264:16;265:11,24; 270:15;302:14;307:4; 308:9,11,12;323:22; 357:1;367:4 maybe (12) 244:20;249:23; 256:11;271:2;299:15; 306:4;323:5;352:8; 353:23;354:4;372:2; 377:20 Mayer (43) 245:3,3;246:11,14; 247:3;273:18,19,19; 299:14,18,20,20;311:3, 3;331:16,17,21;336:18, 19;337:21;338:6,23; 339:14;340:16,22; 341:1;348:5,9,23; 349:12,15;355:5,17;</p>	<p>357:8,10,13;363:23; 364:5;365:2,10,17,22; 376:21 M-A-Y-E-R (1) 245:4 Mayer's (1) 344:21 Mead (1) 283:20 Meadow (29) 249:23;250:3,15,16; 253:18;257:6,10,16,20; 258:4;259:2;260:24; 262:9,10,12,12,18; 263:1,10;264:11,18; 265:6;266:10;267:18, 23;268:23;272:4; 304:21;329:16 mean (18) 252:7;253:11;256:9; 277:8;294:20;300:4; 312:23;313:12,14; 320:2;326:16;345:9; 348:15;351:16;354:14; 357:11;361:11;367:12 means (12) 248:24;274:21; 276:16;285:10,17; 290:3;303:9,13; 309:19;312:15;316:23; 378:4 meant (3) 312:3;341:2,5 measure (3) 280:19;281:16; 292:23 measured (3) 279:11;292:18;351:5 measurement (3) 314:10;321:15,16 measuring (1) 306:5 mechanism (1) 331:2 meet (10) 269:3;270:8;291:12; 310:3;330:2;359:7,20; 360:8;365:7;366:8 meetings (2) 330:12;335:5 meets (3) 310:5,5,6 Memorandum (1) 364:2 memory (1) 359:13 mention (1) 254:10 mentioned (5) 266:11;283:14; 284:21;291:4;351:2 met (3) 270:18;365:4;366:10</p>	<p>metabolic (1) 289:14 meter (1) 294:23 method (3) 271:23;314:11; 355:13 methods (1) 322:22 mic (1) 369:4 Michael (1) 282:5 Michel (2) 239:24;379:4 MICHELINE (2) 239:4;240:2 Michelle (1) 240:8 middle (3) 251:18;295:2;319:3 might (13) 254:14;282:22; 325:16;329:19,19; 331:2;333:7,18; 335:14;360:2;363:23; 368:15;373:21 migration (2) 289:20;335:13 Mike (2) 245:7;366:23 mile (1) 286:22 miles (11) 251:18,22,23;252:2, 4,5,22,22,23,23;374:11 MILLER (14) 242:3;243:18,19; 245:12,15,19;247:16, 19;273:16;281:24; 284:17;299:10,13; 323:1 minimum (5) 253:4;258:3;261:13, 14;279:3 minnow (3) 285:17;287:13; 298:10 minnows (1) 285:11 minus (2) 279:8;295:18 minute (5) 251:14;284:3;286:2, 3;371:22 minutes (7) 299:13,15,15;323:5, 7,18;324:1 mission (1) 340:16 misstate (2) 354:1,5 misunderstanding (1)</p>	<p>342:13 mitigate (3) 288:7,11;290:15 mix (1) 334:2 mixed (1) 244:9 MOA (17) 273:24;291:4,9; 292:6;296:13;298:23; 330:21,22,23;331:1,10, 332:1;335:4;351:15, 16,18;352:1 Moapa (46) 241:9;245:10;249:3; 260:1,7;264:18,24; 265:7,9,13,21;266:2; 271:1,5,8;282:8,17,20; 283:5;284:24;285:5,9, 9;286:17;287:9;288:4, 19;290:3,7;291:10; 293:7;296:6,12,15; 298:19;299:22;311:13; 332:6;337:7,9;341:7; 359:7,15;360:15,19; 368:7 Moapas (3) 300:5;301:11;311:14 Moapa's (4) 311:7;314:23,24; 322:21 model (34) 262:5,5,17;263:5,5, 19,20;267:11;268:15; 270:16;271:16,18,20; 292:21,22;293:5,9,18; 294:6,8;315:3,9,10,16, 18,21,21;316:1; 320:17;322:7,24; 329:19;334:24;344:7 modeling (1) 293:20 models (9) 293:15,16,20,22,22, 24;294:1,5;320:19 modern (1) 335:11 modified (2) 365:8,18 moisture (3) 310:4,6,12 mollies (1) 288:5 Molly (1) 290:16 moment (2) 254:9;287:6 monitor (5) 251:11;269:21,22; 363:6;375:7 monitored (2) 269:19;305:7 monitoring (22)</p>	<p>251:12;277:5,20,21; 280:1,3,3,5,6;300:11, 15;305:6,21;306:16, 19;307:16;349:3; 365:12;366:7;374:13, 14,22 monthly (10) 278:2,3,12,13; 291:12;300:11;302:4, 8,15;313:21 months (1) 335:23 more (25) 246:9;255:9;264:23; 269:19;274:20;282:1, 4;288:3,8;304:1;306:9; 309:20;310:17;311:6; 316:13;318:15;321:2; 322:22;335:11;341:6; 344:18;348:19;359:20; 363:24;364:23 morning (9) 243:4,8,19;324:3; 336:14,17;349:9; 360:18;366:16 Morrison (4) 242:8;360:18,18; 366:11 Mosquitofish (2) 288:5;290:16 most (31) 248:21;249:8;250:4; 251:1,2;254:7,14,15; 261:3;262:2;266:6,7; 274:2,6;276:21; 278:15,23,24;279:15; 281:5,20;284:23; 286:8;288:10,16; 297:3;313:4;315:21; 334:3,12;345:18 mostly (1) 337:14 Mountain (4) 264:17,19;265:1,8 Mountains (4) 251:3;265:10,13; 266:8 move (6) 275:11;286:15; 296:8;298:15;327:4; 331:16 moved (4) 256:7;272:16;273:4; 287:23 movement (1) 287:3 moving (11) 256:16;267:8;272:6; 288:23;289:4,16; 298:12;302:9,9,15; 335:8 MRSA (1) 281:22</p>
---	---	---	---	---

much (26) 252:23;254:17; 257:2;270:2,5;279:9, 14;280:11;281:14; 296:17;301:6,7;303:5; 309:20,21;310:9,12,14, 16;317:9;323:8; 331:11;347:9;360:8; 362:14;363:15	nature (1) 373:20 NCA (1) 241:7 near (3) 252:9;256:3;334:22 nearest (1) 252:15 necessarily (1) 255:14 necessary (3) 259:17;330:8;331:19 need (11) 266:21;267:6;288:9; 290:10,10,23;312:12; 343:24;355:18;367:12; 376:8 needed (4) 255:10,13;327:22; 360:8 needing (1) 298:12 needs (5) 283:1;291:12; 292:11;298:14;378:5 negative (8) 303:15,17;316:12; 320:3,8,10,18,24 neglected (1) 322:23 neither (3) 303:11,11;306:16 NEVADA (14) 239:1;240:17;243:1; 245:9;258:23;259:3; 301:19,19;345:11; 349:10;379:1,7,8,17 new (8) 269:23;276:4,8; 324:12;328:9;335:7, 11;367:24 newer (1) 334:24 news (1) 283:7 Next (18) 263:8;271:14;280:2; 302:22;304:13;305:14, 21,24;306:9;316:2; 327:4;335:16;336:11; 337:7;349:6;360:15; 366:13;368:21 nice (3) 289:23;295:7,11 Nine (3) 251:23;252:5;260:22 NOAA (3) 301:16;332:15,16 Nodded (2) 336:20;338:9 nods (1) 338:22 no-flow (9)	263:8,13,13;264:1,9; 325:18;361:3,18; 371:10 none (2) 318:5;345:16 nonlinear (1) 309:19 non-native (2) 290:15,21 non-natives (1) 334:10 non-pumping (3) 326:18,18;327:1 non-significance (1) 316:5 normal (6) 256:2;352:17,17,18; 354:13,20 north (21) 251:18,22;252:23; 256:2,5;267:18; 284:12;297:20;301:23; 304:19;305:15;311:17, 18;312:4,7;313:21; 317:14,18;354:13,20; 362:16 northern (11) 254:14;255:3,23; 256:16,17;257:12; 261:5;352:16;362:1,7; 365:12 northwest (7) 251:2;254:2;256:1,5; 266:8;354:19;377:23 note (9) 244:2;245:20; 255:21;258:3;297:2; 304:8;309:2;370:3; 372:13 noted (2) 298:13;363:4 notes (2) 379:7,14 noticed (1) 348:1 noting (1) 377:15 nowhere (2) 269:16,23 null (2) 316:21;317:2 number (28) 248:2;251:13;264:9; 272:5;281:17;282:12, 18;284:22;288:16; 293:9;296:14;297:13, 14;315:6;321:18,19; 329:8,24;335:22; 345:12;356:18;357:5; 358:14;360:1,5;363:3; 367:16;375:6 numbers (4) 284:7;297:12;	343:15;344:8 numerical (3) 263:20;268:15; 271:17 numerous (2) 343:13;361:18 NV (2) 240:24;379:22	248:10;299:8,11,17,19; 310:21,24;323:6; 336:11;337:7;349:6; 360:13,15;366:13; 367:5;369:4;370:3; 377:10;378:8 official (1) 337:14 officially (4) 338:5;370:23; 374:12,16 often (1) 289:18 old (3) 334:19,20;335:10 once (1) 310:1 one (74) 244:4;246:9;248:21; 251:20;253:6;254:8; 257:3;260:7;261:3,8; 270:3;277:24;281:24; 282:4;283:2,11,13; 284:23;285:16;286:20; 288:21;289:21;291:4; 292:12;293:17;296:2, 24;300:5,14;303:13,14, 15,16;304:6;306:2; 308:4;309:1,10; 312:10,22;313:3; 315:8,15;317:10,12; 324:14;325:9;326:21; 329:23;330:11;335:22, 24;336:3,17;346:4; 347:4;348:2,2,20; 355:8;356:12;365:13, 13,14,16;366:1,3,4; 370:14,15;374:13; 375:17;376:5;377:11 ones (6) 282:13;286:13; 318:4,10,11;349:2 one-year (1) 346:24 ongoing (3) 326:5;335:3;345:24 only (27) 269:10;276:17; 283:6;286:4,21; 287:12;289:5,9; 291:21;292:1;293:24; 298:24;300:5;305:22; 310:12;322:15;324:13, 14;339:11;340:24; 344:15,15;347:23; 372:10;375:5,5,5 onto (1) 287:24 Oops (1) 269:1 oozing (1) 249:4 opinion (22)
O				
			o0o- (1) 243:2 objectively (1) 315:14 obliterated (1) 287:20 obscured (1) 308:12 observation (2) 268:7;321:18 observations (2) 321:18,19 observe (1) 268:12 observed (4) 270:6;280:19; 322:16;327:1 obtain (1) 339:9 obvious (5) 273:4,9;295:6;340:8, 10 obviously (5) 297:11;331:12; 340:8,8;366:7 occur (7) 264:16;284:2; 288:22;292:8;329:20; 350:9;352:2 occurred (3) 251:5;291:21;354:2 occurring (1) 268:23 occurs (5) 254:8;264:24; 285:18,20;286:21 Oceanic (1) 301:16 O'Connor (1) 240:18 off (3) 271:7;283:8;287:24 offering (1) 369:24 Office (10) 243:20;245:5,9; 269:5;330:10;336:15; 339:22;340:11,17; 341:16 OFFICER (25) 239:4;240:7;243:4; 245:11,13;247:15;	
N				
name (8) 243:19;244:21,21, 24;245:7;282:5;324:3; 349:9 narrative (1) 247:21 National (7) 241:14;301:15; 336:11,16;338:16; 339:11;340:19 NATURAL (4) 239:2;298:1;334:8; 379:9 naturally (2) 282:21;287:18				

<p>268:12;330:7; 331:15,18,22;336:23; 350:5;351:12;352:24; 353:5;355:10,14; 356:1,15;366:19,24; 367:3,9,19;368:5,9,12</p> <p>opinions (7) 337:14,24;338:7; 369:14,24;370:19; 371:5</p> <p>opportunity (3) 243:10;309:9;323:20</p> <p>opted (1) 247:20</p> <p>optimization (1) 342:19</p> <p>optimize (1) 343:20</p> <p>optimized (5) 326:22;342:24; 343:7,12;344:10</p> <p>optimum (1) 315:18</p> <p>orange (1) 311:24</p> <p>Order (31) 243:7;244:1;248:15, 19;250:19;251:8; 252:13,22;261:18; 262:1;263:6;266:20; 267:7,7,13;269:14; 277:2,4;299:22; 328:18;343:1;350:13; 352:1;374:3,10,13,18; 375:2,7,10;377:2</p> <p>ordered (3) 279:22;281:1;350:13</p> <p>Oregon (1) 245:6</p> <p>orifice (2) 275:6;279:5</p> <p>original (9) 258:2;259:1;266:9; 283:19;328:5,18; 345:6;376:23;377:3</p> <p>originally (1) 295:15</p> <p>others (4) 266:14;285:5;289:2; 319:17</p> <p>otherwise (1) 286:10</p> <p>out (20) 248:6;282:10,12; 290:23;292:23;297:13, 14;300:4;307:22; 309:1;311:10;315:17; 329:20;343:16;345:23; 347:21;350:18;358:23; 367:13;370:23</p> <p>outflow (7) 264:16,19,24; 265:12,23;266:2;280:3</p>	<p>output (2) 317:12;318:15</p> <p>outright (1) 286:9</p> <p>outside (3) 307:17;339:9;375:14</p> <p>outstanding (1) 268:13</p> <p>outward (1) 361:2</p> <p>over (36) 243:17;247:23; 248:1;252:12;257:2; 260:17;275:11;279:10; 280:18,19;282:1,9,20; 290:21;296:12;301:17; 306:7;307:4;310:9; 313:12;315:20;316:1; 319:7;320:17;326:8; 335:6;346:7;347:9; 356:22;358:2;361:15; 365:9;369:19;374:7, 11;377:21</p> <p>overall (3) 272:12,24;285:3</p> <p>overlays (1) 301:20</p> <p>overly (2) 269:8;367:3</p> <p>Overton (1) 249:4</p> <p>own (3) 244:10;289:7;311:17</p> <p>owns (1) 351:3</p>	<p>263:1</p> <p>PANEL (7) 242:2;245:17; 294:20,22;337:13; 366:16;369:23</p> <p>panels (2) 294:18,19</p> <p>paper (6) 292:12,15;294:18; 299:1;309:16;344:1</p> <p>papers (1) 283:2</p> <p>paragraph (3) 359:5;368:2;373:1</p> <p>parallel (1) 312:17</p> <p>paralleled (1) 269:20</p> <p>parameter (1) 343:17</p> <p>parameters (7) 342:10,17;343:9,10; 372:24;373:6,12</p> <p>paramount (1) 298:16</p> <p>paraphrase (1) 360:22</p> <p>paraphrasing (1) 341:4</p> <p>Park (6) 241:14;336:12,16; 338:16;339:11,14</p> <p>parsimonious (1) 315:21</p> <p>part (34) 243:23;244:3;246:7, 17;247:10,10;251:2; 256:17,19;258:11; 262:4;266:8;275:11, 17;283:15,16;284:22; 291:11;293:8,8; 297:15,23;306:4,17; 307:6;326:8;340:5; 351:18;358:13;365:12; 370:10,10,11;372:1</p> <p>participants (3) 243:10;323:14,21</p> <p>participating (2) 323:12,15</p> <p>particular (8) 244:8;292:12,15; 296:1,24;327:21; 334:11;361:9</p> <p>particularly (5) 295:10;296:16; 298:23;308:1;347:8</p> <p>parties (6) 291:16;300:6; 323:11,17;339:10; 350:19</p> <p>partition (1) 357:2</p> <p>parts (9)</p>	<p>246:7,17;247:1,1; 250:21;266:6;289:4; 292:10;336:6</p> <p>passage (2) 334:16;335:20</p> <p>passages (1) 352:18</p> <p>passes (2) 354:14,20</p> <p>passing (1) 256:3</p> <p>past (6) 249:7;271:22;287:5; 297:4;355:12,18</p> <p>paste (2) 293:12;294:17</p> <p>path (1) 243:14</p> <p>pattern (5) 260:18;295:7,19; 302:10;308:17</p> <p>Patterson (1) 262:11</p> <p>Paul (1) 349:9</p> <p>PDSI (2) 302:2;303:4</p> <p>peculiarities (1) 282:17</p> <p>Pederson (33) 260:5;269:18,19; 270:3,4;274:1;277:9,9; 278:2,13;279:19,19; 280:10;281:4,17,17,19, 20;284:9,15;287:18; 294:15,21;312:24; 332:2;334:1,3;336:2; 351:10;364:4,4,17; 366:17</p> <p>peer (2) 338:20;339:9</p> <p>pending (4) 253:22;254:4; 257:15;266:10</p> <p>people (2) 274:6;312:23</p> <p>people's (2) 315:2;319:9</p> <p>per (10) 262:2;263:6;268:19; 269:12;270:1;278:18; 294:23;329:24;359:14, 16</p> <p>percent (19) 276:5,9,11,12,16,18; 278:12,18,20;279:8,12; 294:12;295:4,4,4,5,11, 21;299:2</p> <p>perennial (1) 355:20</p> <p>perforation (2) 333:13,16</p> <p>perform (2)</p>	<p>324:18,24</p> <p>performed (1) 324:20</p> <p>perhaps (5) 254:3;265:13; 328:11;374:23;377:20</p> <p>period (18) 258:21;259:5,24; 260:10;278:4;300:18; 302:6,24;305:7;306:7, 10;307:3;308:22; 309:4;330:1,18; 332:11;337:1</p> <p>periodic (2) 272:19;273:6</p> <p>periodically (2) 271:15,24</p> <p>periods (7) 302:13,19,20;304:5, 6;332:12;347:8</p> <p>permeability (1) 263:23</p> <p>permeable (2) 257:2;262:14</p> <p>personally (4) 246:6,16,24;247:9</p> <p>perspective (1) 331:6</p> <p>PEST (1) 343:22</p> <p>Peterson (11) 241:4;242:9;366:16; 367:4,6;369:8,22; 370:5;377:9,12;378:6</p> <p>physical (3) 260:22;310:18;320:1</p> <p>pick (2) 271:7;349:1</p> <p>picked (1) 349:3</p> <p>piles (1) 261:11</p> <p>pin (1) 297:9</p> <p>place (12) 250:6,12;253:1; 269:1;298:20;299:16; 310:19;330:18;335:6, 6,9,18</p> <p>places (1) 263:22</p> <p>plan (2) 289:22;310:22</p> <p>plants (2) 310:3,11</p> <p>play (1) 296:22</p> <p>please (3) 360:22;363:24;369:4</p> <p>pleased (1) 287:6</p> <p>Pleistocene (1) 285:7</p>
P				
<p>package (1) 248:6</p> <p>page (10) 320:16;345:11; 359:3,4,5;367:9;368:2, 3;372:19;377:5</p> <p>pages (5) 371:17,21;372:5,17; 379:13</p> <p>Pahrnagat (8) 250:2;261:3,4,11,12, 19;267:17;283:18</p> <p>Paiute (2) 332:6;337:8</p> <p>Paiutes (1) 299:22</p> <p>Paleozoic (1) 263:22</p> <p>palm (1) 287:17</p> <p>Palmer (7) 260:18;302:1,23; 303:2,8,17;347:24</p> <p>Panaca (5) 262:9,11,18,21;</p>				

plenty (1) 255:10	Portland (1) 245:6	preorder (1) 254:22	270:2,13;273:8;286:4; 287:12;288:15;299:6, 14,15;318:14;319:6; 320:20,24;321:2,11,23; 328:22;333:8;334:12; 353:23	291:10;298:23; 332:2;364:3
plot (24) 270:24;271:10; 278:1;302:5,6,24,24; 303:3,5;305:8,10,16, 17,17;312:15,19,22,22; 313:1,4,13,14;314:3; 361:7	posed (6) 248:15;266:20; 267:7,13;288:5,18	preparation (2) 327:8,12		protection (3) 286:21;298:20;331:7
plots (8) 303:22;305:11; 313:7,8,9;314:18,19,21	position (1) 337:14	prepared (9) 246:6,16,18,24; 247:2,9,11;323:9; 327:8		protects (1) 351:23
plotted (4) 302:8;303:3;313:3, 20	positive (7) 303:19;316:12; 320:2,6,7,21,23	presence/absence (1) 292:22	problem (5) 314:7;318:13; 320:14,15;321:17	protests (1) 349:22
plotting (1) 312:16	possess (1) 267:4	present (11) 243:11;248:16,19, 22;257:17;283:22; 287:4;350:1;352:19, 21;379:7	problems (4) 314:23;315:1; 319:19;321:1	proved (2) 327:17,17
Plummer (8) 260:5;269:18;284:9; 287:18;294:16,21; 296:2;336:1	possesses (4) 252:20;254:18; 266:23;327:20	presentation (18) 244:8;247:21;248:1; 269:7;273:18;281:14; 282:2,4;299:14; 300:14;306:18;311:2; 313:10;323:2;329:24; 332:10;352:6;369:14	procedures (2) 315:16;322:24	provide (5) 248:18;283:23; 331:7;338:13,16
plus (6) 250:24;253:4;258:6; 259:1;266:9;295:17	possessing (3) 250:23;253:10;255:7	presentations (2) 244:13;247:20	proceeding (6) 243:15;245:21; 324:5;339:18;346:14; 368:24	provided (1) 369:13
pluvial (2) 283:16,16	possible (10) 256:10;263:18; 270:15;325:16,17,20; 329:17;346:11;350:10; 353:4	presented (4) 269:6;300:10; 307:20;322:21	proceedings (2) 378:10,12	provides (2) 283:3;292:13
pm (1) 378:12	possibly (2) 272:18;273:6	Preservation (1) 286:19	process (4) 250:7;328:23; 343:18;344:12	providing (1) 244:7
pocket (1) 285:6	post-test (2) 327:7,11	presentations (2) 244:13;247:20	processing (2) 272:19;273:7	province (1) 253:12
point (25) 243:11;245:13; 251:20;290:22;294:22; 297:6,13;298:22; 307:9;309:1,11; 312:13;313:15,16; 314:4,17,17;334:7,9; 341:23;342:4;355:4, 12,18;374:16	potential (9) 256:15;257:8,14; 261:8;262:10;263:8, 24;264:1;351:19	presented (4) 269:6;300:10; 307:20;322:21	produce (2) 328:1,12	provision (1) 365:11
pointed (2) 290:23;297:14	potentially (1) 299:7	pressure (3) 274:12;345:16;346:4	production (1) 357:24	proxies (3) 314:6,14,15
pointer (1) 284:19	potentiometric (11) 274:12,16;275:1,5,8, 14,20,23,24;277:23; 279:2	presumably (1) 304:23	proficient (1) 324:14	proxy (4) 311:19;312:10,12; 314:8
pointing (3) 295:21;296:10;298:3	power (1) 280:11	pretend (2) 269:5;330:13	program (3) 273:14;340:3,10	public (1) 339:7
points (7) 244:15;306:5; 311:10,12;312:8; 314:5;352:5	PowerPoint (1) 353:11	pretty (19) 248:24;261:6,17,18; 262:21;264:3;270:9, 11;273:4;279:13; 280:23;287:6;290:17; 296:2;310:19;324:12, 16;347:9;359:1	project (3) 270:16;335:3;367:21	published (2) 324:13;339:8
policies (2) 338:20;339:2	practical (4) 253:5;261:23; 354:17;361:16	pretend (2) 269:5;330:13	prominent (1) 261:3	pull (1) 334:5
pollution (1) 286:14	precip (1) 302:1	pretend (2) 269:5;330:13	promptly (1) 378:11	pulled (1) 282:12
pools (2) 287:19;288:23	precipitation (20) 249:13;250:1;302:4, 8,16,21;307:22;309:6, 8,18,22;310:1,15; 320:4,5,10;332:10,15, 16;373:24	pretty (19) 248:24;261:6,17,18; 262:21;264:3;270:9, 11;273:4;279:13; 280:23;287:6;290:17; 296:2;310:19;324:12, 16;347:9;359:1	propagation (1) 264:4	pump (8) 329:15;350:8,12,18; 352:1;353:5;355:15,21
poorly (2) 257:11;264:20	precise (1) 244:8	prevalent (1) 296:1	proper (1) 322:24	pumping (113) 250:19;251:8; 252:20;254:22;255:1, 13,15,17,23;256:7,15, 16,20;264:4;267:8,9, 15,15;268:3,6,10,11, 11,18,22;269:10,11,13, 14,16,24;270:2,17,22; 271:5,7;272:7,9,9,11, 11,15,21,23,23;273:3; 275:21;281:11;291:2, 20;301:8;304:15; 305:4;307:7;309:5; 314:10;316:8;318:17, 20,24,24;325:23;326:1, 1,6,7,17,24;327:16; 328:9,18;329:20; 330:17;336:22,24; 337:3,5;343:13,14; 345:19,21,24;346:1,6, 10;350:6,13,14,24; 355:1,2;356:2,2,14,19, 20;358:10,13,20,23; 359:17,23;360:3;
population (1) 297:2	preclude (1) 362:2	previously (2) 284:8;348:11	propose (5) 253:20;255:12; 256:14;264:12;266:4	
PORTION (8) 239:9;250:22; 252:18;253:9;257:9; 261:15;298:4;352:14	predatory (1) 286:9	primarily (1) 340:19	proposed (7) 259:3;266:14; 339:13;353:16;361:22; 367:20;368:5	
	predict (1) 271:18	primary (3) 244:4;259:10;299:21	protect (12) 281:6,6,12,16,19,21, 22;288:12;340:17; 351:20,22;364:16	
	predicting (1) 268:15	prior (3) 260:20;301:4;318:21	protected (1) 340:2	
	premium (1) 296:7	priority (1) 351:14	protecting (4)	
		probability (1) 316:18		
		probably (25) 247:13;248:23; 250:2;259:18;260:5;		

361:17;374:3,5,10,18, 20,22;375:3,10;376:14 pure (1) 374:8 purple (1) 277:6 purpose (11) 258:21;325:22; 326:3;327:15;340:11; 345:17,22;347:13,23; 374:4,8 purposes (3) 253:5;261:23;354:17 put (3) 244:16;250:12; 273:18	265:12,22;268:17; 271:4;347:13;351:12; 359:6;375:16 rates (3) 268:22;272:4;294:15 rather (3) 252:22;297:16; 298:11 rational (1) 244:12 reach (4) 297:14;348:14; 351:10,21 reaches (1) 297:7 read (12) 297:12;335:7,9; 341:20;343:24;357:6, 10,19;367:13,14; 368:8;372:14 readily (2) 312:11;314:7 real (1) 300:17 reality (1) 340:2 really (63) 251:5,6,17;252:8; 255:20;257:23;259:24; 260:11;265:19;266:12, 12;267:6;276:22; 278:8,14;281:9; 282:18;283:24;285:10, 14,21;287:15,24;288:5, 8,17,17,23;289:6; 290:6;291:14;292:13; 295:6,7,11;296:1,18; 297:12;298:7,16; 299:22,23;303:5; 305:18;308:4,5,16,17, 19;317:3,24;322:20; 326:1;335:16;339:23; 343:7;344:13;345:1; 366:22,22,23;367:24; 368:8 reason (7) 258:7,7,10;305:1; 309:21;325:21;371:6 reasonable (1) 244:13 reasonably (1) 270:10 reasons (1) 261:6 rebuttal (13) 244:5,5;247:5;282:4; 299:21,21;302:4; 311:4;322:12;332:6,9; 340:23;342:2 recall (10) 315:8;329:21;330:3; 332:11;341:8,10,13; 354:1;356:15;371:21	receive (1) 286:21 received (2) 298:2,3 recent (4) 262:2;287:5;297:4; 298:19 recently (3) 288:8;290:19;297:3 Recess (1) 310:23 recharge (14) 250:1;267:22,23; 301:24;309:19,22; 310:4,10,15;325:11; 333:3,6;346:7;373:24 Reclamation (1) 338:13 recognize (1) 266:14 recognized (1) 300:21 recommendation (5) 244:14;353:18; 358:13;359:1,12 recommendations (1) 356:12 recommending (1) 350:8 record (34) 243:5;244:21; 245:20;260:9,11; 271:12;277:13;300:11, 19;301:7;302:12,14, 16;303:1;304:1,2,4, 306:4;307:3;308:5,15; 309:2,4,9;311:1,12,23; 312:6;314:12;332:11; 341:15;342:22;364:9; 378:10 records (14) 251:11;260:2,5; 262:22,23,23;300:15, 19;332:10;343:21; 371:24;373:20;375:11, 17 recovery (12) 245:10;268:3;284:6; 288:1,19;291:16; 296:17,21,24;298:2,3; 304:11 recreated (1) 287:23 red (2) 290:1;307:21 REDIRECT (3) 242:2;323:5,8 reduce (3) 272:17;273:5;295:20 reduced (2) 295:23;361:15 reduction (13) 276:5,9,13,14,17,18;	279:5,8,11,12;295:24; 296:4;336:21 reductions (2) 272:10,22 re-explained (1) 375:22 refer (4) 329:18;352:13; 375:21,22 reference (3) 277:19;345:8,10 referred (2) 352:22;368:1 referring (1) 371:11 reflect (1) 271:24 reflected (1) 299:4 reflecting (1) 307:8 Refuge (25) 272:13;274:2;277:6, 8,21;281:19;282:20; 284:10,15;287:9,11,12, 14,16,23,24;288:8; 289:3;298:2,4;300:13; 334:7,18;335:24;351:8 refuges (1) 340:19 regard (1) 370:7 regarding (7) 268:13;273:11; 332:10;349:14;350:5, 23;353:18 regardless (1) 271:22 regards (1) 339:2 region (7) 300:1;307:10; 344:22;370:13,13,15, 18 regional (14) 245:5;249:15; 250:11,22;251:7; 252:19;253:10,16; 257:9;274:10;275:23; 340:17;372:2;375:13 regionally (1) 312:12 regression (30) 292:21;315:5,6,6; 316:4,6,10,15,19,21, 22;317:7,15,22;318:15, 16;319:1,6,15,16,19; 320:1,3,18;321:1,3; 322:5,8,24;344:24 Reich (1) 355:7 reiterate (1) 243:10	reject (1) 317:2 relate (1) 318:18 related (5) 246:2;281:10; 308:23;337:5;367:20 relates (1) 271:4 relating (1) 341:12 relation (1) 367:2 relationship (26) 271:3;274:8;277:16; 278:8,17;283:3; 292:14;295:12;309:8, 18;312:18,20,21;313:5, 7,11;314:2,20;316:7,9, 23;317:16;346:15,17; 347:14;360:7 relationships (3) 273:23;276:24;313:8 relative (10) 253:24;255:20; 258:23;259:7,16; 266:17;278:20,21; 303:21;334:13 relatively (2) 334:20;346:9 relatives (1) 285:11 relevant (3) 273:12;327:14; 334:19 relic (1) 298:9 relied (1) 325:1 relitigating (1) 376:2 remainder (3) 255:18;256:22;273:1 remaining (3) 266:20;267:12; 323:19 remarkable (2) 329:2;344:13 remarkably (3) 251:6;252:11;327:18 remember (7) 284:17;299:5; 330:10;341:3,17; 365:17,21 removal (1) 290:16 remove (3) 290:12;335:10;345:6 removing (1) 287:16 renovations (1) 288:3 reopen (1)
Q				
qualified (9) 245:21;357:11; 363:23;368:24;369:9, 11,16;370:1,23 quality (3) 313:5;334:14;338:20 quantified (1) 316:9 quantity (2) 330:7;331:19 quick (2) 349:19;360:20 quickly (2) 300:17;367:14 quite (7) 274:19;287:7; 289:18;302:11;308:10; 327:10;345:4 quote (2) 341:20,24				
R				
rain (1) 309:24 raised (2) 319:11,11 raising (1) 311:10 rambling (1) 259:4 range (10) 274:21;275:17; 278:7;279:10;280:8, 19;287:1,3;350:20; 358:10 ranked (1) 293:23 rare (1) 285:13 rarity (1) 287:8 rate (10) 251:16;264:19;				

323:20 repeat (1) 373:22 repeated (2) 328:8,17 report (95) 244:4;246:1,13,21; 247:10,11;248:4,13; 257:22;258:2;269:6; 270:14;273:20;277:2; 278:1;279:21;282:4,7, 10,11;283:12,14; 292:1;299:21,22,23,23, 24;300:8,9;301:9,12; 302:4;305:22;306:1, 15,23;307:20,24;311:4, 7,8,11,15;313:17; 314:15,23,24;315:4; 316:2;317:8,13;319:9; 320:15,16;321:5; 322:4,12,21;324:10; 325:2;327:8,13;332:7; 337:4,18;338:17; 339:15;340:24;341:14; 342:1,2,3;345:12; 346:13;357:4,6,9,19; 359:3,4;366:24; 368:10,12,20;371:18; 372:13,20;375:21,23; 376:4,7;377:16,19; 378:1 Reported (1) 239:24 Reporter (1) 379:4 reports (14) 243:23;244:11; 311:11;312:14;316:3; 317:8;319:9;322:4; 338:1,2,14;339:3; 350:18,21 represent (12) 277:22;284:5;305:5; 311:19;324:4;326:24; 336:16;349:10;360:19; 368:3;372:9;373:11 representing (1) 366:17 represents (4) 285:12;303:10; 311:15;318:23 required (4) 359:20;365:12,24; 366:8 requirements (4) 288:12,17;310:7,9 requires (2) 322:22;364:21 research (1) 291:17 reserve (2) 323:5,7 resistance (1)	261:9 RESOURCES (7) 239:2,3;245:5; 340:17,18;355:23; 379:9 respect (3) 272:21;329:13; 370:24 respective (1) 245:22 respectively (2) 294:21;298:22 responded (1) 376:21 responding (2) 304:23;348:7 response (25) 244:1;255:1;258:19; 294:10;297:9;300:22, 23;305:5;307:14,23; 308:3,5,8,12,15,19,24; 309:12,12,13,14; 322:15,17,18;333:18 responses (9) 248:15,15;258:22; 259:6,14,16;260:11; 348:13,18 rest (3) 267:7;286:12;340:14 restate (1) 354:4 restoration (1) 334:9 restore (1) 290:9 result (12) 252:24;265:2; 296:21;299:3,6; 327:22;328:2,13,20; 344:12,12;369:19 results (12) 274:14;279:16; 296:5;322:22;327:7, 12;328:15,17;329:1; 341:23;376:3,5 return (1) 378:10 review (11) 311:6,7;333:2,11; 338:13,20;339:9,11; 341:24;350:17;364:21 reviewed (6) 311:7;332:10; 333:14;350:21;367:23; 377:16 revisions (1) 266:4 riffle (1) 293:2 right (80) 246:19;250:6,12; 251:18;253:1;266:14; 270:12;273:16;275:13;	276:7;280:21;281:24; 282:5;284:9,14,15; 286:20;293:22;295:3; 296:9;299:1;303:15; 305:10,17;307:13; 310:24;312:6;316:10; 317:6;318:2;320:5; 321:13;325:24;326:15; 327:2,24;328:24; 329:16,22;330:18; 332:5;334:17;337:17; 342:15;346:2;347:22; 349:22;351:3,4,5,7,12, 13,19,23;354:14,15,20; 358:15,17,24;359:12; 363:13,18,19,22; 364:19;365:1;366:6, 11;367:18;369:3; 372:8,15,18,23;373:10, 10;374:24;378:8 right-hand (2) 275:11;358:2 rights (11) 269:4;270:9,18; 330:2,14;331:20; 351:22;355:23;359:7, 21;360:8 rises (1) 274:13 RIVER (147) 239:8,12;243:6; 246:3;249:2,2,4,9,10, 11,12,13,14,17,19,20, 22;250:2,8,10,15,24; 252:6;253:6,7,15,18, 22;255:18;256:23; 257:8,13;258:5,6,9,12, 18,24;259:7,10,11,12, 15,20;260:4,6,7,15; 263:3;264:12;265:3, 16;266:1,5,6,19;267:2, 12,16,21;268:1,4,6,8, 20;269:2,4;270:8,9,10, 18,23;271:5,8;272:3,7, 12,16,18;273:1,2,3,4,5, 11,23;274:9,14,17,19; 277:2;281:11;283:15, 15,17,18,19,22;284:21; 285:6;290:20;291:5; 294:13;297:21;298:4; 300:2;301:20,23; 304:14,18;305:1,2; 307:17;311:17,18; 312:5,7;313:22; 317:14,18;322:15,16; 329:6,10;330:1,11,14, 15;331:19;340:1; 349:14;350:6,24; 351:4;353:6,19;356:3, 3,4;357:23;358:24; 359:21;360:9;361:23; 370:7;376:1,14 river's (1)	256:12 Robison (2) 240:19,20 robust (1) 244:12 rock (6) 250:11,22;253:5,12; 294:2;326:13 rocks (1) 263:23 role (3) 340:5;349:19;355:15 room (1) 355:8 round (1) 289:18 rounded (1) 244:12 routines (1) 343:19 RPR (1) 239:24 R-squared (2) 278:11;280:9 R-squares (1) 280:10 ruling (4) 254:11;362:4,8; 374:20 rulings (2) 350:17,23 run (1) 293:2 runoff (1) 249:13 runs (1) 283:17	252:3,4,6;271:5; 309:11;316:2;317:8; 319:8;338:22;363:8; 377:19;378:1 saying (3) 317:24;373:14;375:4 scale (9) 250:23;252:21; 254:19;264:21;266:23; 283:11;325:4;344:9,16 schedule (1) 323:3 Schreck (1) 240:22 Schroeder (2) 241:11,13 SCHWEMM (21) 245:7,7;246:19,22; 282:1,5,6;284:17,20; 333:20,21,23;337:22; 338:5,24;339:4; 340:15;366:18,21,23; 367:10 S-C-H-W-E-M-M (1) 245:8 Schwemm's (1) 282:2 scope (1) 360:24 score (1) 293:21 screen (2) 252:8;354:11 SCSV-2 (1) 252:5 search (3) 248:23,24;249:1 seasonal (1) 263:2 seasonally (1) 289:17 seasons (1) 347:18 seats (2) 273:17;281:24 second (18) 243:5;250:18;291:6; 293:3;302:13,16; 304:1,4;312:13; 313:15;314:17;317:21; 319:2;331:23;348:20; 356:23;362:22;366:4 secondarily (2) 257:4;374:6 Secondly (4) 253:13;261:13; 262:15;268:12 Section (14) 240:7,10;244:3,3,9; 246:18;247:2;273:20, 22;276:22;282:6; 283:2;297:17;367:15 sections (9)
S				
			safe (2) 270:11;361:23 salient (4) 243:11;244:15; 248:16;282:12 same (30) 246:11,19;252:5,6; 254:21,22;255:1,1,2; 295:16,19;297:11; 302:24;304:24;306:10; 307:2,3;315:1,1;328:1, 4,5,11,20,21;329:4; 331:17;335:10;363:8; 379:10 sand (1) 294:2 sandwiched (1) 302:19 satisfies (2) 310:6,8 satisfy (3) 330:8;331:3,19 saw (12)	

245:1;246:10; 248:13;282:10,12; 284:5;297:19,20; 338:17 seeing (1) 346:16 seem (4) 297:21;301:4; 308:23;376:11 seems (4) 265:14,18,20;270:10 seepage (2) 249:11,18 segments (2) 264:9;284:7 select (2) 251:13;375:6 selected (2) 315:5;375:9 selection (6) 292:21;293:18; 315:3,9,16;322:7 sending (1) 341:8 Senior (8) 245:8;269:3;270:8, 17;330:2,14;359:7,21 sense (7) 278:23;320:1;323:4; 327:10;361:17;363:12; 370:24 sensitive (14) 274:2;276:21; 277:16;278:15,24,24; 279:15;280:11;281:5, 20;292:11;309:20; 310:17,17 sensitivity (3) 279:23,23;309:14 sent (1) 341:10 sentence (2) 373:4,5 separate (1) 345:23 SEPTEMBER (3) 243:1;379:6,18 sequence (1) 263:22 series (8) 312:15,19;313:8,9; 314:18,19;342:19; 363:13 SeriesSEE (39) 250:19;251:9; 252:19;324:7,9,11,19, 20,22;325:1,10,14,17, 20;326:3,12,14;327:6, 12,15;328:2,6;342:9, 21;344:11;345:6,22; 346:11,12;372:1; 373:7,14,23;374:8,9; 375:1,4,23;376:10	serious (1) 286:14 serve (1) 373:12 Service (32) 241:14;243:8,21,24; 244:12;245:9;246:1, 12,20;247:5,20; 288:13;291:3;336:12, 16;337:15,18;338:1,10, 16,19;339:12,14; 340:18;345:5;349:20, 21;351:3;364:8,10; 365:19;368:4 Services (3) 323:2;331:3;339:18 Service's (2) 367:19;368:4 SESSION (1) 243:1 set (4) 312:3,4;328:3,9 Seven (2) 257:6;260:14 several (9) 277:1;292:4;300:6; 314:14;341:10,13; 370:15;371:23,23 severe (6) 303:18,20,23,23,24, 24 severely (1) 304:9 severity (5) 260:19;302:1,23; 303:8;347:24 shape (1) 293:1 share (2) 341:23;342:7 shares (1) 285:1 Sharp (1) 240:19 Sheer (6) 261:3,9,12,15,21; 267:17 shift (1) 332:5 shifting (1) 334:13 shifts (1) 334:13 shoot (1) 261:11 show (8) 251:14;292:3; 305:11;306:2,10; 313:2;329:4;355:19 showed (14) 263:11;279:6;293:5, 5;299:2;300:14;304:8; 307:2,12;312:24;	332:9,12,12,13 showing (6) 277:5;278:2;294:17; 347:18;357:23;361:22 shown (5) 277:6;281:8;283:20; 289:1;298:19 shows (7) 284:10;292:13; 295:16;296:10;305:10, 17;307:20 side (9) 254:3,8;265:21; 275:4,11;297:16; 309:2;353:5;377:23 sides (2) 254:8;377:20 sign (4) 320:1,3,6,10 signal (5) 304:24;305:19; 306:21;307:5;348:8 signals (5) 258:13,17;259:24, 24;267:20 significance (8) 258:16;316:4;317:6; 319:22;320:17;321:22, 23;322:8 significant (15) 260:15;261:20; 288:6,18;317:5;318:7, 11,12;319:5,24; 339:24;342:21;345:18; 355:9;371:13 significantly (4) 265:2,17,23;266:13 similar (6) 285:10;292:7; 304:10,11;314:3;350:5 similarly (4) 287:20;288:2; 295:13;323:18 simple (6) 259:23;270:15; 271:3;346:14;347:23; 352:24 simplest (2) 326:16;346:11 simplicity (1) 358:19 simplistic (1) 359:1 simply (3) 248:13;258:14; 274:24 simulated (1) 294:12 simulation (2) 293:4;294:8 simultaneously (2) 290:14;343:20 single (2)	300:4;328:22 singling (2) 307:22;311:9 sit (1) 282:1 site (4) 275:5;280:1,8;314:8 sites (9) 277:1,5,7;278:22; 279:17,18;280:3,5,14 situated (1) 256:1 six (6) 250:21;251:5;257:1; 306:9,10,15 size (1) 298:19 skill (1) 327:20 skip (1) 251:16 slide (15) 251:16;257:24; 273:21;275:4,11; 283:6;289:21;291:18; 294:17;305:24;306:17; 307:12;313:20;322:11; 361:21 slides (11) 248:2,3,5;258:1; 274:3,6;283:7,7;286:3; 287:3;353:23 slight (2) 305:10,11 slightly (3) 290:10;298:10,11 slip (1) 261:10 slope (4) 278:16;280:15,16; 308:22 slow (1) 288:23 small (8) 252:8;285:22; 288:23;296:2;297:12; 335:1;346:5,9 smaller (1) 286:4 snails (1) 285:2 snorkel (1) 292:17 snow (1) 309:24 SNWA (9) 240:16;262:4; 263:19;305:7;349:4,6; 357:4,9;365:23 SNWA's (3) 262:16;263:4;357:4 software (3) 294:13;318:9,11	soil (4) 310:3,3,6,11 Solicitor (2) 243:20;336:15 solid (1) 244:13 somehow (1) 353:4 someone (1) 328:8 sometimes (1) 321:9 somewhat (4) 258:19;301:3; 328:23;360:4 somewhere (4) 257:11;300:20; 347:20;350:20 sophisticated (1) 266:22 Sorry (17) 245:15,24;259:4; 306:12;311:21;318:24; 327:3,5,9;328:9,10; 330:5;350:13;357:21; 361:12;367:16;374:16 sort (11) 282:7;283:24;285:5, 23;286:22;289:15; 291:13;293:1;294:19; 334:23;335:1 sorts (2) 288:2;294:7 sound (1) 341:24 sounds (1) 310:21 source (5) 253:6;258:5,6; 259:11;268:3 sources (9) 249:2,5,8,9,16;250:5, 8;263:21;339:6 south (9) 251:23;252:2,24; 277:21;284:12;297:20; 300:13;354:18;362:16 southeast (1) 252:4 Southern (11) 245:9;254:7,15; 283:13;297:23;298:4; 301:19,19;349:10; 362:1;363:16 southwest (2) 286:8;354:18 southwestern (3) 255:24;256:18; 352:15 span (1) 377:22 sparse (2) 262:21;264:3
---	--	---	--	--

<p>spawn (1) 289:10</p> <p>spawning (2) 285:19;289:18</p> <p>speak (1) 331:5</p> <p>special (1) 243:22</p> <p>species (23) 282:18,23;284:23; 285:15,18;286:7,10; 288:4,6,11,16;290:13; 292:10;296:7,19; 297:8;298:7,9,17; 334:14;340:6;368:16, 18</p> <p>specific (8) 244:3;284:7,18; 290:24;292:12;296:16; 313:17;346:20</p> <p>specifically (6) 265:16;288:22; 294:9;302:17;368:14; 371:10</p> <p>spell (1) 244:21</p> <p>spelled (1) 244:24</p> <p>spoke (1) 366:24</p> <p>Spring (117) 249:24;251:1,19,24; 254:13;255:2,3,16,16, 23;256:17,22;257:2; 258:18,19,22;259:6,15, 15,19;260:1,10,13,14, 15,16;261:5,20,22; 266:7;267:21,21; 268:4;269:17;270:9; 273:22;274:1,2,8,14, 22;275:2,4,6,8,9,12,12, 16;276:2,6,7,10,12,12, 13,17,17,18,19,24; 277:8,9,9,11,14,15, 17;278:2,3,8,13,15,24; 279:1,4,13,15,19,19; 280:2;281:4,9,13; 283:1;284:9;289:10, 24,24;290:5,5,10; 291:10;292:13;300:2; 304:12,17;305:15; 307:1,6;324:1,4;331:4; 347:16,19;348:1; 349:23;350:6,24; 352:8,8;362:12,15; 363:15;365:13,14</p> <p>SPRINGS (150) 239:12;249:3,10,12, 14,17,18,19,20,22; 250:3,10,15,17;251:1; 252:6;253:6,15,18,21, 23,24;254:7,8,9,15; 255:15,17,20,24;256:2,</p>	<p>5,18,23;257:1,13,13; 259:2,19;260:4,5,6,24; 263:10;264:10;266:6, 9;267:2;269:18,19; 270:4;272:12,13,16,17, 24;273:2,23;274:9,10, 14,18,18,19,23;275:18; 276:20;277:2,10; 278:11;279:19,20,20, 22;280:4,7,11;281:2,5, 6,10,15,17,18,20,21,22; 282:8;283:15,23; 284:16;285:6;286:22; 287:22;289:22;291:5, 5,8;298:1,4;304:22; 329:13;331:24;332:2; 334:1,3,8,18;335:21; 339:24;347:22,22; 350:6,24;351:4,6,10; 352:12,14,15,16,17; 353:1,6,8,10;354:15, 19;355:22;356:4; 362:1,2,7,16;363:1,6, 16;364:2,3,13,17; 367:21;374:10;375:3; 376:14,18;377:2,14,22, 24</p> <p>square (1) 252:22</p> <p>stabilized (1) 307:4</p> <p>stable (7) 297:2;300:18;301:5; 305:9,17;306:2;337:1</p> <p>staff (2) 323:19;338:10</p> <p>stage (2) 288:22;289:6</p> <p>stages (1) 289:1</p> <p>standard (5) 303:12,14,16,17,19</p> <p>standardized (1) 303:9</p> <p>standpoint (4) 284:1;285:4,14; 359:18</p> <p>start (14) 244:20;247:23; 295:2;299:15;305:18; 311:6;315:23;316:1; 323:24;324:6;343:16; 347:20;349:11;355:20</p> <p>started (5) 243:7;308:13;313:7; 360:24;374:22</p> <p>starting (7) 245:23;253:1;283:8, 11;293:8;294:22; 330:18</p> <p>starts (2) 300:20;373:6</p> <p>STATE (24)</p>	<p>239:1;240:4;244:1; 253:11;269:4,17,20,22, 24;312:10;323:19; 330:9;339:21;340:11; 341:16,22;345:11; 350:17,23;356:13; 369:22;374:15;377:1; 379:1</p> <p>stated (4) 258:2;323:11;368:9; 375:1</p> <p>static (1) 272:5</p> <p>statistical (8) 258:15,15;314:22; 316:3;317:5;319:22; 321:21,22</p> <p>statistically (7) 317:5;318:7,7,10,12; 319:5,23</p> <p>statistics (1) 315:2</p> <p>status (1) 286:16</p> <p>steady (3) 269:23;270:10,10</p> <p>steepens (1) 301:1</p> <p>steepest (1) 281:1</p> <p>stem (2) 284:13;297:21</p> <p>stenotype (2) 379:7,14</p> <p>step (3) 271:14;303:6;360:2</p> <p>step-wise (1) 315:16</p> <p>stewardship (1) 289:22</p> <p>stick (1) 314:20</p> <p>still (16) 254:1,20;258:20; 275:15;287:6;304:5; 323:3,4;332:1;342:6; 346:7,9;351:23; 361:21;363:16;365:19</p> <p>stipulation (13) 291:7;292:6;364:8, 20,20;365:8,24;367:2; 376:16,18,23,24;377:4</p> <p>stop (1) 310:19</p> <p>stopped (1) 270:4</p> <p>storability (1) 326:11</p> <p>storativities (1) 266:17</p> <p>storativity (3) 266:24;267:4;343:3</p> <p>straight (1)</p>	<p>282:10</p> <p>stranded (1) 285:5</p> <p>stream (20) 258:22;259:6;260:1; 284:15;287:17,20; 288:21;289:8;292:22, 24;294:4,13;297:7,14, 15,19;335:24;348:1; 351:21,23</p> <p>streams (4) 284:4;290:2;295:22; 296:1</p> <p>stresses (6) 326:18,18,19;327:1; 342:20;373:18</p> <p>stretch (1) 334:11</p> <p>striking (1) 256:2</p> <p>strong (1) 305:19</p> <p>structural (6) 333:7;370:8,12,18; 371:3;373:15</p> <p>structure (1) 286:5</p> <p>stuck (1) 285:8</p> <p>study (8) 251:12,13;325:23, 24;346:1;348:15; 374:13;375:7</p> <p>stuff (5) 286:14;288:23; 293:11;313:2,12</p> <p>style (2) 247:21;335:12</p> <p>styles (1) 244:10</p> <p>subject (1) 371:8</p> <p>submit (2) 257:23;337:18</p> <p>submitted (4) 258:1;273:21;277:3; 350:19</p> <p>submitting (2) 338:1;340:23</p> <p>subsequent (1) 287:3</p> <p>substantial (1) 283:23</p> <p>substantive (1) 282:4</p> <p>substituted (4) 365:20,23,23;366:4</p> <p>substrate (2) 294:2,7</p> <p>sub-stream (1) 292:24</p> <p>successful (1) 291:14</p>	<p>succinct (1) 243:15</p> <p>Sue (3) 244:23;245:23; 364:23</p> <p>sufficient (14) 254:4;255:14; 257:18;259:18;265:15, 17;266:19;269:3; 270:8;298:13;323:22; 330:2;331:14;359:7</p> <p>suggest (3) 270:13;271:14; 358:19</p> <p>suggests (1) 270:15</p> <p>Sullivan (2) 240:5;341:16</p> <p>summarization (3) 244:7;247:19;323:2</p> <p>summarize (1) 298:6</p> <p>summarizing (1) 279:16</p> <p>summary (6) 248:1;264:7;266:3,3; 269:7;283:6</p> <p>supervisor (1) 245:4</p> <p>supply (4) 287:21;325:24; 326:5;346:1</p> <p>support (2) 263:19;264:8</p> <p>supports (1) 243:12</p> <p>supposed (1) 278:23</p> <p>Sure (13) 247:24;254:1;258:1; 299:18;325:15;329:7; 335:9;352:12;353:9; 355:23;357:11;358:11; 377:7</p> <p>surface (17) 249:10,18,18; 274:12,13,16;275:1,1, 5,8,14,20,23,24; 277:23;279:2;291:23</p> <p>surprised (2) 301:11;374:6</p> <p>surprising (1) 326:8</p> <p>surprisingly (1) 329:3</p> <p>surveys (5) 292:17;377:13,17, 18;378:2</p> <p>sustainability (1) 329:20</p> <p>sustainable (10) 247:6;268:6,10,16, 20;269:9;270:17;</p>
---	---	--	---	---

271:18,23;272:24 sustainably (1) 272:11 swap (1) 273:17 swapped (2) 358:20,23 swim (1) 290:4 swimming (1) 287:19 switch (3) 281:24;311:5;353:14 sworn (2) 245:14,17 SYSTEM (93) 239:8;243:7;246:3; 253:22;255:18;256:23; 257:8;258:12,18; 259:1,7,10,11,12,16, 21;262:13;263:3; 264:13;265:3,16; 266:1,5,19;267:12,16, 22;268:1,7,8,14,20; 269:10,16,23;270:23; 272:1,3,8;273:11; 274:3;279:15;281:7, 11;283:10,15,23;284:1, 20;285:3,13;288:12; 289:17;290:17,20,20; 291:11;296:4,9,20; 297:7,24;300:2; 301:20,23,24;304:15, 18;305:1,2;307:17,18; 309:20;322:15,17; 329:6,10,14;330:11; 331:11;336:4,9; 349:14;350:15;353:19; 355:22;356:3;357:23; 359:24;361:23;370:7, 10;376:1 systems (2) 286:15;309:19	284:8;336:18;360:1 talking (7) 273:20;277:20; 282:6;284:14,21; 353:24;373:5 target (2) 334:22;336:7 targeting (1) 340:23 tasks (1) 329:9 team (2) 364:21;365:4 technical (7) 273:10,12;312:23; 338:13;339:22;340:12; 364:21 telling (1) 318:2 temperature (2) 289:23;298:10 temperatures (3) 285:20;289:10; 298:11 temporally (1) 254:21 Ten (6) 264:14,15;275:7,10; 276:3;309:4 ten-minute (1) 310:22 tens (1) 261:18 ten-year (1) 300:18 terms (7) 279:11;283:3;303:8; 316:11;326:16;333:12; 365:9 terribly (2) 265:24;377:3 test (39) 250:20;251:8,8; 252:20;254:22;255:1, 13;256:15;269:14,15, 15,24;270:2;301:2,3; 304:7,7;312:2;326:1,2, 7;327:16;328:9,18; 345:21,24;350:9,12,13, 14,18;352:1;355:16; 356:2;374:3,5,19,20; 375:10 testifying (2) 354:2;375:19 testimony (5) 247:22;323:2; 352:19;354:5;355:6 testing (4) 317:1,1,22,23 tests (2) 329:15;374:22 Thanks (3) 299:7;337:9;363:20	That'll (1) 348:3 Theis (4) 342:10;343:2; 372:24;373:6 theoretical (1) 274:7 theorized (1) 279:14 theory (4) 260:21;276:22; 279:24;281:3 thereafter (1) 379:10 therefore (1) 268:9 thereof (5) 246:7,17;247:1; 264:5;371:15 thermophilic (1) 285:16 thinking (2) 254:14;288:9 Third (4) 253:3;313:16; 339:10;373:1 thoroughly (1) 339:7 though (3) 290:14;333:10;371:2 thought (7) 243:13;260:8,12,20; 272:6;286:6;303:12 threat (1) 333:24 threats (2) 286:7;288:6 three (13) 244:2;245:20; 251:18,22;261:10; 286:13;294:20;306:1, 6,16,19,19;367:16 three-part (1) 290:8 threshold (1) 359:9 throughout (5) 260:3;274:17; 275:15;375:6,10 Thrust (3) 256:11;265:5,9 thrusts (2) 264:17;265:22 ties (2) 345:16;346:5 tight (1) 324:16 Tilapia (3) 288:5;290:16;296:19 Tim (10) 240:18;245:3; 273:18,19;284:8,14; 299:20;311:3;341:24;	376:21 timer (2) 282:15;323:24 times (3) 283:16;313:23; 341:13 timetable (1) 324:16 timing (6) 255:2;258:21;259:5, 14,16;282:3 Tim's (2) 344:24;345:3 tip (1) 301:19 title (2) 273:21;283:7 titled (2) 246:1;247:5 Today (9) 243:22;244:7,17; 247:20;282:14;323:12; 350:5;369:24;375:20 together (4) 291:9;313:2;324:19; 336:2 tomorrow (1) 248:7 ton (1) 290:14 took (4) 243:23;244:3,14; 379:7 tool (6) 315:15;326:15,15; 328:14;373:17,17 tools (1) 315:13 top (15) 262:8;269:11;272:3; 278:1;285:19;293:24; 294:5,22;302:5,24; 305:8,10,16,17;311:24 topographic (1) 263:14 total (20) 268:9,11;269:10,13, 13;270:1,22;271:4,7; 272:9,11,23;329:20; 330:14,17;333:12; 356:20;358:3;359:16; 360:3 totals (2) 302:4,8 touch (3) 283:4;286:12;363:10 traditionally (1) 317:4 training (4) 312:2,2,4;369:18 transcribed (1) 379:10 transcript (1)	379:12 transcription (1) 379:14 transform (1) 343:2 transformation (1) 342:11 transforms (2) 373:1,7 transition (1) 334:7 transmissive (2) 254:20;363:17 transmissivities (1) 266:17 transmissivity (21) 250:23;252:21; 253:11;254:12,16,19; 255:6,8;266:23;267:3; 274:15;325:5;326:11; 327:21;343:3;344:7, 10,17;362:17,21; 363:15 transpire (1) 310:11 treated (1) 290:20 trees (1) 287:17 trend (7) 302:18,21;304:3,11; 308:13;328:16;352:18 trending (2) 354:13,20 trends (1) 260:19 triangle (1) 251:18 Tribe (2) 332:6;340:23 tributary (2) 304:17,19 tried (1) 345:6 trigger (9) 273:24;292:6;331:1, 10,24;351:21;364:12, 15,16 triggers (10) 281:15,16,18; 291:21,23;292:3; 298:21,21;364:1; 366:24 TRT (3) 364:21;366:7,8 true (4) 316:19;337:20; 341:2;379:13 truly (2) 317:24;318:3 truth (1) 339:23 try (4)
T				
table (12) 279:16,21;293:23; 297:16,17;317:13,20; 330:10;357:3,18,22; 358:8 Tables (1) 357:15 Taggart (9) 240:16,16;242:7; 349:9,10;357:12,14; 360:12,14 talk (11) 264:15;281:14; 282:8;287:2;288:14; 296:8;315:24;329:5; 344:18;351:16;372:24 talked (3)				

284:17;309:7;326:4; 346:15 trying (26) 244:15,16;255:16; 258:15;287:17;288:3; 290:12,14;312:17; 313:7,10;314:19; 315:11;316:6;317:15; 318:18;320:11;321:7; 340:7;342:22;343:19; 347:13,21;354:6,7; 370:9 TUESDAY (1) 243:1 Tule (5) 304:20;305:21; 306:9;348:6,24 turn (5) 243:17;247:23; 249:14;367:9;369:4 turning (1) 342:8 tutored (1) 324:19 two (20) 261:6;263:21; 265:21;293:21,22,24; 294:18;305:11,16; 310:5,9;312:16,18,20; 313:1;314:20;320:16; 332:12;346:7;365:13 type (3) 280:1;293:2;333:17 types (2) 288:9;290:9 typewriting (1) 379:10 typical (5) 286:7,7;289:12; 292:17,22 typically (5) 286:15;287:11; 289:3,11;293:20	under (3) 250:21;274:11; 315:19 undergone (2) 334:6,8 underlined (1) 253:9 underlying (7) 249:20;250:11; 253:4,16;257:10,12; 325:5 understood (1) 320:19 undertook (1) 259:13 undiminished (2) 269:20,22 unexpected (1) 326:9 unfairly (2) 300:4;340:23 uniform (9) 251:6;252:9,11; 274:17;275:14;326:8; 327:18;329:3;374:7 uniformity (1) 344:13 unique (9) 285:4,12;286:16; 287:13,15;288:17; 298:8,17;314:24 Unit (4) 332:2;364:4,4,17 units (6) 262:14;284:6;303:8, 11;372:9;375:15 univariant (1) 293:16 unknown (3) 256:3,12;354:2 unlikely (4) 265:1,14,18,20 unprocessed (3) 328:1,4,11 unrealistically (1) 319:20 unresolved (2) 273:9,12 unstable (1) 319:20 up (47) 244:9;248:11; 252:16;259:9;261:11; 262:24;268:1;272:2; 273:18;282:11;284:12; 285:8;289:21;290:10; 295:9;297:6;298:6,7; 301:3,4;306:12;308:8, 9;310:12;311:4; 313:23;320:5,5,23,23; 322:12;323:21,21; 328:19;334:5,21; 335:19;336:6;344:3;	345:10;346:15;347:14, 18;361:21;363:2; 366:13;378:5 update (3) 276:23;277:4,12 updated (2) 271:15,24 upon (1) 323:17 upper (1) 286:22 uppermost (1) 249:3 upstream (1) 289:16 URS (1) 377:16 use (15) 243:16;263:17; 281:19;293:3;312:9; 313:8;314:6,18; 315:17;323:8;325:17; 327:11;345:8;347:23; 355:3 used (13) 257:19;268:10; 270:16;271:23;292:21; 293:17;294:13;297:22; 314:14,15;335:4; 342:10;372:8 useful (3) 244:16;268:15; 298:23 user (1) 318:12 users (1) 291:9 uses (2) 292:10;298:10 using (15) 251:9;261:1;262:3; 263:10,21;271:10; 277:22;292:20;311:13, 18;312:7;313:7; 325:20;355:12;372:1 usually (2) 310:5;345:2 Utah (1) 311:17 utilities (1) 343:22 utilize (1) 338:17 utilized (1) 339:7	239:10,11;241:9; 249:3,23,24;250:3,15, 16;251:1,1,2,19,24; 252:2;253:19,21,24; 254:7,8,13,15;255:3,3, 15,17,18,23,24;256:18, 18,22;257:3,6,10,13, 17,20;258:4,10;259:2, 2;260:24,24;261:12, 22;262:9,9,10,12,12, 18,18,21;263:1,1,10, 10;264:10,10,18,18,24; 265:6,7,9,13,21;266:2, 7,7,7,10,10;267:18,23; 268:23;272:4;282:20; 291:6;304:16,16,17,18, 19,19,20,21;305:7,15; 329:14,16;349:7,11,23; 350:6;352:15,16; 360:16,19;362:1,2,7, 12,15,16;363:7,16,16; 365:13;367:21;374:10; 375:3 Valleys (3) 261:5,20;262:11 value (23) 276:3,4;280:9,16; 303:9,13,15,21;316:17, 18,18,19;317:1,3,10, 11,21,23;318:1,2,3; 343:3,18 values (10) 317:4,8,10;319:1,3, 21;342:9;343:17; 344:10;367:1 variability (5) 278:12;280:24; 302:11;309:6;320:12 variable (22) 262:8,19,19;263:3; 267:18;294:3,4; 312:22;315:3,9,11; 316:7,8,13,14,16,24; 319:16;321:7,7,8; 322:7 variables (25) 292:20;293:4,9,10, 18;294:1,7;312:17,18, 20;314:20;315:5,7,10, 17,17,22,23;317:20; 318:5,14;319:13; 320:9,13;321:2 variations (3) 254:22;262:24; 271:21 varied (1) 313:2 varies (2) 274:19;288:22 various (2) 323:14;373:18 vary (4) 275:20;289:5,7;	319:21 varying (1) 326:10 Vegas (3) 245:9;349:7,11 velocity (3) 292:24;294:2,7 verified (1) 375:22 verify (1) 245:24 versus (8) 271:5;278:3;312:22; 313:3,13;317:14; 318:16;347:24 vicinity (4) 263:9;264:9;273:3; 335:21 Vidler (7) 291:7;349:4;364:9, 20;366:14,17;376:20 view (5) 265:3;273:21;354:4; 355:7,14 Virgin (7) 311:17,18;312:5,7; 313:22;317:14,18 virtually (2) 293:16;354:17 visual (1) 347:23 voluntarily (1) 291:23 voluntary (2) 291:2;292:7 volunteered (1) 324:17
U				W
um-hum (24) 246:5;329:11; 330:24;337:19;351:17; 352:4;353:17;354:24; 356:17;358:4,6; 359:10,19,22;365:5; 368:23;372:18,18,21; 373:3,13;374:23; 375:18;377:7 unaffected (1) 307:7 unaltered (1) 293:13 uncertain (1) 264:20 unclaimed (1) 250:22				wait (2) 247:13;371:22 walk (3) 277:24;292:15; 294:19 walked (1) 324:19 Warm (13) 277:9;279:19; 281:15;284:16;289:22; 298:1;331:24;334:8, 18;335:21;351:6; 364:2,13 warming (1) 285:7 warms (1) 248:11 warn (1) 341:21 warranted (1) 287:14 Wash (61) 249:12,17,20,22,23;
		V		
		valid (3) 332:1;364:3,16 validate (1) 350:14 VALLEY (113)		

<p>250:2,3,10,15,16,16, 17;251:2;252:4; 253:15,18,19,24;254:9; 256:2,5;257:1,6,10,14, 17,20;258:4,6,9,10; 259:2;260:24;262:9, 10,12,18;263:1,10; 264:11,18,18;265:6,9, 16;266:8,10;267:19, 23;268:23;272:4; 273:2;304:21;329:16; 352:17;353:9,10; 354:15,19;377:22,24</p> <p>Washburns (1) 267:3</p> <p>waste (1) 367:12</p> <p>WATER (174) 239:3;245:4;247:5; 249:2,9,16;250:8; 251:11;254:22;257:4; 258:5,6,8,22;259:11, 20;260:2,3,4,9;261:11, 19;262:2,4,15,16,17, 19,23;263:4;264:21; 265:2,4;269:3,21; 270:7,18;271:8;272:1; 273:1,13;276:21; 278:3,7;279:3,10; 280:12,13,13,19; 283:23;284:1;285:6, 17,21;286:23,24; 287:21;289:4,19; 291:9;292:23;298:13; 300:11,19;304:11; 305:12,16,19;306:2,11, 20,24;307:11,21,21; 308:4,5,16,21;309:3,6, 8,13;310:9,11;311:15, 20,22,23,23;312:6; 313:1,12,13,20;316:8; 317:14,16;318:16,18, 19;320:4,5,22,23; 321:10,11,12;322:14, 15,20;325:24;326:5, 19;327:1;330:2,8,14, 17;331:19;336:21; 337:1;340:1,3,9,17,18; 342:22;343:21;345:24; 346:6,8,9;347:3;348:7; 349:7,10,11,22;351:3, 4,5,12,13,19,22,22; 353:5;355:6,8,12,15, 19,19,21,24;356:7; 360:8,16,19;362:11; 363:4,8;366:14,17,18; 371:24;373:19,19; 374:13;375:11;376:19; 379:9</p> <p>waterfall (1) 335:1</p> <p>waterfowl (1) 287:11</p>	<p>waters (1) 265:7</p> <p>wave (1) 286:18</p> <p>way (16) 248:21;249:4;258:2; 283:17;285:17;295:13, 16;297:6;312:21; 313:4;317:3;336:8; 344:7,17;351:22;374:3</p> <p>ways (3) 287:7;322:1,2</p> <p>weather (1) 373:24</p> <p>wedge (12) 255:24;256:7,10,16, 16,21;352:8,14;353:1; 354:8,22;355:2</p> <p>week (3) 318:20;321:11,13</p> <p>weekly (3) 318:18,19;321:10</p> <p>weeks (5) 318:16,21,23,24; 335:23</p> <p>wells (49) 251:12,13,14; 253:23;254:3;257:16; 300:15;305:6,21; 306:2,4,7,9,10,16,19, 21;307:16,18;322:16; 325:17;333:12;345:8; 346:8,10,16;349:1,4; 361:6,9;363:5,6;366:2, 8;371:20,23;372:1,4,9, 17;373:20;374:13; 375:6,8,9,14;377:14, 21;378:4</p> <p>weren't (2) 308:11;342:3</p> <p>west (13) 252:23;265:4,8; 277:10;279:19;281:15; 284:16;332:1;351:6; 353:5;354:19;364:2,13</p> <p>wet (38) 258:20,21;259:5,24; 260:10;300:22,22; 302:12,19;303:11,20, 24,24;304:5,6,9,10; 307:14,15,23;308:1,2, 4,10,10,11,24;309:12, 13,20,22;310:10,16,17; 322:17;346:24;347:8, 18</p> <p>wetland (1) 287:12</p> <p>wetter (2) 303:14,20</p> <p>wettest (1) 308:4</p> <p>what's (5) 283:19;294:19;</p>	<p>304:24;347:17;368:1</p> <p>whereas (1) 264:16</p> <p>wherever (1) 263:18</p> <p>WHITE (57) 239:8;243:6;246:2; 253:22;255:18;256:22; 257:7;258:11,18,24; 259:7,10,11,12,15,20; 263:3;264:12;265:3, 15;266:1,5,19;267:11, 16,21;268:1,6,8,20; 270:23;272:3,7; 273:11;281:11;283:17, 18;300:2;301:20,23; 304:14,18,24;305:2; 307:17;322:15,16; 329:6,10;330:11; 349:14;353:19;356:3; 357:23;361:23;370:7; 376:1</p> <p>whole (11) 244:6;247:10,11; 275:15;308:21;322:12; 328:9;331:5;337:13; 342:19;362:17</p> <p>widely (1) 300:21</p> <p>Wildlife (36) 243:8,21,24;244:11; 245:6,9;246:1,12,20; 247:5,20;287:11; 288:13;291:3;323:2; 331:3;337:15,18; 338:10,19;340:18,19; 349:20,21;351:3,6; 364:8,9;365:19; 366:20;367:8;368:3; 371:18;376:17,19; 377:1</p> <p>wildly (1) 319:21</p> <p>willing (1) 341:23</p> <p>WITHIN (21) 239:8;255:24; 256:20;260:7;262:12; 265:2,15;266:1; 267:16;271:12;272:1, 7;287:3;289:7;293:24; 323:23;325:23;347:4; 348:2;354:21;379:9</p> <p>without (3) 264:14;353:6;370:22</p> <p>witness (1) 367:4</p> <p>witnesses (1) 245:14</p> <p>wondering (2) 350:12;352:11</p> <p>words (3) 278:19;311:17;</p>	<p>329:19</p> <p>work (9) 289:2;290:14;335:2; 336:8;348:12;369:18, 19;370:20;375:20</p> <p>worked (1) 289:2</p> <p>working (3) 324:15;330:12; 349:16</p> <p>works (3) 299:17;326:12; 331:11</p> <p>worse (2) 280:10;321:23</p> <p>wrap (2) 298:6;322:12</p> <p>written (1) 343:22</p> <p>wrong (4) 370:18,19;371:3,5</p> <p>wrote (1) 352:7</p>	<p>307:1;313:9;323:18; 353:7,10;355:6</p> <p>yesterday's (1) 352:19</p> <p>yield (6) 268:16,20;270:17; 271:18,23;355:20</p> <p>young (1) 288:23</p>
				Z
				<p>zero (11) 297:20;303:9,10; 316:20,22;317:10; 318:1,3,8,22;361:15</p> <p>zeros (1) 297:18</p> <p>zone (11) 256:12;261:4,9,11, 12,15,22;267:17; 333:13;377:23,24</p> <p>zones (1) 333:17</p>
				0
				<p>05 (5) 278:17;317:4,9,10; 318:6</p>
				1
				<p>1 (5) 279:21;293:15; 300:10;313:20;372:6</p> <p>1,050 (1) 252:22</p> <p>1,797 (1) 275:13</p> <p>1,807 (1) 275:7</p> <p>1,812 (1) 276:1</p> <p>1,817 (3) 275:6,15;276:1</p> <p>1.1 (2) 245:1;246:10</p> <p>1.5 (9) 245:1;246:10;251:7, 20,23,24;252:3,11; 361:14</p> <p>1.6 (9) 246:18;251:7,21,23; 252:1,3,11;273:20; 361:14</p> <p>1.7 (2) 245:2;246:10</p> <p>1:15 (2) 378:10,11</p> <p>10 (6) 294:12;295:4,5,11, 20;299:2</p>

10,000 (2) 269:12,24	1895 (1) 332:17	265:19	26 (2) 285:18;286:24	302:3,5,24;303:3; 307:22;311:23;313:1; 363:5
100 (1) 265:7	19 (2) 278:1,18	2010 (5) 258:20;301:4;305:8; 347:7;374:1	27 (3) 252:2;315:7;320:18	40 (1) 299:13
11 (2) 266:3;324:20	1970 (1) 313:22	2011 (3) 258:20;301:1;347:7	2D (1) 294:13	44 (1) 320:16
1169 (18) 250:19;251:8; 254:22;269:14;277:2; 307:20;328:18;337:4; 350:13;352:1;374:3, 10,13,18;375:2,7,10; 377:2	1977 (1) 260:19	2012 (2) 324:13;350:20	3	45 (2) 299:15,15
12 (10) 260:17;266:16; 318:5,13,21,22,23; 319:4;371:20;372:4	1987 (2) 300:12;332:14	2013 (19) 250:18;252:20; 277:3,12,17;301:2; 307:20;324:10,11,24; 327:6;332:14;345:6; 350:20;372:1;375:21; 376:3,4,6	3 (12) 259:8;260:18; 301:13,22;302:5,23; 303:17,17,19,19; 311:14;368:2	4700-acre-feet (1) 263:6
12:09 (1) 378:12	1989 (2) 260:19;308:16	2015 (10) 268:18;269:3;270:7; 305:18;330:16;345:12; 356:19;358:7;359:15, 17	3- (2) 255:12;256:14	49,500-acre-feet (1) 262:2
1200 (1) 261:14	1990 (4) 302:6;303:1;332:13, 17	2016 (1) 356:19	3,000's (1) 297:6	4-month (2) 255:13;256:14
1200-foot (1) 261:14	1991 (1) 351:14	2017 (2) 269:3;356:19	3.15 (1) 292:7	5
120-millimeter (1) 285:22	1992 (1) 308:2	2019 (14) 243:1;246:3;247:7; 278:5;300:12;302:6; 303:1;305:8;306:8; 307:3;332:13;341:9; 379:6,18	3.2 (1) 292:5	5 (10) 242:12;246:1,12,21; 247:17;357:5;363:5; 371:18;372:22;377:6
12-month (1) 302:9	1995 (1) 260:17	2020 (1) 313:22	3.29 (1) 292:5	50 (5) 276:5,11,16;323:7; 362:9
13 (9) 267:10;293:15; 305:21,23;306:9,19; 318:16,24;319:5	1997 (2) 300:21;349:17	210 (1) 239:9	3.5 (1) 351:13	50- (1) 362:6
1303 (9) 243:7;244:1;248:15; 266:20;267:8;299:21, 22;311:7,15	1998 (3) 308:21;336:22;337:2	211 (1) 239:10	30 (11) 285:20;289:11; 294:12;295:4,11,21; 299:2,13,14,15;323:5	500 (3) 287:5;296:18;297:3
13303 (1) 322:21	2	217 (1) 239:11	30,550-acre-feet (3) 359:6,14,20	5217 (1) 374:21
14 (3) 268:5;371:23;372:19	2 (7) 247:2;282:6;294:6; 302:3;311:14;317:13; 372:6	218 (1) 239:12	315 (1) 298:22	57 (2) 364:10;376:18
15 (8) 252:4;272:6;276:9; 317:17;371:17;372:5, 17;374:11	20 (11) 270:24;271:11; 275:17;276:8;294:12; 295:4,5,11,21;299:2; 348:23	219 (1) 239:13	32 (4) 285:18,20;289:11; 298:22	5712 (3) 254:11,11;362:5
150 (1) 265:19	2001 (3) 350:2,4,15	22 (1) 377:5	324 (1) 242:4	59 (3) 366:20;367:8;368:4
1500 (3) 287:4;297:3;299:1	2002 (2) 308:20,23	239 (1) 379:13	336 (1) 242:5	6
150-foot (1) 265:7	2003 (1) 307:3	24 (5) 243:1;252:23; 369:19;370:20;371:1	337 (1) 242:6	6 (1) 296:13
16 (13) 268:18;270:7; 317:14,20;318:5; 323:18;324:1;358:7; 359:15,17;371:17; 372:5,17	2004 (4) 258:19;278:4; 308:21;347:6	245 (1) 242:3	349 (1) 242:7	60 (1) 252:23
16th (2) 247:7;341:9	2005 (9) 258:19;296:13; 300:21,23;307:15; 308:2,4;347:7;374:1	247 (2) 242:12,13	360 (1) 242:8	66 (1) 286:19
17 (8) 268:18;270:7;283:6; 320:18;330:17;358:7; 359:15,17	2006 (6) 263:17;273:24; 291:4;330:23;332:1; 364:1	24th (1) 379:6	366 (1) 242:9	7
18 (2) 260:19;278:20	2007 (7) 254:11;260:17; 306:7;362:4;374:18, 20,23	25 (4) 276:9,12,18;353:23	37 (4) 359:3,4;367:9;368:3	7 (3) 242:13;247:5,18
	2008 (2) 305:7;309:16	250-foot (1) 265:3	379 (1) 379:13	70 (1) 274:19
	2009 (1) 262:6	256 (1) 345:12	3D (1) 263:18	7144 (1) 358:10
	200-foot (1)	25th (1) 379:17	3rd (4) 244:4;246:3,13,21	72 (1) 279:8
			4	73 (1) 279:12
			4 (14) 258:24;259:4,8; 260:18;301:13,18;	75 (1) 362:9
				7500 (1) 360:1

7500-acre-feet (1)
358:9
75-foot (1)
362:6
7791-acre-feet (1)
358:10

9

9 (2)
306:24;345:11
9,318-acre-feet (1)
329:24
90 (1)
285:19
90's (2)
285:23;286:6
92 (1)
308:2
93 (2)
308:2,3
9318 (4)
357:2;358:14;359:9;
360:5
9318-acre-feet (3)
268:19;356:13;
359:16
95 (1)
308:9
96 (1)
308:18
97 (3)
278:12,12;280:9
98 (3)
300:21;308:10,12

In The Matter Of:

*DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES*

*Vol. II
September 24, 2019*

*Capitol Reporters
123 W. Nye Lane, Ste 107

Carson City, Nevada 89706*

Original File 092419water pm FINAL.txt
Min-U-Script® with Word Index

SE ROA 53114

JA_17511

Page 380

1 STATE OF NEVADA
 2 DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
 3 DIVISION OF WATER RESOURCES
 4 BEFORE MICHELINE N. FAIRBANK, HEARING OFFICER
 5
 6 IN THE MATTER OF THE ADMINISTRATION
 AND MANAGEMENT OF THE LOWER
 7 WHITE RIVER FLOW SYSTEM WITHIN
 COYOTE SPRING VALLEY HYDROGRAPHIC
 8 BASIN (210), A PORTION OF BLACK
 MOUNTAINS AREA HYDROGRAPHIC
 9 BASIN (215), GARNET VALLEY
 HYDROGRAPHIC BASIN (216), HIDDEN
 10 VALLEY HYDROGRAPHIC BASIN (217),
 CALIFORNIA WASH HYDROGRAPHIC BASIN
 11 (218), AND MUDDY RIVER SPRINGS AREA
 (AKA UPPER MOAPA VALLEY HYDROGRAPHIC
 12 BASIN (219)).
 _____ /
 13
 14
 15
 16 TRANSCRIPT OF PROCEEDINGS
 PUBLIC HEARING
 17 HEARING ON ORDER 1303
 18 VOLUME II
 (P.M. SESSION, PAGES 380-488)
 19
 20 TUESDAY, SEPTEMBER 24, 2019
 21
 22
 23
 24 Reported by: Kathy Terhune, RPR

Page 381

1 APPEARANCES:
 2 Micheline N. Fairbank,
 Hearing Officer
 3
 4 Tim Wilson,
 Acting State Engineer
 5 Adam Sullivan,
 Deputy State Engineer
 6
 7 Melissa Flatley,
 Chief of the Hearing Officer Section
 8 Michelle Barnes,
 Supervising Professional Engineer
 9
 10 Levi Kryder,
 Chief of the Hydrology Section
 11 John Benedict,
 Hydrologist
 12
 13 Christi Cooper,
 Geologist
 14 Bridget Bliss,
 Basin Engineer
 15
 16 For SNWA: Taggart & Taggart, Ltd.
 By: Paul G. Taggart, Esq.
 17 Carson City, Nevada
 -and-
 18 Tim O'Connor, Esq.
 19 For CSI: Robison, Belaustegui, Sharp
 & Low
 20 By: Kent R. Robison, Esq.
 Reno, Nevada
 21
 22 For CSI: Brownstein Hyatt Farber
 Schreck
 23 By: Brad Herrema, Esq.
 Los Angeles, California
 24

Page 382

1 APPEARANCES:
 2 For NV Energy: Justina Caviglia, Esq.
 Reno, Nevada
 3
 4 For Lincoln County
 Water District
 -and-
 5 Vidler Water Company: Allison MacKenzie
 By: Karen Peterson, Esq.
 6 Carson City, Nevada
 7 For Moapa Band of Paiutes: Beth Baldwin, Esq.
 8 For NCA: Alex Flangas, Esq.
 Reno, Nevada
 9
 10 For Moapa Valley
 Water District: Greg Morrison, Esq.
 11
 12 For Bedroc: Schroeder Law
 By: Laura Schroeder, Esq.
 13 For City of North Las Vegas: Schroeder Law
 By: Laura Schroeder, Esq.
 14
 15 For National Park Service: Karen Glasgow, Esq.
 16
 17 For Center for Biologic
 Diversity: Patrick Donnelly, Esq.
 18 For U.S. Fish and Wildlife: Luke Miller, Esq.
 Ass. Regional Solicitor
 Sacramento, CA
 19 For Muddy Valley Irrigation
 Company: Steve King, Esq.
 20
 21
 22
 23
 24

Page 383

1
 2
 3
 4
 5 By Mr. Schroeder 384
 6 By Mr. Donnelly 388
 7 By Ms. Harrison 403
 8 By Mr. King 414
 9 By Ms. Caviglia 424
 10 By Mr. Benedict 429
 11 By Ms. Cooper 435
 12 By Mr. Sullivan 437
 13 By Hearing Officer Fairbank 439
 14 RECROSS
 15 By Ms. Baldwin 441
 16 By Mr. Taggart 448
 17 By Mr. Morrison 454
 18 By Ms. Peterson 460
 19 By Mr. Donnelly 466
 20 By Ms. Cooper 473
 21 By Mr. Sullivan 475
 22 By Mr. Benedict 477
 23 By Mr. Miller 479
 24

Page 384

1 SEPTEMBER 24, 2019; 1:15 P.M.; CARSON CITY, NEVADA.
2
3 -o0o-
4 HEARING OFFICER FAIRBANK: Okay. We'll go
5 ahead and go back on record.
6 So, next we'll take questions from the City of
7 North Las Vegas.
8 And I should have said this yesterday, but just
9 as reminder, all the witnesses are still under oath.
10 MS. SCHROEDER: Thank you. I'm
11 Laura Schroeder, and I represent the City of North Las
12 Vegas.
13 MS. SCHROEDER: Do I need to hit my button?
14 Okay. Now can you hear me?
15 HEARING OFFICER FAIRBANK: Yes.
16 MS. SCHROEDER: I'm Laura Schroeder, and I
17 represent the City of North Las Vegas. I just have a
18 couple of questions for Mr. Mayer.
19
20 SUE BRAUMILLER, MICHAEL SCHWEMM, TIM MAYER,
21 called as a witnesses herein by U.S. Fish and Wildlife
22 Service, having been previously duly sworn, were
23 examined and testified as follows:
24

Page 385

1 CROSS-EXAMINATION
2 BY MS. SCHROEDER:
3 Q. And I would like, if possible, for you to pull
4 up your PowerPoint. And this is -- we're looking at
5 U.S. FWS Exhibit 7. I think we're looking at probably
6 about slide number six.
7 A. Is this the rebuttal report?
8 Q. Yes, please. And this would be the one that
9 includes figures 3 and 5.
10 A. Yeah, okay, this is it.
11 Q. All right. Thank you.
12 And this -- these two figures I believe, at
13 least it appears to me, that they were in your rebuttal
14 report at pages 5 and 6. And I'm going to focus just
15 on the upper graph, which is the division three graph,
16 which appears to be figure five from page 6 of your
17 report -- your rebuttal report.
18 So, looking at that report and looking at that
19 graph, can you give us an average drought severity
20 index before and after 2000?
21 A. An average drought severity index? I would
22 just have to guess. So, no, I really can't do that. I
23 can't give you a visual average. But let me say that
24 this drought index is an average. It's a moving

Page 386

1 average. It looks back at the preceding 12 months.
2 So, that's the reason I didn't put a moving average in
3 here, because it is a moving average.
4 It looks back at conditions of the past
5 12 months, and just a running look back, so to -- so to
6 speak.
7 Q. Right. So, looking visually at this, I drew a
8 line on the zero axis through your graph.
9 A. Uh-hum.
10 Q. And drawing -- just using a visual on that, and
11 drawing the line through the zero, and then looking at
12 the year 2000 -- I think that you have January, 2002,
13 but just ahead of that line. So, I have line at zero
14 and a line that divides us between two -- before 2000
15 and after 2000. What I see is a lot more area below
16 the zero line after 2000 than before 2000. Would you
17 agree with me, Mr. Mayer?
18 A. Yeah, I would agree with you.
19 Q. Is there a Palmer drought severity index value
20 that was published for the years before 1990?
21 A. I think this record goes back to 1885.
22 Q. And I think you testified earlier to that.
23 But, I don't think that person who asked you -- the
24 attorney that asked you, asked you why you didn't

Page 387

1 include earlier years. And so, I'd like to ask you
2 that question, Mr. Mayer.
3 A. Well, this is a 30-year record, and I -- this
4 is the record that we have for the water levels.
5 Basically, this is a time of interest, so, that's why I
6 focused on this.
7 Q. That period of time?
8 A. Right.
9 Q. Okay. Now, the rest of the slides in your
10 rebuttal report focus on illustrating water levels and
11 basins that were without pumping. And I would like to
12 ask you as to those if you have any opinion as to why
13 some of those basins have declined and some have
14 increasing water levels?
15 A. Some of them have decline, some have stable
16 water levels, and some have increasing water levels. I
17 would say the majority are increasing. That was my
18 point. They're not declining. I have an opinion,
19 yeah. It is that the climate is wetter.
20 Q. All right. At least in those basins, it's your
21 opinion that those -- that it's wetter in those areas?
22 A. It's responding to the wetter climates, yes.
23 Q. And even though that your figures here show
24 that there is more areas below the zero line than above

Page 388

1 them?
2 A. Yes, this is just one data point. One metric.
3 Q. All right.
4 A. Yeah.
5 Q. But it's an average of those 12 -- rolling
6 average of those 12 months, correct?
7 A. Yes.
8 MS. SCHROEDER: All right. No further
9 questions.
10 HEARING OFFICER FAIRBANK: Next will be the
11 Center For Biological Diversity.
12 MR. DONNELLY: Thank you. Patrick Donnelly
13 with the Center For Biological Diversity. I have a lot
14 of questions, so I'll be moving quickly, and probably
15 taking some more time. Appreciate your testimony, and
16 obviously, appreciate the work Fish and Wildlife does
17 to protect the Moapa dace.
18
19 CROSS-EXAMINATION
20 BY MR. DONNELLY:
21 Q. These first questions I will direct toward
22 Ms. Braumiller, but they could be for anybody there
23 drawing on your experience as Fish and Wildlife Service
24 employees and not on your legal opinions.

Page 389

1 So, the Fish and Wildlife Service's mission is
2 to conserve -- in part is to conserve, protect, and
3 enhance fish, wildlife, and plants in their habitat; is
4 that correct?
5 ANSWERS BY MS. BRAUMILLER:
6 A. That's my understanding.
7 Q. And that includes the implementation of the
8 Endangered Species Act?
9 A. Definitely.
10 Q. The definition of "take" in section three of
11 the Endangered Species Act is "to harass, harm, pursue,
12 hunt, shoot, wound, kill, trap, capture, or collect, or
13 to attempt to engage in any such conduct."
14 Does that sound right to you?
15 A. That sounds familiar. The focus of my work is
16 not regulatory.
17 Q. To the best of your awareness, does section
18 nine of the Act prohibit take of endangered species?
19 A. I think it does because there are take permits,
20 but I don't know the details of the basis on which
21 those are provided.
22 Q. Okay. I'm seeing nods from your co-witnesses
23 there.
24 A. They probably know better than I do.

Page 390

1 Q. All right. And perhaps I'll direct this to
2 Dr. Schwemm. Might individuals or agencies taking
3 action which result in the unauthorized take of species
4 be violating Section Nine?
5 ANSWERS BY DR. SCHWEMM:
6 A. That's true.
7 Q. That you're aware of, are citizens able to file
8 lawsuits to enforce the Endangered Species Act,
9 including Section Nine, suits against entities
10 responsible for unauthorized take?
11 A. Yes.
12 HEARING OFFICER FAIRBANK: If you'll make sure
13 that your mic is on and that you're speaking in your
14 microphone. Thank you.
15 MR. MILLER: I object, too. I don't know if
16 it's a relevant line of questioning for the issue that
17 we've been proffered here for.
18 HEARING OFFICER FAIRBANK: And I would ask
19 if -- how this is relevant to the issue -- the four
20 issues with respect to the geographic boundaries, the
21 quantity of water that can be developed and the
22 movement of pumping?
23 MR. DONNELLY: Understood. I will end that
24 line of questioning.

Page 391

1 HEARING OFFICER FAIRBANK: Thank you.
2 MR. DONNELLY: Thank you.
3 BY MR. DONNELLY:
4 Q. Dr. Schwemm, you state that flow and habitat
5 are proportional to the Muddy River Spring area; is
6 that correct?
7 A. Yes.
8 Q. And that any reduction in flow will decrease
9 the amount of habitat available?
10 A. Yes.
11 Q. Would a reduction in habitat reduce the number
12 of individual dace present?
13 A. Yes.
14 Q. In a general sense then -- I'll pass on that
15 question.
16 Ms. Braumiller's presentation stated that
17 carbonate pumping reduces spring flow; is that correct?
18 A. Oh, that's me?
19 Q. Either of you.
20 A. All right.
21 ANSWERS BY MS. BRAUMILLER
22 A. Yes.
23 Q. Thank you. Since that is true, doesn't this
24 imply that carbonate pumping would result in a

Page 392

1 reduction in the amount of individuals Moapa dace?
2 A. I guess that's a combo question.
3 I would say that's highly likely.
4 Q. It's highly likely. Thank you.
5 Given that maintaining stream flows is the
6 stated goal of the MOA and other proceedings related to
7 the Moapa dace, doesn't that imply there should be zero
8 carbonate pumping in the Lower White River Flow System?
9 A. Oh, no, I don't think so.
10 Q. Is it the goal to maintain spring flows?
11 A. Yes.
12 Q. Does carbonate pumping reduce spring flows?
13 A. Yes.
14 Q. Doesn't it then follow that we need to cease
15 carbonate pumping in order to maintain spring flows?
16 A. No, it doesn't.
17 Q. Why is that?
18 A. Okay. Yeah, because you do have inflows to the
19 Lower White River Flow System's basins and local
20 recharge. And some amount can be captured, right,
21 without reducing spring flows below an unacceptable
22 level?
23 Q. You stated -- and this is for you continuing,
24 Ms. Braumiller.

Page 393

1 Now, you stated that there are too many
2 questions to come up with a sustainable yield number?
3 A. No, I did not.
4 Q. Okay.
5 A. Well, I -- what I did say -- let me clarify, if
6 I could. That I think there are too many outstanding
7 questions right now to construct a numerical flow model
8 that could be used to predict the sustained level of
9 total pumping.
10 Q. Okay. Thank you.
11 A. You're welcome.
12 Q. You stated then that 9318 acre-feet per annum
13 is a good starting estimate?
14 A. I did.
15 Q. For sustainable yield?
16 A. Right.
17 Q. You justified this by citing the steady
18 discharge and monitoring well management measurements
19 since the pump test, correct?
20 A. Right. Groundwater levels, spring flows, and
21 flows in the Muddy River, 2015, '16, '17.
22 Q. So, I'm going to ask you about a trend, and I'm
23 referring to figures 7 to 8, and 13 from your report.
24 Basically, these are charts depicting flow levels in

Page 394

1 CSVN1, CSVN2, CSVN4, CSVN6, UNVM1, GV1, Warm Springs
2 West and Iverson Flume.
3 Are you aware of a trend common to those since
4 2015?
5 A. Since 2015?
6 Q. Yes, in the 2015 to 2017?
7 A. I don't specifically remember what the
8 hydrographs looked like from 2015 to 2018, not off the
9 top of my head. I'd have to look.
10 Q. Are your other witnesses able to pull up those
11 charts from your report? It's figure 7 to 8, and 13.
12 A. Go ahead.
13 Q. Yeah, it would be the CSVN wells, Warm Springs
14 West, and Iverson Flume that I'm referring to.
15 A. You did say figure seven?
16 Q. It would be 7 to 8A, and then 13.
17 A. All right. I'm looking at that.
18 Q. Yeah. Thank you.
19 I'm just wondering if you observed a trend
20 common to those monitoring points from 2015 to 2017?
21 A. Well, I'm looking at the hydrographs for the
22 CSVN wells, and 2015 through '18, some of them
23 generally appear to decline. All right.
24 The data measurements of KMW1 from 2015 to

Page 395

1 2018, are pretty sparse, so I wouldn't conclude
2 anything.
3 Q. Yeah, I think the other ones of interest to me
4 would be Warm Springs West and Iverson Flume which are
5 in figure 13.
6 A. Okay. I'm getting there.
7 Q. Yeah. Thank you for working with me here.
8 A. Iverson Flume and what else?
9 Q. Warm Springs West.
10 A. Warm Springs West. Well, you know, Warm
11 Springs West, I -- just looking at the hydrograph, it
12 might be declining somewhat. Right.
13 And Iverson Flume, I'm not all that confident
14 in these measurements, but it certainly looks like it's
15 declining.
16 Q. So, we can observe declines in numerous
17 monitoring wells across Coyote Springs and Upper Muddy
18 River Springs area?
19 A. Some decline.
20 Q. Some decline.
21 A. Not like pumping --
22 Q. Not like the pumps --
23 A. Not like the initiation of pumping, et cetera.
24 Q. So, if that's the case, if we have a decrease

Page 396

1 in trend, and the 9300 number was arrived at due to
2 some idea that there is sustainable yield right now,
3 don't those -- don't those two things conflict with one
4 another? That 9300 is meant to be maintaining spring
5 flows, and yet we can observe spring flows declining at
6 that pumping level?
7 A. Well, it's not to say that you couldn't have
8 declines in groundwater levels in spring and stream
9 flows at that level of total pumping. But the question
10 is, does it leave enough water in the river to satisfy
11 senior decreed water rights on the river?
12 Q. Well, so, I'd like to question that because in
13 your presentation you said that was the justification,
14 was maintaining spring -- maintaining senior water
15 rights on the river. But isn't the Fish and Wildlife's
16 mission to conserve, protect, and enhance wildlife
17 populations? So, shouldn't your basis be whether or
18 not spring flows that the Moapa dace requires are
19 maintained?
20 A. No, and -- I'm sorry, I think I probably lost
21 track of what you just said. Would you repeat that,
22 Patrick?
23 Q. Yes.
24 A. Because the first part I don't think I agree

Page 397

1 with.
2 Q. The justification for the 9300 number put
3 forward in your slideshow was that it maintained senior
4 water rights on the river?
5 A. I actually -- yeah, that's right. Stop right
6 there?
7 Q. Yes.
8 A. I actually did not say that. What I said is
9 that from 2015 to 2017, spring flows, groundwater
10 levels and flow through the Moapa dace, for instance,
11 was relatively constant. I didn't say it was constant.
12 Relatively constant. And assuming that 9318 is
13 sufficient to be senior decreed water rights on the
14 river, that that is a best initial estimate of --
15 Q. Understanding that --
16 A. Yes.
17 Q. -- spring flows are declining at that pumping
18 level?
19 A. Yeah, they're declining somewhat --
20 Q. Sure.
21 A. -- right?
22 Q. Sorry.
23 A. There's multiple factors that contribute to
24 that, of course.

Page 398

1 Q. You stated there should be no increase in
2 either carbonate or alluvial pumping?
3 A. Oh, yeah. And above the 9318 --
4 Q. Yes.
5 A. -- as an initial starting point for sustainable
6 yield, yeah. And we don't know precisely how much
7 higher it might be possible to go than 9318 and still
8 meet senior decreed water rights on the river. But I
9 do believe that we have evidence that pumping at the
10 average rate that we pumped during the Order 1169
11 pumping test is too high -- okay -- for the springs.
12 As I said before, in an undiminished state of decline
13 and at the end of the pumping test, meaning the system
14 was nowhere close to being in a new steady state.
15 Q. But is it not in steady state now as we observe
16 continued declines?
17 A. No groundwater system is ever in a steady
18 state.
19 Q. Okay. Granted. Thank you.
20 Yeah. I'd like to change track for a moment
21 and ask a few questions of Dr. Schwemm?
22 Does it sound correct to you that section two
23 of the Endangered Species Act says that it is declared
24 to be a policy of Congress that agencies shall conserve

Page 399

1 endangered species and shall utilize their authorities
2 in furtherance of the Act?
3 ANSWERS BY DR. SCHWEMM:
4 A. I'd rather speak to elements of the report.
5 Q. Absolutely. 1983 recovery plan for the Moapa
6 dace details criteria for down and delisting. Are you
7 aware if any of those criteria are currently being met?
8 A. No, the -- I believe downlisting is 4500
9 animals and 6000 for delisting. In the '90s, we've
10 approached some pretty high numbers in the high 3000s
11 and -- but then it really was a -- I think the effects
12 -- the combined effects of tilapia in the system that
13 really knocked it down to 500 animals, and then since
14 then we've increased the -- we've taken care of the
15 invasive species problem to a vast degree, and that's
16 why we've gone up to 1500. But we're not -- you know,
17 we're not too close to -- very close to the 4500 for
18 downlisting.
19 Q. And additional delisting criteria is 75 percent
20 of historical habitat unless we provide spawning,
21 nursery, cover, or forging habitat; is that correct?
22 A. That is.
23 Q. Do you have a rough ballpark estimate of what
24 percent of historic habitat is providing these

Page 400

1 essential functions right now?
2 A. Not offhand. I'd have to calculate --
3 calculate that.
4 Q. Order of magnitude, 7.5 percent, 75 percent?
5 A. I wouldn't be comfortable with numbers, but I
6 could estimate, you know, where that is on that figure.
7 So, I -- when I showed that slide that had the data
8 where the dace are, you can see that the majority of
9 that is coming from Apar, Pederson, and Plummer
10 Streams. And where they intersect and then the main
11 stem of Muddy River with the north and south fork is
12 where there's very little dace that we find in any size
13 range, whether it's a, you know, spawning, a juvenile,
14 or whatever. There's few dace.
15 Q. So, based on the data you provided, it appears
16 the Fish and Wildlife is successfully avoiding the
17 extinction of the Moapa dace; is that correct?
18 A. Yeah, I think that we're stable at that 1500
19 animals, and we have been for a few years. Typically,
20 they'll be some disturbance event or major recovery
21 actions or -- such as removal of tilapia -- and you'll
22 see an effect in that, and then you'll tend to see, you
23 know, the system stabilize until the next event,
24 whether positive or negative.

Page 401

1 Q. So, understanding that extinct -- preventing
2 extinction is being accomplished, do you feel you're
3 making any headway toward the recovery goals?
4 A. We are. I consider, you know, recovery
5 goals -- or recovering species, if you think about what
6 it was in 2006 and '07, you had about 500 animals. So,
7 I consider that having three times as many is great.
8 But for a very small fish, and particularly one that
9 has a complex life history but more importantly a very
10 short lifespan, that's certainly not secure, and we
11 have a long way to go.
12 Q. So, given that we're not rapidly advancing
13 toward recovery, is the currently recommended pumping
14 level of 9318-acre-feet per year going to contribute to
15 the recovery of the species, given also that pumping at
16 that level was causing spring flow declines?
17 A. That's a tough question. So, just to repeat
18 and make sure I got the question right, is that at
19 3.2 -- well, you -- you're asking me at 3.2 would that
20 be limiting the population of the dace at this
21 particular point? Yes. And that's a -- that's a
22 complex question because of all of the recovery
23 actions.
24 It's difficult to say, but I would say that we

Page 402

1 know that 3.2 is at least enough to maintain 1500
2 animals. And whether -- how that, you know, might
3 fluctuate around that is difficult to say. But, wait.
4 Let me refresh on this. We do definitely want to
5 provide the caveat that, you know, based on the
6 evidence that we have from the Hatten et al Paper is
7 that increasing flow 10, 20, 30 percent is going to
8 resolve increased habitat, and I believe that will be
9 useful for the dace. So, I think that, you know, while
10 it may be maintaining it, that 1500 may or may not be.
11 But, certainly more habitat is going to get us closer
12 to recovery.
13 Q. So, that means that if recovery is the primary
14 goal, Fish and Wildlife should be recommending
15 pull-over (sic) amount of pumping to increase spring
16 flow?
17 A. That could be what -- it's difficult to make --
18 I really -- it's difficult to have a relationship
19 directly between pumping and the actual number of the
20 dace. But, I do believe that increasing the dace will
21 increase the habitat because that's the best data we
22 have.
23 MR. DONNELLY: Thank you.
24 HEARING OFFICER FAIRBANK: Georgia Pacific and

Page 403

1 Republic.
2 MS. HARRISON: Good afternoon. Sylvia Harrison
3 for Georgia Pacific and Republic Environmental
4 Services. And with me today also representing George
5 Pacific is Paulina Williams.
6
7 CROSS-EXAMINATION
8 BY MS. HARRISON:
9 Q. My questions today are more for Ms. Braumiller,
10 and I would like you to refer to page 8 in Fish and
11 Wildlife Service Exhibit 5. That's the initial report.
12 ANSWERS BY MS. BRAUMILLER:
13 A. Sure.
14 Q. And if I recall correctly, Ms. Braumiller, you
15 you testified that you prepared this portion of the
16 report; is that correct?
17 A. Yes.
18 Q. I just wanted to discuss with you the evolution
19 of thinking that's described on page 8 about the
20 recharge, or lack thereof, from the carbonate
21 aquifer to the alluvial aquifer. And as you describe
22 on this page, you note that back in the '60s it was
23 believed that the Muddy Creek Formation could act as a
24 barrier preventing the recharge in the carbonate

Page 404

1 aquifer into the alluvial aquifer and discussed that
2 was because of the low permeability; is that correct?
3 A. No. Maxey et al 1966, mapped a lot on Muddy
4 Creek Formations that went throughout the Wind River
5 Springs area, and that's the difference.
6 Q. And that was also substantiated with the
7 results at the time by the difference in the water
8 quality between that alluvial aquifer water which is
9 the better quality than the Muddy Creek Formation?
10 A. No, actually that --
11 Q. Low tow ray row(phonetic)?
12 A. Yeah, the -- yeah, the better water quality
13 from the alluvial aquifer of the Muddy River Springs
14 area -- yeah, the quality of water in the Muddy Creek
15 Formation's poor. And so the fact that water quality
16 was good in alluvial aquifer in Muddy River Springs
17 Area suggests that water's getting in there from
18 somewhere, and it's not coming through the Muddy Creek
19 Formation in all likelihood.
20 Q. That's what I thought I said, but I guess I
21 didn't.
22 Okay. But then you described how at the
23 present time beginning in about the mid-1990s, it was
24 later hypothesized that there was a significant leakage

Page 405

1 upward through -- into the alluvial aquifers from a
2 carbonate aquifer to the point where the State Engineer
3 has completed as you quote, "There's a significant
4 connection between the carbonate aquifers and the
5 alluvial", and essentially, the State Engineer has
6 concluded the alluvial aquifers surrounding the Muddy
7 River ultimately drives virtually all of its water
8 supply from the carbonate.
9 Do you have an explanation for the different --
10 the basis for the different interpretations over time?
11 A. Well, I think what Dettinger at L95 says is
12 that generally they observed, that they hypothesized
13 that there was leakage from the carbonate aquifer into
14 alluvial aquifer generally.
15 As for the basis, the State Engineer's basis,
16 in the 2014 rulings for that same conclusion, I can't
17 speak to that. It actually wasn't terribly clear in
18 the rulings to me. But, I have -- which is why I took
19 a really hard look at groundwater level data with
20 carbonate aquifer and alluvial aquifers in the Muddy
21 River Springs area and California Wash to see if I
22 could demonstrate that indeed there is leakage from the
23 carbonate aquifer into the alluvial aquifer into Muddy
24 River Springs area and in California Wash, and I

Page 406

1 believe I can demonstrate that, and I did.
2 Q. Are there water quality data that would help
3 substantiate that connection?
4 A. There may be, but I relied on hydraulic data.
5 Q. Okay.
6 A. Yeah.
7 Q. All right. I would like you now to turn to
8 page 36 of that same report. Is it five? And again,
9 I verify that you prepared this portion of the report?
10 A. I did, yeah.
11 Q. This morning when you were giving your direct
12 testimony, you didn't really have a chance to get to
13 your hypothesis of the source of the Big Muddy Springs,
14 and I'd be interested to have you just give us a
15 summary of that, those proposed sources for us?
16 A. And it is important because it is about 7 CFS.
17 And it is just a hypothesis. But, Maxey et al 1966,
18 during the 1966 report mapped Muddy Creek Formation in
19 the Muddy River Springs area, including -- including
20 high chromiability, massive limestone pebble
21 fanglomerates, which were described as high
22 permeability units within Muddy Creek Formation. And,
23 you know, I noted that the Big Muddy Springs, it was
24 approximately located within area of the Maxey, et al,

Page 407

1 '66 mapped as massive limestone pebble fanglomerates.
2 And that could explain how there could be significant
3 spring discharge through Muddy Creek Formation. It
4 happens to be -- I submit it's probably not a
5 coincidence. And there are -- you know, additionally,
6 it's a warm spring, right? So, that means that the
7 water is coming from depth. You know, I mean, and you
8 can't say how deep. That's a whole another deal. But
9 from depth. And also, if you look at the hydrograph
10 for flows from the Big Muddy stream -- stream --
11 Spring, sorry, the -- the changes in spring fills are
12 very attenuated compared to the rest of the springs.
13 And between the warm temperature, the fact that
14 the location of the spring corresponds roughly to the
15 location of these mapped limestone pebble fanglomerates
16 by Maxey et al, it makes me wonder if what we're not
17 looking at is water that's flowing at depth through
18 Moapa Valley, either through the carbonates or maybe
19 really deep basin fill, greatly attenuating water level
20 changes. I'm sorry, the discharge from the spring.
21 And yet deep, so warm.
22 And also, it was completely unresponsive as far
23 as I think any of us could tell to the Order 1169
24 pumping. Which might be explained by the fact that

Page 408

1 this chunk of massive limestone pebble conglomeration is
2 sort encased in Muddy Creek Formation. So, I think it
3 could fit.
4 Q. So, is the -- just in short, it's clearly a
5 different source from the carbonate aquifer so-called
6 we've been discussing as the major source of many of
7 the wells that have been discussed today?
8 A. Right. Well, it could be carbonate beneath
9 Lower Meadow Valley Wash, but it does not seem to be
10 portion -- the portion of the carbonate aquifer that we
11 identified with the SeriesSEE analysis.
12 Q. At least not in direct hydraulic connectivity?
13 A. Yeah. The two may be in hydraulic connection,
14 but it's not -- it's -- the source does not seem to be
15 this highly -- exceptionally high transmissive portion
16 of carbonate aquifer.
17 Q. And you mentioned that the flow of that spring
18 was, what, 7 CFS?
19 A. Yes.
20 Q. And what percentage of that is -- does that
21 make up of the river flow?
22 A. Yeah, so, I just ballparked that, because it
23 depends on what years we're talking about. But it's
24 about three percent of the Muddy River Spring

Page 409

1 discharge, and about 15 percent of the Muddy River
2 Moapa gage, at least in 2001 -- actually, when Beck and
3 Wilson 2006 did their seepage study on the Muddy River.
4 Q. That's a lot.
5 So, is it reasonable to say that that discharge
6 could be a significant source of recharge to the
7 alluvial aquifers along the Muddy River?
8 A. I don't know about that. Because the spring
9 discharges to a spring branch, flows into the main stem
10 of the Muddy River, and on down the river, so.
11 Q. You don't whether the stream is gaining or
12 losing at that point?
13 A. Yeah. And actually it's gaining through almost
14 all the Muddy River Springs area. There is a losing
15 reach. I can't remember. Maybe two or three miles,
16 Moapa Valley gage. But most of it is gaining, apart
17 from the actual spring flow. You know, the surface
18 discharges in the springs in the river. If you take
19 that out of what Beck and Wilson found in their 2001
20 seepage run, you could track out the documented spring
21 surface flows into the river, you still end up with
22 gains through most of the Muddy River Springs area.
23 So it's clearly gaining from the local alluvial
24 aquifer, right? But the mud -- Big Muddy Spring itself

Page 410

1 is discharging into a tributary that flows in the main
2 stem. So, it's not necessarily -- in fact, it probably
3 is not -- yeah, water is going the opposite way. It's
4 going through the alluvial aquifer into the stream in
5 the Muddy River Springs area not the other direction.
6 Q. Okay. Thank you.
7 In any event, would you agree that it would be
8 a very important thing to know about the source of that
9 spring as we're trying to determine sustainable yields
10 within this proposed unit?
11 A. The source did you say?
12 Q. Yeah. Know more about it?
13 A. Well, yeah, it would be one of those
14 outstanding, hydrogeology questions, right? Because
15 it's clearly a large contribution to the river. And
16 so, in order to, you know, to prevent unduly impacting
17 the spring flow, we're going to have to understand
18 more --
19 Q. About the sources?
20 A. Yeah.
21 Q. Thank you.
22 You mentioned that the Muddy Creek Formation
23 has been mapped extensively. Is it generally true that
24 that acts as an aquifer, at least in part?

Page 411

1 A. Yeah. And first I would say I don't know I
2 would say it was mapped extensively. It was a
3 hand-drawn map by Maxey 1966, right? But, it is a
4 relatively low permeability formation.
5 Q. So, with respect to trying to understand the
6 recharge of the carbonates into the alluvial, again, is
7 the extent of the Muddy Creek Formation something we
8 need to know more about?
9 A. Do you mean the hydra -- what is the nature of
10 the hydraulic connection between carbonate and alluvial
11 aquifer --
12 Q. Yeah.
13 A. -- and the Muddy River --
14 Q. It's part of -- it's part of the question that
15 we need to answer.
16 A. Yeah. I think I -- I think I demonstrated that
17 there is a hydraulic connection, and I tried quite a
18 while to see if I could figure out exactly where.
19 Okay? And concluded that I can't tell. There is --
20 there is Bird Springs Formation carbonates. You know,
21 in the surface geologic map there -- you know, there's
22 contact between the Bird Spring Formation carbonates
23 and the alluvial in the Muddy River Springs area, but
24 I'm not convinced that the water table is lower than

Page 412

1 that contact. Can't tell.
2 You know, and then over -- according to
3 Maxey's, et al, hand-drawn geologic map, there's a lot
4 of Muddy Creek Formation, you know, throughout the
5 Muddy River Springs area. And also, Page et al 2005's
6 geologic map, he maps a lot of Muddy Creek Formation
7 throughout the Muddy River Springs area. And others
8 map somewhat less.
9 But, what I concluded is that one way or the
10 other, I know there's a hydraulic connection, but due
11 to the carbonate aquifer and alluvial aquifer in the
12 Muddy River Spring area? Because I see -- I see the --
13 the effect of carbonate pumping on groundwater level
14 variations in carbonate monitoring wells. And I see
15 those same signals in the water level levels for
16 alluvial wells in the Muddy River Spring. I there's a
17 connection. I just don't know exactly how. But I
18 don't think that matters. I just know that there is
19 one.
20 And additionally, the carbonate aquifer in
21 Muddy River Springs area is higher, up to like a
22 hundred feet higher than in the alluvial aquifers. So,
23 there is a connection. I don't know exactly how. And
24 there is an upward gradient from the carbonate aquifer

Page 413

1 into the alluvial aquifer. So, it's happening, but I
2 don't know how.
3 Q. And would you be confident that there's a
4 similar connection with the -- in other areas of the
5 proposed management unit?
6 A. Yeah, in California Wash I think I demonstrated
7 the same thing, only through somewhat different logic.
8 But, there the first thing I did was I noticed that
9 water levels and basin fill wells, and this was -- I
10 mostly rely here on groundwater level measurements
11 provided to Fish and Wildlife Service and SNWA to
12 prepare the photokinetic biological opinion for the
13 groundwater project they had.
14 Anyway, long story short, there is apparently
15 south to north flow through the basin fill in
16 California Wash from, you know, higher water levels to
17 lower, and yet there's no -- you know, according to
18 water budget analysis, also prepared by SNWA 2000, it's
19 part of their conceptual model -- or their numerical
20 model. No local recharge. So, how is that occurring?
21 Okay. Where is the water that's coming from south
22 California Wash to north? Where is it coming from?
23 And I think it's coming from the regional
24 carbonate aquifer. And again, head is a lot higher

Page 414

1 than the regional carbonate aquifer in the California
2 Wash than in the basin.
3 Q. I had the impression in the report maybe --
4 HEARING OFFICER FAIRBANK: That was the time.
5 We'll get back. We'll have -- we'll probably
6 have time to do another round.
7 Next will be the Muddy Valley Irrigation
8 Company.
9
10 CROSS-EXAMINATION
11 BY MR. KING:
12 Q. Okay. Good afternoon. My name's Steve King.
13 I'm counsel for Muddy Valley Irrigation Company. I
14 think my questions will be to directed to
15 Ms. Braumiller.
16 And first question, I know you've got the last
17 set of questions. Would you agree that the carbonate
18 and the alluvial aquifers are sources of supply of
19 water for the Muddy River Springs and Muddy River?
20 ANSWERED BY MS. BRAUMILLER:
21 A. I would agree -- I would agree that a carbonate
22 aquifer and the alluvial aquifer in the Muddy River
23 Springs area is a source of water in Muddy River and
24 also in California Wash.

Page 415

1 Q. Right.
2 Now, in today's PowerPoint and I think in your
3 salient finding number three, that's -- I believe it's
4 for all practical purposes one groundwater basin is the
5 source of the Muddy River Springs and Muddy River.
6 Would be -- would that be accurate?
7 A. I'm sorry. I was looking at this when you said
8 that.
9 Q. I just read what your PowerPoint said, and I
10 just wanted to confirm that was your testimony. That
11 for all practical purposes, it was one groundwater
12 basin that is the source of Muddy River Springs and
13 Muddy River?
14 A. Yeah, I think the combination portions of the
15 source of water for Muddy River and Muddy River
16 Springs.
17 Q. And is that the general conclusion in your --
18 in your mind of the results of the 1169 test?
19 A. Only part of that is based on the results of
20 the DOI 2013. The only part of that conclusion he's
21 asking about is based on the results of the DOI 2013
22 SeriesEEE interpretation of the Order 1169 pumping
23 test, and that is the observation that -- or the
24 conclusion that a large portion of the regional

Page 416

1 carbonate aquifer is up to exceptionally high field to
2 scale transmissivity.
3 HEARING OFFICER FAIRBANK: Ms. Braumiller, I'm
4 just going to ask if you don't mind speaking into the
5 microphone as best as possible. Because when you turn
6 away, it fades out and it might be hard for people that
7 are remote to hear.
8 THE WITNESS: I'm sure you're right. Okay.
9 BY MR. KING:
10 Q. Then if we could just turn pages that question
11 the purpose of this hearing and other purposes of
12 course. And Order 1303, I just -- several --
13 paraphrase several of the points there. It references
14 the results of the 1169 aquifer test that caused
15 significant decline in Pederson and Pederson East
16 Springs. Would you agree with that?
17 A. I do, yeah.
18 Q. The order 1303, which I've read at this
19 hearing, also noted that there were declines in Baldwin
20 and Jones Spring. Do you recall that?
21 A. You're referring to the DOI 2013?
22 Q. The order itself on page 6.
23 A. Oh.
24 Q. The reason we're here for these hearings --

Page 417

1 A. Right.
2 Q. -- 1303. I made that statement. I just want
3 to ask if you agree with that?
4 A. Yeah, I can't recall off top of my head what
5 the hydrographs for Baldwin and Jones Springs looked
6 like. I cannot speak to that right now.
7 Q. Then further in the order, the State Engineer
8 concludes there's a direct interrelationship with Muddy
9 River -- excuse me -- Muddy -- Muddy River Spring flows
10 and fully appropriated Muddy River senior decreed
11 rights. Do you recall that, or similar language?
12 A. Perhaps.
13 Q. Do you know what Muddy River senior decree
14 rights are?
15 A. I don't know the total of those.
16 Q. But do you know what --
17 A. What it is, yes, I do.
18 Q. Maybe you can give us a brief explanation of
19 your understanding?
20 A. Okay. I should say I have a sense of what that
21 means. Okay? I understand senior in priority, right?
22 And by decreed, there was let's see an adjudication.
23 Q. So, surface water rights?
24 A. I think most of them, if maybe not all of them

Page 418

1 are, but I don't know.
2 Q. So, under State Engineer Exhibit 333, that is
3 the Muddy River decree?
4 A. Okay.
5 Q. It's a 1920 Nevada district court decree that
6 was -- that incorporated the State Engineer's order of
7 determination at that time, and it's all new surface
8 water. So, I don't think anyone else so far during the
9 hearing has asked the imbedded foundational protection
10 that's discussed in Order 1303, senior decreed rights.
11 That's why I'm trying to bring this into the record and
12 your understanding what that means.
13 So, let's go back to page -- if we can, to I
14 think it's Fish and Wildlife Exhibit 5. Your -- that's
15 in fact has been referenced several times today. Page
16 37 I believe.
17 A. Okay.
18 Q. And there the very last paragraph. And this is
19 your contribution to the report; is that -- is that
20 correct?
21 A. Yes.
22 Q. And so, there is language that talks about
23 assuming a flow rate of 30,550 acre-feet per year
24 through Muddy -- through Moapa gage is sufficient to

Page 419

1 meet senior decreed water rights on and along the Muddy
2 River. (The domain of the State Engineer's Office.)
3 So, do you see that part?
4 A. Yes.
5 Q. And so, that was -- I was asking the foundation
6 of a question of what the senior decreed water rights
7 meant to you.
8 So where did that number 30,550-acre-feet come
9 from?
10 A. That -- you know, I think I mentioned this
11 earlier. I'm going from memory here. But I thought
12 30,550 acre-feet per year, according to my calculations
13 was the average flow through Moapa gage in 2015, '16,
14 and '17 calendar years.
15 Q. And that's -- this discussion is placed in your
16 report under section 1.4 sustainable levels of pumping
17 of lower -- of the LWRS. So, by sustainable, what does
18 that mean?
19 A. Well, I --
20 Q. Spring flows, would that be --
21 A. Yeah. Sustainable in the sense that the spring
22 flows part from the Muddy -- Big Muddy Springs, which
23 they're operating from a different place. The Refuge
24 Springs flow through the Moapa gage and carbonate

Page 420

1 groundwater levels throughout at least the five plus
2 basins were all relatively constant -- not constant,
3 and that there was sufficient water discharge springs
4 to maintain the dace.
5 Q. Okay.
6 A. Yeah. And when I said assuming that this flow
7 is sufficient to the senior decreed water rights on the
8 river, I'm not assuming anything. I'm -- leave that to
9 the State Engineer's Office. I'm saying assuming it is
10 sufficient to meet them.
11 Q. So could you call that a placeholder number for
12 just sustainable?
13 A. I'm sorry.
14 Q. Can we use the term as a "placeholder number"
15 that you -- that you chose to use?
16 A. I think it is the best available initial
17 estimate of sustainable level of pumping.
18 Q. And then you have again, same sentence turning
19 to (the domain of State Engineer's Office.).
20 A. Right.
21 Q. Okay. So, and I understand you haven't read
22 the decree, that's the State Engineer Exhibit 333. But
23 that was a Nevada district court case in which bench/
24 State Engineer in 1920 issued an order and

Page 421

1 determination. So, that took place then.
2 A. Okay.
3 Q. And that -- to be consistent it seems to me,
4 but would that be -- strike that question, please. Put
5 that in the record.
6 That's the State Engineer's Exhibit. It speaks
7 for itself.
8 Let me ask you another question, if I may.
9 Let's consider the following. If the decree, State
10 Engineer Exhibit 533, which protects senior decreed
11 rights, which is the subject of this -- one of the
12 subjects of this hearing, and you can jump to
13 management question with grandfather rights, if that
14 decree provides that all of the stream system has been
15 fully consumed by appropriation, would -- and that the
16 river is -- excuse me. It says fully consumed by
17 appropriation, would that change your opinion as to
18 that 9,138 feet as far as a placeholder number?
19 A. Well, let me see if I understand your question.
20 So, you're saying if the river is fully consumed
21 meeting senior decreed water rights on the river, would
22 that change my estimate?
23 Q. That's a fair -- yes.
24 A. Yeah. Well, assuming -- I guess what you're

Page 422

1 stating is under this hypothetical senior decreed water
2 rights are fully met and now there's no water in the
3 river. Because it lies down stream from the Muddy
4 River Springs, it's still possible that, you know,
5 conditions -- there's still spring flow. It's just
6 that downstream down the river is consumed by rights.
7 Q. Well, that --
8 A. Right? So --
9 Q. -- the answer I suppose. My question though
10 wasn't -- isn't a very good question. This is a little
11 different.
12 Really assuming that the decree determined that
13 all the water was exhausted and that there was no other
14 development allowed that would deplete the flows, would
15 your number change as far as that 9138 acre-feet?
16 A. Well, you know, maybe it depends on the
17 priority of groundwater rights of various other
18 locations in the Lower White River Flow System. So, I
19 can't exactly answer that.
20 Q. Okay. So, let me just ask one -- just a
21 question.
22 So, I want you to assume that the senior
23 decreed right holders in the Muddy River are entitled
24 to the water that is depleted from the stream by

Page 423

1 pumping, would that change your 9138 acre-foot -- feet
2 number -- foot number for a placeholder number to
3 satisfy senior decreed water rights?
4 A. Okay. So, let me see if I have your question
5 right. So if pumping did not allow enough water to go
6 down the river to meet senior decreed water rights on
7 the -- on the river, would I consider that level of
8 pumping to be sustainable? I would say no, by
9 definition.
10 Q. Thank you. Okay.
11 I'll try to ask a similar question, a little
12 different. If water is being captured by wells from
13 pumping that was decreed water that was under the
14 decree itself, was -- senior decreed water rights were
15 entitled to all that water, would that change the 9138
16 acre number?
17 A. Somehow I got loss in the middle of that
18 question. Could you give it to me again?
19 Q. Strike the question. I think your answers -- I
20 know you're not an attorney, you're not familiar with
21 the decree. But I was simply trying to wrap -- come
22 around to the -- one of the conjunctive management
23 questions here that's central that hasn't been asked
24 yet.

Page 424

1 Are there any groundwater rights that are
2 available to be pumped under the 1920 decree which is
3 already determined by the federal district court
4 through the incorporation of State Engineer's
5 determination, are there any groundwater rights that is
6 able to be pumped without affecting senior decreed
7 rights?
8 A. I think it depends on the uteral (phonetic) and
9 the conditions.
10 Q. Thank you very much.
11 MR. KING: I have no further questions.
12 HEARING OFFICER FAIRBANK: Okay. Next will be
13 Nevada Energy.
14 MS. CAVIGLIA: Justina Caviglia on behalf of
15 Nevada Energy. I should be pretty quick. I have one
16 question for Ms. Braumiller.
17
18 CROSS-EXAMINATION
19 BY MS. CAVIGLIA:
20 Q. So you state that you recommend that the State
21 Engineer should not allow water rights to be moved from
22 alluvial to carbonate, from the carbonate to alluvial;
23 is that correct?
24 ANSWERS BY MS. BRAUMILLER:

Page 425

1 A. Yeah, and I did -- it was intentionally, maybe
2 somewhat oversimplified recommendation.
3 Q. Okay. As part of this recommendation, did you
4 consider water rights or the priority of water rights?
5 A. The priority of water rights?
6 Q. Correct.
7 A. No.
8 Q. You did not.
9 Did you consider whether water rights were
10 permitted, certificated?
11 A. I did not.
12 Q. What did you base your opinion on? Like,
13 basically, the hydrology and that was it?
14 A. Yes. It was based on this. If you swap
15 current alluvial water rights for carbonate water
16 rights, you are going to impact the discharge of Muddy
17 River Springs, and as a consequence, slow down the
18 Muddy River. You're going to do that. If it's within
19 that zone of exceptionally high field scale
20 transmissivity, it's pretty much not going to matter
21 where in that area. If you turn alluvial rights into
22 carbonate water rights, you're going to impact Muddy
23 River Springs.
24 Would you do it, you know, somewhat lower

Page 426

1 transmissivity portion of the Lower White River Flow
2 System, you're still going to impact it. It might be
3 somewhat less. If you turn carbonate rights into a
4 alluvial rights and they're close to the river, that's
5 a bad thing. I think it's going to be a challenge to
6 come up with rules that allow swapping alluvial rights
7 for carbonate rights. That probably -- probably a bad
8 bet altogether within that zone of exceptionally high
9 transmissivity to carbonate. It's going to be hard to
10 come up with rules that allow you to turn carbonate
11 rights into alluvial rights without getting into a lot
12 of debate like in Amargosa Valley -- or Desert rather,
13 about has it moved closer, is it, you know, increased
14 negative impact on water levels in the alluvial
15 aquifers, Muddy River Springs area, and California
16 Wash.
17 That gets complicated. That's why I just, you
18 know, recommended something simple. Don't swap
19 alluvial rights out for carbonate. Don't swap
20 carbonate out to alluvial. Particularly with a concern
21 that if you were to change carbonate water rights into
22 alluvial rights and they happen to be close -- pretty
23 close to the river, you may not have time to -- the
24 impacts may occur before you can detect them and

Page 427

1 process the data and go Oh, I think we're impacting
2 flow in the river because we moved alluvial pumping,
3 changed it from carbonate into alluvial, and we've
4 gotten it close to the river. You may not be able to
5 detect it in time. Right? Maybe not horrible, but,
6 you know, you're going to find out about it after the
7 horse is out of the barn, right? So, it was -- it was
8 very, maybe oversimplified recommendation, but I think
9 it's implementable. So, that's why I suggested it the
10 way I did.
11 Q. And to follow up with that, because I know
12 Mr. King asked you a similar question.
13 So you're -- are you familiar at all with
14 Nevada water law when it comes to senior priorities or
15 anything like --
16 A. Probably --
17 Q. -- when it comes to groundwater?
18 A. The basics, yes.
19 Q. So, based on this model, would you ask the
20 State Engineer to completely ignore that?
21 A. The primary?
22 Q. The water priority system?
23 A. Oh, I don't think they can. Based on my
24 understanding of water law I don't think that can be

Page 428

1 done.
2 Q. So, even though there's a conflict between the
3 idea of you can't move water rights, but you can't --
4 so, if you have -- for example, if you had a senior
5 alluvial water right, they couldn't move to a
6 carbonate?
7 A. Well, we're talking about change applications,
8 right?
9 Q. Not necessarily under your recommendation. So,
10 I'm just -- I'll leave it at that because you don't
11 understand.
12 A. Yeah, I may not understand enough about that.
13 Q. Okay. It's just based -- your recommendation
14 is based on the hydrology, and that's basically what
15 where --
16 A. Yeah. And --
17 Q. -- it's coming from?
18 A. And handing an ability to protect impacts in a
19 timely -- all right?
20 So, but for sure, if you turn alluvial rights
21 into carbonate rights, and it happens to be within this
22 very large area, you know, like a thousand square miles
23 of exceptionally high transmissivity carbonate, you
24 will impact the springs, which then impacts the river.

Page 429

1 So, in general that -- you know, there might be some
2 ways or some situations where you could do it. But, in
3 general, I think it's probably negative that you would
4 accept --
5 MS. CAVIGLIA: No other questions.
6 HEARING OFFICER FAIRBANK: Okay. So, at this
7 time we'll go ahead and open it up to State Engineer
8 staff for questions.
9 MR. BENEDICT: I'll start. John Benedict for
10 the record.
11
12 EXAMINATION
13 BY MR. BENEDICT:
14 Q. I have a question about climate signature
15 discussions, so to speak, maybe for Mr. Mayer. I'm
16 kind of interested in your opinion after reviewing some
17 hydrographs, getting a little bit more insight on what
18 climate signature that you described. And I think Sue
19 Braumiller also described this. So, this may be
20 something that could be answered by either or both.
21 But in a review of those hydrographs, you've
22 described that there's a response during wet years, in
23 particular I think 2005, and perhaps 2010 as well,
24 perhaps others in smaller response.

Page 430

1 Would you say that that response that you see
2 that in most cases I think you've also said it happens
3 within a year of precipitation. Do you see any
4 evidence that that response to what I guess I'd call a
5 yearly spike in precipitation looks like a spike in
6 water levels, or does it look like something else? Or
7 can you tell me what that response looks like with
8 respect to the water levels? Obviously, there's a
9 rise. Is that the response that you're talking about?
10 Is there any other dynamics there?
11 ANSWERS BY MS. BRAUMMILLER:
12 A. Yeah, I was just referring to a rise in
13 groundwater level or spring flows?
14 Q. Water level, let's talk -- let's just talk
15 groundwater level.
16 A. Yeah. A rise in the groundwater level, the
17 water level.
18 Q. And that's the -- that's the response? So that
19 one-year period of time is the climate response to --
20 A. Yeah. And it varied depending on whether I was
21 looking at alluvial -- you know, water level records
22 for alluvial wells, a number of spring areas or for
23 carbonate wells, you know, almost throughout, but it
24 was within a year. It's just -- you know, it was very

Page 431

1 rough observation.
2 ANSWERS BY MR. MAYER:
3 A. Again, this is Tim Mayer. I think in 2005, the
4 effect probably lasted for a couple of years it looks
5 like when I looked at the hydrograph. The recharge
6 response may have occurred right within a year, but
7 lasted for a couple.
8 ANSWERS BY MS. BRAUMILLER:
9 A. Yeah. To clarify, I'm not talking about the
10 length of the response. What I was looking for was how
11 long did it take for change to manifest in the
12 groundwater levels. Because what I -- what I was
13 looking for was, you know, just something to start with
14 to try to start figuring out by what means climate, wet
15 season --
16 A. (MR. MAYER) Wet periods.
17 A. -- are influencing groundwater levels.
18 Q. (MR. MAYER) And also spring and stream flows.
19 A. Like that's the first clue to the mechanisms by
20 which the climate, wet seasons, wet periods are
21 influencing water resources in the Lower White River
22 Flow. That was my purpose. It's only -- it seems to
23 be possibly 18 years at Big Muddy Springs. That's
24 wild. Okay? But, everywhere else it seems to be

Page 432

1 within a year. That's pretty short really. So, I
2 wasn't referring to how long the affects it takes for a
3 recharge pause to travel through the system. That's
4 not in evidence.
5 Q. Okay. So, your characterization really has
6 more to do with the initial signature --
7 A. Yes.
8 Q. -- I guess actually seeing that in the water
9 levels?
10 A. Yeah.
11 Q. Okay. Thank you. Next question. If I could,
12 I'd like to go back to the CSVN5 hydrograph, and I
13 think this is for Ms. Braumiller.
14 You've alluded to an understanding or a
15 conceptual model for that hydrograph, but I don't think
16 you've described, and I'm just curious. Because it
17 does have a relatively unique response, and I just
18 thought I'd see if I could hear your side on that.
19 A. Well, I'll say this much. I noticed that it's
20 a pretty deep well. I can't remember how deep, maybe
21 900 feet or something like that. But, it's a completed
22 up-rigging of a series of overturned anticlines. And
23 in my past experience, and I cite northern territory of
24 Australia, you know, the fractures, it's conductivity

Page 433

1 through fractures, right?
2 So, if you have a over -- an anticline, much
3 less overturn anticline, you could get disconnects
4 across the anticline through the fractures. And so, I
5 think when CSI said -- Steve said yesterday that
6 perhaps it's kind of perched up there, I think it may
7 be. And it's also at the bottom of a small drainage,
8 right? So, you have recharge downhill, you know, and
9 then you've got the well completed behind, you know, an
10 overturned anticline. It could be -- could be, you
11 know, relatively low permeability structure. I mean,
12 you know, I'm sure it leaks, but I've seen that before
13 where the fractures, there's just a disruption in the
14 connectivity of the fractures around the anticline.
15 So, I think somehow it's probably related to that.
16 But, it's just an observation.
17 Q. I have one other question, and it goes to
18 equilibrium, and I think this is for Ms. Braumiller,
19 again. Because you had indicated that based on the
20 responses that we're seeing during the 1169 aquifer
21 test, both to water levels and discharge, that the
22 system wasn't in equilibrium and end of aquifer
23 testing. I'm just wondering has there been any thought
24 to length of time to reach equilibrium? It's apparent

Page 434

1 that water levels -- in your opinion, at least the
2 water levels that the response is relatively rapid and
3 widespread. And the springs also respond rapidly to
4 that change. So, it seems as though in some sense time
5 becomes a little bit less important with respect to
6 impacts, and yet, in addition it's discussed that
7 equilibrium's not reached very rapidly. I just
8 wondered -- see if I could get your thoughts about that
9 concept and when you think something like equilibrium
10 would be reached in a system like this?
11 A. Yeah. I don't think those two observations are
12 inconsistent. Because equilibrium is reached when the
13 cone of depression expands to the point where it's
14 capturing, you know, sources of water out there at the
15 same rate that you're pumping, right? So, although the
16 cone of depression was very expansive through the
17 official two years of the test, it hadn't come anywhere
18 close to tapping into sources of water that it could
19 capture. It wasn't anywhere close. So, does that make
20 sense?
21 I mean, the transmissivity of that the
22 carbonate aquifer is exceptionally high, but it still
23 has to get out there far enough that it captures
24 sources of water. Where would they be? Well, the

Page 435

1 Muddy River. You know? The language phrase. But it
2 hadn't gotten there. It wasn't anywhere close. And if
3 that's clear, because carbonate water levels were still
4 declining at, you know, undiminished rate when the MX5
5 pump was turned off at the end of 2013. And so were
6 spring flows to Refuge Springs. So, I don't think that
7 those two things are inconsistent at all. I mean,
8 that's a basically, capture problem, right?
9 Things keep declining until you capture enough
10 ET, screens, springs, et cetera. And it hadn't gotten
11 there. I don't think they contradict each other.
12 Q. Okay. Thank you.
13
14 EXAMINATION
15 BY MS. COOPER:
16 Q. Christi Cooper. Looking at your map of the
17 Lower White River Flow System, page 60 in your report,
18 figure one of your presentation, could you elaborate a
19 little bit more as to what your opinion is on the areas
20 of high transmissivity and lower transmissivity in the
21 Lower White River River Flow?
22 A. Yeah. You know, in 2013, DOI used SeriesEEE to
23 isolate MX-5 induced drawdown in select wells. If we
24 had the time we could have done that with virtually all

Page 436

1 of them. But, based on the analysis we did do, see
2 that extends at least the CSV2, the Coyote Springs
3 down, which I described as a simple Coyote Springs
4 well. It extends as far south as GV1 in Garnet
5 Valley for sure. I have to look at a picture. Let's
6 see. I'm just going from memory here.
7 As far east as CSV2 in Muddy River Springs area
8 for sure. I think EH4 was only isolated 1.2 feet of
9 drawdown rather than 1.5 to 1.6. You know, five other
10 target wells.
11 But I think that the SeriesEEE curve fitting
12 may have underestimated the MX5 induced drawdown in H4
13 because there's, you know, a low permeability structure
14 that creates the layer of spring flow that was not
15 accounted for in SeriesEEE as a MX5 reduced drawdown.
16 And it extends into California Wash to I think it was
17 -- I think it -- which one is the more northern, M1 or
18 M2? I can't remember off the top.
19 Q. M1.
20 A. M1. I keep getting them mixed up. You know,
21 so, you know, CSBM6 in Coyote Spring Valley. GD1 in
22 Garnet Valley over to M1 in California Wash, CSV2 in
23 Muddy River Springs area, that was all 1.5 and 1.6 feet
24 of drawdown to MX5 pumping. That's what we estimated.

Page 437

1 So, at minimum it includes the area delineated
2 by those wells. And, again, because drawdowns due to
3 pumping generally decreases what rhythmically the
4 distance. You know, that can't be the end of it. It
5 extends further than that. And with no better option,
6 I extended -- I extended my delineation of a portion of
7 the aquifer that's exceptionally high in transmissivity
8 to the nearest likely known full boundaries. And
9 that's -- that was the basis for the five plus basin,
10 roughly a thousand five hundred square miles.
11 Q. Thank you.
12 MS. COOPER: Okay.
13 MR. SULLIVAN: Adam Sullivan.
14
15 CROSS-EXAMINATION
16 BY MR. SULLIVAN:
17 Q. Mr. Mayer, I have a clarifying question about
18 the 2006 memorandum of agreement.
19 ANSWERS BY MR. MAYER:
20 A. I'll do my best.
21 Q. This is actually an exhibit that Mr. Schwemm
22 had done, but it demonstrates the consequences of the
23 discharge at Warm Springs West reaching certain flow
24 level. One of the columns is regarding Arrow Canyon

Page 438

1 Well in that it flowed Warm Springs West less than
2 three CFS that pumping Arrow Canyon Well would have to
3 cease.
4 And in reviewing the exhibit, it seems that
5 that is only for the duration of the Mumford test. I'm
6 curious if you recall what the rule would be or what
7 the Agreement is if that threshold were met now?
8 A. I can attempt to answer that. And I honestly
9 don't recall all, but I do remember having the same
10 question, Adam, when I -- when I saw that agreement way
11 back in 2006. I think I may have even asked about it,
12 but I honestly don't remember. I'd just have a look at
13 that agreement.
14 Q. I don't remember that.
15 ANSWERS BY MS. BRAUMILLER:
16 A. I remember that. I remember the MOA reading
17 just like you said, Adam. That restriction on Arrow
18 Canyon pumping was during the pumping test. Which
19 didn't make sense for me.
20 ANSWERS BY MR. MAYER:
21 A. I think that's the way it was.
22 Q. Okay. Thank you.
23 And one more question about the MOA.
24 Is there a -- is there a provision in the MOA

Page 439

1 that defines what the -- what the cause of spring flow
2 decline would be? I mean, the consequences of the
3 pumping would be reduced, but say a portion of the
4 decline was determined to be pumping from a variety of
5 different wells or climate. Does it matter?
6 ANSWERS BY MR. MAYER:
7 A. Yeah, according to the terms of the MOA, from
8 our understanding, it doesn't matter. We went low
9 enough that we felt we were below any climate
10 variability impacts. So, it would clearly be
11 responding to pumping impacts and not the climate
12 variability. So, that was the idea. But, I don't
13 think there's any means in the MOA of saying no.
14 Unless maybe pad together and renegotiate it or
15 something, I don't know, but if we said yeah, all of --
16 all of us agree this is climate, you don't have to --
17 even if it's climate, then, you know, you still --
18 pumping is going to make it worse. So, it would still
19 seem like it has to be ratcheted back or cut off.
20 Q. Thank you.
21 EXAMINATION
22
23 HEARING OFFICER FAIRBANK: Ms. Braumiller, I
24 actual have a question. Would you mind describing or

Page 440

1 differentiating the difference between a groundwater
2 hydrologist and a hydrogeologist for me as you
3 understand it.
4 ANSWERS BY MS. BRAUMILLER:
5 A. Thanks for asking that. I don't think -- a
6 groundwater hydrologist is schooled in groundwater flow
7 dynamics and transport, the physics of groundwater flow
8 and transport. And hydrogeology is that and also all
9 the geologic considerations you have to make in order
10 to analyze groundwater systems. So, they are
11 inseparable. My education happens to be as a
12 groundwater hydrologist, flow dynamics and transport.
13 But, actually, beginning before I started
14 working, which was 24 years ago or so, even my master's
15 thesis was a hydrogeologic -- hydrogeologic site
16 characterization for a research site in northern
17 territory of Australia. So, that was literally my
18 introduction to hydrogeology, not being an
19 undergraduate geologist. They're inseparable. You
20 can't do groundwater analysis without, you know, giving
21 not minor but constant consideration to geologic
22 information.
23 And yet, I don't believe that geology alone,
24 clearly, is not enough to analyze groundwater problems,

Page 441

1 because that -- you know, that's only one factor in
2 determining groundwater flow problems, right?
3 They're -- they're one in the same. You can't do one
4 without the other.
5 HEARING OFFICER FAIRBANKS: Okay. So, we have
6 some additional time. So, we'll reopen it back up to
7 the participants for some additional time for
8 questions. At this point, I think we'll go ahead and
9 note that there's about an additional seven minutes for
10 each of the participants if they have follow-up
11 questions, and we'll start with Coyote Springs
12 Investments.
13 MR. HERREMA: We have no further questions.
14 HEARING OFFICER FAIRBANK: Thank you.
15 National Park Service?
16 MS. GLASGOW: No questions. Thank you.
17 HEARING OFFICER FAIRBANK: Okay. Thank you.
18 Same no questions from National Park Service.
19 The Moapa? Okay.
20
21 FURTHER RECROSS EXAMINATION
22 BY MS. BALDWIN:
23 Q. Beth Baldwin for the Moapa Band of Paiute
24 Indians. I know it's been a long day, and I appreciate

Page 442

1 the witnesses' participation. Just bear with us for a
2 few minutes.
3 Mr. Mayer, we left off talking about your
4 rebuttal report, specifically the hydrograph in Dry
5 Lake Valley, Delamar Valley, Tule Desert.
6 You said you looked at 20 wells total, correct?
7 ANSWERS BY MR. MAYER:
8 A. I think you add them up.
9 Q. Okay.
10 A. I will accept that.
11 Q. Okay.
12 A. That's about what it was, yes.
13 Q. Were there more wells available that you did
14 not include in your analysis?
15 A. Well, there are more wells in those basins,
16 yes.
17 Q. So, I'm looking at I believe it's rebuttal
18 slide eight. It's the four monitoring wells in Dry
19 Lake Valley.
20 A. Okay.
21 Q. So, I can tell that the top right one is a
22 decline, correct?
23 A. Uh-hum. Right.
24 Q. Which of the other three are increasing?

Page 443

1 A. The bottom two have slight increases and top
2 left one is stable. And I apologize, it's probably
3 hard to see on this hardcopy with slides. It's clear
4 in the report.
5 Q. Can you give a rough estimate of the magnitude
6 of the increases?
7 A. It's hard for me to see the scale on the graph,
8 so.
9 Q. I can't -- I can't read the numbers at all.
10 A. Yeah.
11 Q. Have you done any kind of statistical analysis
12 to look at whether those increases are significant in
13 any way?
14 A. I'm not sure how you would determine what was
15 your hypothesis test to be if they're significant or
16 not. Are you saying, is that noise? Is that random
17 noise?
18 Q. You're the statistician. I'm asking you.
19 A. Looks consistent to me.
20 Q. Okay. So, looking now at two slides forward,
21 Tule Desert wells, do you know what causes that drop in
22 early 2009 that we see in all four wells?
23 A. No, I don't know what that is.
24 Q. Do you know if water year 2011 was a

Page 444

1 particularly wet year or dry year?
2 A. Water year 2011 was pretty wet.
3 Q. Do you see any reflection of that in these
4 hydrographs?
5 A. No, I don't.
6 Q. In your opinion, are groundwater levels more
7 sensitive to wet years than dry years?
8 A. Two of the wet years closest.
9 Q. I'm sorry?
10 A. I need to clarify these wells are not in Lower
11 White River Flow System.
12 Q. Thank you. Give me one second.
13 Is it your opinion that groundwater systems
14 react more slowly than surface water systems to short
15 terms wet trends?
16 A. It would generally be generally true. Not in
17 all cases.
18 Q. And just to -- I think I asked this before.
19 But did you examine whether the water levels in Delamar
20 Valley, Dry Lake, or Tule Dessert are responding to any
21 delayed climate?
22 A. No. I didn't look at these well hydrographs in
23 relation to climate. I just looked the well
24 hydrographs.

Page 445

1 Q. In your opinion, is there any consensus on how
2 climate variability is reflected in well hydrographs?
3 A. I don't have an opinion on that question.
4 That's a hard one to answer.
5 Q. As a hydrologist, do you have any opinions
6 about the hydrological impacts of climate change?
7 A. Yes.
8 Q. Would you agree that climate change may bring
9 warmer air temperatures?
10 A. Certainly. It has.
11 Q. Could we expect to see spacial changes in the
12 distribution and timing of precipitation?
13 A. We already have.
14 Q. Could you explain what that means in terms of
15 rainfall or snowfall?
16 A. Well, we're seeing more warmer temperatures and
17 seeing more rain versus snow in the winter in terms of
18 winter precipitation. We're seeing earlier snow melt,
19 so, earlier runoff. We're also seeing more frequent
20 and intense rainstorms, rain events. So, more heavy
21 rain events. It was just a little bit.
22 Q. So, hypothetically, if we were experiencing an
23 average water year -- not dry, not wet, average -- but
24 more of that precipitation was falling as rain, would

Page 446

1 you expect to see a rising hydrograph as a result, or
2 no change at all? Or a decrease? How would you
3 expect that?
4 A. The hydrograph we're responding to is
5 precipitation only, and you are saying there's less
6 precipitation or recharge -- implying there's less
7 recharge, then I would expect the water level to go
8 down. If that's your question.
9 Q. So, yeah, maybe -- I don't know. Let me ask it
10 again. We can see if we're understanding each other.
11 Average water year but more precipitation
12 falling as rain as opposed than snow, does that have
13 any impact on a hydrograph?
14 A. That would be hard to say on a stream. That
15 was probably -- that's going to be reflected more, and
16 I'm more comfortable looking at the impacts of that
17 kind of situation in a stream and what that is going to
18 mean is that the runoff signal is going to be advanced
19 in time. It's going to occur. It's not necessarily
20 you would have less runoff, and so, it just may be
21 coming earlier. So, it may be the same way in the
22 winter having been groundwater. I shouldn't -- but
23 there's a lot of other factors, because you get into
24 the rain evaporates, but now it falls earlier. So, I

Page 447

1 don't know. It's sort of complicated.
2 Q. Fair enough.
3 And Sue, I have one question for you.
4 Mr. Donnelly was asking you a question about a
5 pumping rate of -- I think he said 9318 acre-feet, and
6 whether that carbonate pumping was causing spring
7 discharge to decline. And I think, I think you said
8 that there were other factors to consider.
9 I might have misheard you. So, I'm just trying
10 to understand.
11 ANSWERS BY MS. BRAUMILLER:
12 A. I think what I remember Patrick asking was if
13 the average total pumping rate in 2015, '16, and '17
14 calendar years was about 9318 acre-feet per year. And
15 then he asked me if, you know, there were visible
16 declines in groundwater levels and some spring flows
17 during that same period. And I said, I mean, just
18 visually.
19 There were some. But they were -- it was still
20 relatively constant groundwater levels and relatively
21 constant spring and stream flows during that period.
22 And for that reason, 9318 is as good a place as I know
23 to start.
24 Q. I just wanted to make sure I understand.

Page 448

1 A. Okay.
2 Q. Thank you.
3 HEARING OFFICER FAIRBANK: SNWA.
4
5 RE CROSS-EXAMINATION
6 BY MR. TAGGERT:
7 Q. Good afternoon. Once again, Paul Taggart
8 represent Southern Nevada Water Authority and Las Vegas
9 Valley Water District. I think this question may be to
10 Dr. Mayer, but, we'll see.
11 Do you -- now, it has it do with the MOA. And
12 would you agree with me that the MOA is an
13 environmental -- there is an Endangered Species Act
14 compliance document. Is that a fair statement?
15 ANSWERS BY DR. MAYER:
16 A. Yes. This might be for Mike, too.
17 Q. Okay.
18 A. (DR. SCHWEMM) Yeah, I'll chime in as
19 necessary. But, yes.
20 Q. So, this ESA is based upon biological opinion,
21 right? I'm sorry, not the ESA. The MOA is based on
22 biological opinion, right?
23 A. (DR. MAYER) Right.
24 Q. And is it fair to say that the parties to the

Page 449

1 MOA have Endanger Species Act Compliance to the extent
2 that Warm Springs West goes down to 3.2, for instance?
3 Do you understand my question?
4 A. I think I'll let Mike answer this.
5 ANSWERS BY DR. SCHWEMM:
6 A. I don't think I'll be able to answer it
7 accurately.
8 Q. Okay. Well, does the MOA allow the parties
9 who've signed it to pump groundwater and to have
10 that -- have the flows at Warm Springs West go down to
11 3.2?
12 A. Yes, I believe that one, that's what it means.
13 Q. Now, are -- I guess Dr. Mayer, this would be
14 you. Is -- are there parties -- strike that please.
15 Are there entities that are pumping water, in
16 your opinion, that are not parties to the MOA but their
17 pumping is affecting the Muddy River Springs?
18 ANSWERS BY DR. MAYER:
19 A. Yes.
20 Q. And do any of -- do those nonparties of the
21 MOA, do they have Endangered Species Act compliance
22 through the MOA?
23 A. That would be, again, a question for Mike.
24 ANSWERS BY DR. SCHWENN:

Page 450

1 A. That's difficult for me to address because
2 that's not really something that I talked about in my
3 report. But, the Fish and Wildlife Service would
4 always entertain any conversations with anyone that
5 thought that they needed compliance.
6 Q. Okay. Is it fair to say that if the flow of
7 Warm Springs West gage goes below 3.2, it calls into
8 question far more issues with the Endangered Species
9 Act than if the flow is above 3.2? Do you agree with
10 that?
11 A. Yes from a biological standpoint. This is
12 Michael Schwenn.
13 Q. Okay. In your opinion, should the State
14 Engineer include the consideration of how to maintain
15 the 3.2 CFS flow at Warm Springs West gage as a
16 consideration of what the sustainable quantity of
17 groundwater is that should be pumped in the Lower White
18 River Flow System?
19 ANSWERS BY DR. MAYER:
20 A. This is Tim. I'll say yes to that. So, yes.
21 Q. Anybody else?
22 ANSWERS BY MS. BRAUMILER:
23 A. I would say no. Because that's not --
24 enforcing the MOA is not the jurisdiction of the State

Page 451

1 Engineer's Office.
2 Q. So, you don't think the State Engineer should
3 take into account --
4 A. I'm not saying --
5 Q. -- the flow that's necessary for the fish?
6 A. My understanding is it's not their obligation.
7 Q. Okay. But that wasn't my question.
8 A. Okay.
9 Q. I mean, do you think they should just ignore
10 the fact that 3.2 is necessary for the fish when they
11 manage groundwater?
12 A. Well, I guess I can't answer that.
13 Q. You -- I --
14 A. I can't answer that. I mean, as a hydrologist.
15 I'm not -- neither biologist or a regulator, so.
16 Q. Okay. Mr. -- or I'm sorry, Dr. Mayer, the
17 precipitation analysis you did looked at standard
18 deviations, and you were asked about the time period
19 that you selected. Do you recall that question?
20 ANSWERS BY DR. MAYER:
21 A. Yes.
22 Q. And were you present yesterday when there was a
23 presentation that was done by I think Ms. Molly Palmer
24 that was using cumulative departure from the mean? Do

Page 452

1 you recall that?
2 A. Yes.
3 Q. And which is a better approach, and why?
4 A. Well, the cumulative departure of the mean --
5 this is really getting into the weeds, so I don't want
6 to say too much about this except that that behaves
7 very, very strangely, and it should not be looked at as
8 a moving average, which people tend to read it as a
9 moving average. But, it does some very strange things
10 when you start playing around with the angles of
11 cumulative departure of means. And there's a paper by
12 a person who we didn't cite it in the exhibit. There's
13 a paper that looks critically at the use of critical
14 departure by -- cumulative departure from the mean as a
15 a parameter of climate, and it brings out several
16 critical points about it.
17 I thought that was just -- I know this is just,
18 sort of like I said, going into a lot of detail, a lot
19 into the weeds, so I didn't bring that up. But, I
20 don't really support that as a good measure of
21 precipitation. I think something like a moving average
22 or a low S smooth or something like is much better.
23 So, the parameter I looked at was the Palmer Drought
24 Severity Index, the PDSI, and that really is in itself

Page 453

1 a moving average.
2 Q. Okay. And my other question to you, Dr. Mayer,
3 is, you were present during yesterday's testimony,
4 right?
5 A. Yes.
6 Q. And what is your opinion regarding Mr. Wright's
7 conclusion that 5280 acre-feet of water can be pumped
8 to the west side of the structures that he identified
9 in Coyote Spring Valley without impacting the Muddy
10 River Springs?
11 A. Oh, I think that's a better question for Sue
12 because she's really looked at the groundwater. So, if
13 I can defer that to Sue, I'd rather do that.
14 ANSWERS BY MS. BRAUMILLER:
15 A. Yeah, I think it's clear that -- and again, I
16 wasn't -- I wasn't very clear about which of these
17 various faults CSI talked about yesterday corresponds
18 to Kane Springs Valley fault. But, at any rate, there
19 are all basically north trending, and what I think is
20 really clear, is that there's about 50,000 acre-feet
21 per year that flows into Coyote Spring Valley from
22 Pahrnagat Valley with the -- creating a share zone.
23 And probably largely does that on the west side of the
24 Kane Springs Wash fault.

Page 454

1 Only because -- I say that only because it's on
2 that side of Kane Springs Wash fault, and actually a
3 normal fault trending that whole sequence of Paleozoic
4 carbonates is present. So, you got a large volume of
5 water coming over the Pahrnagat shear zone mostly on
6 the west side of Kane Spring Wash fault, and clearly it
7 gets through the fault at some point in Coyote Spring
8 Valley because a large amount of it discharges into
9 Muddy River Springs. Right? So, whatever that barrier
10 was that was hypothesized yesterday, I think it's
11 pretty clear that there's no complete
12 compartmentalization.
13 Q. Okay. Thank you.
14 MR. TAGGERT: I heard my buzzer go off, right?
15 HEARING OFFICER FAIRBANK: Yes. Thank you.
16 Moapa Valley Water District.
17
18 RE-CROSS-EXAMINATION
19 BY MR. MORRISON:
20 Q. Hi. Greg Morrison again. Moapa Valley Water
21 District. I'm going try to keep this as brief as
22 possible?
23 Real quick for, Dr. Mayer. And anybody else,
24 feel free to chime in if they feel like they have a

Page 455

1 better answer.
2 But when Mr. Sullivan asked you about State
3 Engineer's Exhibit 244, which showed trigger levels
4 under the MOA and required responses to those trigger
5 levels, everyone seemed little confused as to why Arrow
6 Canyon pumping curtailment would only apply during the
7 1169 pump testing. So, I just want to see if you have
8 a little better understanding than I think of that 2006
9 MOA.
10 Are you aware that Moapa Valley Water District
11 operates the Arrow Canyon well -- wells?
12 ANSWERS BY DR. MAYER:
13 A. Yes.
14 Q. Okay. You're also aware that pursuant to that
15 2006 MOA Moapa Valley Water District dedicated 1.0 CFS
16 against Jones Spring water right for dace protection
17 and restoration?
18 A. Yes, I do remember that.
19 Q. And that was 25 percent of the district's water
20 portfolio?
21 A. Yes.
22 Q. All right. Now, dedication of that 1.0 CFS had
23 the effect of augmenting flows at Apcar Springs?
24 A. Right. With the Apcar unit, yes, it did.

Page 456

1 Q. Okay. So, that's it for that line of
2 questioning.
3 Now, Dr. Schwemm, I want to take it back to the
4 Center For Biological Diversities' cross-examination.
5 Mr. Donnelly was asking you whether -- I think in a
6 nutshell it's safe to say he was asking if any amount
7 of pumping in carbonate aquifer would per se result in
8 reduction of dace numbers because of reduction of dace
9 habitat. Does that sound pretty familiar?
10 ANSWERS BY DR. SCHWENN:
11 A. This a microphone?
12 I don't know about the carbonate aquifer. I
13 wouldn't want to attest to that on the hydrology part.
14 But, I'm happy to talk about the Hatten et al published
15 paper that showed reduction in flow result in reduction
16 in habitat.
17 Q. Okay.
18 A. Carbonate's that's something that would be --
19 Q. Maybe his --
20 A. -- my colleague.
21 Q. If I direct you to your testimony, it was
22 slides 16 and 17. You talk about dace abundance and
23 dace counts.
24 A. Okay. Let me -- let me key it up.

Page 457

1 Q. Sure. Dace is on there. Is that slide 16?
2 A. Go ahead. Yeah. This one slide?
3 Q. Slide 16. I'm looking at -- the period of
4 order 1169 pump testing, which I think you can place
5 from roughly early 2011 to the end of 2012?
6 A. Right.
7 Q. Can you tell me what that trendline of dace
8 abundance is showing during that time frame?
9 A. From 2012 to 2013, it's going up.
10 Q. Pretty -- would you call it pretty steep spike?
11 A. Yes, absolutely.
12 Q. Okay. If you to go your next slide.
13 A. Just for -- if I might explain it?
14 Q. Please.
15 A. So, right after -- in this time period we had a
16 lot of recovery action taking place, so, we had a lot
17 of expansion into other areas and positive dace
18 response.
19 Q. Great. Thank you.
20 Next slide more or less shows the same thing.
21 Shows pretty good increase in dace population. I think
22 I see a February 2010 count of right around 700?
23 A. Yes. It's exactly the same data.
24 Q. Okay. So, then I think what this shows us --

Page 458

1 and I want to get your concurrence on this -- is that
2 Lower White River Flow System pumping at some volume
3 can coexist with the dace and dace habitat restoration?
4 A. Yeah. Especially when the dace population
5 is -- it was as low as it was. So, I believe that at
6 least for -- at that level, that provided enough
7 habitat for the population to increase.
8 So, if we may go back? So, during that period,
9 that was, you know, just little over 500 or so fish.
10 So, that was likely enough water to provide for that
11 population size -- that amount of habitat rather.
12 Q. Okay. So, just to wrap it up with a bit of a
13 bow, accomplishing a goal and restoration of dace
14 numbers and dace habitat, that does not require that
15 carbonate pumping to cease, does it?
16 A. Can you rephrase that? I guess.
17 Q. Sure.
18 A. Can recovery of the base as far as the -- as
19 defined, let's say to 4500 for downlisting or 6000.
20 So, they're -- I guess I see it as three main threats
21 that affect the dace, and they all have a role to
22 play.
23 And what exactly is limiting the dace at that
24 particular time could be all three of those. And in

Page 459

1 this case, what this graph depicts is their recovery
2 that we had based on recovery actions that have gone on
3 in that period, and that allowed the dace to expand.
4 So, I would say that we have approximately 1500
5 animals, and that may be -- may be compatible with the
6 amount of water that was at the time, but certainly a
7 long ways from recovery I would say. Because we still
8 need to incorporate more habitat to approach, you know,
9 3-, 4-, 5000 animals.
10 Q. Sure. And I would assure --
11 A. Yeah, I understand.
12 Q. I'm not trying to get you to pin down a
13 number --
14 A. Yeah, but --
15 Q. -- you fantasized but some pumping can occur
16 and of course not all dace habitat restoration and dace
17 health.
18 A. For very low numbers of dace, yes. Such as
19 what's shown here.
20 Q. Okay. I'll leave it there. Thanks.
21 HEARING OFFICER FAIRBANK: Next will be Lincoln
22 County Water District.
23 MS. PETERSON: Thank you. And just to note for
24 the record, Dylan Frehner, the Lincoln County District

Page 460

1 Attorney, is now here.
2
3 RE CROSS EXAMINATION
4 BY MS. PETERSON:
5 Q. Thank you. Good afternoon, Panel, again.
6 Karen Peterson representing Lincoln County Water
7 District and Vidler Water Company.
8 And, Ms. Braumiller, when we left off we were
9 talking about the geophysical surveys from the 2006 USR
10 study. Do you recall that?
11 ANSWERS BY MS. BRAUMILLER:
12 A. Yes.
13 Q. And you've had a chance to review those
14 geophysical studies now?
15 A. I reviewed, you know, them briefly a couple
16 months ago. I mean, I didn't actually review the
17 studies. I skimmed through the report looking for any
18 interpretation by the authors of the geophysical
19 results concerning whether or not either one or both of
20 the wells are completely through the Kane Springs -- or
21 you know what I'm trying to say. Kane Springs Wash
22 fault. And I didn't see it.
23 Q. All right. And the reason you wanted to see
24 that is you needed clarification of the completion of

Page 461

1 the two existing carbonate wells in Kane Spring Valley
2 relative to the Kane Springs Wash vault; is that
3 correct?
4 A. Yes. To facilitate the interpretation of water
5 level data that's collected. Either one of them. Or
6 if a pumping test is conducted, I know one was
7 conducted previously, how to interpret that concerning
8 the transmissivity of the carbon on one side or perhaps
9 both sides of that fault in Kane Springs Valley.
10 Q. And so, you didn't look at figure 3 3, from
11 the -- this is the cross-section of the well location?
12 A. No, I -- you're right. I did look at the text,
13 and I didn't see that.
14 Q. Okay. And so, you're not familiar with the
15 Willow Springs fault?
16 A. There's a whole series of faults in Kane
17 Springs Valley, and I'm not sure which one that is.
18 No, I don't know the details.
19 Q. In forming any of your opinions did you look at
20 any of the precip data in Kane Springs?
21 A. No. No, and I didn't have an opinion. I
22 really had a question is what I had.
23 Q. All right. And the U.S. Fish and Wildlife
24 Services proposing a pump test to determine whether to

Page 462

1 include Kane Springs into the Lower White River Flow
2 System; is that correct?
3 A. Well, what I expressed was that if we
4 understood which side of the fault, or perhaps both
5 sides of the fault, KPW1, that's be KMW1, are completed
6 on, then a pump -- a longer pumping test with
7 observation wells that include MW1, but also many other
8 observation wells that are very close to KPW1. All
9 right? You know, it could be informative. But only if
10 we know which side or sides of the fault the two wells
11 are completed on.
12 Q. And leading up to your July 3rd report, the
13 U.S. Fish and Wildlife Service had all the data in the
14 URS 2006 report at it's -- it was available to them.
15 Would you agree with that?
16 A. Yeah. I can't remember when it became
17 available to me, but it was -- yeah, it was pretty
18 close to June.
19 Q. Okay. Well, it's been on the State Engineer's
20 website, and of course, it's been available since the
21 Kane 2006 hearing.
22 A. Okay. I didn't actually know about it.
23 Q. So, the U.S. Fish and Wildlife Service had
24 every opportunity to do the pump test that it's

Page 463

1 proposing in this case prior to your July 3rd report.
2 Would you agree with that?
3 A. Do I agree? No, I don't. No, they would not
4 be. They're not our wells, and we don't conduct
5 pumping tests.
6 Q. Did I hear you correctly that you did -- there
7 was no approval of superiors for the position taken in
8 this report -- in your reports to include Kane Springs?
9 A. There was. It was reviewed internally. Not by
10 any other groundwater hydrologists or hydrogeologist
11 because there are none available to us within the
12 agency. But no, it was reviewed by management and a
13 number of other -- number of other folks within the
14 agency and Solicitor's Office. And yes, it was was
15 approved to submit.
16 Q. Was a legal opinion specifically requested to
17 determine whether your position violated the amended
18 stipulation in the Kane Spring's proceeding?
19 MR. MILLER: Objection; lack of relevance and
20 calls into question attorney/client privileged
21 information.
22 HEARING OFFICER FAIRBANK: I'll sustain that
23 objection.
24 BY MS. PETERSON:

Page 464

1 Q. And do you understand that the position that
2 you -- that U.S. Fish and Wildlife is taking in this
3 proceeding by wanting to include Kane Springs into the
4 Lower White River Flow System would impact Lincoln
5 County Water District and their various property
6 rights?
7 ANSWERS BY MS. BRAUMILLER:
8 A. Well, first of all, I have to disagree with the
9 premise of your question. I don't want Kane Springs
10 Valley to be included. I said I think it should be
11 considered for inclusion pending clarification of what
12 or which sides of the Kane Springs Wash fault the two
13 wells are completed in and the collection of additional
14 hydraulic data to characterize the nature of the
15 connection between Kane Springs Valley and Coyote
16 Spring Valley. I don't -- I think what I was trying to
17 clarify -- and I certainly don't want Kane Springs
18 Valley to be included in the Lower White River Flow
19 System.
20 I said that I think it should be considered
21 pending clarification of what side or sides of the Kane
22 Springs Wash fault the two existing wells are completed
23 on and the collection of the additional hydraulic data
24 to fully characterize the hydraulic connection between

Page 465

1 Kane Springs Valley and Southern Kane Springs Valley
2 and Central Coyote Spring Valley, Consequently the
3 remainder of the Lower White River Flow System.
4 Q. Mr. Mayer, sorry, I don't mean to be rude. I
5 just -- I'm sorry. I thought I heard you say that
6 pumping from the Arrow Canyon wells impacts Pederson
7 Springs?
8 ANSWERS BY MR. MAYER:
9 A. Yes, I may have said that. It does.
10 Q. Okay. What are the impacts?
11 A. It lowers the groundwater level.
12 Q. And do you -- do you have a quantification of
13 that?
14 A. It's the top plot in figure 19 in the report.
15 Q. Okay. Thank you.
16 And, Mr. Mayer, again, is the hydrologic
17 setting for the Tule basin the same as the Lower White
18 River Flow System?
19 A. The hydrologic setting? Could you define that?
20 Q. Like the geologic structure?
21 A. I don't know.
22 Q. I'm sorry?
23 A. I don't know.
24 Q. You don't know?

Page 466

1 A. No.
2 Q. Okay. Do you know if the recharge sources are
3 the same?
4 A. I would assume that the climate's the same.
5 MS. PETERSON: Darn it. Thank you. Thank you.
6 HEARING OFFICER FAIRBANK: City of North Las
7 Vegas.
8 MS. SCHROEDER: No questions.
9 HEARING OFFICER FAIRBANK: So, no additional
10 questions.
11 Centers for -- Center for Biological Diversity.
12 MR. DONNELLY: Okay. Thank you.
13
14 RE CROSS EXAMINATION
15 BY MR. DONNELLY:
16 Q. Patrick Donnelly, Center for Biological
17 Diversity. I want to go back to this question of take.
18 And so, the -- I'm trying to get at a question that
19 involves both Ms. Braumiller and Dr. Schwemm, and so,
20 you're going to have to build on each other's answers I
21 think.
22 So, Ms. Braumiller, as you said earlier, just
23 to confirm, carbonate pumping in the Lower White River
24 Flow System causes spring flow declines in the Muddy

Page 467

1 River Spring area; is that correct?
2 ANSWERS BY MS. BRAUMILLER:
3 A. Yes, generally.
4 Q. Dr. Schwemm, spring declines caused a loss in
5 habitat; is that correct?
6 ANSWERS BY DR. SCHWEMM:
7 A. Correct.
8 Q. Loss in habitat causes a loss of individual
9 dace; is that correct?
10 A. Likely, yes.
11 Q. As we confirmed based on your general knowledge
12 of the Endangered Species Act earlier, a loss of
13 individual dace constitutes take; does it not?
14 A. If could, yes.
15 Q. Therefore, carbonate pumping causes take?
16 A. Yes.
17 Q. And thus as we defined section nine of the
18 Endangered Species Act earlier, carbonate pumping would
19 be a violation of the Endanger Species Act?
20 A. Yes.
21 Q. To go to the line of questioning that came up
22 just earlier regarding the population trends of the
23 Moapa -- oh, I'm sorry, were you not done?
24 A. Yeah. If it -- if it's below the -- I assume

Page 468

1 if it goes below the thresholds.
2 Q. So, I'd like to explore that for a moment.
3 What is the current flow rate at Warm Springs
4 West? Ballpark.
5 A. It's around 3.2. This is Michael Schwemm
6 and -- but, I think Tim might know a more recent
7 number.
8 Q. We can go with -- we can go with around 3.2,
9 maybe a little more, maybe a little less. As we -- Ms.
10 Braumiller observed earlier, spring flows and
11 groundwater levels are slightly declining since 2015;
12 is that right, Ms. Braumiller, as you observed?
13 ANSWERS BY MS. BRAUMILLER:
14 A. They appear to.
15 Q. Thus on some level, Dr. Schwemm, there is
16 incrementally less habitat now than there was, say, six
17 months ago? Incrementally less so?
18 ANSWERS BY DR. SCHWEMM:
19 A. On average there could be, yes.
20 Q. So if we are experiencing declines in spring
21 flow and thus -- incremental, granted -- declines in
22 habitat, why would we think that 3.2 CFS is an
23 acceptable flow level and a sustainable flow level for
24 the dace?

Page 469

1 A. Say that again.
2 Q. If we are currently at current pumpage levels
3 experiencing -- and at thus flow levels of 3.2, we are
4 experiencing declines in habitat, why should we think
5 3.2 is an acceptable level to prevent the decline of
6 the dace?
7 A. I think that if -- maybe I'm not getting the
8 whole question. But at 3.2 -- or at our current level,
9 I believe the dace population is fairly stable. Given
10 the other factors, if those stayed the same and we're
11 just going off of flow, it looks like the population is
12 relatively stable, around 1500 animals for that flow.
13 Q. And thank you. So, that gets to a question
14 that was raised earlier from the Moapa Valley Water
15 District regarding the population trend during the pump
16 test.
17 The MOA's set up a number of conservation
18 actions to be conducted; is that correct?
19 A. Yes, they did. But, I'm only aware of them
20 kind of in a general sense that --
21 Q. Sure.
22 A. -- recovery actions would be taken.
23 Q. So, there were a number of ongoing recovery
24 actions simultaneous to the pump test?

Page 470

1 A. Yeah, they've been ongoing since '79.
2 Q. So, in some ways, dace populations during the
3 pump test were increasing in spite of trends on water
4 levels?
5 A. Yeah. Because there's multiple forces at work.
6 I mean, what could be increasing could be -- is the
7 interplay of those three things, and they could all be
8 modified to some extent.
9 Q. Okay. I just want to clarify a question you
10 answered earlier, Ms. Braumiller. You seem to imply
11 there are some years in which you can't pump any
12 groundwater in the Lower White River Flow System
13 without impacting senior decreed water rights on the
14 river.
15 A. Oh, I don't think I said that. Not the way I'm
16 interpreting --
17 Q. Okay.
18 A. -- what you just said.
19 Q. Are there years in which one can -- any amount
20 of pumping would result in impacts to senior decreed
21 water rights on the river?
22 A. You know, again, I don't know the total volume
23 of senior decreed water rights on the river, so, I
24 can't answer that question.

Page 471

1 Q. Okay. Thank you.
2 I'd like to go to the boundaries of the Lower
3 White River Flow System, in particular the idea of a
4 pump test in Kane Springs Valley. You said earlier
5 that you don't know what the affects of pumping would
6 be there right now; is that correct?
7 A. I think based on data that we already have that
8 predated -- water level data -- groundwater level data
9 that predated the Order 1169 pumping test than a
10 response KMW1 during the pumping test, wasn't official
11 part of it, but there was groundwater level monitoring
12 in it during that period, and since then, all show that
13 there is a hydraulic connection between southern Kane
14 Springs Valley and Central Coyote Springs Valley and
15 the the rest of the Lower White River Flow System.
16 But, it's -- well, since we don't know -- or I don't
17 know at least -- which side of the Kane Springs Wash
18 fault KMW1 is completed on, or perhaps both, I don't
19 know if the connection only meets carbonate on one the
20 side of it --
21 Q. Sorry --
22 A. -- the other side, or both. I don't know.
23 Q. And I get why you want to do it. The question
24 is, if -- is there a chance that the system is so

Page 472

1 interconnected that a pump test would result in
 2 catastrophic declines at the Muddy River Springs just
 3 like we saw on the last pump test?
 4 A. Well, I took a three-month long pump test is
 5 long enough to pick up signals in the observation wells
 6 that I specifically posed -- proposed in my analysis.
 7 But, as in -- at other locations, you could -- you
 8 could identify stopping criteria for the test.
 9 Q. If there is the potential for impacts to
 10 endangered species, does Fish and Wildlife Service need
 11 to conduct a Section 7 consultation before embarking on
 12 such an exercise?
 13 A. Regulatory matters are not something I'm very
 14 well-versed in, and I can't tell you. But somebody
 15 would know.
 16 Q. Perhaps one of your other colleagues?
 17 ANSWERS BY DR. SCHWEMM:
 18 A. Repeat the question.
 19 Q. If Fish and Wildlife is to embark on an
 20 exercise such as a pump test which could cause impacts
 21 to endangered species, does Section 7 compliance need
 22 to be done, a consultation.
 23 A. Yes.
 24 Q. Thank you.

Page 473

1 HEARING OFFICER FAIRBANK: Georgia Pacific and
 2 Republic.
 3 MS. HARRISON: No, questions.
 4 HEARING OFFICER FAIRBANK: Muddy Valley
 5 Irrigation Company.
 6 MR. KING: No questions.
 7 HEARING OFFICER FAIRBANK: NV Energy, do you
 8 have any further questions?
 9 MS. CAVIGLIA: No questions.
 10 HEARING OFFICER FAIRBANK: We'll go ahead and
 11 open it up to State Engineer and finish with Water
 12 Resources staff for questions.
 13 MS. COOPER: Christi Cooper.
 14
 15 EXAMINATION
 16 BY CHRISTI COOPER:
 17 Q. Ms. Braumiller, just in my previous question
 18 and your answer, you identified GV1 well as one of the
 19 highly transmissive wells; is that correct?
 20 ANSWERS BY MS. BRAUMILLER:
 21 A. Identified it as one of the wells that -- in
 22 which we isolated MX5 induced drawdown on the order of
 23 1.5 to 1.6 feet.
 24 Q. Okay. So, in the hydrograph of 4GV1 on page

Page 474

1 71, figure 12, did you describe your opinion of the
 2 trend of the hydrographs since the conclusion of the
 3 Order 1169 test?
 4 A. I can't even read my own X axis, so, that's bad
 5 news. So, must have ended right there.
 6 You know, there are always seasonal variations,
 7 and it was fairly constant for a year, year and a half,
 8 and then it did seem to start declining. That's what I
 9 see.
 10 Q. Okay. So, is it -- do you think that it is
 11 possibly still declining, or a static steadying off, or
 12 what may be causing that?
 13 A. So, are you asking if it's recovered from the
 14 pumping test, or just in general are water levels --
 15 Q. In general in this particular well.
 16 A. Yeah, yeah. Yeah, in general it looks like in
 17 2017 and '18, that they were continuing to decline
 18 somewhat. I mean, just based on a visual inspection of
 19 the hydrograph.
 20 Q. Okay. Thank you.
 21 A. Sure.
 22 MR. SULLIVAN: One question.
 23 ///
 24 ///

Page 475

1 RE CROSS EXAMINATION
 2 BY MR. SULLIVAN:
 3 Q. Ms. Braumiller, I have a question regarding the
 4 hypotheses that you described regarding the source of
 5 water for Big Muddy Spring.
 6 Do you have an opinion of whether or not the
 7 water discharging at Big Muddy Spring is part of the
 8 same water budget that is represented by the
 9 approximately 50,000 acre-feet involved with the
 10 Pahrana gat shear zone?
 11 ANSWERS BY MS. BRAUMILLER:
 12 A. Well, no. Right? Because, I mean, these
 13 groundwater flow systems boundaries are, you know, a
 14 simplification, right? But, if you look at the trends
 15 in groundwater levels, it's mostly basins of water
 16 levels. Right? Down the Meadow Valley Flow Systems,
 17 it's clearly north to south from lake to, you know, get
 18 them down Patterson to Panaca to Lower Meadow Valley
 19 Wash, and that is a separate flow line. But it's not
 20 -- it's separate from the flow that's coming down the
 21 White River Flow System to Pahrana gat and to Coyote
 22 Spring Valley.
 23 So, that would not be. I don't think that
 24 would be. If you've got a -- say that one more time.

Page 476

1 Now, so, the 50,000 acre-feet is previous estimate of
2 known flow from Pahrnatagat, right? That would be
3 separate. Although, based on SNWA's water budget
4 analysis for their conceptual model, the CCRP model,
5 the inflow at the north and to Lower Meadow Valley Wash
6 from Upper Ameous(phonetic), is like 4700 acre-feet per
7 year. It's a tenth, tenth of what comes across the
8 Pahrnatagat shear zone as far as we know.
9 Did that answer your question? I'm not sure
10 that it did. I'm sorry.
11 Q. It does in part. I'm gathering that there
12 isn't enough data to validate that hypothesis; is that
13 a fair characterization?
14 A. Well, we have the water budget analysis from
15 SNWA new conceptual model, and, you know, it's a water
16 budget analysis. So, you know, I'm sure it's
17 approximate, and not necessarily 100 percent correct,
18 but, it is a reasonable, probably the best
19 approximation we have right now of what would be coming
20 from Panaca into Lower Meadow Valley Wash versus what's
21 coming from Pahrnatagat into Coyote Spring Valley. It's
22 the best that we have.
23 And so, they're in different flow systems, and,
24 you know, they -- the inflow to Lower Meadow Valley

Page 477

1 Wash would be separate from what's flowing in from up
2 gradient and White River Flow System.
3 Q. Okay. Thanks.
4 MR. BENEDICT: John Benedict for the record.
5
6 EXAMINATION
7 BY MR. BENEDICT:
8 Q. So, I just want to try and understand that
9 because it's maybe not still not clear. So, you're
10 suggesting that the flow coming from north to south
11 which has a different flow path, but then also enters
12 Muddy River Springs Area is more likely to go to Big
13 Muddy Springs? I mean, can you really diagnose the
14 flow path once it's gone into the Muddy River Springs
15 and say that these particles of water from other basins
16 are correlated to Muddy River Springs, and then the
17 others go to the other springs? Or is that -- is that
18 an interpretation that's based on data?
19 A. I didn't quite follow the question, John. So,
20 better try that again on me.
21 Q. You seem to apply a connection between water
22 that's flowing from north to south, but outside of what
23 we're calling Lower White River Flow System currently
24 as being connected to Big Muddy Springs? Am I wrong?

Page 478

1 A. It looks like it to me. I mean, one, we didn't
2 see any response to the order to combine pumping in Big
3 Muddy Springs, right? And it's a really big spring.
4 So, it's discharging from something that is pretty darn
5 conductive, right? And that those fanglomerates that
6 Maxey et al '66 mapped are -- happen to be in, you
7 know, the general vicinity. As far as I can tell,
8 they're right about at the location that we currently
9 map the Big Muddy Springs, and that could be such a
10 conduit. Plus, the water is warm, so it's flowing
11 through some kind of pretty significant depths. And
12 the water level variations are very attenuated compared
13 to the other springs. So, to me that suggests that
14 it's flowing for some distance at depth through
15 something before discharging through something that's
16 quite permeable which could be those same fanglomerates
17 that Maxey et al 1966 mapped.
18 So, I think it's a reasonable hypothesis. I by
19 no means have any proof of that. It's just an
20 intriguing problem because it does seem like the
21 climate signal is delayed by perhaps 18 years or
22 something like that. Which I believe the Moapa Band of
23 Paiute suggested in the past. It's just a hypothesis.
24 Yeah.

Page 479

1 Q. Thank you.
2 HEARING OFFICER FAIRBANK: All right. We'll go
3 ahead and take a ten-minute break, and then when we
4 return from our break, we'll go ahead and open it back
5 up if there's any redirect on the part of Fish and
6 Wildlife Services.
7 (Recess.)
8
9 HEARING OFFICER FAIRBANK: Okay. Let's go
10 ahead and go back on the record, and we'll open it back
11 up for Fish and Wildlife Services.
12 MR. MILLER: Okay. Thank you. This is
13 Luke Miller again for the Fish and Wildlife Service. I
14 just have a few questions here. I don't think this
15 will take too long at all.
16 ///
17 ///
18 REDIRECT EXAMINATION
19 BY MR. MILLER:
20 Q. Sue, I'll start with you. A couple of
21 questions here. Just kind of referencing back hours
22 ago now, you were discussing, I think some Kane Springs
23 Valley well issues.
24 Can you just clarify whether either of the Kane

Page 480

1 Spring Valley wells were officially monitored as part
2 of the 1169 study?
3 ANSWERS BY MS. BRAUMILLER:
4 A. Yeah, my recollection is they weren't -- they
5 weren't officially part of the Order 1169 study
6 monitoring that work, but KMW1 was in fact monitored.
7 Groundwater levels were monitored in that well
8 throughout the pumping test and prior to it for at
9 least a couple years.
10 Q. And I think Ms. Fairbank touched on this, but
11 just to clarify. In your 24 years of working
12 experience, how much have you spent, say, using both
13 hydrologic and geologic information to analyze
14 groundwater levels?
15 A. With the exception of maybe a year or year and
16 a half where I did some laboratory testing, read rain
17 gages on Yucca Mountain, 22 out 24 years easily. Every
18 single groundwater problem that I've worked on, I've
19 evaluated the geologic and hydrologic data to do those
20 groundwater analyses. There's no other way. So,
21 easily 22 years of experience doing that. Plus, you
22 know, I hate to harp back to my master's thesis, but it
23 was a really tough hydrogeology problem.
24 And it had -- just the hydrogeology of that

Page 481

1 international test site, you know, Australia had been a
2 complete mystery through two international NRC funded
3 studies in the '80s and the '90s. So, I was quite
4 pleased with that. It was good experience. But,
5 that's when I first did hydrogeology, was 19 -- early
6 1990s.
7 Q. Okay. Thank you. Let me lob one over there to
8 Tim for a minute.
9 Again, referencing back probably a couple hours
10 now, you were asked about using your -- or your use of
11 well or driller log information in relation to your
12 analysis hydrographs. Do you recall that?
13 ANSWERS BY MR. MAYER:
14 A. Yes, I recall that.
15 Q. Was that really a necessary function or action
16 for what you were trying to do?
17 A. No. It was -- I was really looking at the
18 long-term regional response to climate in those wells,
19 and I wasn't trying to look at individual well
20 responses. So, I didn't even look at well logs.
21 Q. Now, Mr. Schwemm over there. You were also
22 asked -- and I think this was actually the first line
23 of questioning from the morning. So, you were asked I
24 think about the overall and biggest threats to the

Page 482

1 Moapa dace, in particular fish passage issues at the I
2 think the Pederson gage. Do you recall that?
3 ANSWERS BY DR. SCHWEMM:
4 A. Yes.
5 Q. Okay. How do these impacts maybe relate to
6 your -- the fish passage impacts related to your
7 presentation about the impacts and overall preservation
8 of the dace?
9 A. Okay. So, overall -- so there's -- there's --
10 the overall picture of Moapa dace I think is generally
11 formed by that having available habitat, the right kind
12 of habitat, invasive species and adequate flow for fish
13 to move around. And while that -- whether they --
14 well, I -- the Pederson gage issue, while that does
15 limit dace, that's only in one particular spot. And
16 when we look at the numbers as a whole, I don't believe
17 that that -- that any one particular part of the stream
18 is responsible for the overall population size.
19 There's enough movement that -- you know, collectively,
20 we need to maintain connectivity, but any particular
21 issue is -- you know, it's of small importance in the
22 bigger picture.
23 As the overall threat to Moapa dace right now
24 is, you know, potential or going in the future, I think

Page 483

1 is much related to the flow of the water given what we
2 know about Hatten et al paper. Because we've done so
3 much recovery action to improve much of the habitat and
4 we've removed nonnative -- just finished removal of
5 nonnative fishes from the system, part -- tilapia
6 explicitly. But, we've been working to remove them
7 from other parts of the system as well. So, those
8 two -- at this point in time, those two threats are
9 like I say, are lower level to the flow.
10 Q. Okay. Well, in relation to the questions
11 related to the ESA, I know you got peppered with a
12 couple of different approaches to your thoughts and
13 conclusions about ESA and take.
14 And I should ask first of all, were any of you
15 actually proffered today to give testimony and discuss
16 ESA compliance issues?
17 A. I'm not. I'm not an expert in ESA compliance.
18 I typically work more on the biology and recovery end
19 of things.
20 Q. Tim?
21 ANSWERED BY MR. MAYER:
22 A. No, I'm not expert in that or qualified to talk
23 about that at all.
24 ANSWERED BY MS. BRAUMILLER:

Page 484

1 A. Nor am I.
 2 Q. Thank you.
 3 So, is it -- is it -- is it something you can
 4 clarify then whether you have a position that you think
 5 that -- I think was inferred maybe from the Center for
 6 Biological Diversity's cross-exam that essentially any
 7 or all pumping is just inherently take?
 8 ANSWERED BY DR. SCHWEMM:
 9 A. I'll clarify that. This is Michael Schwemm.
 10 You know, likely not. And it's -- take is a more
 11 nuanced -- it would -- it would -- it would take a very
 12 sophisticated explicit analysis to analyze take.
 13 Because of the other features -- or the other
 14 attributes that are at work. It's difficult.
 15 Q. Okay.
 16 MR. MILLER: That's all I have.
 17 HEARING OFFICER FAIRBANK: Thank you. All
 18 right. Thank you very much.
 19 So just one final clarifying matter.
 20 So, Ms. Braumiller, you were admitted as an
 21 expert in groundwater hydrology. And Dr. Mayer, you've
 22 been previously admitted by our office. And
 23 Mr. Schwemm, you were admitted for the purposes of this
 24 hearing subject to no objection in the discipline of

Page 485

1 biology, but that will be limited to the purposes of
 2 this particular proceeding on the basis of there was no
 3 objection. And so we appreciate you guys' testimony,
 4 and providing us the information with respect to your
 5 reports.
 6 Just a couple of other housekeeping matters
 7 since we have a little bit of extra time today. So,
 8 one of the things is, is for purposes of this week,
 9 we're limiting. Even though we may conclude a little
 10 bit early, just due to the efficiency by the
 11 participants, we're not starting subsequent
 12 participants early. So, tomorrow we'll proceed with
 13 the National Park Service, and then -- and then again,
 14 on Thursday will be the Moapa Band of Paiute Indians,
 15 and then commencing Friday will be Southern Nevada
 16 Water Authority. Beginning next week, because we have
 17 multiple parties over multiple days, if we had happen
 18 to conclude a particular participant early, then we'll
 19 go ahead and immediately move into the next
 20 participant.
 21 And also, I just wanted to address on
 22 October 3rd we had originally scheduled Technichrome as
 23 a participant based upon their submission of initial
 24 report. We've subsequently been notified by

Page 486

1 Technichrome that they are not going to present anyone
 2 with respect to that submission. And so, we're just
 3 going to go ahead and move -- advance everyone, you
 4 know, basically by that time.
 5 So, I just wanted to find out or just provide
 6 notice to the Moapa -- or excuse me -- the Muddy Valley
 7 Irrigation Company unless it presents some form of a
 8 scheduling problem, anticipate that we would probably
 9 start you on October 3rd. And then we're going to move
 10 that additional time that was allotted to Technichrome
 11 for public comment just because we had tried to
 12 maximize the time for all the participants and limited
 13 the time for public comment, and that was certainly
 14 our -- our desire was to allow for additional time for
 15 public comment as that was an essential component of
 16 our public process.
 17 So, that's just kind of a little bit of
 18 forecast into next week. And I thank you very much,
 19 and we'll go ahead conclude today's hearing.
 20 Yes, Ms. Harrison?
 21 MS. HARRISON: Now, if you don't mind, can you
 22 let us know when transcripts might be available? I
 23 mean, how soon they would be available online.
 24 HEARING OFFICER FAIRBANK: The question was how

Page 487

1 soon the transcripts would be available, and I don't
 2 have a good answer to that right now. But, I can go
 3 ahead and have an answer by tomorrow.
 4 MS. HARRISON: Thank you.
 5 HEARING OFFICER FAIRBANK: All right. Thank
 6 you very much everyone.
 7
 8
 9 (End of Proceedings.)
 10
 11 * * * * *
 12
 13
 14
 15
 16
 17
 18
 19
 20
 21
 22
 23
 24

1 CERTIFICATE
2
3 STATE OF NEVADA)
4)SS.
5 CARSON CITY)
6

7 I, Kathy Terhune, CCR 209, do hereby certify
8 that I reported the foregoing proceedings; that the
9 same is a true and correct rough draft as reflected by
10 my original machine shorthand notes taken at said time
11 and place, Pages 380-488.
12

13 Dated at Carson City, Nevada, this
14 26th day of September, 2019.
15
16

17 _____
18 CCR #209
19
20
21
22
23
24

#	481:15;483:3 actions (6) 400:21;401:23; 459:2;469:18,22,24	agencies (2) 390:2;398:24 agency (2) 463:12,14 acts (1) 410:24 actual (3) 402:19;409:17; 439:24 actually (14) 397:5,8;404:10; 405:17;409:2,13; 432:8;437:21;440:13; 454:2;460:16;462:22; 481:22;483:15	426:12 amended (1) 463:17 Ameousphonetic (1) 476:6 amount (9) 391:9;392:1,20; 402:15;454:8;456:6; 458:11;459:6;470:19 analyses (1) 480:20 analysis (13) 408:11;413:18; 436:1;440:20;442:14; 443:11;451:17;472:6; 476:4,14,16;481:12; 484:12 analyze (4) 440:10,24;480:13; 484:12 Angeles (1) 381:23 angles (1) 452:10 animals (8) 399:9,13;400:19; 401:6;402:2;459:5,9; 469:12 annum (1) 393:12 ANSWERED (6) 414:20;429:20; 470:10;483:21,24; 484:8 anticipate (1) 486:8 anticline (5) 433:2,3,4,10,14 anticlines (1) 432:22 apart (1) 409:16 Apcar (3) 400:9;455:23,24 apologize (1) 443:2 apparent (1) 433:24 apparently (1) 413:14 appear (2) 394:23;468:14 APPEARANCES (2) 381:1;382:1 appears (3) 385:13,16;400:15 applications (1) 428:7 apply (2) 455:6;477:21 Appreciate (4) 388:15,16;441:24; 485:3	approach (2) 452:3;459:8 approached (1) 399:10 approaches (1) 483:12 appropriated (1) 417:10 appropriation (2) 421:15,17 approval (1) 463:7 approved (1) 463:15 approximate (1) 476:17 approximately (3) 406:24;459:4;475:9 approximation (1) 476:19 aquifer (37) 403:21,21;404:1,1,8, 13,16;405:2,13,14,20, 23,23;408:5,10,16; 409:24;410:4,24; 411:11;412:11,11,20, 24;413:1,24;414:1,22, 22;416:1,14;433:20, 22;434:22;437:7; 456:7,12 aquifers (8) 405:1,4,6,20;409:7; 412:22;414:18;426:15 AREA (28) 380:11;386:15; 391:5;395:18;404:5, 14,17;405:21,24; 406:19,24;409:14,22; 410:5;411:23;412:5,7, 12,21;414:23;425:21; 426:15;428:22;436:7, 23;437:1;467:1;477:12 areas (6) 387:21,24;413:4; 430:22;435:19;457:17 around (9) 402:3;423:22; 433:14;452:10;457:22; 468:5,8;469:12;482:13 arrived (1) 396:1 Arrow (6) 437:24;438:2,17; 455:5,11;465:6 assume (3) 422:22;466:4;467:24 assuming (7) 397:12;418:23; 420:6,8,9;421:24; 422:12 assure (1) 459:10 attempt (2)
#209 (1) 488:18		agreement (4) 437:18;438:7,10,13 ahead (14) 384:5;386:13; 394:12;429:7;441:8; 457:2;473:10;479:3,4, 10;485:19;486:3,19; 487:3 air (1) 445:9 al (11) 402:6;404:3;406:17, 24;407:16;412:3,5; 456:14;478:6,17;483:2 Alex (1) 382:8 Allison (1) 382:5 allotted (1) 486:10 allow (6) 423:5;424:21;426:6, 10;449:8;486:14 allowed (2) 422:14;459:3 alluded (1) 432:14 alluvial (41) 398:2;403:21;404:1, 8,13,16;405:1,5,6,14, 20,23;409:7,23;410:4; 411:6,10,23;412:11,16, 22;413:1;414:18,22; 424:22,22;425:15,21; 426:4,6,11,14,19,20, 22;427:2,3;428:5,20; 430:21,22 almost (2) 409:13;430:23 alone (1) 440:23 along (2) 409:7;419:1 although (2) 434:15;476:3 altogether (1) 426:8 always (2) 450:4;474:6 Amargosa (1)		
/				
/// (4) 474:23,24;479:16,17				
A				
ability (1) 428:18 able (5) 390:7;394:10;424:6; 427:4;449:6 above (3) 387:24;398:3;450:9 Absolutely (2) 399:5;457:11 abundance (2) 456:22;457:8 accept (2) 429:4;442:10 acceptable (2) 468:23;469:5 accomplished (1) 401:2 accomplishing (1) 458:13 according (4) 412:2;413:17; 419:12;439:7 account (1) 451:3 accounted (1) 436:15 accurate (1) 415:6 accurately (1) 449:7 acre (1) 423:16 acre-feet (11) 393:12;418:23; 419:12;422:15;447:5, 14;453:7,20;475:9; 476:1,6 acre-foot (1) 423:1 across (3) 395:17;433:4;476:7 Act (14) 389:8,11,18;390:8; 398:23;399:2;403:23; 448:13;449:1,21; 450:9;467:12,18,19 Acting (1) 381:4 action (4) 390:3;457:16;				

389:13;438:8 attenuated (2) 407:12;478:12 attenuating (1) 407:19 attest (1) 456:13 attorney (3) 386:24;423:20;460:1 attorney/client (1) 463:20 attributes (1) 484:14 augmenting (1) 455:23 Australia (3) 432:24;440:17;481:1 authorities (1) 399:1 Authority (2) 448:8;485:16 authors (1) 460:18 available (12) 391:9;420:16;424:2; 442:13;462:14,17,20; 463:11;482:11;486:22, 23;487:1 average (20) 385:19,21,23,24; 386:1,2,3;388:5,6; 398:10;419:13;445:23, 23;446:11;447:13; 452:8,9,21;453:1; 468:19 avoiding (1) 400:16 aware (6) 390:7;394:3;399:7; 455:10,14;469:19 awareness (1) 389:17 away (1) 416:6 axis (2) 386:8;474:4	399:23;468:4 ballparked (1) 408:22 Band (4) 382:7;441:23; 478:22;485:14 barn (1) 427:7 Barnes (1) 381:8 barrier (2) 403:24;454:9 base (2) 425:12;458:18 based (20) 400:15;402:5; 415:19,21;425:14; 427:19,23;428:13,14; 433:19;436:1;448:20, 21;459:2;467:11; 471:7;474:18;476:3; 477:18;485:23 Basically (7) 387:5;393:24; 425:13;428:14;435:8; 453:19;486:4 basics (1) 427:18 BASIN (12) 380:8,9,10,12; 407:19;413:9,15; 414:2;415:4,12;437:9; 465:17 basins (8) 387:11,13,20; 392:19;420:2;442:15; 475:15;477:15 basis (7) 389:20;396:17; 405:10,15,15;437:9; 485:2 bear (1) 442:1 became (1) 462:16 Beck (2) 409:2,19 becomes (1) 434:5 beginning (3) 404:23;440:13; 485:16 behalf (1) 424:14 behaves (1) 452:6 behind (1) 433:9 Belaustegui (1) 381:19 below (7) 386:15;387:24; 392:21;439:9;450:7;	467:24;468:1 bench/ (1) 420:23 beneath (1) 408:8 Benedict (9) 381:11;383:10,22; 429:9,9,13;477:4,4,7 best (8) 389:17;397:14; 402:21;416:5;420:16; 437:20;476:18,22 bet (1) 426:8 Beth (2) 382:7;441:23 better (10) 389:24;404:9,12; 437:5;452:3,22; 453:11;455:1,8;477:20 Big (13) 406:13,23;407:10; 409:24;419:22;431:23; 475:5,7;477:12,24; 478:2,3,9 bigger (1) 482:22 biggest (1) 481:24 Biological (10) 388:11,13;413:12; 448:20,22;450:11; 456:4;466:11,16;484:6 biologist (1) 451:15 biology (2) 483:18;485:1 Bird (2) 411:20,22 bit (8) 429:17;434:5; 435:19;445:21;458:12; 485:7,10;486:17 BLACK (1) 380:8 Bliss (1) 381:14 both (9) 429:20;433:21; 460:19;461:9;462:4; 466:19;471:18,22; 480:12 bottom (2) 433:7;443:1 boundaries (4) 390:20;437:8;471:2; 475:13 bow (1) 458:13 branch (1) 409:9 BRAUMILER (1) 450:22	BRAUMILLER (39) 384:20;388:22; 389:5;391:21;392:24; 403:9,12,14;414:15,20; 416:3;424:16,24; 429:19;431:8;432:13; 433:18;438:15;439:23; 440:4;447:11;453:14; 460:8,11;464:7; 466:19,22;467:2; 468:10,12,13;470:10; 473:17,20;475:3,11; 480:3;483:24;484:20 Braumiller's (1) 391:16 BRAUMMILLER (1) 430:11 break (1) 479:4 brick (1) 479:3 Bridget (1) 381:14 brief (2) 417:18;454:21 briefly (1) 460:15 bring (3) 418:11;445:8;452:19 brings (1) 452:15 budget (5) 413:18;475:8;476:3, 14,16 build (1) 466:20 button (1) 384:13 buzzer (1) 454:14	came (1) 467:21 can (37) 384:14;385:19; 390:21;392:20;395:16; 396:5;400:8;406:1; 417:18;418:13;420:14; 421:12;426:24;427:23, 24;430:7;438:8; 442:21;443:5;446:10; 453:7,13;457:4,7; 458:3,16,18;459:15; 468:8,8;470:19; 477:13;478:7;479:24; 484:3;486:21;487:2 Canyon (6) 437:24;438:2,18; 455:6,11;465:6 capture (4) 389:12;434:19; 435:8,9 captured (2) 392:20;423:12 captures (1) 434:23 capturing (1) 434:14 carbon (1) 461:8 carbonate (57) 391:17,24;392:8,12, 15;398:2;403:20,24; 405:2,4,8,13,20,23; 408:5,8,10,16;411:10; 412:11,13,14,20,24; 413:24;414:1,17,21; 416:1;419:24;424:22, 22;425:15,22;426:3,7, 9,10,19,20,21;427:3; 428:6,21,23;430:23; 434:22;435:3;447:6; 456:7,12;458:15; 461:1;466:23;467:15, 18;471:19 carbonates (5) 407:18;411:6,20,22; 454:4 Carbonate's (1) 456:18 care (1) 399:14 Carson (5) 381:17;382:6;384:1; 488:5,13 case (4) 395:24;420:23; 459:1;463:1 cases (2) 430:2;444:17 catastrophic (1) 472:2 cause (2) 439:1;472:20
B			C	
back (21) 384:5;386:1,4,5,21; 403:22;414:5;418:13; 432:12;438:11;439:19; 441:6;456:3;458:8; 466:17;479:4,10,10,21; 480:22;481:9 bad (3) 426:5,7;474:4 Baldwin (6) 382:7;383:15; 416:19;417:5;441:22, 23 ballpark (2)			CA (1) 382:18 calculate (2) 400:2,3 calculations (1) 419:12 calendar (2) 419:14;447:14 California (11) 381:23;405:21,24; 413:6,16,22;414:1,24; 426:15;436:16,22 call (3) 420:11;430:4;457:10 called (1) 384:21 calling (1) 477:23 calls (2) 450:7;463:20	

<p>caused (2) 416:14;467:4</p> <p>causes (4) 443:21;466:24; 467:8,15</p> <p>causing (3) 401:16;447:6;474:12</p> <p>caveat (1) 402:5</p> <p>Caviglia (7) 382:2;383:9;424:14, 14,19;429:5;473:9</p> <p>CCR (2) 488:7,18</p> <p>CCRP (1) 476:4</p> <p>cease (3) 392:14;438:3;458:15</p> <p>Center (6) 388:11,13;456:4; 466:11,16;484:5</p> <p>Centers (1) 466:11</p> <p>central (3) 423:23;465:2;471:14</p> <p>certain (1) 437:23</p> <p>certainly (7) 395:14;401:10; 402:11;445:10;459:6; 464:17;486:13</p> <p>CERTIFICATE (1) 488:1</p> <p>certificated (1) 425:10</p> <p>certify (1) 488:7</p> <p>cetera (2) 395:23;435:10</p> <p>CFS (7) 406:16;408:18; 438:2;450:15;455:15, 22;468:22</p> <p>challenge (1) 426:5</p> <p>chance (3) 406:12;460:13; 471:24</p> <p>change (13) 398:20;421:17,22; 422:15;423:1,15; 426:21;428:7;431:11; 434:4;445:6,8;446:2</p> <p>changed (1) 427:3</p> <p>changes (3) 407:11,20;445:11</p> <p>characterization (3) 432:5;440:16;476:13</p> <p>characterize (2) 464:14,24</p> <p>charts (2) 393:24;394:11</p>	<p>Chief (2) 381:7,10</p> <p>chime (2) 448:18;454:24</p> <p>chose (1) 420:15</p> <p>Christi (3) 435:16;473:13,16</p> <p>chromiability (1) 406:20</p> <p>chunk (1) 408:1</p> <p>cite (2) 432:23;452:12</p> <p>citing (1) 393:17</p> <p>citizens (1) 390:7</p> <p>City (10) 381:17;382:6,13; 384:1,6,11,17;466:6; 488:5,13</p> <p>clarification (3) 460:24;464:11,21</p> <p>clarify (9) 393:5;431:9;444:10; 464:17;470:9;479:24; 480:11;484:4,9</p> <p>clarifying (2) 437:17;484:19</p> <p>clear (8) 405:17;435:3;443:3; 453:15,16,20;454:11; 477:9</p> <p>clearly (7) 408:4;409:23; 410:15;439:10;440:24; 454:6;475:17</p> <p>climate (19) 387:19;429:14,18; 430:19;431:14,20; 439:5,9,11,16,17; 444:21,23;445:2,6,8; 452:15;478:21;481:18</p> <p>climates (1) 387:22</p> <p>climate's (1) 466:4</p> <p>close (12) 398:14;399:17,17; 426:4,22,23;427:4; 434:18,19;435:2; 462:8,18</p> <p>closer (2) 402:11;426:13</p> <p>closest (1) 444:8</p> <p>clue (1) 431:19</p> <p>coexist (1) 458:3</p> <p>coincidence (1) 407:5</p>	<p>colleague (1) 456:20</p> <p>colleagues (1) 472:16</p> <p>collect (1) 389:12</p> <p>collected (1) 461:5</p> <p>collection (2) 464:13,23</p> <p>collectively (1) 482:19</p> <p>columns (1) 437:24</p> <p>citing (1) 415:14</p> <p>combine (1) 478:2</p> <p>combined (1) 399:12</p> <p>combo (1) 392:2</p> <p>comfortable (2) 400:5;446:16</p> <p>coming (13) 400:9;404:18;407:7; 413:21,22,23;428:17; 446:21;454:5;475:20; 476:19,21;477:10</p> <p>commencing (1) 485:15</p> <p>comment (3) 486:11,13,15</p> <p>common (2) 394:3,20</p> <p>Company (6) 382:5;414:8,13; 460:7;473:5;486:7</p> <p>compared (2) 407:12;478:12</p> <p>compartmentalization (1) 454:12</p> <p>compatible (1) 459:5</p> <p>complete (2) 454:11;481:2</p> <p>completed (8) 405:3;432:21;433:9; 462:5,11;464:13,22; 471:18</p> <p>completely (3) 407:22;427:20; 460:20</p> <p>completion (1) 460:24</p> <p>complex (2) 401:9,22</p> <p>compliance (7) 448:14;449:1,21; 450:5;472:21;483:16, 17</p> <p>complicated (2) 426:17;447:1</p>	<p>component (1) 486:15</p> <p>concept (1) 434:9</p> <p>conceptual (4) 413:19;432:15; 476:4,15</p> <p>concern (1) 426:20</p> <p>concerning (2) 460:19;461:7</p> <p>conclude (4) 395:1;485:9,18; 486:19</p> <p>concluded (3) 405:6;411:19;412:9</p> <p>concludes (1) 417:8</p> <p>conclusion (6) 405:16;415:17,20, 24;453:7;474:2</p> <p>conclusions (1) 483:13</p> <p>concurrence (1) 458:1</p> <p>conditions (3) 386:4;422:5;424:9</p> <p>conduct (3) 389:13;463:4;472:11</p> <p>conducted (3) 461:6,7;469:18</p> <p>conductive (1) 478:5</p> <p>conductivity (1) 432:24</p> <p>conduit (1) 478:10</p> <p>cone (2) 434:13,16</p> <p>confident (2) 395:13;413:3</p> <p>confirm (2) 415:10;466:23</p> <p>confirmed (1) 467:11</p> <p>conflict (2) 396:3;428:2</p> <p>confused (1) 455:5</p> <p>Congress (1) 398:24</p> <p>conjunctive (1) 423:22</p> <p>connected (1) 477:24</p> <p>connection (14) 405:4;406:3;408:13; 411:10,17;412:10,17, 23;413:4;464:15,24; 471:13,19;477:21</p> <p>connectivity (3) 408:12;433:14; 482:20</p>	<p>consensus (1) 445:1</p> <p>consequence (1) 425:17</p> <p>consequences (2) 437:22;439:2</p> <p>Consequently (1) 465:2</p> <p>CONSERVATION (2) 380:2;469:17</p> <p>conserve (4) 389:2,2;396:16; 398:24</p> <p>consider (7) 401:4,7;421:9;423:7; 425:4,9;447:8</p> <p>consideration (3) 440:21;450:14,16</p> <p>considerations (1) 440:9</p> <p>considered (2) 464:11,20</p> <p>consistent (2) 421:3;443:19</p> <p>constant (9) 397:11,11,12;420:2, 2;440:21;447:20,21; 474:7</p> <p>constitutes (1) 467:13</p> <p>construct (1) 393:7</p> <p>consultation (2) 472:11,22</p> <p>consumed (4) 421:15,16,20;422:6</p> <p>contact (2) 411:22;412:1</p> <p>continued (1) 398:16</p> <p>continuing (2) 392:23;474:17</p> <p>contradict (1) 435:11</p> <p>contribute (2) 397:23;401:14</p> <p>contribution (2) 410:15;418:19</p> <p>conversations (1) 450:4</p> <p>convinced (1) 411:24</p> <p>Cooper (8) 383:11,20;435:15, 16;437:12;473:13,13, 16</p> <p>correctly (2) 403:14;463:6</p> <p>correlated (1) 477:16</p> <p>corresponds (2) 407:14;453:17</p> <p>counsel (1)</p>
--	--	--	--	---

414:13 count (1) 457:22 counts (1) 456:23 County (4) 459:22,24;460:6; 464:5 couple (9) 384:18;431:4,7; 460:15;479:20;480:9; 481:9;483:12;485:6 course (4) 397:24;416:12; 459:16;462:20 court (3) 418:5;420:23;424:3 cover (1) 399:21 co-witnesses (1) 389:22 Coyote (13) 395:17;436:2,3,21; 441:11;453:9,21; 454:7;464:15;465:2; 471:14;475:21;476:21 creates (1) 436:14 creating (1) 453:22 Creek (13) 403:23;404:4,9,14, 18;406:18,22;407:3; 408:2;410:22;411:7; 412:4,6 criteria (4) 399:6,7,19;472:8 critical (2) 452:13,16 critically (1) 452:13 cross-exam (1) 484:6 CROSS-EXAMINATION (7) 385:1;388:19;403:7; 414:10;424:18;437:15; 456:4 cross-section (1) 461:11 CSBM6 (1) 436:21 CSI (3) 381:19;433:5;453:17 CSV2 (2) 436:7,22 CSVM1 (1) 394:1 CSVM2 (1) 394:1 CSVM4 (1) 394:1 CSVM6 (1) 394:1	CSVM-6 (1) 436:2 CSVN (2) 394:13,22 CSVNS (1) 432:12 cumulative (4) 451:24;452:4,11,14 curious (2) 432:16;438:6 current (4) 425:15;468:3;469:2, 8 currently (5) 399:7;401:13;469:2; 477:23;478:8 curtailment (1) 455:6 curve (1) 436:11 cut (1) 439:19	474:17 declined (1) 387:13 declines (12) 395:16;396:8; 398:16;401:16;416:19; 447:16;466:24;467:4; 468:20,21;469:4;472:2 declining (11) 387:18;395:12,15; 396:5;397:17,19; 435:4,9;468:11;474:8, 11 decrease (3) 391:8;395:24;446:2 decreases (1) 437:3 decree (10) 417:13;418:3,5; 420:22;421:9,14; 422:12;423:14,21; 424:2 decreed (21) 396:11;397:13; 398:8;417:10,22; 418:10;419:1,6;420:7; 421:10,21;422:1,23; 423:3,6,13,14;424:6; 470:13,20,23 dedicated (1) 455:15 dedication (1) 455:22 deep (5) 407:8,19,21;432:20, 20 defer (1) 453:13 define (1) 465:19 defined (2) 458:19;467:17 defines (1) 439:1 Definitely (2) 389:9;402:4 definition (2) 389:10;423:9 degree (1) 399:15 Delamar (2) 442:5;444:19 delayed (2) 444:21;478:21 delineated (1) 437:1 delineation (1) 437:6 delisting (3) 399:6,9,19 demonstrate (2) 405:22;406:1 demonstrated (2)	411:16;413:6 demonstrates (1) 437:22 DEPARTMENT (1) 380:2 departure (5) 451:24;452:4,11,14, 14 depending (1) 430:20 depends (3) 408:23;422:16;424:8 depicting (1) 393:24 depicts (1) 459:1 deplete (1) 422:14 depleted (1) 422:24 depression (2) 434:13,16 depth (4) 407:7,9,17;478:14 depths (1) 478:11 describe (2) 403:21;474:1 described (9) 403:19;404:22; 406:21;429:18,19,22; 432:16;436:3;475:4 describing (1) 439:24 Desert (3) 426:12;442:5;443:21 desire (1) 486:14 Dessert (1) 444:20 detail (1) 452:18 details (3) 389:20;399:6;461:18 detect (2) 426:24;427:5 determination (3) 418:7;421:1;424:5 determine (4) 410:9;443:14; 461:24;463:17 determined (3) 422:12;424:3;439:4 determining (1) 441:2 Dettinger (1) 405:11 developed (1) 390:21 development (1) 422:14 deviations (1) 451:18	diagnose (1) 477:13 difference (3) 404:5,7;440:1 different (11) 405:9,10;408:5; 413:7;419:23;422:11; 423:12;439:5;476:23; 477:11;483:12 differentiating (1) 440:1 difficult (6) 401:24;402:3,17,18; 450:1;484:14 direct (6) 388:21;390:1; 406:11;408:12;417:8; 456:21 directed (1) 414:14 direction (1) 410:5 directly (1) 402:19 disagree (1) 464:8 discharge (10) 393:18;407:3,20; 409:1,5;420:3;425:16; 433:21;437:23;447:7 discharges (3) 409:9,18;454:8 discharging (4) 410:1;475:7;478:4, 15 discipline (1) 484:24 disconnects (1) 433:3 discuss (2) 403:18;483:15 discussed (4) 404:1;408:7;418:10; 434:6 discussing (2) 408:6;479:22 discussion (1) 419:15 discussions (1) 429:15 disruption (1) 433:13 distance (2) 437:4;478:14 distribution (1) 445:12 District (15) 382:4,10;418:5; 420:23;424:3;448:9; 454:16,21;455:10,15; 459:22,24;460:7; 464:5;469:15 district's (1)
	D			
	dace (47) 388:17;391:12; 392:1,7;396:18; 397:10;399:6;400:8, 12,14,17;401:20;402:9, 20,20;420:4;455:16; 456:8,8,22,23;457:1,7, 17,21;458:3,3,4,13,14, 21,23;459:3,16,16,18; 467:9,13;468:24; 469:6,9;470:2;482:1,8, 10,15,23 Darn (2) 466:5;478:4 data (21) 388:2;394:24;400:7, 15;402:21;405:19; 406:2,4;427:1;457:23; 461:5,20;462:13; 464:14,23;471:7,8,8; 476:12;477:18;480:19 Dated (1) 488:13 day (2) 441:24;488:14 days (1) 485:17 deal (1) 407:8 debate (1) 426:12 declared (1) 398:23 decline (12) 387:15;394:23; 395:19,20;398:12; 416:15;439:2,4; 442:22;447:7;469:5;			

455:19 disturbance (1) 400:20 Diversities' (1) 456:4 Diversity (5) 382:16;388:11,13; 466:11,17 Diversity's (1) 484:6 divides (1) 386:14 DIVISION (2) 380:3;385:15 document (1) 448:14 documented (1) 409:20 DOI (4) 415:20,21;416:21; 435:22 domain (2) 419:2;420:19 done (8) 428:1;435:24; 437:22;443:11;451:23; 467:23;472:22;483:2 Donnelly (15) 382:16;383:6,19; 388:12,12,20;390:23; 391:2,3;402:23;447:4; 456:5;466:12,15,16 down (15) 399:6,13;409:10; 422:3,6;423:6;425:17; 436:3;446:8;449:2,10; 459:12;475:16,18,20 downhill (1) 433:8 downlisting (3) 399:8,18;458:19 downstream (1) 422:6 Dr (30) 390:2,5;391:4; 398:21;399:3;448:10, 15,18,23;449:5,13,18, 24;450:19;451:16,20; 453:2;454:23;455:12; 456:3,10;466:19; 467:4,6;468:15,18; 472:17;482:3;484:8,21 draft (1) 488:9 drainage (1) 433:7 drawdown (6) 435:23;436:9,12,15, 24;473:22 drawdowns (1) 437:2 drawing (3) 386:10,11;388:23	drew (1) 386:7 driller (1) 481:11 drives (1) 405:7 drop (1) 443:21 drought (5) 385:19,21,24; 386:19;452:23 Dry (6) 442:4,18;444:1,7,20; 445:23 due (4) 396:1;412:10;437:2; 485:10 duly (1) 384:22 duration (1) 438:5 during (16) 398:10;406:18; 418:8;429:22;433:20; 438:18;447:17,21; 453:3;455:6;457:8; 458:8;469:15;470:2; 471:10,12 Dylan (1) 459:24 dynamics (3) 430:10;440:7,12	407:18;429:20;460:19; 461:5;479:24 elaborate (1) 435:18 elements (1) 399:4 else (6) 395:8;418:8;430:6; 431:24;450:21;454:23 embark (1) 472:19 embarking (1) 472:11 employees (1) 388:24 encased (1) 408:2 end (9) 390:23;398:13; 409:21;433:22;435:5; 437:4;457:5;483:18; 487:9 Endanger (2) 449:1;467:19 Endangered (13) 389:8,11,18;390:8; 398:23;399:1;448:13; 449:21;450:8;467:12, 18;472:10,21 ended (1) 474:5 Energy (4) 382:2;424:13,15; 473:7 enforce (1) 390:8 enforcing (1) 450:24 engage (1) 389:13 Engineer (14) 381:4;405:2,5;417:7; 418:2;420:22,24; 421:10;424:21;427:20; 429:7;450:14;451:2; 473:11 Engineer's (10) 405:15;418:6;419:2; 420:9,19;421:6;424:4; 451:1;455:3;462:19 enhance (2) 389:3;396:16 enough (14) 396:10;402:1;423:5; 428:12;434:23;435:9; 439:9;440:24;447:2; 458:6,10;472:5; 476:12;482:19 enters (1) 477:11 entertain (1) 450:4 entities (2)	390:9;449:15 entitled (2) 422:23;423:15 Environmental (2) 403:3;448:13 equilibrium (5) 433:18,22,24;434:9, 12 equilibrium's (1) 434:7 ESA (6) 448:20,21;483:11, 13,16,17 Especially (1) 458:4 Esq (9) 381:18,20;382:2,7,8, 10,12,16,17 essential (2) 400:1;486:15 essentially (2) 405:5;484:6 estimate (8) 393:13;397:14; 399:23;400:6;420:17; 421:22;443:5;476:1 estimated (1) 436:24 et (14) 395:23;402:6;404:3; 406:17,24;407:16; 412:3,5;435:10,10; 456:14;478:6,17;483:2 evaluated (1) 480:19 evaporates (1) 446:24 even (8) 387:23;428:2; 438:11;439:17;440:14; 474:4;481:20;485:9 event (3) 400:20,23;410:7 events (2) 445:20,21 everyone (3) 455:5;486:3;487:6 everywhere (1) 431:24 evidence (4) 398:9;402:6;430:4; 432:4 evolution (1) 403:18 exactly (6) 411:18;412:17,23; 422:19;457:23;458:23 EXAMINATION (10) 429:12;435:14; 439:21;441:21;460:3; 466:14;473:15;475:1; 477:6;479:18 examine (1)	444:19 examined (1) 384:23 example (1) 428:4 except (1) 452:6 exception (1) 480:15 exceptionally (7) 408:15;416:1; 425:19;426:8;428:23; 434:22;437:7 excuse (3) 417:9;421:16;486:6 exercise (2) 472:12,20 exhausted (1) 422:13 Exhibit (11) 385:5;403:11;418:2, 14;420:22;421:6,10; 437:21;438:4;452:12; 455:3 existing (2) 461:1;464:22 expand (1) 459:3 expands (1) 434:13 expansion (1) 457:17 expansive (1) 434:16 expect (4) 445:11;446:1,3,7 experience (5) 388:23;432:23; 480:12,21;481:4 experiencing (4) 445:22;468:20; 469:3,4 expert (3) 483:17,22;484:21 explain (3) 407:2;445:14;457:13 explained (1) 407:24 explanation (2) 405:9;417:18 explicit (1) 484:12 explicitly (1) 483:6 explore (1) 468:2 expressed (1) 462:3 extended (2) 437:6,6 extends (4) 436:2,4,16;437:5 extensively (2)
E				
	earlier (15) 386:22;387:1; 419:11;445:18,19; 446:21,24;466:22; 467:12,18,22;468:10; 469:14;470:10;471:4 early (6) 443:22;457:5;481:5; 485:10,12,18 easily (2) 480:17,21 East (2) 416:15;436:7 education (1) 440:11 effect (4) 400:22;412:13; 431:4;455:23 effects (2) 399:11,12 efficiency (1) 485:10 EH4 (1) 436:8 eight (1) 442:18 Either (7) 391:19;398:2;			

410:23;411:2 extent (3) 411:7;449:1;470:8 extinct (1) 401:1 extinction (2) 400:17;401:2 extra (1) 485:7	fault (15) 453:18,24;454:2,3,6, 7;460:22;461:9,15; 462:4,5,10;464:12,22; 471:18 faults (2) 453:17;461:16 features (1) 484:13 February (1) 457:22 federal (1) 424:3 feel (3) 401:2;454:24,24 feet (7) 412:22;421:18; 423:1;432:21;436:8, 23;473:23 felt (1) 439:9 few (5) 398:21;400:14,19; 442:2;479:14 field (2) 416:1;425:19 figure (10) 385:16;394:11,15; 395:5;400:6;411:18; 435:18;461:10;465:14; 474:1 figures (4) 385:9,12;387:23; 393:23 figuring (1) 431:14 file (1) 390:7 fill (3) 407:19;413:9,15 fills (1) 407:11 final (1) 484:19 find (3) 400:12;427:6;486:5 finding (1) 415:3 finish (1) 473:11 finished (1) 483:4 first (10) 388:21;396:24; 411:1;413:8;414:16; 431:19;464:8;481:5, 22;483:14 Fish (29) 382:17;384:21; 388:16,23;389:1,3; 396:15;400:16;401:8; 402:14;403:10;413:11; 418:14;450:3;451:5,	10;458:9;461:23; 462:13,23;464:2; 472:10,19;479:5,11,13; 482:1,6,12 fishes (1) 483:5 fit (1) 408:3 fitting (1) 436:11 five (6) 385:16;406:8;420:1; 436:9;437:9,10 Flangas (1) 382:8 FLOW (75) 380:7;391:4,8,17; 392:8,19;393:7,24; 397:10;401:16;402:7, 16;408:17,21;409:17; 410:17;413:15;418:23; 419:13,24;420:6; 422:5,18;426:1;427:2; 431:22;435:17,21; 436:14;437:23;439:1; 440:6,7,12;441:2; 444:11;450:6,9,15,18; 451:5;456:15;458:2; 462:1;464:4,18;465:3, 18;466:24,24;468:3,21, 23,23;469:3,11,12; 470:12;471:3,15; 475:13,16,19,20,21; 476:2,23;477:2,10,11, 14,23;482:12;483:1,9 flowed (1) 438:1 flowing (5) 407:17;477:1,22; 478:10,14 flows (30) 392:5,10,12,15,21; 393:20,21;396:5,5,9, 18;397:9,17;407:10; 409:9,21;410:1;417:9; 419:20,22;422:14; 430:13;431:18;435:6; 447:16,21;449:10; 453:21;455:23;468:10 fluctuate (1) 402:3 Flume (5) 394:2,14;395:4,8,13 focus (3) 385:14;387:10; 389:15 focused (1) 387:6 folks (1) 463:13 follow (3) 392:14;427:11; 477:19	following (1) 421:9 follows (1) 384:23 follow-up (1) 441:10 foot (1) 423:2 forces (1) 470:5 forecast (1) 486:18 foregoing (1) 488:8 forging (1) 399:21 fork (1) 400:11 form (1) 486:7 Formation (14) 403:23;404:9,19; 406:18,22;407:3; 408:2;410:22;411:4,7, 20,22;412:4,6 Formations (1) 404:4 Formation's (1) 404:15 formed (1) 482:11 forming (1) 461:19 forward (2) 397:3;443:20 found (1) 409:19 foundation (1) 419:5 foundational (1) 418:9 four (3) 390:19;442:18; 443:22 fractures (5) 432:24;433:1,4,13, 14 frame (1) 457:8 free (1) 454:24 Frehner (1) 459:24 frequent (1) 445:19 Friday (1) 485:15 full (1) 437:8 fully (6) 417:10;421:15,16, 20;422:2;464:24 function (1)	481:15 functions (1) 400:1 funded (1) 481:2 further (7) 388:8;417:7;424:11; 437:5;441:13,21;473:8 furtherance (1) 399:2 future (1) 482:24 FWS (1) 385:5
F			G	
facilitate (1) 461:4 fact (7) 404:15;407:13,24; 410:2;418:15;451:10; 480:6 factor (1) 441:1 factors (4) 397:23;446:23; 447:8;469:10 fades (1) 416:6 fair (6) 421:23;447:2; 448:14,24;450:6; 476:13 FAIRBANK (33) 380:4;381:2;383:13; 384:4,15;388:10; 390:12,18;391:1; 402:24;414:4;416:3; 424:12;429:6;439:23; 441:14,17;448:3; 454:15;459:21;463:22; 466:6,9;473:1,4,7,10; 479:2,9;480:10; 484:17;486:24;487:5 FAIRBANKS (1) 441:5 fairly (2) 469:9;474:7 falling (2) 445:24;446:12 falls (1) 446:24 familiar (5) 389:15;423:20; 427:13;456:9;461:14 fanglomerate (1) 408:1 fanglomerates (5) 406:21;407:1,15; 478:5,16 fantasized (1) 459:15 far (11) 407:22;418:8; 421:18;422:15;434:23; 436:4,7;450:8;458:18; 476:8;478:7			gauge (9) 409:2,16;418:24; 419:13,24;450:7,15; 482:2,14 gages (1) 480:17 gaining (4) 409:11,13,16,23 gains (1) 409:22 GARNET (3) 380:9;436:4,22 gathering (1) 476:11 GD1 (1) 436:21 general (10) 391:14;415:17; 429:1,3;467:11; 469:20;474:14,15,16; 478:7 generally (9) 394:23;405:12,14; 410:23;437:3;444:16, 16;467:3;482:10 geographic (1) 390:20 geologic (8) 411:21;412:3,6; 440:9,21;465:20; 480:13,19 Geologist (2) 381:13;440:19 geology (1) 440:23 geophysical (3) 460:9,14,18 George (1) 403:4 Georgia (3) 402:24;403:3;473:1 gets (3) 426:17;454:7;469:13 Given (5) 392:5;401:12,15; 469:9;483:1	

<p>giving (2) 406:11;440:20</p> <p>GLASGOW (1) 441:16</p> <p>goal (4) 392:6,10;402:14; 458:13</p> <p>goals (2) 401:3,5</p> <p>goes (5) 386:21;433:17; 449:2;450:7;468:1</p> <p>good (12) 393:13;403:2; 404:16;414:12;422:10; 447:22;448:7;452:20; 457:21;460:5;481:4; 487:2</p> <p>gradient (2) 412:24;477:2</p> <p>grandfather (1) 421:13</p> <p>Granted (2) 398:19;468:21</p> <p>graph (6) 385:15,15,19;386:8; 443:7;459:1</p> <p>great (2) 401:7;457:19</p> <p>greatly (1) 407:19</p> <p>Greg (2) 382:10;454:20</p> <p>Groundwater (51) 393:20;396:8;397:9; 398:17;405:19;412:13; 413:10,13;415:4,11; 420:1;422:17;424:1,5; 427:17;430:13,15,16; 431:12,17;440:1,6,6,7, 10,12,20,24;441:2; 444:6,13;446:22; 447:16,20;449:9; 450:17;451:11;453:12; 463:10;465:11;468:11; 470:12;471:8,11; 475:13,15;480:7,14,18, 20;484:21</p> <p>guess (10) 385:22;392:2; 404:20;421:24;430:4; 432:8;449:13;451:12; 458:16,20</p> <p>guys' (1) 485:3</p> <p>GVI (3) 394:1;436:4;473:18</p>	<p>389:3;391:4,9,11; 399:20,21,24;402:8,11, 21;456:9,16;458:3,7, 11,14;459:8,16;467:5, 8;468:16,22;469:4; 482:11,12;483:3</p> <p>half (2) 474:7;480:16</p> <p>hand-drawn (2) 411:3;412:3</p> <p>handing (1) 428:18</p> <p>happen (3) 426:22;478:6;485:17</p> <p>happening (1) 413:1</p> <p>happens (4) 407:4;428:21;430:2; 440:11</p> <p>happy (1) 456:14</p> <p>harass (1) 389:11</p> <p>hard (7) 405:19;416:6;426:9; 443:3,7;445:4;446:14</p> <p>hardcopy (1) 443:3</p> <p>harm (1) 389:11</p> <p>harp (1) 480:22</p> <p>Harrison (8) 383:7;403:2,2,8; 473:3;486:20,21;487:4</p> <p>hate (1) 480:22</p> <p>Hatten (3) 402:6;456:14;483:2</p> <p>head (3) 394:9;413:24;417:4</p> <p>headway (1) 401:3</p> <p>health (1) 459:17</p> <p>hear (4) 384:14;416:7; 432:18;463:6</p> <p>heard (2) 454:14;465:5</p> <p>HEARING (42) 380:4,17,18;381:7; 383:13;384:4,15; 388:10;390:12,18; 391:1;402:24;414:4; 416:3,11,19;418:9; 421:12;424:12;429:6; 439:23;441:5,14,17; 448:3;454:15;459:21; 462:21;463:22;466:6, 9;473:1,4,7,10;479:2,9; 484:17,24;486:19,24; 487:5</p>	<p>hearings (1) 416:24</p> <p>heavy (1) 445:20</p> <p>help (1) 406:2</p> <p>hereby (1) 488:7</p> <p>herein (1) 384:21</p> <p>HERREMA (1) 441:13</p> <p>Hi (1) 454:20</p> <p>high (13) 398:11;399:10,10; 406:20,21;408:15; 416:1;425:19;426:8; 428:23;434:22;435:20; 437:7</p> <p>higher (5) 398:7;412:21,22; 413:16,24</p> <p>highly (4) 392:3,4;408:15; 473:19</p> <p>historic (1) 399:24</p> <p>historical (1) 399:20</p> <p>history (1) 401:9</p> <p>hit (1) 384:13</p> <p>holders (1) 422:23</p> <p>honestly (2) 438:8,12</p> <p>horrible (1) 427:5</p> <p>horse (1) 427:7</p> <p>hours (2) 479:21;481:9</p> <p>housekeeping (1) 485:6</p> <p>hundred (2) 412:22;437:10</p> <p>hunt (1) 389:12</p> <p>hydra (1) 411:9</p> <p>hydraulic (10) 406:4;408:12,13; 411:10,17;412:10; 464:14,23,24;471:13</p> <p>hydrogeologic (2) 440:15,15</p> <p>hydrogeologist (2) 440:2;463:10</p> <p>hydrogeology (6) 410:14;440:8,18; 480:23,24;481:5</p>	<p>hydrograph (11) 395:11;407:9;431:5; 432:12,15;442:4; 446:1,4,13;473:24; 474:19</p> <p>HYDROGRAPHIC (1) 380:10</p> <p>hydrographs (11) 394:8,21;417:5; 429:17,21;444:4,22,24; 445:2;474:2;481:12</p> <p>hydrologic (4) 465:16,19;480:13,19</p> <p>hydrological (1) 445:6</p> <p>hydrologist (5) 440:2,6,12;445:5; 451:14</p> <p>hydrologists (1) 463:10</p> <p>Hydrology (5) 381:10;425:13; 428:14;456:13;484:21</p> <p>hypotheses (1) 475:4</p> <p>hypothesis (6) 406:13,17;443:15; 476:12;478:18,23</p> <p>hypothesized (3) 404:24;405:12; 454:10</p> <p>hypothetical (1) 422:1</p> <p>hypothetically (1) 445:22</p>	<p>426:24;428:18,24; 434:6;439:10,11; 445:6;446:16;465:6, 10;470:20;472:9,20; 482:5,6,7</p> <p>implementable (1) 427:9</p> <p>implementation (1) 389:7</p> <p>imply (3) 391:24;392:7;470:10</p> <p>implying (1) 446:6</p> <p>importance (1) 482:21</p> <p>important (3) 406:16;410:8;434:5</p> <p>importantly (1) 401:9</p> <p>impression (1) 414:3</p> <p>improve (1) 483:3</p> <p>include (7) 387:1;442:14; 450:14;462:1,7;463:8; 464:3</p> <p>included (2) 464:10,18</p> <p>includes (3) 385:9;389:7;437:1</p> <p>including (3) 390:9;406:19,19</p> <p>inclusion (1) 464:11</p> <p>inconsistent (2) 434:12;435:7</p> <p>incorporate (1) 459:8</p> <p>incorporated (1) 418:6</p> <p>incorporation (1) 424:4</p> <p>increase (5) 398:1;402:15,21; 457:21;458:7</p> <p>increased (3) 399:14;402:8;426:13</p> <p>increases (3) 443:1,6,12</p> <p>increasing (8) 387:14,16,17;402:7, 20;442:24;470:3,6</p> <p>incremental (1) 468:21</p> <p>incrementally (2) 468:16,17</p> <p>indeed (1) 405:22</p> <p>index (5) 385:20,21,24; 386:19;452:24</p> <p>Indians (2)</p>
H		I		
<p>H4 (1) 436:12</p> <p>habitat (26)</p>		<p>idea (4) 396:2;428:3;439:12; 471:3</p> <p>identified (4) 408:11;453:8; 473:18,21</p> <p>identify (1) 472:8</p> <p>ignore (2) 427:20;451:9</p> <p>II (1) 380:19</p> <p>illustrating (1) 387:10</p> <p>imbedded (1) 418:9</p> <p>immediately (1) 485:19</p> <p>impact (7) 425:16,22;426:2,14; 428:24;446:13;464:4</p> <p>impacting (4) 410:16;427:1;453:9; 470:13</p> <p>impacts (16)</p>		

441:24;485:14 indicated (1) 433:19 individual (4) 391:12;467:8,13; 481:19 individuals (2) 390:2;392:1 induced (3) 435:23;436:12; 473:22 inferred (1) 484:5 inflow (2) 476:5,24 inflows (1) 392:18 influencing (2) 431:17,21 information (5) 440:22;463:21; 480:13;481:11;485:4 informative (1) 462:9 inherently (1) 484:7 initial (6) 397:14;398:5; 403:11;420:16;432:6; 485:23 initiation (1) 395:23 inseparable (2) 440:11,19 insight (1) 429:17 inspection (1) 474:18 instance (2) 397:10;449:2 intense (1) 445:20 intentionally (1) 425:1 interconnected (1) 472:1 interest (2) 387:5;395:3 interested (2) 406:14;429:16 internally (1) 463:9 international (2) 481:1,2 interplay (1) 470:7 interpret (1) 461:7 interpretation (4) 415:22;460:18; 461:4;477:18 interpretations (1) 405:10	interpreting (1) 470:16 interrelationship (1) 417:8 intersect (1) 400:10 into (39) 404:1;405:1,13,23, 23;409:9,21;410:1,4; 411:6;413:1;416:4; 418:11;425:21;426:3, 11,11,21;427:3; 428:21;434:18;436:16; 446:23;450:7;451:3; 452:5,18,19;453:21; 454:8;457:17;462:1; 463:20;464:3;476:20, 21;477:14;485:19; 486:18 intriguing (1) 478:20 introduction (1) 440:18 invasive (2) 399:15;482:12 Investments (1) 441:12 involved (1) 475:9 involves (1) 466:19 Irrigation (5) 382:19;414:7,13; 473:5;486:7 isolate (1) 435:23 isolated (2) 436:8;473:22 issue (4) 390:16,19;482:14,21 issued (1) 420:24 issues (5) 390:20;450:8; 479:23;482:1;483:16 Iverson (5) 394:2,14;395:4,8,13	jurisdiction (1) 450:24 justification (2) 396:13;397:2 justified (1) 393:17 Justina (2) 382:2;424:14 juvenile (1) 400:13	475:17 language (3) 417:11;418:22;435:1 large (5) 410:15;415:24; 428:22;454:4,8 largely (1) 453:23 Las (6) 382:13;384:7,11,17; 448:8;466:6 last (3) 414:16;418:18;472:3 lasted (2) 431:4,7 later (1) 404:24 Laura (3) 382:12;384:11,16 Law (3) 382:13;427:14,24 lawsuits (1) 390:8 layer (1) 436:14 leading (1) 462:12 leakage (3) 404:24;405:13,22 leaks (1) 433:12 least (12) 385:13;387:20; 402:1;408:12;409:2; 410:24;420:1;434:1; 436:2;458:6;471:17; 480:9 leave (4) 396:10;420:8; 428:10;459:20 left (3) 442:3;443:2;460:8 legal (2) 388:24;463:16 length (2) 431:10;433:24 less (12) 412:8;426:3;433:3; 434:5;438:1;446:5,6, 20;457:20;468:9,16,17 level (35) 392:22;393:8;396:6, 9;397:18;401:14,16; 405:19;407:19;412:13, 15;413:10;420:17; 423:7;430:13,14,15,16, 17,21;437:24;446:7; 458:6;461:5;465:11; 468:15,23,23;469:5,8; 471:8,8,11;478:12; 483:9 levels (39) 387:4,10,14,16,16;	393:20,24;396:8; 397:10;412:15;413:9, 16;419:16;420:1; 426:14;430:6,8; 431:12,17;432:9; 433:21;434:1,2;435:3; 444:6,19;447:16,20; 455:3,5;468:11;469:2, 3;470:4;474:14; 475:15,16;480:7,14 lies (1) 422:3 life (1) 401:9 lifespan (1) 401:10 likelihood (1) 404:19 likely (7) 392:3,4;437:8; 458:10;467:10;477:12; 484:10 limestone (4) 406:20;407:1,15; 408:1 limit (1) 482:15 limited (2) 485:1;486:12 limiting (3) 401:20;458:23;485:9 Lincoln (4) 459:21,24;460:6; 464:4 line (13) 386:8,11,13,13,14, 16;387:24;390:16,24; 456:1;467:21;475:19; 481:22 literally (1) 440:17 little (15) 400:12;422:10; 423:11;429:17;434:5; 435:19;445:21;455:5, 8;458:9;468:9,9;485:7, 9;486:17 lob (1) 481:7 local (3) 392:19;409:23; 413:20 located (1) 406:24 location (4) 407:14,15;461:11; 478:8 locations (2) 422:18;472:7 log (1) 481:11 logic (1) 413:7	
	J	K			
	January (1) 386:12 John (4) 381:11;429:9;477:4, 19 Jones (3) 416:20;417:5;455:16 July (2) 462:12;463:1 jump (1) 421:12 June (1) 462:18	Kane (28) 453:18,24;454:2,6; 460:20,21;461:1,2,9, 16,20;462:1,21;463:8, 18;464:3,9,12,15,17, 21;465:1,1;471:4,13, 17;479:22,24 Karen (1) 460:6 Kathy (2) 380:24;488:7 keep (3) 435:9;436:20;454:21 Kent (1) 381:20 key (1) 456:24 kill (1) 389:12 kind (9) 429:16;433:6; 443:11;446:17;469:20; 478:11;479:21;482:11; 486:17 King (7) 383:8;414:11,12; 416:9;424:11;427:12; 473:6 KMW1 (5) 394:24;462:5; 471:10,18;480:6 knocked (1) 399:13 knowledge (1) 467:11 known (2) 437:8;476:2 KPW1 (2) 462:5,8	L		
		L95 (1) 405:11 laboratory (1) 480:16 lack (2) 403:20;463:19 Lake (4) 442:5,19;444:20;			

logs (1) 481:20	381:16	matters (3) 412:18;472:13;485:6	meet (4) 398:8;419:1;420:10; 423:6	mission (2) 389:1;396:16
long (9) 401:11;413:14; 431:11;432:2;441:24; 459:7;472:4,5;479:15	Luke (2) 382:17;479:13	Maxey (7) 404:3;406:17,24; 407:16;411:3;478:6,17	meeting (1) 421:21	mixed (1) 436:20
longer (1) 462:6	LWRS (1) 419:17	Maxey's (1) 412:3	meets (1) 471:19	MOA (18) 392:6;438:16,23,24; 439:7,13;448:11,12,21; 449:1,8,16,21,22; 450:24;455:4,9,15
long-term (1) 481:18	M	maximize (1) 486:12	melt (1) 445:18	Moapa (28) 382:7;388:17;392:1, 7;396:18;397:10; 399:5;400:17;407:18; 409:2,16;418:24; 419:13,24;441:19,23; 454:16,20;455:10,15; 467:23;469:14;478:22; 482:1,10,23;485:14; 486:6
look (16) 386:5;394:9;405:19; 407:9;430:6;436:5; 438:12;443:12;444:22; 461:10,12,19;475:14; 481:19,20;482:16	M1 (4) 436:17,19,20,22	may (25) 402:10,10,10;406:4; 408:13;421:8;426:23, 24;427:4;428:12; 429:19;431:6;433:6; 436:12;438:11;445:8; 446:20,21;448:9; 458:8;459:5,5;465:9; 474:12;485:9	memorandum (1) 437:18	MOA's (1) 469:17
looked (9) 394:8;417:5;431:5; 442:6;444:23;451:17; 452:7,23;453:12	M2 (1) 436:18	maybe (21) 407:18;409:15; 414:3;417:18,24; 422:16;425:1;427:5,8; 429:15;432:20;439:14; 446:9;456:19;468:9,9; 469:7;477:9;480:15; 482:5;484:5	memory (2) 419:11;436:6	model (8) 393:7;413:19,20; 427:19;432:15;476:4, 4,15
looking (21) 385:4,5,18,18;386:7, 11;394:17,21;395:11; 407:17;415:7;430:21; 431:10,13;435:16; 442:17;443:20;446:16; 457:3;460:17;481:17	machine (1) 488:10	Mayer (32) 384:18,20;386:17; 387:2;429:15;431:2,3, 16,18;437:17,19; 438:20;439:6;442:3,7; 448:10,15,23;449:13, 18;450:19;451:16,20; 453:2;454:23;455:12; 465:4,8,16;481:13; 483:21;484:21	mentioned (3) 408:17;410:22; 419:10	modified (1) 470:8
looks (11) 386:1,4;395:14; 430:5,7;431:4;443:19; 452:13;469:11;474:16; 478:1	MacKenzie (1) 382:5	Meadow (6) 408:9;475:16,18; 476:5,20,24	met (3) 399:7;422:2;438:7	Molly (1) 451:23
Los (1) 381:23	magnitude (2) 400:4;443:5	mean (22) 407:7;411:9;419:18; 433:11;434:21;435:7; 439:2;446:18;447:17; 451:9,14,24;452:4,14; 460:16;465:4;470:6; 474:18;475:12;477:13; 478:1;486:23	metric (1) 388:2	moment (2) 398:20;468:2
losing (2) 409:12,14	main (4) 400:10;409:9;410:1; 458:20	meaning (1) 398:13	mic (1) 390:13	monitored (3) 480:1,6,7
loss (5) 423:17;467:4,8,12	maintain (6) 392:10,15;402:1; 420:4;450:14;482:20	means (10) 402:13;407:6; 417:21;418:12;431:14; 439:13;445:14;449:12; 452:11;478:19	MICHAEL (4) 384:20;450:12; 468:5;484:9	monitoring (7) 393:18;394:20; 395:17;412:14;442:18; 471:11;480:6
lost (1) 396:20	maintained (2) 396:19;397:3	meant (2) 396:4;419:7	MICHELINE (2) 380:4;381:2	months (5) 386:1,5;388:6; 460:16;468:17
lot (13) 386:15;388:13; 404:3;409:4;412:3,6; 413:24;426:11;446:23; 452:18,18;457:16,16	maintaining (5) 392:5;396:4,14,14; 402:10	measure (1) 452:20	Michelle (1) 381:8	more (35) 386:15;387:24; 388:15;401:9;402:11; 403:9;410:12,18; 411:8;429:17;432:6; 435:19;436:17;438:23; 442:13,15;444:6,14; 445:16,17,19,20,24; 446:11,15,16;450:8; 457:20;459:8;468:6,9; 475:24;477:12;483:18; 484:10
low (9) 404:2,11;411:4; 433:11;436:13;439:8; 452:22;458:5;459:18	major (2) 400:20;408:6	measurements (4) 393:18;394:24; 395:14;413:10	microphone (3) 390:14;416:5;456:11	morning (2) 406:11;481:23
Lower (31) 392:8,19;408:9; 411:24;413:17;419:17; 422:18;425:24;426:1; 431:21;435:17,20,21; 444:10;450:17;458:2; 462:1;464:4,18;465:3, 17;466:23;470:12; 471:2,15;475:18; 476:5,20,24;477:23; 483:9	majority (2) 387:17;400:8	mechanisms (1) 431:19	mid-1990s (1) 404:23	Morrison (4) 382:10;383:17; 454:19,20
lowers (1) 465:11	makes (1) 407:16		middle (1) 423:17	most (4) 409:16,22;417:24; 430:2
Ltd (1)	making (1) 401:3		Might (13) 390:2;395:12;398:7; 402:2;407:24;416:6; 426:2;429:1;447:9; 448:16;457:13;468:6; 486:22	mostly (3) 413:10;454:5;475:15

480:17 move (6) 428:3,5;482:13; 485:19;486:3,9 moved (3) 424:21;426:13;427:2 movement (2) 390:22;482:19 moving (8) 385:24;386:2,3; 388:14;452:8,9,21; 453:1 much (14) 398:6;424:10; 425:20;432:19;433:2; 452:6,22;480:12; 483:1,3,3;484:18; 486:18;487:6 mud (1) 409:24 MUDDY (92) 380:11;382:19; 391:5;393:21;395:17; 400:11;403:23;404:3, 9,13,14,16,18;405:6, 20,23;406:13,18,19,22, 23;407:3,10;408:2,24; 409:1,3,7,10,14,22,24; 410:5,22;411:7,13,23; 412:4,5,6,7,12,16,21; 414:7,13,19,19,22,23; 415:5,5,12,13,15,15; 417:8,9,9,10,13;418:3, 24;419:1,22,22;422:3, 23;425:16,18,22; 426:15;431:23;435:1; 436:7,23;449:17; 453:9;454:9;466:24; 472:2;473:4;475:5,7; 477:12,13,14,16,24; 478:3,9;486:6 multiple (4) 397:23;470:5; 485:17,17 Mumford (1) 438:5 must (1) 474:5 MW1 (1) 462:7 MX5 (5) 435:4;436:12,15,24; 473:22 MX-5 (1) 435:23 mystery (1) 481:2	441:15,18;485:13 NATURAL (1) 380:2 nature (2) 411:9;464:14 NCA (1) 382:8 nearest (1) 437:8 necessarily (4) 410:2;428:9;446:19; 476:17 necessary (4) 448:19;451:5,10; 481:15 need (9) 384:13;392:14; 411:8,15;444:10; 459:8;472:10,21; 482:20 needed (2) 450:5;460:24 negative (3) 400:24;426:14;429:3 neither (1) 451:15 NEVADA (13) 380:1;381:17;382:6; 384:1;418:5;420:23; 424:13,15;427:14; 448:8;485:15;488:3,13 new (3) 398:14;418:7;476:15 news (1) 474:5 next (12) 384:6;388:10; 400:23;414:7;424:12; 432:11;457:12,20; 459:21;485:16,19; 486:18 nine (4) 389:18;390:4,9; 467:17 nods (1) 389:22 noise (2) 443:16,17 none (1) 463:11 nonnative (2) 483:4,5 nonparties (1) 449:20 Nor (1) 484:1 normal (1) 454:3 North (13) 382:13;384:7,11,17; 400:11;413:15,22; 453:19;466:6;475:17; 476:5;477:10,22	northern (3) 432:23;436:17; 440:16 note (3) 403:22;441:9;459:23 noted (2) 406:23;416:19 notes (1) 488:10 notice (1) 486:6 noticed (2) 413:8;432:19 notified (1) 485:24 nowhere (1) 398:14 NRC (1) 481:2 nuanced (1) 484:11 number (23) 385:6;391:11;393:2; 396:1;397:2;402:19; 415:3;419:8;420:11, 14;421:18;422:15; 423:2,2,2,16;430:22; 459:13;463:13,13; 468:7;469:17,23 numbers (7) 399:10;400:5;443:9; 456:8;458:14;459:18; 482:16 numerical (2) 393:7;413:19 numerous (1) 395:16 nursery (1) 399:21 nutshell (1) 456:6 NV (2) 382:2;473:7	395:16;396:5;398:15 observed (4) 394:19;405:12; 468:10,12 obviously (2) 388:16;430:8 occur (3) 426:24;446:19; 459:15 occurred (1) 431:6 occurring (1) 413:20 O'Connor (1) 381:18 October (2) 485:22;486:9 off (10) 394:8;417:4;435:5; 436:18;439:19;442:3; 454:14;460:8;469:11; 474:11 offhand (1) 400:2 Office (6) 419:2;420:9,19; 451:1;463:14;484:22 OFFICER (33) 380:4;381:7;383:13; 384:4,15;388:10; 390:12,18;391:1; 402:24;414:4;416:3; 424:12;429:6;439:23; 441:5,14,17;448:3; 454:15;459:21;463:22; 466:6,9;473:1,4,7,10; 479:2,9;484:17; 486:24;487:5 official (2) 434:17;471:10 officially (2) 480:1,5 Once (2) 448:7;477:14 one (47) 385:8;388:2,2;396:3; 401:8;410:13;412:9, 19;415:4,11;421:11; 422:20;423:22;424:15; 433:17;435:18;436:17; 437:24;438:23;441:1, 3,3;442:21;443:2; 444:12;445:4;447:3; 449:12;457:2;460:19; 461:5,6,8,17;470:19; 471:19;472:16;473:18, 21;474:22;475:24; 478:1;481:7;482:15, 17;484:19;485:8 ones (1) 395:3 one-year (1) 430:19	ongoing (2) 469:23;470:1 online (1) 486:23 only (15) 413:7;415:19,20; 431:22;436:8;438:5; 441:1;446:5;454:1,1; 455:6;462:9;469:19; 471:19;482:15 open (4) 429:7;473:11;479:4, 10 operates (1) 455:11 operating (1) 419:23 opinion (22) 387:12,18,21; 413:12;421:17;425:12; 429:16;434:1;435:19; 444:6,13;445:1,3; 448:20,22;449:16; 450:13;453:6;461:21; 463:16;474:1;475:6 opinions (3) 388:24;445:5;461:19 opportunity (1) 462:24 opposed (1) 446:12 opposite (1) 410:3 option (1) 437:5 ORDER (21) 380:18;392:15; 398:10;400:4;407:23; 410:16;415:22;416:12, 18,22;417:7;418:6,10; 420:24;440:9;457:4; 471:9;473:22;474:3; 478:2;480:5 original (1) 488:10 originally (1) 485:22 others (3) 412:7;429:24;477:17 other's (1) 466:20 out (14) 409:19,20;411:18; 416:6;426:19,20; 427:6,7;431:14; 434:14,23;452:15; 480:17;486:5 outside (1) 477:22 outstanding (2) 393:6;410:14 over (9) 405:10;412:2;433:2;
N		O		
name's (1) 414:12 National (3)		o0o- (1) 384:3 oath (1) 384:9 object (1) 390:15 Objection (4) 463:19,23;484:24; 485:3 obligation (1) 451:6 observation (6) 415:23;431:1; 433:16;462:7,8;472:5 observations (1) 434:11 observe (3)		

436:22;454:5;458:9; 481:7,21;485:17 overall (6) 481:24;482:7,9,10, 18,23 oversimplified (2) 425:2;427:8 overturn (1) 433:3 overturned (2) 432:22;433:10 own (1) 474:4	476:11;479:5;480:1,5; 482:17;483:5 participant (3) 485:18,20,23 participants (5) 441:7,10;485:11,12; 486:12 participation (1) 442:1 particles (1) 477:15 particular (11) 401:21;429:23; 458:24;471:3;474:15; 482:1,15,17,20;485:2, 18 particularly (3) 401:8;426:20;444:1 parties (5) 448:24;449:8,14,16; 485:17 parts (1) 483:7 pass (1) 391:14 passage (2) 482:1,6 past (3) 386:4;432:23;478:23 path (2) 477:11,14 Patrick (5) 382:16;388:12; 396:22;447:12;466:16 Patterson (1) 475:18 Paul (1) 448:7 Paulina (1) 403:5 pause (1) 432:3 PDSI (1) 452:24 pebble (4) 406:20;407:1,15; 408:1 Pederson (6) 400:9;416:15,15; 465:6;482:2,14 pending (2) 464:11,21 people (2) 416:6;452:8 peppered (1) 483:11 per (8) 393:12;401:14; 418:23;419:12;447:14; 453:21;456:7;476:6 percent (9) 399:19,24;400:4,4; 402:7;408:24;409:1;	455:19;476:17 percentage (1) 408:20 perched (1) 433:6 perhaps (10) 390:1;417:12; 429:23,24;433:6; 461:8;462:4;471:18; 472:16;478:21 period (10) 387:7;430:19; 447:17,21;451:18; 457:3,15;458:8;459:3; 471:12 periods (2) 431:16,20 permeability (5) 404:2;406:22;411:4; 433:11;436:13 permeable (1) 478:16 permits (1) 389:19 permitted (1) 425:10 person (2) 386:23;452:12 Peterson (6) 383:18;459:23; 460:4,6;463:24;466:5 phonetic (1) 424:8 photokinetic (1) 413:12 phrase (1) 435:1 physics (1) 440:7 pick (1) 472:5 picture (3) 436:5;482:10,22 pin (1) 459:12 place (6) 419:23;421:1; 447:22;457:4,16; 488:11 placed (1) 419:15 placeholder (4) 420:11,14;421:18; 423:2 plan (1) 399:5 plants (1) 389:3 play (1) 458:22 playing (1) 452:10 please (4)	385:8;421:4;449:14; 457:14 pleased (1) 481:4 plot (1) 465:14 Plummer (1) 400:9 plus (4) 420:1;437:9;478:10; 480:21 PM (1) 384:1 point (10) 387:18;388:2;398:5; 401:21;405:2;409:12; 434:13;441:8;454:7; 483:8 points (3) 394:20;416:13; 452:16 policy (1) 398:24 poor (1) 404:15 population (10) 401:20;457:21; 458:4,7,11;467:22; 469:9,11,15;482:18 populations (2) 396:17;470:2 portfolio (1) 455:20 PORTION (10) 380:8;403:15;406:9; 408:10,10,15;415:24; 426:1;437:6;439:3 portions (1) 415:14 posed (1) 472:6 position (4) 463:7,17;464:1; 484:4 positive (2) 400:24;457:17 possible (5) 385:3;398:7;416:5; 422:4;454:22 possibly (2) 431:23;474:11 potential (2) 472:9;482:24 PowerPoint (3) 385:4;415:2,9 practical (2) 415:4,11 preceding (1) 386:1 precip (1) 461:20 precipitation (10) 430:3,5;445:12,18,	24;446:5,6,11;451:17; 452:21 precisely (1) 398:6 predated (2) 471:8,9 predict (1) 393:8 premise (1) 464:9 prepare (1) 413:12 prepared (3) 403:15;406:9;413:18 present (6) 391:12;404:23; 451:22;453:3;454:4; 486:1 presentation (5) 391:16;396:13; 435:18;451:23;482:7 presents (1) 486:7 preservation (1) 482:7 pretty (16) 395:1;399:10; 424:15;425:20;426:22; 432:1,20;444:2; 454:11;456:9;457:10, 10,21;462:17;478:4,11 prevent (2) 410:16;469:5 preventing (2) 401:1;403:24 previous (2) 473:17;476:1 previously (3) 384:22;461:7;484:22 primary (2) 402:13;427:21 prior (2) 463:1;480:8 priorities (1) 427:14 priority (5) 417:21;422:17; 425:4,5;427:22 privileged (1) 463:20 probably (19) 385:5;388:14; 389:24;396:20;407:4; 410:2;414:5;426:7,7; 427:16;429:3;431:4; 433:15;443:2;446:15; 453:23;476:18;481:9; 486:8 problem (6) 399:15;435:8; 478:20;480:18,23; 486:8 problems (2)
P				
Pacific (4) 402:24;403:3,5; 473:1 pad (1) 439:14 page (11) 385:16;403:10,19, 22;406:8;412:5; 416:22;418:13,15; 435:17;473:24 pages (3) 385:14;416:10; 488:11 Pahranaagat (7) 453:22;454:5; 475:10,21;476:2,8,21 Paiute (3) 441:23;478:23; 485:14 Paiutes (1) 382:7 Paleozoic (1) 454:3 Palmer (3) 386:19;451:23; 452:23 Panaca (2) 475:18;476:20 Panel (1) 460:5 Paper (5) 402:6;452:11,13; 456:15;483:2 paragraph (1) 418:18 parameter (2) 452:15,23 paraphrase (1) 416:13 Park (3) 441:15,18;485:13 part (20) 389:2;396:24; 410:24;411:14,14; 413:19;415:19,20; 419:3,22;425:3; 456:13;471:11;475:7;				

440:24;441:2 proceed (1) 485:12 proceeding (3) 463:18;464:3;485:2 PROCEEDINGS (4) 380:16;392:6;487:9; 488:8 process (2) 427:1;486:16 proffered (2) 390:17;483:15 prohibit (1) 389:18 project (1) 413:13 proof (1) 478:19 property (1) 464:5 proportional (1) 391:5 proposed (4) 406:15;410:10; 413:5;472:6 proposing (2) 461:24;463:1 protect (4) 388:17;389:2; 396:16;428:18 protection (2) 418:9;455:16 protects (1) 421:10 provide (4) 399:20;402:5; 458:10;486:5 provided (4) 389:21;400:15; 413:11;458:6 provides (1) 421:14 providing (2) 399:24;485:4 provision (1) 438:24 PUBLIC (5) 380:17;486:11,13, 15,16 published (2) 386:20;456:14 pull (2) 385:3;394:10 pull-over (1) 402:15 pump (17) 393:19;435:5;449:9; 455:7;457:4;461:24; 462:6,24;469:15,24; 470:3,11;471:4;472:1, 3,4,20 pumpage (1) 469:2	pumped (5) 398:10;424:2,6; 450:17;453:7 pumping (66) 387:11;390:22; 391:17,24;392:8,12,15; 393:9;395:21,23; 396:6,9;397:17;398:2, 9,11,13;401:13,15; 402:15,19;407:24; 412:13;415:22;419:16; 420:17;423:1,5,8,13; 427:2;434:15;436:24; 437:3;438:2,18,18; 439:3,4,11,18;447:5,6, 13;449:15,17;455:6; 456:7;458:2,15; 459:15;461:6;462:6; 463:5;465:6;466:23; 467:15,18;470:20; 471:5,9,10;474:14; 478:2;480:8;484:7 pumps (1) 395:22 purpose (2) 416:11;431:22 purposes (6) 415:4,11;416:11; 484:23;485:1,8 pursuant (1) 455:14 pursue (1) 389:11 put (3) 386:2;397:2;421:4	445:15 rainstorms (1) 445:20 raised (1) 469:14 random (1) 443:16 range (1) 400:13 rapid (1) 434:2 rapidly (3) 401:12;434:3,7 ratcheted (1) 439:19 rate (8) 398:10;418:23; 434:15;435:4;447:5, 13;453:18;468:3 rather (5) 399:4;426:12;436:9; 453:13;458:11 ray (1) 404:11 reach (2) 409:15;433:24 reached (3) 434:7,10,12 reaching (1) 437:23 react (1) 444:14 read (7) 415:9;416:18; 420:21;443:9;452:8; 474:4;480:16 reading (1) 438:16 Real (1) 454:23 really (22) 385:22;399:11,13; 402:18;405:19;406:12; 407:19;422:12;432:1, 5;450:2;452:5,20,24; 453:12,20;461:22; 477:13;478:3;480:23; 481:15,17 reason (4) 386:2;416:24; 447:22;460:23 reasonable (3) 409:5;476:18;478:18 rebuttal (6) 385:7,13,17;387:10; 442:4,17 recall (12) 403:14;416:20; 417:4,11;438:6,9; 451:19;452:1;460:10; 481:12,14;482:2 recent (1) 468:6	Recess (1) 479:7 recharge (12) 392:20;403:20,24; 409:6;411:6;413:20; 431:5;432:3;433:8; 446:6,7;466:2 recollection (1) 480:4 recommend (1) 424:20 recommendation (5) 425:2,3;427:8;428:9, 13 recommended (2) 401:13;426:18 recommending (1) 402:14 record (10) 384:5;386:21;387:3, 4;418:11;421:5; 429:10;459:24;477:4; 479:10 records (1) 430:21 recovered (1) 474:13 recovering (1) 401:5 recovery (18) 399:5;400:20;401:3, 4,13,15,22;402:12,13; 457:16;458:18;459:1, 2,7;469:22,23;483:3,18 RECROSS (5) 383:14;441:21; 460:3;466:14;475:1 RECROSS-EXAMINATION (2) 448:5;454:18 redirect (2) 479:5,18 reduce (2) 391:11;392:12 reduced (2) 436:15;439:3 reduces (1) 391:17 reducing (1) 392:21 reduction (7) 391:8,11;392:1; 456:8,8,15,15 refer (1) 403:10 referenced (1) 418:15 references (1) 416:13 referencing (2) 479:21;481:9 referring (5) 393:23;394:14; 416:21;430:12;432:2	reflected (3) 445:2;446:15;488:9 reflection (1) 444:3 refresh (1) 402:4 Refuge (2) 419:23;435:6 regarding (6) 437:24;453:6; 467:22;469:15;475:3,4 regional (4) 413:23;414:1; 415:24;481:18 regulator (1) 451:15 regulatory (2) 389:16;472:13 relate (1) 482:5 related (5) 392:6;433:15;482:6; 483:1,11 relation (3) 444:23;481:11; 483:10 relationship (1) 402:18 relative (1) 461:2 relatively (10) 397:11,12;411:4; 420:2;432:17;433:11; 434:2;447:20,20; 469:12 relevance (1) 463:19 relevant (2) 390:16,19 relied (1) 406:4 rely (1) 413:10 remainder (1) 465:3 remember (12) 394:7;409:15; 432:20;436:18;438:9, 12,14,16,16;447:12; 455:18;462:16 reminder (1) 384:9 remote (1) 416:7 removal (2) 400:21;483:4 remove (1) 483:6 removed (1) 483:4 renegotiate (1) 439:14 reopen (1)
	Q			
	qualified (1) 483:22 quality (6) 404:8,9,12,14,15; 406:2 quantification (1) 465:12 quantity (2) 390:21;450:16 quick (2) 424:15;454:23 quickly (1) 388:14 quite (4) 411:17;477:19; 478:16;481:3 quote (1) 405:3			
	R			
	rain (7) 445:17,20,21,24; 446:12,24;480:16 rainfall (1)			

<p>441:6 repeat (3) 396:21;401:17; 472:18 rephrase (1) 458:16 report (28) 385:7,14,17,17,18; 387:10;393:23;394:11; 399:4;403:11,16; 406:8,9,18;414:3; 418:19;419:16;435:17; 442:4;443:4;450:3; 460:17;462:12,14; 463:1,8;465:14;485:24 Reported (2) 380:24;488:8 reports (2) 463:8;485:5 represent (3) 384:11,17;448:8 represented (1) 475:8 representing (2) 403:4;460:6 Republic (3) 403:1,3;473:2 requested (1) 463:16 require (1) 458:14 required (1) 455:4 requires (1) 396:18 research (1) 440:16 resolve (1) 402:8 RESOURCES (4) 380:2,3;431:21; 473:12 respect (6) 390:20;411:5;430:8; 434:5;485:4;486:2 respond (1) 434:3 responding (4) 387:22;439:11; 444:20;446:4 response (16) 429:22,24;430:1,4,7, 9,18,19;431:6,10; 432:17;434:2;457:18; 471:10;478:2;481:18 responses (3) 433:20;455:4;481:20 responsible (2) 390:10;482:18 rest (3) 387:9;407:12;471:15 restoration (4) 455:17;458:3,13;</p>	<p>459:16 restriction (1) 438:17 result (7) 390:3;391:24;446:1; 456:7,15;470:20;472:1 results (6) 404:7;415:18,19,21; 416:14;460:19 return (1) 479:4 review (3) 429:21;460:13,16 reviewed (3) 460:15;463:9,12 reviewing (2) 429:16;438:4 rhythmically (1) 437:3 right (83) 385:11;386:7;387:8, 20;388:3,8;389:14; 390:1;391:20;392:20; 393:7,16,20;394:17,23; 395:12;396:2;397:5,5, 21;400:1;401:18; 406:7;407:6;408:8; 409:24;410:14;411:3; 415:1;416:8;417:1,6, 21;420:20;422:8,23; 423:5;427:5,7;428:5,8, 19;431:6;433:1,8; 434:15;435:8;441:2; 442:21,23;448:21,22, 23;453:4;454:9,14; 455:16,22,24;457:6,15, 22;460:23;461:12,23; 462:9;468:12;471:6; 474:5;475:12,14,16; 476:2,19;478:3,5,8; 479:2;482:11,23; 484:18;487:2,5 rights (49) 396:11,15;397:4,13; 398:8;417:11,14,23; 418:10;419:1,6;420:7; 421:11,13,21;422:2,6, 17;423:3,6,14;424:1,5, 7,21;425:4,4,5,9,15,16, 21,22;426:3,4,6,7,11, 11,19,21,22;428:3,20, 21;464:6;470:13,21,23 rise (3) 430:9,12,16 rising (1) 446:1 RIVER (111) 380:7,11;391:5; 392:8,19;393:21; 395:18;396:10,11,15; 397:4,14;398:8; 400:11;404:4,13,16; 405:7,21,24;406:19;</p>	<p>408:21,24;409:1,3,7, 10,10,14,18,21,22; 410:5,15;411:13,23; 412:5,7,12,16,21; 414:19,19,22,23;415:5, 5,12,13,15,15;417:9,9, 10,13;418:3;419:2; 420:8;421:16,20,21; 422:3,4,6,18,23;423:6, 7;425:17,18,23;426:1, 4,15,23;427:2,4; 428:24;431:21;435:1, 17,21,21;436:7,23; 444:11;449:17;450:18; 453:10;454:9;458:2; 462:1;464:4,18;465:3, 18;466:23;467:1; 470:12,14,21,23;471:3, 15;472:2;475:21; 477:2,12,14,16,23 Robison (2) 381:19,20 role (1) 458:21 rolling (1) 388:5 rough (4) 399:23;431:1;443:5; 488:9 roughly (3) 407:14;437:10;457:5 round (1) 414:6 rowphonetic (1) 404:11 RPR (1) 380:24 rude (1) 465:4 rule (1) 438:6 rules (2) 426:6,10 rulings (2) 405:16,18 run (1) 409:20 running (1) 386:5 runoff (3) 445:19;446:18,20</p>	<p>434:15;438:9;441:3, 18;446:21;447:17; 457:20,23;465:17; 466:3,4;469:10;475:8; 478:16;488:9 satisfy (2) 396:10;423:3 saw (2) 438:10;472:3 saying (6) 420:9;421:20; 439:13;443:16;446:5; 451:4 scale (3) 416:2;425:19;443:7 scheduled (1) 485:22 scheduling (1) 486:8 schooled (1) 440:6 Schreck (1) 381:22 Schroeder (11) 382:12,13;383:5; 384:10,11,13,16,16; 385:2;388:8;466:8 SCHWEMM (22) 384:20;390:2,5; 391:4;398:21;399:3; 437:21;448:18;449:5; 456:3;466:19;467:4,6; 468:5,15,18;472:17; 481:21;482:3;484:8,9, 23 SCHWENN (3) 449:24;450:12; 456:10 screens (1) 435:10 se (1) 456:7 season (1) 431:15 seasonal (1) 474:6 seasons (1) 431:20 second (1) 444:12 Section (11) 381:7,10;389:10,17; 390:4,9;398:22; 419:16;467:17;472:11, 21 secure (1) 401:10 seeing (7) 389:22;432:8; 433:20;445:16,17,18, 19 seem (7) 408:9,14;439:19;</p>	<p>470:10;474:8;477:21; 478:20 seeded (1) 455:5 seems (5) 421:3;431:22,24; 434:4;438:4 seepage (2) 409:3,20 select (1) 435:23 selected (1) 451:19 senior (25) 396:11,14;397:3,13; 398:8;417:10,13,21; 418:10;419:1,6;420:7; 421:10,21;422:1,22; 423:3,6,14;424:6; 427:14;428:4;470:13, 20,23 sense (7) 391:14;417:20; 419:21;434:4,20; 438:19;469:20 sensitive (1) 444:7 sentence (1) 420:18 separate (4) 475:19,20;476:3; 477:1 SEPTEMBER (3) 380:21;384:1;488:14 sequence (1) 454:3 series (2) 432:22;461:16 SeriesEEE (4) 415:22;435:22; 436:11,15 SeriesSEE (1) 408:11 Service (12) 384:22;388:23; 403:11;413:11;441:15, 18;450:3;462:13,23; 472:10;479:13;485:13 Services (4) 403:4;461:24;479:6, 11 Service's (1) 389:1 set (2) 414:17;469:17 setting (2) 465:17,19 seven (2) 394:15;441:9 several (4) 416:12,13;418:15; 452:15 severity (4)</p>
		S		
		<p>Sacramento (1) 382:18 safe (1) 456:6 salient (1) 415:3 same (20) 405:16;406:8; 412:15;413:7;420:18;</p>		

385:19,21;386:19; 452:24 shall (2) 398:24;399:1 share (1) 453:22 Sharp (1) 381:19 shear (3) 454:5;475:10;476:8 shoot (1) 389:12 short (5) 401:10;408:4; 413:14;432:1;444:14 shorthand (1) 488:10 show (2) 387:23;471:12 showed (3) 400:7;455:3;456:15 showing (1) 457:8 shown (1) 459:19 shows (3) 457:20,21,24 sic (1) 402:15 side (12) 432:18;453:8,23; 454:2,6;461:8;462:4, 10;464:21;471:17,20, 22 sides (5) 461:9;462:5,10; 464:12,21 signal (2) 446:18;478:21 signals (2) 412:15;472:5 signature (3) 429:14,18;432:6 signed (1) 449:9 significant (8) 404:24;405:3;407:2; 409:6;416:15;443:12, 15;478:11 similar (4) 413:4;417:11; 423:11;427:12 simple (2) 426:18;436:3 simplification (1) 475:14 simply (1) 423:21 simultaneous (1) 469:24 single (1) 480:18 site (3)	440:15,16;481:1 situation (1) 446:17 situations (1) 429:2 six (2) 385:6;468:16 size (3) 400:12;458:11; 482:18 skimmed (1) 460:17 slide (8) 385:6;400:7;442:18; 457:1,2,3,12,20 slides (4) 387:9;443:3,20; 456:22 slideshow (1) 397:3 slight (1) 443:1 slightly (1) 468:11 slow (1) 425:17 slowly (1) 444:14 small (3) 401:8;433:7;482:21 smaller (1) 429:24 smooth (1) 452:22 snow (3) 445:17,18;446:12 snowfall (1) 445:15 SNWA (5) 381:16;413:11,18; 448:3;476:15 SNWA's (1) 476:3 so-called (1) 408:5 Solicitor's (1) 463:14 somebody (1) 472:14 Somehow (2) 423:17;433:15 somewhat (8) 395:12;397:19; 412:8;413:7;425:2,24; 426:3;474:18 somewhere (1) 404:18 soon (2) 486:23;487:1 sophisticated (1) 484:12 sorry (15) 396:20;397:22;	407:11,20;415:7; 420:13;444:9;448:21; 451:16;465:4,5,22; 467:23;471:21;476:10 sort (3) 408:2;447:1;452:18 sound (3) 389:14;398:22;456:9 sounds (1) 389:15 source (12) 406:13;408:5,6,14; 409:6;410:8,11; 414:23;415:5,12,15; 475:4 sources (7) 406:15;410:19; 414:18;434:14,18,24; 466:2 south (7) 400:11;413:15,21; 436:4;475:17;477:10, 22 Southern (4) 448:8;465:1;471:13; 485:15 spacial (1) 445:11 sparse (1) 395:1 spawning (2) 399:20;400:13 speak (5) 386:6;399:4;405:17; 417:6;429:15 speaking (2) 390:13;416:4 speaks (1) 421:6 Species (20) 389:8,11,18;390:3,8; 398:23;399:1,15; 401:5,15;448:13; 449:1,21;450:8; 467:12,18,19;472:10, 21;482:12 specifically (4) 394:7;442:4;463:16; 472:6 spent (1) 480:12 spike (3) 430:5,5;457:10 spite (1) 470:3 spot (1) 482:15 Spring (68) 391:5,17;392:10,12, 15,21;393:20;396:4,5, 8,14,18;397:9,17; 401:16;402:15;407:3, 6,11,11,14,20;408:17,	24;409:8,9,17,20,24; 410:9,17;411:22; 412:12,16;416:20; 417:9;419:20,21; 422:5;430:13,22; 431:18;435:6;436:14, 21;439:1;447:6,16,21; 453:9,21;454:6,7; 455:16;461:1;464:16; 465:2;466:24;467:1,4; 468:10,20;475:5,7,22; 476:21;478:3;480:1 SPRINGS (99) 380:11;394:1,13; 395:4,9,10,11,17,18; 398:11;404:5,13,16; 405:21,24;406:13,19, 23;407:12;409:14,18, 22;410:5;411:20,23; 412:5,7,21;414:19,23; 415:5,12,16;416:16; 417:5;419:22,24; 420:3;422:4;425:17, 23;426:15;428:24; 431:23;434:3;435:6, 10;436:2,3,7,23; 437:23;438:1;441:11; 449:2,10,17;450:7,15; 453:10,18,24;454:2,9; 455:23;460:20,21; 461:2,9,15,17,20; 462:1;463:8;464:3,9, 12,15,17,22;465:1,1,7; 468:3;471:4,14,14,17; 472:2;477:12,13,14,16, 17,24;478:3,9,13; 479:22 Spring's (1) 463:18 square (2) 428:22;437:10 SS (1) 488:4 stabilize (1) 400:23 stable (5) 387:15;400:18; 443:2;469:9,12 staff (2) 429:8;473:12 standard (1) 451:17 standpoint (1) 450:11 start (9) 429:9;431:13,14; 441:11;447:23;452:10; 474:8;479:20;486:9 started (1) 440:13 starting (3) 393:13;398:5;485:11 STATE (32)	380:1;381:4;391:4; 398:12,14,15,18;405:2, 5,15;417:7;418:2,6; 419:2;420:9,19,22,24; 421:6,9;424:4,20,20; 427:20;429:7;450:13, 24;451:2;455:2; 462:19;473:11;488:3 stated (6) 391:16;392:6,23; 393:1,12;398:1 statement (2) 417:2;448:14 static (1) 474:11 stating (1) 422:1 statistical (1) 443:11 statistician (1) 443:18 stayed (1) 469:10 steady (4) 393:17;398:14,15,17 steading (1) 474:11 steep (1) 457:10 stem (3) 400:11;409:9;410:2 Steve (2) 414:12;433:5 still (14) 384:9;398:7;409:21; 422:4,5;426:2;434:22; 435:3;439:17,18; 447:19;459:7;474:11; 477:9 stipulation (1) 463:18 Stop (1) 397:5 stopping (1) 472:8 story (1) 413:14 strange (1) 452:9 strangely (1) 452:7 stream (14) 392:5;396:8;407:10, 10;409:11;410:4; 421:14;422:3,24; 431:18;446:14,17; 447:21;482:17 Streams (1) 400:10 strike (3) 421:4;423:19;449:14 structure (3) 433:11;436:13;
--	--	--	---	--

465:20 structures (1) 453:8 studies (3) 460:14,17;481:3 study (4) 409:3;460:10;480:2, 5 subject (2) 421:11;484:24 subjects (1) 421:12 submission (2) 485:23;486:2 submit (2) 407:4;463:15 subsequent (1) 485:11 subsequently (1) 485:24 substantiate (1) 406:3 substantiated (1) 404:6 successfully (1) 400:16 SUE (6) 384:20;429:18; 447:3;453:11,13; 479:20 sufficient (5) 397:13;418:24; 420:3,7,10 suggested (2) 427:9;478:23 suggesting (1) 477:10 suggests (2) 404:17;478:13 suits (1) 390:9 Sullivan (9) 381:5;383:12,21; 437:13,13,16;455:2; 474:22;475:2 summary (1) 406:15 superiors (1) 463:7 supply (2) 405:8;414:18 support (1) 452:20 suppose (1) 422:9 sure (19) 390:12;397:20; 401:18;403:13;416:8; 428:20;433:12;436:5, 8;443:14;447:24; 457:1;458:17;459:10; 461:17;469:21;474:21; 476:9,16	surface (6) 409:17,21;411:21; 417:23;418:7;444:14 surrounding (1) 405:6 surveys (1) 460:9 sustain (1) 463:22 sustainable (13) 393:2,15;396:2; 398:5;410:9;419:16, 17,21;420:12,17; 423:8;450:16;468:23 sustained (1) 393:8 swap (3) 425:14;426:18,19 swapping (1) 426:6 sworn (1) 384:22 Sylvia (1) 403:2 SYSTEM (32) 380:7;392:8;398:13, 17;399:12;400:23; 421:14;422:18;426:2; 427:22;432:3;433:22; 434:10;435:17;444:11; 450:18;458:2;462:2; 464:4,19;465:3,18; 466:24;470:12;471:3, 15,24;475:21;477:2, 23;483:5,7 systems (6) 440:10;444:13,14; 475:13,16;476:23 System's (1) 392:19	Technichrome (3) 485:22;486:1,10 temperature (1) 407:13 temperatures (2) 445:9,16 tend (2) 400:22;452:8 ten-minute (1) 479:3 tenth (2) 476:7,7 Terhune (2) 380:24;488:7 term (1) 420:14 terms (4) 439:7;444:15; 445:14,17 terribly (1) 405:17 territory (2) 432:23;440:17 test (30) 393:19;398:11,13; 415:18,23;416:14; 433:21;434:17;438:5, 18;443:15;461:6,24; 462:6,24;469:16,24; 470:3;471:4,9,10; 472:1,3,4,8,20;474:3, 14;480:8;481:1 testified (3) 384:23;386:22; 403:15 testimony (7) 388:15;406:12; 415:10;453:3;456:21; 483:15;485:3 testing (4) 433:23;455:7;457:4; 480:16 tests (1) 463:5 Thanks (3) 440:5;459:20;477:3 Therefore (1) 467:15 thereof (1) 403:20 thesis (2) 440:15;480:22 thinking (1) 403:19 though (5) 387:23;422:9;428:2; 434:4;485:9 thought (7) 404:20;419:11; 432:18;433:23;450:5; 452:17;465:5 thoughts (2) 434:8;483:12	thousand (2) 428:22;437:10 threat (1) 482:23 threats (3) 458:20;481:24;483:8 three (11) 385:15;389:10; 401:7;408:24;409:15; 415:3;438:2;442:24; 458:20,24;470:7 three-month (1) 472:4 threshold (1) 438:7 thresholds (1) 468:1 throughout (6) 404:4;412:4,7;420:1; 430:23;480:8 Thursday (1) 485:14 thus (4) 467:17;468:15,21; 469:3 tilapia (3) 399:12;400:21;483:5 Tim (7) 381:18;384:20; 431:3;450:20;468:6; 481:8;483:20 timely (1) 428:19 times (2) 401:7;418:15 timing (1) 445:12 today (6) 403:4,9;408:7; 418:15;483:15;485:7 today's (2) 415:2;486:19 together (1) 439:14 tomorrow (2) 485:12;487:3 took (3) 405:18;421:1;472:4 top (6) 394:9;417:4;436:18; 442:21;443:1;465:14 total (6) 393:9;396:9;417:15; 442:6;447:13;470:22 touched (1) 480:10 tough (2) 401:17;480:23 tow (1) 404:11 toward (3) 388:21;401:3,13 track (3)	396:21;398:20; 409:20 TRANSCRIPT (1) 380:16 transcripts (2) 486:22;487:1 transmissive (2) 408:15;473:19 transmissivity (10) 416:2;425:20;426:1, 9;428:23;434:21; 435:20,20;437:7;461:8 transport (3) 440:7,8,12 trap (1) 389:12 travel (1) 432:3 trend (6) 393:22;394:3,19; 396:1;469:15;474:2 trending (2) 453:19;454:3 trendline (1) 457:7 trends (4) 444:15;467:22; 470:3;475:14 tributary (1) 410:1 tried (2) 411:17;486:11 trigger (2) 455:3,4 true (5) 390:6;391:23; 410:23;444:16;488:9 try (5) 423:11;431:14; 454:21;477:8,20 trying (11) 410:9;411:5;418:11; 423:21;447:9;459:12; 460:21;464:16;466:18; 481:16,19 TUESDAY (1) 380:21 Tule (4) 442:5;443:21; 444:20;465:17 turn (7) 406:7;416:5,10; 425:21;426:3,10; 428:20 turned (1) 435:5 turning (1) 420:18 two (19) 385:12;386:14; 396:3;398:22;408:13; 409:15;434:11,17; 435:7;443:1,20;444:8;
	T			
	table (1) 411:24 Taggart (3) 381:16,16;383:16 TAGGERT (3) 448:6,7;454:14 talk (5) 430:14,14;456:14, 22;483:22 talked (2) 450:2;453:17 talking (6) 408:23;428:7;430:9; 431:9;442:3;460:9 talks (1) 418:22 tapping (1) 434:18 target (1) 436:10			

461:1;462:10;464:12, 22;481:2;483:8,8 Typically (2) 400:19;483:18	481:10 used (2) 393:8;435:22 useful (1) 402:9 using (4) 386:10;451:24; 480:12;481:10 USR (1) 460:9 uteral (1) 424:8 utilize (1) 399:1	390:4 violation (1) 467:19 virtually (2) 405:7;435:24 visible (1) 447:15 visual (3) 385:23;386:10; 474:18 visually (2) 386:7;447:18 VOLUME (4) 380:19;454:4;458:2; 470:22	471:8;473:11;474:14; 475:5,7,8,15;476:3,14, 15;477:15,21;478:10, 12;483:1;485:16 water's (1) 404:17 way (10) 401:11;410:3;412:9; 427:10;438:10,21; 443:13;446:21;470:15; 480:20 ways (3) 429:2;459:7;470:2 website (1) 462:20 weeds (2) 452:5,19 week (3) 485:8,16;486:18 welcome (1) 393:11 wells (36) 394:13,22;395:17; 408:7;412:14,16; 413:9;423:12;430:22, 23;435:23;436:10; 437:2;439:5;442:6,13, 15,18;443:21,22; 444:10;455:11;460:20; 461:1;462:7,8,10; 463:4;464:13,22; 465:6;472:5;473:19, 21;480:1;481:18 well-versed (1) 472:14 weren't (2) 480:4,5 West (16) 394:2,14;395:4,9,10, 11;437:23;438:1; 449:2,10;450:7,15; 453:8,23;454:6;468:4 wet (11) 429:22;431:14,16, 20,20;444:1,2,7,8,15; 445:23 wetter (3) 387:19,21,22 what's (3) 459:19;476:20;477:1 WHITE (23) 380:7;392:8,19; 422:18;426:1;431:21; 435:17,21;444:11; 450:17;458:2;462:1; 464:4,18;465:3,17; 466:23;470:12;471:3, 15;475:21;477:2,23 whole (5) 407:8;454:3;461:16; 469:8;482:16 who've (1) 449:9	widespread (1) 434:3 wild (1) 431:24 Wildlife (22) 382:17;384:21; 388:16,23;389:1,3; 396:16;400:16;402:14; 403:11;413:11;418:14; 450:3;461:23;462:13, 23;464:2;472:10,19; 479:6,11,13 Wildlife's (1) 396:15 Williams (1) 403:5 Willow (1) 461:15 Wilson (2) 409:3,19 Wind (1) 404:4 winter (3) 445:17,18;446:22 WITHIN (13) 380:7;406:22,24; 410:10;425:18;426:8; 428:21;430:3,24; 431:6;432:1;463:11,13 without (8) 387:11;392:21; 424:6;426:11;440:20; 441:4;453:9;470:13 WITNESS (1) 416:8 witnesses (3) 384:9,21;394:10 witnesses' (1) 442:1 wonder (1) 407:16 wondered (1) 434:8 wondering (2) 394:19;433:23 work (6) 388:16;389:15; 470:5;480:6;483:18; 484:14 worked (1) 480:18 working (4) 395:7;440:14; 480:11;483:6 worse (1) 439:18 wound (1) 389:12 wrap (2) 423:21;458:12 Wright's (1) 453:6 wrong (1)
U	V	W		
Uh-hum (2) 386:9;442:23 ultimately (1) 405:7 unacceptable (1) 392:21 unauthorized (2) 390:3,10 under (8) 384:9;418:2;419:16; 422:1;423:13;424:2; 428:9;455:4 underestimated (1) 436:12 undergraduate (1) 440:19 Understood (2) 390:23;462:4 undiminished (2) 398:12;435:4 unduly (1) 410:16 unique (1) 432:17 unit (3) 410:10;413:5;455:24 units (1) 406:22 unless (3) 399:20;439:14;486:7 unresponsive (1) 407:22 UNVM1 (1) 394:1 up (28) 385:4;393:2;394:10; 399:16;408:21;409:21; 412:21;416:1;426:6, 10;427:11;429:7; 433:6;436:20;441:6; 442:8;452:19;456:24; 457:9;458:12;462:12; 467:21;469:17;472:5; 473:11;477:1;479:5,11 upon (2) 448:20;485:23 upper (3) 385:15;395:17;476:6 up-rigging (1) 432:22 upward (2) 405:1;412:24 URS (1) 462:14 use (4) 420:14,15;452:13;	validate (1) 476:12 VALLEY (51) 380:9,10;382:19; 407:18;408:9;409:16; 414:7,13;426:12; 436:5,21,22;442:5,5, 19;444:20;448:9; 453:9,18,21,22;454:8, 16,20;455:10,15;461:1, 9,17;464:10,15,16,18; 465:1,1,2;469:14; 471:4,14,14;473:4; 475:16,18,22;476:5,20, 21,24;479:23;480:1; 486:6 value (1) 386:19 variability (3) 439:10,12;445:2 variations (3) 412:14;474:6;478:12 varied (1) 430:20 variety (1) 439:4 various (3) 422:17;453:17;464:5 vast (1) 399:15 vault (1) 461:2 Vegas (6) 382:13;384:7,12,17; 448:8;466:7 verify (1) 406:9 versus (2) 445:17;476:20 vicinity (1) 478:7 Vidler (2) 382:5;460:7 violated (1) 463:17 violating (1)	wait (1) 402:3 Warm (17) 394:1,13;395:4,9,10, 10;407:6,13,21; 437:23;438:1;449:2, 10;450:7,15;468:3; 478:10 warmer (2) 445:9,16 Wash (23) 405:21,24;408:9; 413:6,16,22;414:2,24; 426:16;436:16,22; 453:24;454:2,6; 460:21;461:2;464:12, 22;471:17;475:19; 476:5,20;477:1 WATER (129) 380:3;382:4,5,10; 387:4,10,14,16,16; 390:21;396:10,11,14; 397:4,13;398:8;404:7, 8,12,14,15;405:7; 406:2;407:7,17,19; 410:3;411:24;412:15; 413:9,16,18,21;414:19, 23;415:15;417:23; 418:8;419:1,6;420:3,7; 421:21;422:1,2,13,24; 423:3,5,6,12,13,14,15; 424:21;425:4,4,5,9,15, 15,22;426:14,21; 427:14,22,24;428:3,5; 430:6,8,14,17,21; 431:21;432:8;433:21; 434:1,2,14,18,24; 435:3;443:24;444:2, 14,19;445:23;446:7, 11;448:8,9;449:15; 453:7;454:5,16,20; 455:10,15,16,19; 458:10;459:6,22; 460:6,7;461:4;464:5; 469:14;470:3,13,21,23;		

477:24	10 (1) 402:7	2006 (9) 401:6;409:3;437:18; 438:11;455:8,15; 460:9;462:14,21	30 (1) 402:7	383:22
Y	100 (1) 476:17	2009 (1) 443:22	30,550 (2) 418:23;419:12	479 (1) 383:23
year (21) 386:12;401:14; 418:23;419:12;430:3, 24;431:6;432:1; 443:24;444:1,1,2; 445:23;446:11;447:14; 453:21;474:7,7;476:7; 480:15,15	1169 (12) 398:10;407:23; 415:18,22;416:14; 433:20;455:7;457:4; 471:9;474:3;480:2,5	2010 (2) 429:23;457:22	30,550-acre-feet (1) 419:8	4GV1 (1) 473:24
yearly (1) 430:5	12 (5) 386:1,5;388:5,6; 474:1	2011 (3) 443:24;444:2;457:5	3000s (1) 399:10	5
years (21) 386:20;387:1; 400:19;408:23;419:14; 429:22;431:4,23; 434:17;440:14;444:7, 7,8;447:14;470:11,19; 478:21;480:9,11,17,21	13 (4) 393:23;394:11,16; 395:5	2012 (2) 457:5,9	30-year (1) 387:3	5 (4) 385:9,14;403:11; 418:14
yesterday (5) 384:8;433:5;451:22; 453:17;454:10	15 (1) 409:1	2013 (6) 415:20,21;416:21; 435:5,22;457:9	333 (2) 418:2;420:22	50,000 (3) 453:20;475:9;476:1
yesterday's (1) 453:3	16 (6) 393:21;419:13; 447:13;456:22;457:1,3	2014 (1) 405:16	36 (1) 406:8	500 (3) 399:13;401:6;458:9
yield (4) 393:2,15;396:2; 398:6	17 (4) 393:21;419:14; 447:13;456:22	2015 (12) 393:21;394:4,5,6,8, 20,22,24;397:9; 419:13;447:13;468:11	37 (1) 418:16	5000 (1) 459:9
yields (1) 410:9	18 (4) 394:22;431:23; 474:17;478:21	2017 (4) 394:6,20;397:9; 474:17	380-488 (1) 488:11	5280 (1) 453:7
Yucca (1) 480:17	1885 (1) 386:21	2018 (2) 394:8;395:1	384 (1) 383:5	533 (1) 421:10
Z	19 (2) 465:14;481:5	2019 (3) 380:21;384:1;488:14	388 (1) 383:6	6
zero (6) 386:8,11,13,16; 387:24;392:7	1920 (3) 418:5;420:24;424:2	209 (1) 488:7	3rd (4) 462:12;463:1; 485:22;486:9	6 (3) 385:14,16;416:22
zone (6) 425:19;426:8; 453:22;454:5;475:10; 476:8	1966 (5) 404:3;406:17,18; 411:3;478:17	210 (1) 380:8	4	60 (1) 435:17
0	1983 (1) 399:5	211 (1) 380:9	4- (1) 459:9	6000 (2) 399:9;458:19
07 (1) 401:6	1990 (1) 386:20	217 (1) 380:10	403 (1) 383:7	60s (1) 403:22
1	1990s (1) 481:6	218 (1) 380:11	414 (1) 383:8	66 (2) 407:1;478:6
1.0 (2) 455:15,22	2	219 (1) 380:12	424 (1) 383:9	7
1.2 (1) 436:8	20 (2) 402:7;442:6	22 (2) 480:17,21	429 (1) 383:10	7 (8) 385:5;393:23; 394:11,16;406:16; 408:18;472:11,21
1.4 (1) 419:16	2000 (7) 385:20;386:12,14, 15,16,16;413:18	24 (5) 380:21;384:1; 440:14;480:11,17	435 (1) 383:11	7.5 (1) 400:4
1.5 (3) 436:9,23;473:23	2001 (2) 409:2,19	244 (1) 455:3	437 (1) 383:12	700 (1) 457:22
1.6 (3) 436:9,23;473:23	2002 (1) 386:12	25 (1) 455:19	439 (1) 383:13	71 (1) 474:1
1:15 (1) 384:1	2005 (2) 429:23;431:3	26th (1) 488:14	441 (1) 383:15	75 (2) 399:19;400:4
	2005's (1) 412:5	3	448 (1) 383:16	79 (1) 470:1
		3 (3) 385:9;461:10,10	4500 (3) 399:8,17;458:19	8
		3- (1) 459:9	454 (1) 383:17	8 (4) 393:23;394:11; 403:10,19
		3.2 (15) 401:19,19;402:1; 449:2,11;450:7,9,15; 451:10;468:5,8,22; 469:3,5,8	460 (1) 383:18	80s (1) 481:3
			466 (1) 383:19	8A (1) 394:16
			4700 (1) 476:6	
			473 (1) 383:20	
			475 (1) 383:21	
			477 (1)	

9				
<p>9,138 (1) 421:18</p> <p>900 (1) 432:21</p> <p>90s (2) 399:9;481:3</p> <p>9138 (3) 422:15;423:1,15</p> <p>9300 (3) 396:1,4;397:2</p> <p>9318 (7) 393:12;397:12; 398:3,7;447:5,14,22</p> <p>9318-acre-feet (1) 401:14</p>				

In The Matter Of:

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

Vol. III

September 25, 2019

Capitol Reporters

123 W. Nye Lane, Ste 107

Carson City, Nevada 89706

Original File 092519finalWater.txt

Min-U-Script® with Word Index

SE ROA 53161

JA_17558

Page 489

1 STATE OF NEVADA
 2 DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
 3 DIVISION OF WATER RESOURCES
 4 BEFORE MICHELINE FAIRBANK, HEARING OFFICER
 5 ---oOo---
 6 IN THE MATTER OF THE ADMINISTRATION
 AND MANAGEMENT OF THE LOWER
 7 WHITE RIVER FLOW SYSTEM WITHIN
 COYOTE SPRING VALLEY HYDROGRAPHIC
 8 BASIN (210), A PORTION OF BLACK
 MOUNTAIN'S AREA HYDROGRAPHIC
 9 BASIN (215), GARNET VALLEY
 HYDROGRAPHIC BASIN (216), HIDDEN
 10 VALLEY HYDROGRAPHIC BASIN (217),
 CALIFORNIA WASH HYDROGRAPHIC BASIN
 11 (218), AND MUDDY RIVER SPRINGS AREA
 (AKA UPPER MOAPA VALLEY HYDROGRAPHIC
 12 BASIN (219)).

13
 14 TRANSCRIPT OF PROCEEDINGS
 15 PUBLIC HEARING
 16 HEARING ON ORDER 1303
 17 VOLUME III
 (A.M. SESSION, Pages 489 - 598)
 18
 19 WEDNESDAY, SEPTEMBER 25, 2019
 20
 21 REPORTED BY: CAPITOL REPORTERS
 Certified Shorthand Reporters
 22 BY: CHRISTY Y. JOYCE, CCR
 Nevada CCR #625
 23 123 W. Nye Lane Suite 107
 Carson City, Nevada 89706
 24 (775)882-5322

Page 490

1 A P P E A R A N C E S
 2
 3 Micheline N. Fairbank,
 Hearing Officer
 4
 5 Tim Wilson,
 Acting State Engineer
 6 Adam Sullivan,
 Deputy State Engineer
 7
 8 Melissa Flatley,
 Chief of the Hearing Officer Section
 9 Michelle Barnes,
 Supervising Professional Engineer
 10
 11 Levi Kryder,
 Chief of the Hydrology Section
 12 Jon Benedict,
 Senior Hydrologist
 13
 14 Christi Cooper,
 Well Supervisor
 15 Bridget Bliss,
 Basin Engineer
 16
 17
 18
 19
 20
 21
 22
 23
 24

Page 491

1 A P P E A R A N C E S
 (Continued)
 2
 3 For SNWA: Taggart & Taggart, Ltd.
 By: Paul G. Taggart, Esq.
 4 Carson City, Nevada
 -and-
 5 Tim O'Connor, Esq.
 6 For CSI: Robison, Belaustegui, Sharp
 & Low
 7 By: Kent R. Robison, Esq.
 Reno, Nevada
 8
 9 For CSI: Brownstein Hyatt Farber Schreck
 By: Bradley J. Herrema, Esq.
 Los Angeles, California
 10
 11 For NV Energy: Justina Caviglia, Esq.
 Reno, Nevada
 12 For Lincoln County
 Water District
 13 -and-
 Vidler Water Company: Allison MacKenzie
 14 By: Karen Peterson, Esq.
 Carson City, Nevada
 15
 16 For NCA: Alex Flangas, Esq.
 Reno, Nevada
 17 For Moapa Band of Paiutes: Beth Baldwin, Esq.
 18 For Moapa Valley
 Water District: Greg Morrison, Esq.
 19
 20 For Bedroc: Laura Schroeder, Esq.
 21 For City of North Las Vegas: Laura Schroeder, Esq.
 22 For National Park Service: Karen Glasgow
 23 For Center for Biologic
 Diversity: Patrick Donnelly
 24

Page 492

1 I N D E X
 2 WITNESS PAGE
 3 RICHARD WADDELL, JR.
 4 Direct Examination by Ms. Glasgow 494
 5
 6
 7
 8
 9
 10
 11
 12
 13
 14
 15
 16
 17
 18
 19
 20
 21
 22
 23
 24

Page 493

1 CARSON CITY, WEDNESDAY, SEPTEMBER 25, 2019, A.M. SESSION
2 ---oOo---

3 HEARING OFFICER FAIRBANK: So today is the third
4 day of the hearing in the matter of the administration of the
5 Lower White River Flow System 1303 proceedings. And, so
6 similar as we've done the last couple of days, we're going to
7 go ahead and start with the National Park Service.
8 And, again, we have a sign-in sheet. And just
9 for everyone's reference as well, each of these sign-in
10 sheets are going to be marked as State Engineer subsequent
11 exhibits. So I think our State Engineer exhibits ended at
12 334. So they're going to just be marked next in line. So
13 those will be exhibits to these proceedings.
14 And, so, Ms. Glasgow.
15 MS. GLASGOW: Housekeeping matters to that
16 effect. So we're signing in every day?
17 HEARING OFFICER FAIRBANK: Yes.
18 MS. GLASGOW: Okay. So yesterday's sign-in sheet
19 is still available for signing in?
20 (The court reporter interrupts)
21 MS. GLASGOW: My name is Karen Glasgow,
22 G-l-a-s-g-o-w. Hello, good morning. I'm Karen Glasgow with
23 the Department of Interior Office of the Solicitor and I'm
24 here representing the National Park Service. And today we

Page 494

1 are presenting our expert witness, Dr. Richard Waddell,
2 Junior, for your consideration.
3 Good morning, Dr. Waddell. Would you please
4 introduce yourself and spell your name for the court
5 reporter.
6 THE WITNESS: My name is Richard Kent Waddell,
7 Junior, and my last name is spelled W-a-d-d-e-l-l.
8 MR. GLASGOW: Dr. Waddell, by whom are you
9 employed?
10 THE WITNESS: I am employed by a company called
11 Tetra Tech.
12 HEARING OFFICER FAIRBANK: And, Ms. Glasgow,
13 sorry. Not to interrupt, but can we go ahead and swear in
14 the witness before we proceed with questions.
15 MS. GLASGOW: Thank you. Yes.
16 (The witness was sworn in)
17
18 RICHARD WADDELL, JUNIOR
19 Called as a witness on behalf of
20 National Park Service, having been first duly sworn,
21 Was examined and testified as follows:
22
23 DIRECT EXAMINATION
24 By Ms. Glasgow:

Page 495

1 Q. And, again, you work for a company called Tetra
2 Tech?
3 A. That's correct.
4 Q. And what do you do there?
5 A. Well, Tetra Tech is an environmental consulting
6 company that works in lots of different areas. My
7 concentration is in groundwater hydrology. I do a
8 combination of different things, contaminant transport,
9 computer modeling, water resource investigations, and so
10 forth.
11 Q. And were you at some point hired by the National
12 Park Service to respond to the Interim Order 1303?
13 A. Yes, I was.
14 Q. And what were you hired specifically to do for
15 the National Park Service?
16 A. I was hired and my company was hired to perform
17 some computer simulations to look at the effects of questions
18 before the State Engineer's office, specifically the effects
19 of moving the location of pumping from the Muddy River
20 Springs area and more specifically alluvial pumping in that
21 area and along the Muddy River to different parts of the
22 Lower White River Flow System.
23 And, in addition, to provide, prepare reports,
24 and to prepare for providing testimony such as today.

Page 496

1 Q. And did you provide reports?
2 A. Yes, we did.
3 Q. I would like you to -- Do you have a copy of what
4 has been marked as NPS Exhibit Number 2?
5 A. I do.
6 Q. Could you read the title of that for us please?
7 A. It is titled prediction of the effects of
8 changing the special distribution of pumping in the Lower
9 White River Flow System dated July 3rd of 2019.
10 Q. And is this a report that you prepared or was
11 prepared at your behest in furtherance of the contract with
12 the park service?
13 A. It is. There were some sections specifically
14 related to the simulations or the input data sets for pumping
15 for the simulations that was written by Gary Carst. He had
16 put together I guess the request to which wells and what
17 pumping to move and how to do that. And then we took that
18 information, modified our modeling data sets, and made the
19 simulation. So he prepared the section describing those.
20 And he also prepared an introductory section describing the
21 resources that the National Park Service has in the Lake Mead
22 area and the needs for protecting those resources.
23 Q. Is this your signature on the July 3rd, 2019
24 document?

1 A. Yes, it is.
 2 Q. So is this -- And as you sort of peruse this
 3 document, is this the document that you prepared or had
 4 prepared for the park service?
 5 A. Yes. Let me just correct. Some of the sections
 6 in here specifically related to some of the modeling were
 7 prepared under my direction dealing with some of the
 8 simulations being performed. Some of the data tables and
 9 that sort of stuff they prepared. I did not.
 10 Q. Okay. And, similarly, do you have a copy of NPS
 11 Exhibit Number 3?
 12 A. I do.
 13 Q. And could you tell us what this document is?
 14 A. It's entitled National Park Services response to
 15 July 2019 Interim Order 1303 reports.
 16 Q. And did you prepare or have prepared at your
 17 behest this report?
 18 A. I prepared this report in its entirety.
 19 Q. Is that your signature on the face page?
 20 A. It is.
 21 Q. And, as you look through the document briefly,
 22 does this represent the document that you prepared for the
 23 National Park Service?
 24 A. It is.

1 MS. GLASGOW: At this time I would actually like
 2 to introduce in to evidence NPS Numbers 2 and 3.
 3 HEARING OFFICER FAIRBANK: NPS Exhibits 2 and 3
 4 are so admitted.
 5 MS. GLASGOW: Thank you very much.
 6 Q. (By Ms. Glasgow) So, Dr. Waddell, prior to
 7 preparing the park services reports for the -- for the Order
 8 1303, had you worked in the same or had you worked in the
 9 geographic area before?
 10 A. Yes.
 11 Q. Could you tell us what -- a little bit about your
 12 experience in that area?
 13 A. I would be glad to. When I completed graduate
 14 school in 1977, my first job was with the US Geological
 15 Survey working on a couple of projects at what was called the
 16 Nevada Test Site at that time. Most of the work involved the
 17 Yucca Mountain project. My assignments were to look at
 18 regional geology and hydrology around the test site, prepare
 19 a computer model of flow in the vicinity of Yucca Mountain
 20 that basically covered the entirety as it was thought of at
 21 that time of the Death Valley Regional Flow System. I also
 22 did research on movement of radionuclides and fractured
 23 rocks, specifically tufts around Yucca Mountain and
 24 carbonates that underlie Yucca Mountain to the east or

1 present to the east.
 2 I left the USGS in 1985 and went in to
 3 environmental consulting with a company then called Geotrans,
 4 which was shortly thereafter purchased by Tetra Tech. I was
 5 the manager of our Colorado office until 1991 when Tetra Tech
 6 had joined with IT Corporation to submit a proposal to the US
 7 Department of Energy to be their environmental resource
 8 services contractor. And that work was to basically get the
 9 process going on closing contamination sites at the Nevada
 10 Test Site.
 11 And part of that project that I was part of was
 12 investigation of the underground test sites, all of the
 13 underground explosion cavities in the vicinity. I was listed
 14 on that proposal as the key hydrogeologist for that contract.
 15 We won that work.
 16 And I was informed about a year later by the DOE
 17 project manager that the reason that IT Corporation won that
 18 contract was because of my inclusion on the proposal, my
 19 experience, that had been gained at the test site in the
 20 Yucca Mountain area as well as in some of the testing areas,
 21 underground testing areas.
 22 And so it started about a 12-year project with IT
 23 Corporation and later on became Shaw. Basically serving as
 24 the key hydrogeologist for the underground testing project

1 that the contractor was a participant in and worked in
 2 conjunction with numerous national laboratories at the time
 3 as well as Desert Research Institute and US Geological
 4 Survey.
 5 That work continued, like I said, for 12 years
 6 when the contract was rebid and was a small business set
 7 aside so our team did not win that work because we were a
 8 large business. But I still maintained involvement with the
 9 DOE project as the subcontractor to the company or the
 10 company team that won that work. And through the years that
 11 kind of tapered off.
 12 But as recently as last year I served on a blue
 13 ribbon peer review committee for modeling that was done for
 14 closure of the Ranier Mesa corrective action unit. There
 15 were four peer reviewers and I was the reviewer selected
 16 based upon my experience with Southwestern US Hydrogeology
 17 and specifically Nevada Test Site, now Nevada National
 18 Security Site geohydrology.
 19 Q. Thank you.
 20 A. So that describes my experience at the test site
 21 basically within the Death Valley Regional Flow System.
 22 In addition, I think, in approximately 2001,
 23 there was a hearing coming up related to applications in
 24 Coyote Spring Valley. I was hired by the National Park

Page 501

1 Service at that time to put together a computer model of flow
2 within Coyote Spring Valley and surrounding areas, which
3 included the Muddy River Springs area.
4 And so that went to hearing. And other instances
5 came up where support was required either by National Park
6 Service, Fish and Wildlife Service, or Bureau of Land
7 Management. One of those was work in the Corn Creek area
8 associated with water rights within the Death Valley Flow
9 System. And then another one -- another hearing related to
10 proposals for change applications in the Amargosa Desert and
11 the impact on Devil's Hole.
12 Q. Thank you. I understood today that you prepared
13 a power point presentation to assist you in your testimony;
14 is that correct?
15 A. That is correct.
16 Q. Okay. As you -- Are there any corrections or
17 changes to your power point presentation that you would like
18 to make before you get started?
19 A. There are. And I've changed the presentation,
20 but I wanted to notify people that when they're going through
21 the copies of the presentation there are some minor changes
22 that they need to be aware of.
23 The first of these is on slide eight which is a
24 map where there's a hydrograph for MX-4 and an inset map that

Page 502

1 shows the location of MX-4. When I was putting this
2 together, I needed to move the location of the map so that
3 the page number would not get hidden by the map. And I
4 forgot to move the location point for MX-4. So, in your
5 copies, MX-4 is shown as the red cross is in the wrong
6 location, so that has been corrected.
7 On page 36 there is a discussion about oxygen and
8 deuterium isotopes and water. And I have a short discussion
9 about, as I recall, precipitation. And I make this statement
10 in there about something being isotopically lighter on one of
11 the bullets that should have read isotopically heavier.
12 There is a second instance on that same page where I made the
13 same mistake. So in the presentation it now says
14 isotopically heavier in those two locations.
15 And then the third is just a slide that is out of
16 order. I decided not to move it in the presentation so it
17 wouldn't mess up the page numbering. So that when questions
18 are -- arise, the page numbers on your copies are the same as
19 they are on the presentation. And that was just a summary
20 slide for discussion about water levels. So that's out of
21 location in the printed packet. I did not move it in the
22 presentation and I'll deal with that during the presentation.
23 Q. Thank you. So before we get started, I wanted to
24 sort of identify the subjects at which you had been qualified

Page 503

1 as an expert here today so that it will aid in your
2 testimony. We qualified you as a geologist, a
3 hydrogeologist, and computer modeling; correct?
4 A. That is correct.
5 Q. Thank you. And with that, if you would like to
6 get started on your testimony.
7 A. I'll be glad to. So this is an outline of my
8 presentation. I'm generally trying to answer the four
9 questions that were asked that I have woven in other aspects
10 related to the geohydrology of the area.
11 I wanted to first talk a little bit about water
12 balance. I had something earlier that became apparent the
13 last couple of days I really didn't need to discuss. There's
14 a pretty good understanding of the concepts of capture and
15 depletion in the aquifer, so I removed that. But I still
16 have a little bit in there that I might talk about.
17 I want to talk about recommendations on changes
18 to the geographic boundary for the joint administrative unit.
19 One of them kind of tongue in cheek, but I'll discuss that.
20 Third bullet is discussion about climatic
21 effects. And this will be somewhat similar to what Tim Mayer
22 had talked about previously, but I'll be presenting
23 additional examples of rising water levels in the area.
24 And then there will be a discussion about the

Page 504

1 flow model that we had constructed in 2013 and then its use
2 in the report in our Exhibit 2.
3 And then certain discussion about the concept of
4 using capture zones to describe where pumping effects will
5 occur.
6 And then I'll wrap up with a summary.
7 So, this first slide, slide three, is just a
8 short quote out of a paper by Lynn Konikow and Stan Leake of
9 the USGS. Discussion and depletion and capture. And the
10 bullet -- I'll just read the first part of it. An important
11 corollary to Theis' 1940 principles is that the average
12 pre-development rate of natural recharge itself is largely
13 irrelevant to storage depletion and capture responses.
14 And then it lists some references to John
15 Bredehoeft and others discuss this concept. If you're
16 unaware of who John Bredehoeft is, he's an ex USGS researcher
17 and he testified before the State Engineer's office back in
18 the Coyote Spring Valley hearing.
19 So the idea here is that when you're looking at
20 capture, we don't really need to know what the recharge is.
21 It does serve as a constraint on modeling and so forth. But
22 it's less important than understanding what the discharge is.
23 You're capturing discharge. You're not capturing recharge.
24 And if you change the estimates on recharge, then you have to

1 deal with where that water is going, say, in a computer model
2 or in your conceptual model. But the discharge number is
3 pretty well fixed. And so if you change discharge and, say,
4 overestimate -- I mean, if you change recharge and you
5 overestimate what the recharge rate is, that water has got to
6 be leaving the system somewhere. And if it's not discharge
7 because you have a good idea of what that number is, it's got
8 to be through the boundaries of the system, which gets to the
9 next slide about the sources of uncertainty and water
10 budgets.

11 In my view, the two largest sources of error are
12 in estimates of those boundary fluxes. So in the concept of
13 here, how much water is coming across the Pahrnagat Valley
14 sheer zone. Their guesses as to what that is, they seem
15 reasonable in terms of the water budget for a much larger
16 area, but there's still uncertainty in those numbers. How
17 much water is discharging in to Lake Mead, for example? This
18 was an area of discussion a couple of decades ago when
19 recharge, some of the recharge estimates, were high and the
20 excess water was being shut off in to the Colorado River in
21 to Lake Mead. So there are arguments about was there any
22 evidence for that discharge occurring. So there's
23 uncertainty about the boundary fluxes.

24 I already talked about the recharge rates.

1 Discharge is something that we can measure. We can measure
2 that pretty well. We've been measuring spring flow for
3 years. We know how to do that. And in the last decade or so
4 techniques have been developed for developing good estimates
5 of evapotranspiration, using field instrumentation and using
6 satellite imagery to assess the help of plants and so forth.
7 And USGS has done this at several sites in the southern
8 Nevada area. They did that some for this particular flow
9 system.

10 One of the first was in the Oasis Valley areas
11 near Beatty and then down in the Amargosa Desert. So that's
12 been applied very, you know, in recent years and it was a
13 pretty reliable technique. And then we can measure the
14 discharge in rivers by synoptic surveys along the river --
15 measuring flow along rivers and measuring how much inflow or
16 outflow there are along different stretches.

17 So, since recharge can't be measured, we can't
18 measure the boundary fluxes, but discharge is one of the
19 things that we're interested in in terms of effects of
20 pumping. We need to concentrate on the discharge question,
21 not what the over water budget is because there's going to be
22 error in the budgets.

23 I do want to make one comment about recharge. I
24 was involved with a modeling effort in the northeastern part

1 of Arizona with the Navajo Sandstone. This was a model that
2 was put together for water management questions related to
3 the pumping of water by Peabody Western Cold Company from the
4 Navajo. And one of the questions in that modeling is what is
5 the recharge rate.

6 And so we did a, basically a computer experiment
7 using a calibrated model. We calibrated it with a parameter
8 estimation technique called PEST and ran the simulations of
9 what the effects of pumping would be. We then modified what
10 the specified recharge rate was by a substantial amount. I
11 think we increased it by 50 percent or something like that.
12 We were able to successfully recalibrate the model to the
13 pumping -- One of the things about this particular question
14 was Peabody had been pumping water for decades and they were
15 really the only major pumper in the basin. It was, in
16 effect, a pumping test that had gone on for decades.

17 And what we found was, in our simulations, that
18 changing the assumptions on recharge rates really didn't
19 change the effects on the simulations when we predicted the
20 effects of their pumping on capture from the streams. It
21 really didn't change those results because we had this good
22 data set that we could calibrate against.

23 So, again, my recommendation is let's concentrate
24 on the discharge and the process involved there.

1 One of the questions from the State Engineer was
2 are there any recommendations for changing the boundary of
3 the Lower White River Flow System for this joint
4 administrative. And, to my mind, the critical question there
5 is what is the connectedness of the different areas. And
6 this is where the Order 1169 test provided very valuable
7 information. I'll make a comment on that just real briefly.

8 There's a lot of seasonal pumping, seasonal ET,
9 going on in the area that generates a water level response
10 signal throughout the area. Back when the 1169 pumping test
11 was being designed, the National Park Service was adamant
12 that the pumping signal related to Order 1169 pumping be
13 different than the seasonal pumping throughout the area so
14 that we could separate out the effects of the pumping. So
15 instead of doing seasonal pumping in the same -- in the phase
16 with the other seasonal pumping which would generate a signal
17 that we couldn't separate, we were insistent that that
18 pumping signal looked differently, it was shaped differently.

19 I'm not sure that our arguments really had much
20 effect on the State Engineer's office, but it turned out that
21 when that test was run it was run the way that we were
22 recommending. And so that helped in terms of differentiating
23 the effects of other pumping in the area from the MX-5
24 pumping.

Page 509

1 Getting back to the question here, the overriding
2 consideration on which areas should be included in this joint
3 unit is related to connectedness. And so I've got some
4 examples here. And I use the terms well connected or
5 connected or briefly connected or unconnected. And so I'll
6 go through some of these examples.

7 One of the things that surprised I think
8 everybody on the basis of the results from Order 1169 was how
9 connected large areas were. We also found out that the areas
10 that don't have swift connection.

11 So what determines this connectedness? The first
12 I've listed here is lithologic continuity. If your aquifer
13 is not well connected through faulting or something like
14 that -- And I'm not talking about the barrier effects that
15 faults may have. But if, say, the carbonate aquifer is much
16 thinner and there was normal faulting which completely offset
17 the carbonate aquifer from itself, we wouldn't have this
18 connectedness to cross that fault.

19 One of the nice things about the carbonate
20 aquifer is it's very thick. And that provides that
21 geographic continuity throughout the flow system.

22 The next on the list is faulting and fracturing.
23 And that's related to the next bullet, the permeability of
24 the rock matrix. The carbonate rock itself, excuse me, with

Page 510

1 exceptions doesn't have that high of a matrix permeability.
2 It's not like a basin fill aquifer developed in a gravel
3 where there's a lot of permeability within the matrix itself.
4 Generally the grains are small. The rocks are well
5 submitted. There's not a whole lot of water that you can
6 push through that. There are exceptions to that. The
7 limestone or dolomites being carbonates are subject to
8 dissolution features.

9 There is a well that we deepened on the Nevada
10 Test Site and a well that had been constructed in volcanic
11 rock and we were understood in getting information from
12 carbonates, which we would underlie that location at a
13 slightly greater depth. This well was UE-10-J. We deepened
14 that well in to the carbonates. We got a lot of water out of
15 it. Ran a camera down that well and found a zone that was
16 basically a small cave system. There was this interval that
17 was about two or three feet thick that you could see a noted
18 calcite that had been precipitated on the walls like you see
19 in caves and produced a lot of water.

20 That doesn't happen all -- You know, we don't see
21 that very often. Commonly, we don't send cameras down many
22 wells because of the expense. But there are dissolution
23 features within the carbonates.

24 So fracturing is important. The water moves

Page 511

1 through fractures. And so knowing -- understanding something
2 about the details of the fractures isn't all that important.
3 But recognizing that we are dealing with a fractured medium
4 is important in terms of understanding the system.

5 There have been discussion about the row of
6 faults in the carbonates and whether or not they provide a
7 barrier. And my answer to that is it depends. There are
8 examples of where we do aquifer tests across the faults and
9 we don't really see that the fault has much effect on
10 responses.

11 But there's a very good example again at the
12 Nevada Test Site of where faults and the data that were
13 collected show that there is a significant barrier effect at
14 times, certainly in this location.

15 We had installed a well to run a tracer test in
16 the carbonate rock so that we could get some information on
17 running nuclides in to the carbonates. There were two wells
18 that were put in. One was going to be an injection well and
19 the other was a pumping well. And we were pulling tracers,
20 not really nuclides, but the tracers that were injected in
21 the injection well -- I think there are actually two
22 injection wells -- towards this pumping well. And that well
23 pumped for approximately seven months as I recall.

24 Almost immediately -- Again, the concept was

Page 512

1 let's pump this well, ER-6-1#2, and pull the tracers out.
2 Transducers were placed in a large number of the wells in the
3 vicinity in Yucca Flat. And, fortunately, in addition, there
4 were measurements of water levels being made in other areas,
5 including off the test site.

6 Almost immediately after the well was turned on,
7 drawdown was seen in a well about seven miles to the north
8 that was located in the same fault block as ER-6-1#2.

9 At the same time, there were wells that had been
10 instrumented across faults that define that fault block which
11 saw very little response. And that's probably because those
12 faults were providing a barrier. So that's certainly
13 something that I think is a valid argument in trying to
14 understand the system here in this flow system and
15 understanding the role of faults as serving as impediments to
16 flow.

17 The next bullet is fracture fill and alteration.
18 I bring this up with respect to fracture fill. There was
19 some discussion on Monday about the role of thrust faults
20 versus normal faults and the different stress environments
21 for the faults. The older thrust faults moved rocks over
22 large distances, miles, tens of miles. And commonly the
23 upper thrust sheet, the upper plate of that thrust sheet, was
24 intensively faulted and fractured. You look at maps of

1 certain exposures of the upper sheet and the faulting is just
2 incredible. And you wonder how somebody, first of all, how
3 could they map it?

4 But when you look at the permeability of those,
5 because those rocks are old, a lot of those fractures and
6 faults have been filled in by precipitation of calcite and
7 other minerals.

8 There's also, in the upper part of the carbonate
9 aquifer, there is a long hiatus where those rocks were
10 exposed, younger rocks had not been placed on top of those
11 yet, and their dissolution features in those. Very commonly
12 when you drill through the contact, say, between basin fill
13 and carbonates or volcanic rocks and carbonates, you find a
14 lot of red clay that filled the pores. Those dissolution
15 features in the upper part of the aquifer. So this is
16 something that also affects what's going on and something to
17 watch out for.

18 And I can't remember if it was EH-3 or EH-7, the
19 well went in to carbonate aquifer and this red clay was
20 found, which to me indicates that that was Paleozoic rock and
21 Paleozoic carbonate aquifer.

22 The other well went in to what was described as a
23 carbonate but it was overlain by cretaceous rocks without any
24 description of this. I think it was actually Muddy Creek on

1 top as well. It's unclear to me as to whether that was
2 Paleozoic carbonate or some younger carbonate associated with
3 Muddy Creek. So this is a different thing that may affect
4 connectedness.

5 The final bullet is just related to the
6 permeability detected in the monitoring well. If you happen
7 to have bad luck and drill a well in a location that doesn't
8 encounter permeability -- Again, this is secondary
9 permeability associated with fracturing -- that low
10 permeability around the well board itself may prevent you
11 from seeing effects of pumping other wells. So just another
12 thing to be aware of.

13 So one of the signs of connectedness within the
14 flow system. My first bullet here, just because it's been
15 going on for so long, water level responses to seasonal
16 pumping or seasonal evapotranspiration. I think both of
17 those generated signals.

18 I went back and looked at flow measurements
19 within the Muddy River back in the period of approximately
20 1910 to 1920 before much pumping would have been going on.
21 I'm not saying there wasn't any pumping, but before much
22 pumping was going on in the alluvial aquifer. And you see
23 the same seasonal pattern in the flow of the river that you
24 saw -- that you see today. So evapotranspiration certainly

1 has a seasonal impact that generates a response, a seasonal
2 response, in other areas.

3 But, then again, the pumping is on top of that.

4 People like to pump water in the summer for crops and running
5 power plants and that kind of stuff. So certainly in the
6 Muddy River Springs area and along the Muddy River there's
7 seasonal pumping that generates a signal. CSI's wells in the
8 Coyote Spring Valley pump seasonally that generates a
9 seasonal signal. Wells down in Garnet Valley, some of those
10 are seasonal pumping and generate seasonal signal.

11 So you can see these seasonal changes in the
12 record, you need to be mindful of there are multiple sources
13 of these seasonal stresses.

14 The next bulletin is the Order 1169 pumping test
15 where water was pumped almost continually for a couple of
16 years that generated a very nice signal, generating water
17 level responses in the area. And we'll talk more about that.

18 Next is looking for low hydraulic gradient. And
19 basically from the mid part of Coyote Spring Valley southward
20 and down through Garnet Valley and down to the shear zone the
21 hydraulic ratings are very low. The hydraulic gradient is
22 basically determined by two things. One is how much water is
23 moving through the well. And, two, what the permeability or
24 transmissivity of the rock is. And these very low hydraulic

1 gradients tell us that with the amount of water we think is
2 coming through the shear zone that there's a lot of high
3 transmissivity in the rocks that generates that low gradient.

4 There are other areas where the gradients are not
5 as low, certainly. If you get in to the volcanic rock,
6 gradients are much, much higher. It tells us that the
7 transmissivity of those rocks is much, much lower.

8 And then of interest to these proceedings is the
9 gradient in the northern part of the Coyote Spring Valley
10 where the gradient is higher than it is a little further to
11 the south.

12 Water chemistry provides this information really
13 on what the sources of water are for discharge areas. And I
14 bring this up because with respect to Rogers and Blue Point
15 Springs, which are important to the park service, we think
16 that the water chemistry gives us information about
17 connectedness to the aquifer.

18 I also mention temperature on here. I'll show
19 you something later on that Vidler had put together that
20 demonstrates this as well.

21 And then, finally, the geology. And I put on
22 here whether I think that something is sufficient to
23 demonstrate connectedness or necessary or whatever. So
24 geology I think is necessary. If you don't have geologic

Page 517

1 continuity, you can't have connectedness.

2 The water level responses to seasonal pumping to,
3 say, Order 1169, I think those are sufficient to demonstrate
4 connectedness.

5 The low hydraulic gradient, I said it was
6 supportive but not necessarily sufficient. The reason I did
7 that was some of the older conceptual models of flow in the
8 southern part of the system was that most of the water -- And
9 this depends on what your estimates of the water budget are.
10 But most of the water that is moving down the White River
11 Flow System discharged in the Muddy River Springs area. And
12 the flow continuing to the south may not -- certainly is not
13 as high as in the northern part. And the low gradient there
14 may be due to just absence of flow.

15 Water has a hard time getting across the Las
16 Vegas Valley shear zone. It has a hard time getting across
17 some of the rocks that intervene between the carbonate
18 aquifer and the Colorado River, limiting flow and discharge
19 out of the system. So there might just be not that much
20 flow. The waters there, the gradients flow, but the gradient
21 could be low because there's not much flow.

22 That was the conceptual model until the Order
23 1169 test when we saw that pumping signal propagate down the
24 Garden Valley very quickly.

Page 518

1 The water chemistry I said is supportive but not
2 sufficient. I just talked about geology. I think it's
3 necessary.

4 So not to beat a dead horse, but I'm going to
5 talk about hydrographs. And this is one of the slides that I
6 mentioned I had to make some changes on. Specifically the
7 location of MX-4 in your handout, it's a little bit further
8 to the south. And that was just an error made in preparation
9 of the slide.

10 But MX-4 is a well that is important in the
11 history of carbonate pumping in the Coyote Spring Valley.

12 Early time -- And, again, the MX wells were put
13 in by the Air Force to look for water supplies for the MX
14 program. So that's why this well is available for
15 measurements in the early part of the period of record.

16 So you'll see a combination of manual
17 measurements here that are made either by USGS or SNWA. And
18 then there are also some transducer data shown as a line,
19 which provides a more continuous data set and is nice to have
20 in terms of looking at short term responses and seasonal
21 effects.

22 And so we see a fairly flat hydrograph in the
23 early part with some, I would say, some measurement noise.
24 And then, as Tim Mayer testified yesterday, in 1998 Arrow

Page 519

1 Canyon started pumping at a higher rate at approximately
2 four-fold. And MX-4 -- Again, Arrow Canyon is down in the
3 Muddy River Springs area to the southeast of MX-4. There was
4 a very quick response that was noticed in the hydrograph with
5 a pretty significant decrease in water levels showing that
6 the carbonate aquifer between those two areas was connected.

7 And this is the 2004-2005 recharge event. We
8 don't see a lot of other recharge events in most of the
9 record. This is a significant one.

10 And then, following that, we see a decline in
11 water levels. You still see the seasonal effects going on.
12 But we see a decline in water levels and we can discuss what
13 the cause of that decline is. But you'll notice that the
14 slope of that decline is very similar to the decline that
15 occurred before the recharge event that was due to pumping of
16 Arrow Canyon.

17 The Order 1169 test began late in 2010, continued
18 for a couple of years. MX-5 pumping continued at a higher
19 rate in to 2013. And so you see a change in slope in this
20 area beginning with initiation of MX-5 pumping. MX-5 is
21 turned off and you see a recovery occurring very quickly in
22 MX-4. Realize that MX-4 is only a short distance from MX-5,
23 the well that was being pumped.

24 And then that recovery kind of levels off and

Page 520

1 it's kind of looking like flat responses through the period
2 since then. But, as you'll see in other hydrographs, there
3 might be some hint that we're starting to downward trend
4 again.

5 One other point and it's kind of hard to see in
6 this one, this is CSVM-1, which is located in the same
7 general area. The base map that I'm using here is the map of
8 faults that CSI had put together based upon their CSAMT work.
9 And this is -- Well, here's a fault just to the west of the
10 red cross representing CSVM-1. And then there's an area just
11 to the west, which is a structural block that CSI has
12 interpreted to be a barrier to flow. It's bounded on the
13 west and crossed by both the CSAMT lines, AA prime and BB
14 prime. And this showed up very well in the CSAMT record.

15 The CSAMT is, in my opinion, a good technique for
16 trying to pick up these faults where you have carbonate rock
17 that is present at depths within the depth of investigation
18 of the technique. And you saw -- you saw these lines. And
19 this shows that very distinctly.

20 So this well is located, according to this map,
21 just to the east of that structural line. And in this, the
22 period of record is much shorter. We're missing the earlier
23 time data or it doesn't exist. But we see the 2004-2005
24 recharge pulse, a decline in water levels like we saw in

1 MX-4, the initiation of MX-5 testing, which increased the
2 slope of decline. And then shut off of the well, we see
3 recovery. And then it looks like we've got declining water
4 levels going on again.

5 And what I was going to try to show on the other
6 slide was that during the Order 1169 test, pumping stopped
7 for a fairly short period of time, as I understand, to do
8 some work on the arsenic treatment facility. But it resulted
9 in a pretty sharp increase in water levels. And then when
10 the pumping started again there was decline in one of those.
11 It shows up nicely in the transducer data. So this is
12 another part of the signature of the MX-5 pumping.

13 So in these two examples, you see the seasonal
14 pumping, you see the Order 1169 pumping. MX-4 we saw Arrow
15 Canyon pumping. I would turn these wells being well
16 connected with the source of the stresses, those sources
17 being Muddy River Springs area and -- Well, let's just say
18 Muddy River Springs area for the seasonal signal and then
19 MX-5 for the Order 1169. So it's well connected to both
20 areas.

21 Same kind of story on CSVM-6, shown again pretty
22 close to MX-5. We see similar types of responses. The
23 seasonal pumping, the decline prior to initiation of MX-5
24 pumping, the shutdown of the well about halfway through the

1 low permeability.

2 So here we see seasonal effects and transducer
3 data indicating connection with the Muddy River Springs area.
4 We see the increase in slope with MX-5 pumping. We see the
5 recovery that takes place after that and then a decline
6 starting to appear in the more recent record. And this well
7 is quite a bit to the south.

8 I'm not going to present hydrographs from
9 California Wash or from Garnet, but they have similar
10 responses to these, showing that those areas are well
11 connected.

12 CSV-3 -- The other wells that I presented are all
13 on carbonate. And CSV-3 is completed alluvium. And it shows
14 similar but attenuated responses. So, fairly flat hydrograph
15 up until initiation of Arrow Canyon pumping where we start
16 seeing water levels decline. We see the 2004-2005 wet winter
17 creating an increase in water levels, the decline in water
18 levels following that until initiation of MX-5 pumping, at
19 which time the slope of the decline increases. We see the
20 recovery from MX-5 towards the end of this record and then
21 water levels starting to go down.

22 So what this shows us is that at least at this
23 location the basin fill aquifer is also connected with these
24 areas. When that means is that if you wanted to go in and

1 testing, recovery at the end of the test. And now it looks
2 like water levels are starting to decline again after that
3 recovery.

4 Another well, CSV-2, looks similar to what we saw
5 with MX-4. So a fairly stable water levels early on, a lot
6 of noise in the measurements. Measurement protocols were
7 being worked on, developed, to improve those or perhaps
8 getting new equipment that responded better. And transducer
9 data that shows the seasonal effects, shows the 2005 recharge
10 event, the decline in water levels following that event.
11 Order 1169 pumping recovery and now water levels appearing to
12 start downward again.

13 Okay. This is a well, CSVM-2, which is located
14 quite a bit to the south along the highway. MX-5 is in this
15 general location. CSI testified that that well penetrates
16 the fault on the east side of the structural block and that
17 the reason it's so productive is because of faults or
18 fracturing faulting -- fracturing associated with that
19 faulting.

20 And, according to the model of the permeability
21 associated with faults, that permeability runs parallel to
22 the strike of the fault, the high permeability. And then the
23 low permeability perpendicular to it. And, again, this
24 structural block is one that CSI has interpreted as being a

1 pump from the basin fill in this area, you would obviously
2 get different responses because of the different properties
3 in the basin fill compared with the carbonates. But the
4 water level changes in the basin fill will be transmitted
5 downward in to the carbonate aquifer. And because of the
6 connectedness both with Muddy River Springs area and MX-5,
7 those effects will be transmitted to those areas.

8 CSVM-4 is one that is of interest with respect to
9 the connectedness with Kane Spring Valley. We still see
10 similar responses, although, they are greatly attenuated
11 compared to the others. Now, we see an increase in water
12 levels associated with 2004-2005 wet winter recharge event.
13 We see a decline in water levels that kind of matches the
14 slope that we've seen in others. We see an increase in the
15 slope associated with Order 1169 pumping. We see recovery
16 following cessation of MX-5 pumping. And then we see water
17 levels start to go down again.

18 So I would term this, instead of being well
19 connected, I say this is connected. We're not seeing the
20 seasonal effect of the pumping in ET in the Muddy River
21 Springs area. But we are seeing all the other
22 characteristics of the hydrographs that we've seen. And, you
23 know, obviously there are reasons for why this is attenuated
24 that CSI has discussed and Vidler has in their reports. And

Page 525

1 I'll get in to those. Did I skip one? Yeah.
 2 So this is CE-VF-2, which is located along the
 3 highway on the west side of this structural block. And,
 4 unfortunately, from this plot it's a little difficult to see
 5 what's going on with the hydrograph. And I guess for the
 6 record I should say that all of these hydrographs that I've
 7 been showing are out of Nevada State Engineer Exhibit Number
 8 228, which is the 2018 HRT report. And these are all plots
 9 that were produced by SNWA.
 10 So this is the well that had a casing failure
 11 during the Order 1169 test. So there's a sharp increase in
 12 water levels as water levels in the well try to start to
 13 calibrate with the higher water levels in the alluvium
 14 overlying the carbonates.
 15 And what we see in it is basically a flat
 16 response and basically the noise disappeared for the most
 17 part in these measurements up until a certain point. And
 18 then we see water levels starting to go down beginning with
 19 pumping in Arrow Canyon. We see the 2004-2005 wet water
 20 recharge event. There's a period of additional decline. And
 21 I think that it's kind of hard to pick out, a decrease in
 22 water levels associated with Order 1169. At the bottom of
 23 this, I show that the later part of that record expanded just
 24 to make it a little bit easier to see. We do see that there

Page 526

1 is still this seasonal response. But I don't think it's as
 2 well defined as what we had otherwise.
 3 Order 1169 started approximately here and then
 4 there's a change in slope. But, unfortunately, the record is
 5 not as complete in others. And so there's still a question
 6 about are we seeing MX-5 pumping. I think we are. But it
 7 certainly can be debated. But the overall parts of the
 8 hydrograph looks similar to what I've been showing you.
 9 CSVM-3 on, this is slide 16, is located in the
 10 northern part of Coyote Spring Valley. It is shown here
 11 right along the highway. There's an increase in water level
 12 occurring. The record starts about the same time as the
 13 recharge event, 2004-2005. This increase in water level
 14 seems to continue longer than what we see in other areas.
 15 The hydrograph flattens out and then starts going down again.
 16 And basically this is not as well connected as the other
 17 areas that we've been talking about. It's got some of the
 18 characteristics of the other hydrographs, but it's certainly
 19 much more difficult to make a definite statement that, oh,
 20 we're seeing MX-5 pumping in this well. So the degree of
 21 connection -- connectedness is less than what I've been
 22 showing you.
 23 And then, finally -- And you've seen this
 24 hydrograph before. This is CSVM-5, which is located further

Page 527

1 to the west. And this one is pretty anomalous to what
 2 everybody -- you know, all of the other wells have been
 3 looking at. This isn't new to you. You've seen this.
 4 There's the recharge pulse. There's rising water
 5 levels. There's probably an adjustment of the measurement
 6 data at this break in the record and then continuation of
 7 increasing water levels to the present.
 8 But this one clearly behaves differently than the
 9 other wells further to the east. And I'll show you gradient
 10 information a little bit later. But this well has a higher
 11 water level than those to the east.
 12 Because of this different hydrograph response, I
 13 classify this as not connected. It doesn't mean that it's
 14 not connected. But based on the data we've got, I classify
 15 it as not connected.
 16 So CSI has made claims that the wells that are on
 17 the western side of the structural block don't show a
 18 response to pumping the signals generated in the springs area
 19 or MX-5. I differ in my interpretation from them. I think
 20 that CSVM-2 located to the south is well connected. I showed
 21 you that hydrograph. It's got the seasonal effects. It's
 22 got all the hallmarks that we saw in, for example, MX-4.
 23 It's well connected to the sources of those signals.
 24 On the other hand, CSVM-3 is, I classify it as

Page 528

1 poorly connected.
 2 CSVM-4, the one just southwest of Kane Spring
 3 Valley, I say is connected. It is on the eastern side of the
 4 structural block.
 5 CSVM-5 I agree with that's not connected.
 6 And this well, CE-VF-02, which is on the western
 7 side of the fault that was -- that defines that structural
 8 block has a weak connection.
 9 Their basic claim is that as you go from east to
 10 west the degree of connection with, for example, MX-5 or with
 11 the spring area decreases. And I would say in a general way
 12 I agree with that, that it does decrease. But it doesn't
 13 necessarily mean that it's not connected.
 14 They have made the claim that the structural
 15 block is impermeable, this is carbonate rock that is
 16 impermeable. Recognize that the carbonate aquifer is the
 17 aquifer that's transmitting all of this water. This block
 18 itself is impermeable, according to CSI.
 19 So why would the permeability of the carbonate
 20 rock in this horst block, this structurally high block, be
 21 low? I agree with them that permeability is perpendicular to
 22 the fault is probably lower than parallel to the fault.
 23 There is a gouge zone that's developed. There is fracturing
 24 on either side of the fault that would enhance permeability

Page 529

1 parallel to the fault. So we agree on that.
2 But, within the fault block itself, I think the
3 permeability is high. And I'll first talk about just in a
4 general sense why within the region we don't -- we don't
5 think that carbonate rock blocks between faults have low
6 permeability or are impermeable.

7 You can go in to these wells when you're doing
8 aquifer testing and run flow surveys or temperature surveys
9 during pumping and see where water is coming in to the well
10 bore. We did this all the time on the test site. And what
11 you find out is that, one, you can't predict very well where
12 the water is going to come in because you don't know where
13 the permeable fracture zones are. You also find that in
14 instances you know from the core or the cuttings that are
15 collected in the well that you've gone through a fault and
16 you see no water coming in through that fault. Certainly
17 much, much less, I mean, to the point of not being easily
18 detectible than what you see in other areas.

19 So, the structures, the fracture zones, within
20 the carbonate block that are not the fault in many of these
21 instances turn out to be the permeable part of the rock, not
22 the fault zone itself.

23 So we know that we have of permeability elsewhere
24 than just the faults.

Page 530

1 I already mentioned this pumping test of
2 ER-6-1#2. I can't get into details, because the report has
3 not been released by the USGS. I talked a little bit about
4 the responses seem to pumping in the near vicinity within a
5 few miles of the pumping well itself. But USGS has done an
6 analysis and has determined that they see responses from that
7 pumping test in a well called Army 1, which was an old
8 carbonate water supply well located just to the south of
9 Mercury. And those -- Like I say, I can't get in to details,
10 because it has not been released yet.

11 But there is an Amargosa tracer site located a
12 little bit further down, a little bit further meaning in the
13 context here, several miles, further down gradient where
14 those pumping responses were also picked up. So we've got
15 another example of where pumping responses from this pumping
16 went tens of miles. And ER-6-1#2 was in the middle of this
17 fault block. There were faults on either side of it. But we
18 were pumping -- I say we were. I helped design the test, but
19 I left the program by the time the test was run. But the
20 well was in a fault block, not along the edges, not the fault
21 down to the edges.

22 The carbonate aquifer that is up gradient of Ash
23 Meadows is very transmissive. I don't know if it's the same
24 as what we see between MX-5 and the Muddy River Springs area,

Page 531

1 if it's that high. But it's very transmissive. There's 17,
2 18,000 acre feet of water coming out at Ash Meadows. And all
3 of that water is traveling through this area to the northeast
4 of that, which has a very low gradient. I don't have
5 specific information that it's not moving just to the faults,
6 but it makes sense that it's moving through the rock and the
7 faults might assist.

8 The Amargosa Tracer Site, I mentioned a while
9 ago, is a site that the USGS had constructed in the early,
10 mid-seventies, early to mid-seventies to evaluate tracer
11 movement, in fact, radionuclide movement in the carbonate
12 aquifer. They actually injected tritium in to the aquifer
13 and watched its recovery. And I don't recall the details on
14 the wells and their productivity. But I think there were,
15 like, six-inch wells that produced in the vicinity of eight
16 or 900 GPM out at Bonanza King. And certainly a lot of
17 permeability there.

18 And I mentioned earlier the very low gradient in
19 most of the Lower White River Flow System I think is an
20 indication that the fault, although they certainly have
21 probably more barriers, is that the rock itself is permeable
22 and plays a significant role in the transmission of water.

23 We mentioned earlier that we had put together a
24 flow model, a three-dimensional flow model of this system as

Page 532

1 well as aquifers to the east. As part of that effort we
2 compiled transmissivity information from aquifer tests that
3 were performed in these wells. We had I think about 25 or 30
4 analyses that we found. And I went through and just listed
5 the ones with transmissivities greater than 100,000 feet
6 squared per day. MX-5 certainly showed up in this list.
7 MX-4 did. Arrow Canyon did. There's a lot of carbonate
8 wells, including one way down to the south.

9 Let me correct something real quick. The upper
10 ones came out of our modeling report. Well BM-DL-2, the
11 number I pulled was the one that Moapa Band of Paiutes had
12 put in to their initial report for transmissivity.

13 And so there was a significant number of wells,
14 significant population out of this, say, 25 wells where we've
15 got data or that I had readily available data that show high
16 permeability. This is maybe a fourth of the wells. So, you
17 know, there's transmissive rock out there.

18 Moving on to slide 21, I want to discuss in a
19 little bit more detail the structural block as a barrier. I
20 like CSAMT. I think that it does a very good job of picking
21 up changes in electrical resistivity which can provide clues
22 as to not only the geology but the hydrology.

23 In the profiles that were shown by CSI and in
24 profiles that Vidler has prepared, you can definitely see

Page 533

1 where you've got faulting associated with carbonate blocks.
2 Because if the carbonate comes up high enough that it's
3 within the depth of investigation of the technique. You see
4 a very definite change in the measured resistivity from the
5 lower resistivity of the carbonate block to the higher
6 resistivity basin fill. Yeah, I got that backwards. Higher
7 resistivity of the carbonate rock and the lower resistivity
8 basin fill. So it is very good at that.

9 It does not measure hydraulic properties.
10 There's nothing in that technique -- It's responding to the
11 rock matrix. It's not responding to the fractures. It does
12 not provide you information on the hydraulic properties of
13 the rock. It shows you where there's fault and displacements
14 very well if you have good contracts. And, in general, I
15 think it's a good technique and provides various flow
16 information.

17 I think there is a high degree of connectivity
18 that's been demonstrated across this block. MX-5 was said to
19 be penetrating, getting productivity out of the fault, on the
20 eastern side of the block.

21 CSVM-2, the well to the south and on the west
22 side of the block, is highly connected with both MX-5 and the
23 Muddy River Spring area. That signal is being transmitted
24 across the structural block that is reported to be

Page 534

1 impermeable. I think that indicates it is not impermeable.
2 And my comment here is that if there's going to
3 be a claim that a block or whatever is impermeable, that
4 needs to be demonstrated. The CSAMT does not provide you
5 information on that. You just can't make the assumption
6 because it has a high resistivity that it has low
7 permeability. That's an invalid interpretation.

8 So how do you get that? You can do aquifer
9 tests. I mentioned the response that you see across the
10 block between MX-5 and CSVM-2. If hydrology is correct, you
11 can maybe measure hydraulic gradients across the block. But,
12 you know, you can have low gradients across a block that do
13 not show that it's permeable. That may be due to just the
14 geometry of the flow system. So you have to be careful on
15 how you interpret stuff. And I'll show you an example a
16 little later, I think, that also provides information this
17 structural block has permeability.

18 So let's get back to the geographic boundary of
19 the flow system. I'm going to talk about three different
20 areas: Kane Spring Valley, which is one that others said
21 should be included. Las Vegas Valley. I mentioned early in
22 the presentation that there's one that I recommend kind of
23 tongue in cheek. That's Las Vegas Valley. And then the
24 remainder of the Black Mountains area. And I'll talk about

Page 535

1 Rogers and Blue Point Spring in the context of that.
2 So Kane Spring Valley I've already discussed.
3 The hydrograph, this is just another set of those. The
4 presentation provided by Lincoln County, Vidler produced the
5 diagram on the left. And this is that CSVM-4 and Kane Vidler
6 1 in it. And the same information is shown on the right
7 presented in a slightly different form. It's the same data.

8 And one of the things that Lincoln County Vidler
9 did on theirs was draw a line in here which talks about --
10 Let me look at that. I think the long term water level trend
11 line. And that kind of draws your eye to there's this
12 declining water level in there, at least it drew my eye to
13 that, and drew it away from the fact that we have an increase
14 in the slope of the decline associated with the Order 1169
15 test.

16 And so on the right what we had done is to break
17 the lineup in to different segments, three different
18 segments, and run regressions on those. I know you can't
19 read the numbers on the slide. But it is in the report as
20 well. And what we see in both of these wells is an initial
21 trend of declining water levels, an increase in the slope of
22 declining water levels during the period of the Order 1169
23 testing and then at the cessation of MX-5 pumping either a
24 trend that is shown as being slightly increasing -- I'm not

Page 536

1 going to claim that it is increasing. This may be the data
2 set. We see that in Kane W-1. And then in the other well
3 which is located to the southwest in Coyote Spring Valley
4 return to declining water levels. And note that the slope
5 post Order 1169 record is basically the same as what the
6 slope was prior to that.

7 Lincoln County, Vidler, also performed CSAMT
8 testing. I think it provides useful information. Again, I
9 think it's a good technique that provides you information on
10 the structure, especially where you have carbonates shallow
11 enough to be picked up by the technique. If they're too
12 deep, you can't see them.

13 I didn't say a while ago, but in these profiles
14 that were produced, and I think they mentioned this, if you
15 see blue up near the surface, it's indicative of unsaturated
16 sediments. There's not water in the sediments to increase
17 the conductivity or decrease the resistivity of the rocks.
18 And that shows up as blue. It looks like it might be
19 carbonate, but it's not. It's dry sediment. You can see in
20 the basin fill where the sediments are saturated. They show
21 up as red. So you can get some hydrologic information on
22 water content and that kind of stuff as well as the location
23 of carbonates.

24 So Vidler, Lincoln County, ran CSAMT surveys.

1 One is shown here. The trends from this outcrop area in the
2 southeastern side of Kane Spring Wash across the wash to the
3 northwest. Another line that has a similar trend, just to
4 locate it a little bit further to the southwest, and then
5 across the line. And the two lines that trend from southeast
6 to northwest have a different response. They show different
7 geology. That was their interpretation. That's my
8 interpretation.

9 And on the basis of that difference between those
10 two lines, they say there must be a fault in between those
11 two. And that's the fault that's shown on their diagram as a
12 red dash line and they have named that fault -- Let me make
13 sure I get it right -- the northern LWFSX boundary fault. So
14 in their interpretation, this is the boundary of the flow
15 system. And normally a geologist wouldn't say, you know,
16 give it a name like that. You know, they might say, you
17 know -- I know geologist who has done a lot of work in the
18 area and he likes naming his stuff after women that he knows.
19 So he might call that the Susan fault or something like that.
20 So it could be the Weiser or the Kane Spring Valley
21 termination fault or something like that. But not, you know,
22 indicating it's the fault, it's the boundary for the flow
23 system.

24 And I don't necessarily disagree that there's a

1 that have been available for years and are very useful. We
2 use data, these data and other data, when we constructed our
3 flow model.

4 Between N-2 and N-1, two of the survey profiles,
5 there is an area of moderate gradient in the contour lines
6 that extends from southeast toward northwest over to an
7 outcrop area in the northwestern corner of the right panel on
8 this figure that is carbonate outcrop. And this indicates
9 that there is also likely to be some faulting in this area,
10 something that is causing the carbonate to be deeper on the
11 southwestern side of that moderate gradient gravity signature
12 than to the northeast.

13 And this is in the same general area where
14 Lincoln, Vidler County(sic) has interpreted a fault to be
15 present. So I think that the location might be somewhat
16 uncertain. This third east/west profile that they ran did
17 not really pick up the location of that fault, but it's
18 because the carbonate rock is too deep to be picked up by the
19 technique.

20 So, you know, there's likely to be faulting in
21 that area. We don't know specifically where it is. And
22 based upon this conceptual model that normal faults, which
23 these would be, produce an impediment to flow -- I like to
24 use the term impediment as opposed to barrier, because

1 fault in this area. I provided in my report -- And this is
2 referred to by CSI -- a gravity interpretation that was
3 published by Phelps and others for Coyote Spring Valley. And
4 CSI had discussed these lines further to the south and the
5 results from those.

6 And I want to concentrate a little bit on what's
7 going on further to the north near Kane Spring Valley. And
8 basically what this shows is that on the eastern side of Kane
9 Spring Valley there is a gravity low in this area that
10 indicates that carbonate rocks are deeper than they are
11 further to the west. And there is an area of high gradient
12 on the eastern side of that gravity level. And one of their
13 profiles in two goes across that, not in the middle of it,
14 because they didn't know where the middle of it was at the
15 time they were in the survey. But their interpretation of
16 N-2 is that there's a fault on the eastern end of that
17 profile. And you see closely spaced contour lines in that
18 area leading down in to the basin. The gravity data had
19 picked up a fault in that location.

20 Similarly, further to the south and closer to
21 where CSI was looking, we see another area of high gradient.
22 The contour lines are close together. And here we have
23 gravity profiles that again picked up faulting in that area
24 to that gravity level in that location. And these are data

1 barrier sounds pretty absolute. Impediment allows flow to go
2 across it. So I'm going to try to say impediment, but I'm
3 going to forget sometimes and say barrier. I'll try to be
4 clear, when I say barrier, I'm talking about a significant
5 barrier. Here I'll say these faults are likely to be
6 impediments to flow.

7 So we're basically in agreement with CSI that
8 there's faulting in this area and that those faults may
9 impede flow through Kane Spring Valley in to Coyote Spring
10 Valley.

11 I had mentioned gradients earlier and this has
12 been an argument that data set that's been available for
13 quite a long time. And, in fact, in a previous order from
14 the State Engineer's office pertaining to whether or not Kane
15 Spring Valley should be included -- I don't know the
16 terminology at that time, but, you know, their area of
17 concern I guess for the carbonate aquifer. They had noted
18 that -- or you had noted -- I don't know if any of you were
19 part of that process -- but that there is water that's moving
20 from Kane Spring Valley in to Coyote Spring Valley, that
21 there's an area of higher gradients in northern Coyote Spring
22 Valley than what we find to the south. So in our figure
23 there are gradients listed in such a small font that they're
24 difficult to read on the printed page. I put those in

1 scientific notation in boxes so that you can read those.
2 So, up to the north between Kane W-1 and CSVM-4,
3 we had measured a gradient that is indicated here as five E
4 minus three. That's L-4 tran terminology. It means five
5 times ten to the minus three. And the units would be feet
6 per foot or meters per meter or whatever. But five times ten
7 to the minus three is what that indicates.

8 A little bit further to the southwest, moving
9 between CSVM-4 and CVF-2, the gradient is somewhat lower, but
10 recognize that it is calculated over a much larger area and
11 there may be higher gradient areas along that profile. We're
12 looking at the average between those two wells. But that's
13 four times ten to the minus four.

14 Another area up in the north, again, a long
15 distance between wells, you're looking at a gradient of five
16 times ten to the minus three. These are all reasonable
17 gradient that you see in groundwater systems everywhere. If
18 you saw these numbers for a gradient in, say, a basin study,
19 your response would be that's pretty typical, you know,
20 that's not a high gradient. That's a pretty common gradient.

21 When they move further to the south -- And I'll
22 skip on down to the gradient calculated between I think that
23 says CSVM-5 but I'm not sure, and EH-4, this well that's
24 close to the Muddy River Spring area that Tim Mayer talked

1 about, we see gradients considerably lower, three times ten
2 to the minus five. So we're about two orders of magnitude in
3 this area lower than what we see in the northern part of the
4 Coyote Spring Valley.

5 So the argument that it's less permeable to the
6 north I think is substantiated by the gradients that we see.
7 We have a very good idea of how much water is moving through
8 this area because of the discharge measurements in the Muddy
9 River Spring area. And, you know, we know that this is very
10 transmissive. This area to the north is less transmissive.
11 And I think Sue Braumiller yesterday was using language like
12 it's much, much lower or something like that.

13 You know, the transmissivity is potentially a
14 couple of order of magnitude lower than what we see in this
15 area even though you have to take in to consideration that
16 the cross-section, the area across which the flow is
17 occurring is larger than it is in this corridor between
18 Coyote Spring Valley leading to the southeast down to EH-4.

19 CSVM-5, which I had classified as not connected
20 to either the MX-5 pumping or to the seasonal pumping in the
21 spring area, we see six times ten to the minus three. But,
22 again, that is averaged over this distance.

23 We don't know what causes this to have a higher
24 head and a separate hydrograph response than the other wells.

1 But there's likely a structure on the east side of the elbow
2 range in here which provides the barrier effect. And I use
3 the word barrier here. I didn't say impediment. It doesn't
4 mean that it does not flow across it. But it's more
5 significant than what we see in this area. And I make that
6 statement based upon the different hydrographic response we
7 see in CSVM-5 than we see in these two wells at the mouth of
8 the Kane Spring Valley.

9 Interestingly enough, down here to the south,
10 which I think is CSVM-2 -- I can't read it either. But these
11 data show a gradient -- a gradient for flow back to the
12 north. Water levels are lower in the central part of the
13 Coyote Spring Valley than they are to the south down where
14 there's this little break in the range between Arrow Canyon
15 range and the Elbow range. So water levels are higher here
16 and they decrease to the north. We see a low gradient, you
17 know, approximately ten to the minus four, but a little bit
18 lower than that between those wells.

19 And just an aside here, the conceptual model
20 generally has been that water is moving to the south through
21 Coyote Spring Valley and continuing further down in to Hidden
22 and Garnet Valley, just kind of as a continuous pathway. I
23 haven't done an in-depth study of what's going on in this
24 well, but that conceptual model may be a little bit of an

1 error, it may be that that groundwater divide in the southern
2 part of Coyote Spring Valley at least in the shallow part of
3 the aquifer, maybe the depth we would have an underflow to
4 the south. You know, we don't know.

5 It doesn't really affect this question of
6 connectivity. This is a -- If this is a divide, it's a
7 divide based on water levels. It's not a divide based on a
8 barrier between the two basins.

9 To the west in the Sheep range, we have a divide
10 in both water levels. You know, when water levels are
11 highest and associated with the springs and the kind of stuff
12 we see here and measured levels either to the east or west.
13 And, in addition, we've got low permeability rock that's
14 present in here, what's been termed by Ike Winograd as the
15 lower class to defining unit. That's a permeability barrier
16 as well. We have no evidence of permeability down in this
17 area of CSVM-5.

18 So Vidler's argument is that the lower hydraulic
19 gradients in the northern part of Coyote Spring Valley are
20 indicative of lower transmissivities in the northern part of
21 the valley. And I agree with that one on that. Something
22 had resulted in lower permeability and lower transmissivity
23 in the northern part of the Coyote Spring Valley than what we
24 find in the central and southern part.

1 Just another geologic aside, we've talked some
2 about normal faulting and thrust faulting. And then there
3 are lateral strike slip faults that are also present. And
4 Kane Spring Valley is one of these. The primary strike slip
5 faults in the region is the Las Vegas Valley shear zone which
6 runs from southeast to northwest. It's a right lateral
7 strike slip fault and it's got kilometers of displacement
8 across it. It's believed to be a significant permeability
9 barrier.

10 There are some other right lateral strike slip
11 faults. And at least some have been mapped. And it shows up
12 on the Reilly and others map of this area between Central and
13 Coyote Spring Valley, the area where MX-5 pumping occurred
14 and the other production wells are and the Muddy River
15 Springs area. If you look on Pete's map and there is right
16 lateral strikes that faulting indicated in this area that may
17 be responsible for the high transmissivity we see in that
18 area.

19 To the north of this figure is the Pahrnatag
20 shear zone. It's a left lateral strike slip fault and is a
21 permeability barrier. The White River Flow System flows to
22 the south. Water hits that barrier. And because of the high
23 gradient that gets developed across it on the northern side
24 of the barrier, groundwater discharges. There is surface

1 water discharge in that area. There's a lot
2 evapotranspiration that's occurring because of the low
3 permeability caused by the Pahrnatag shear zone.

4 There's another left lateral fault that runs up
5 Kane Spring Valley. This is another one of these shear
6 zones. And the argument has been that the presence of the
7 shear zone on the southeastern side with that strike slip
8 fault comes and turns to the south and forms a normal fault
9 on the east side of Coyote Spring Valley, which is part of
10 the basin range pull-apart structure. Others have
11 interpreted it as extending a little bit further towards the
12 middle of the valley. We don't really know.

13 So the presence of these right lateral faults is
14 significant to the hydrology and hydraulic properties is
15 significant to the hydrology of the area.

16 So here is the Reilly and others map of the Kane
17 Spring Valley area. It's kind of hard to pick up. And you
18 have to be careful that you're not -- There's also some
19 thrust faulting that shows up in the Paleozoic rocks in this
20 area. There's some mapping of this left lateral shear zone
21 through here. You can see lots of older non-basin range
22 faulting that runs through -- I take it back. I'm getting
23 confused with the volcanics and the boulder limestones and
24 other. You see basin range associated with faulting in the

1 volcanics in this area.

2 One thing that I wanted to point out to you --
3 Oh, before I move on. This is one of the displays of the
4 Pahrnatag shear zone. So one of the displays here a little
5 bit further to the north is another. This is left lateral
6 movement. There's a third. This would be on echelon
7 faulting. Basically the movement across the shear zone is
8 taken up on several distinct faults that have been mapped and
9 outcropped in this area.

10 But what I wanted to point out -- It's kind of
11 hard to see just because of the calibration and that kind of
12 stuff. And I'm outlining something called the Kane Springs
13 Launch Caldera Complex. Most of that caldera complex is on
14 the northwestern side of the Kane Spring Valley. Just to the
15 northeast of the Kane Spring Wash Complex is another caldera
16 complex called Boulder Canyon. And then there's a third one
17 to the north of it, Narrow Canyon Caldera. What these
18 calderas are, are ancient, ancient meaning tertiary, volcanic
19 centers. A caldera is a volcanic feature in which the magma
20 is high silica, high water content. And when they erupt,
21 they tend to erupt explosively. So you get this large volume
22 of ash that comes out of the caldera complex. You then have
23 an instant magma chamber. What used to be a magma chamber is
24 now basically empty. And the overlying rock of the volcano

1 fall back in to that magma chamber and you end up with a
2 caldera complex.

3 On the test site there's a large series of these
4 that are present up in the Paiute Mesa area. Timber Mountain
5 is a well known caldera in that area that is a little bit
6 different. It's got a resurgent dome. These do not have
7 resurgent domes.

8 They are important here though is not the fact
9 that we've got these complexes with the boundaries as
10 depicted here. It's the fact that we had this large magma
11 chamber sitting in this area that had a lot of heat
12 associated with it. You know, we're looking at temperatures
13 in the magma chamber that are, you know, a thousand to 2,000
14 degrees celsius, so hot rock, a lot of heat.

15 Why is this important to the hydrology? That
16 heat makes a very good tracer for water coming out of Kane
17 Spring Valley. This is a figure that Lincoln Vidler put
18 together showing temperatures measured in wells in the
19 northern part of Coyote Spring Valley as well as down in the
20 central part. And what we see here, again, the calderas are
21 in kind of the central part of Kane Spring Valley, kind of
22 where the labeling is. The hottest water temperature
23 measured was 130 -- 136 degrees Fahrenheit in Kane W-1. A
24 little bit to the southwest of that we had a measurement of

1 106 degrees. This is warm water. And typically we talk
2 about warm water springs occurring down in the measurement
3 spring area. You know, yeah, there is warm water but it's
4 not of the same temperature.

5 A short distance to the northwest where we've got
6 water coming down out of Pahrnagat Valley across the shear
7 zone, water temperatures are in the upper seventies. So
8 we're looking about, you know, 30 or 40 degrees Fahrenheit
9 temperature difference between these two sets of wells in the
10 northern part of Coyote Spring Valley.

11 As we go to the south, temperatures decrease, but
12 they still remain elevated on the eastern side of Coyote
13 Spring Valley. We've reached this complex of wells that
14 we've been talking about and looking at values of 90, a
15 hundred, 106 degrees. Continuing down to the south to CSVM-2
16 where we have still got a hundred degrees.

17 And then as we go, this water that's moving
18 toward the spring area, the temperatures decline to about 90
19 degrees in EH-4. When the Arrow Canyon well was first pumped
20 its temperature was similar. I'm not saying it's changed.
21 But we're looking at similar temperature water in the upper
22 part of the carbonate aquifer of that location.

23 And then, like I said, up in the northern Coyote
24 Spring Valley on the western side, we've got temperatures in

1 the upper seventies.

2 Move down to CSVM-5, which is this well that has
3 a different hydrographic response on the west side, it's
4 about the same temperature. And so what Vidler has done is
5 interpreted flow along these paths connecting areas of
6 similar temperature. So the wells in the northwestern part
7 of Coyote Spring Valley with temperatures of 77 is associated
8 with flow in CSVM-5 where the temperature is 76. So here's a
9 western flow path in their interpretation. And I don't
10 disagree with that.

11 And then they also -- they don't show flow from
12 Kane Spring Valley down to these areas in the eastern part of
13 the Coyote Spring Valley. But they show a flow line from
14 this well. And I can't read what it is. But with a
15 temperature of 99 degrees extending to the south to CSVM-2
16 with a temperature of a hundred degrees and then some
17 movement. 89 degrees in the central part down to the warm
18 springs on the Muddy River Spring area.

19 What's important about this is -- Well, two
20 things that are important. The first is that this
21 demonstrates that we've got water moving out of Kane Spring
22 Valley in to the eastern part of Coyote Spring Valley. Kane
23 Spring Valley is contributing flow to Coyote Spring Valley
24 and it's contributing flow to the Muddy River Springs area.

1 This is hydraulic connection. So that's one interpretation
2 from this that I think is important.

3 The other is related to the structural block that
4 CSI maintains is impermeable. We've got water on the eastern
5 side of that block up to the north -- northern end of up
6 close to the Lincoln County line that flows across that block
7 to CSVM-2, which is on the western side of the block.
8 Something is carrying this heat down to this location. It's
9 not another magma chamber sitting down here. It's transport
10 of heat by water from the area on the eastern side of the
11 structural block to the western side of the structural block.

12 The structural block itself is permeable enough
13 to allow that flow to occur. The faults on the side of that
14 structural block are permeable enough to allow that flow to
15 occur. So I've got another signal here in the data that
16 tells us that this impermeable structural block is being
17 mischaracterized by Vidler -- I'm sorry -- Lincoln County.

18 And then final note, we have gradients, and this
19 has been known for quite a while for flow to occur out of
20 Kane Spring Valley. The heads, the springs are about 3200
21 feet at the head of the valley and at the southwestern down
22 around 1880 feet. So we know we've got flow that's coming
23 out that's contributing flow to the Lower White River Valley
24 flow system.

1 Okay. Las Vegas Valley. I wanted to talk about
2 this in the context of some statements made by the Moapa Band
3 of Paiute Indians. The common interpretation of the Las
4 Vegas Valley shear zone is it's got low permeability. Some
5 of the first indications of that were -- Well, at least they
6 were identified by Ike Winograd in his landmark professional
7 paper on the Death Valley System with the springs at Indian
8 Springs and Corn Creek on the northern and southern side.
9 Corn Creek is on the northern side of the shear zone. Indian
10 Springs is water coming off the Spring Mountains that's on
11 the southern side of the shear zone. So on both sides we
12 know that we've got a permeability barrier that causes this
13 groundwater flow to move to the surface for discharge.

14 There may have been other hydrologists that
15 picked that up earlier. Ike's is just, his was the first one
16 that I became aware of.

17 In SNWA's Exhibit 9 where they were also
18 responding to the Moapa Band of Paiute Indian claims they
19 talked about the low permeability sediments in wells near the
20 Las Vegas Valley near the shear zone. I'm going to say if
21 anybody knows about the geology of Las Vegas Valley, it ought
22 to be SNWA and the Las Vegas Valley Water District. I think
23 this is a very significant finding or comment from them.

24 Jim Harrill, who is a USGS hydrologist who worked

Page 553

1 in Nevada for decades and moved the regional hydrology of
2 Nevada very well was hired by the National Park Service to
3 develop estimates to help guide us in our modeling effort of
4 this area. And he estimated, I can't remember the number.
5 We ended up using a value of zero, treating the shear zone as
6 a no flow boundary based upon his recommendation.

7 And then, finally, when you look at water level
8 data, you're not seeing a gradient, a nice strong gradient
9 across the shear zone, which you would expect to see if
10 you're getting a lot of water movement across the shear zone.
11 On both the north side and the south side of this shear zone
12 flow is to the southeast. So there's no indication from the
13 data that we've got that the shear zone is a permeable area
14 that's allowing water to leave the, you know, the area that
15 we're concerned about. Senior moment here. So it does not
16 appear to be a discharge area for flow from the carbonate
17 aquifer.

18 City of Las Vegas did some modeling. Their
19 estimate is that there's about 700 acre-feet flowing actually
20 in to our flow system from Las Vegas Valley. I'm not sure I
21 believe that. But it's still we're looking at low numbers in
22 terms of what that flux is.

23 In contrast, the Moapa Band of Paiute Indians
24 calculated the flow of about 40,000 acre-feet using darcy

Page 554

1 calculations of water moving across the shear zone from a
2 well in that area that I showed you that has a value greater
3 than 100,000 feet squared per day. And this is a
4 considerable amount of water. And I think they're saying
5 this so that they say that there's excess water that's
6 available for somebody to pump.

7 And the reason I'm bringing this in -- Well,
8 there's another part of this. They made this one calculation
9 and then did a second calculation using combination flow and
10 heat transport modeling that for their Las Vegas center they
11 used what the current groundwater production is in an assumed
12 steady state for the flow and it shows all of these flow
13 lines going in to that pumping center. And I think that
14 calculated a large area but it's including flow from the
15 Death Valley system as well as in our system. And it's even
16 a larger number.

17 So my interpretation is I believe the
18 conventional conceptual model, I see no evidence to suggest
19 that it's invalid. But just a tongue in cheek I guess that
20 if Moapa Band of Paiute Indian interpretation is correct and
21 if they get water rights based upon all of this excess water
22 then somebody is going to be impacted by that pumping and
23 it's going to be Las Vegas Valley, which has water that's
24 been beneficial use for years. So don't put Las Vegas Valley

Page 555

1 in to the definition of this, the area.

2 HEARING OFFICER FAIRBANK: Dr. Waddell, we've
3 been going for about two hours. Is this a good time to maybe
4 take a break?

5 THE WITNESS: It's a great place.

6 HEARING OFFICER FAIRBANK: Okay. Perfect. Let's
7 go ahead and take about a ten-minute break and so we'll go
8 back on the record at 10:34. Thank you.

9 (Break was taken)

10 HEARING OFFICER FAIRBANK: Dr. Waddell, you may
11 continue.

12 THE WITNESS: So at this point I would like to
13 discuss the Rogers and Blue Point Springs and the reason that
14 the National Park Service is participating in this process.
15 Rogers and Blue Point are a couple of springs that are
16 located in this approximate location near the Overton arm of
17 Lake Mead. You can't see it all that well. I'll show you a
18 geological map in just a minute. But there's an escarpment
19 along the northern edge here of this block and the Rogers
20 Spring fault is in this general location.

21 And looking at it in greater detail in this
22 Google Earth image, Blue Point Springs is the spring that's
23 located kind of at the apex of this geomorphic feature
24 associated with the Arrowhead fault in this location and the

Page 556

1 Rogers Spring fault in this location.

2 So this is Blue Point. And then a little bit to
3 the southwest is another spring, Rogers Spring. And flow
4 from both of these areas, the discharge flows in to Lake
5 Mead. And you can see the increase of vegetation in this
6 area that creates habitat and is one of the few locations in
7 this area with these type features.

8 There are other springs that are present along
9 the Rogers Spring fault that I'm highlighting on the
10 northwestern side of the road between Blue Point and Rogers
11 Springs. And then some others that are a little more
12 difficult to see further to the southwest.

13 This is the hydrograph for Rogers Spring. A
14 little over one and a half CFS discharges. It's got a little
15 bit of noise. When you're measuring discharge from something
16 like this, you have problems with the flume getting chock
17 with vegetation and stuff like that. So the record tends to
18 be a little noisy. But we're looking on average, according
19 to this calculation, about 1.6 CFS discharge. And I really
20 wouldn't want to say I see trends in these data.

21 This is the discharge hydrograph for Blue Point
22 Spring. A little over .5 CFS. When we get out in time,
23 2013, something was going on in the record here. The
24 discharge decreased. There's a gap in the record that was

Page 557

1 actually associated with new construction of the discharge
2 measuring facility. And since that time kind of a slow
3 increase in flow. I would have expected that you fix the
4 flume and you see a sudden increase and the thing stabilizes.
5 But that's not quite what we're seeing. I don't know the
6 cause for this.

7 There have been two sources of the water
8 discharging from the springs that have been proposed. Desert
9 Research Institute, Carl Pullman and others did a geochemical
10 study of the springs in the area. And based upon the
11 isotopic composition -- We'll talk more about it in a
12 minute -- of the water discharging from Rogers and Blue Point
13 Springs and measurements that were made in wells and springs
14 in other locations in the vicinity, they suggested that the
15 Weiser Wash area is a likely source of the water discharging
16 at Rogers and Blue Point and they base that on samples from
17 EH-3 and EH-7.

18 These waters have similar chemistry to the
19 discharge at Rogers and Blue Point. But, as I will point
20 out, the geology is unfavorable and as well the hydraulic
21 head in that area is unfavorable, the Weiser Wash area being
22 a source area for this discharge.

23 The other proposed source is California Wash and
24 Garnet Valley, the carbonate aquifer in those areas. The

Page 558

1 chemistry is different, which is why Pullman and others
2 suggested Weiser Wash would be the source. But the chemistry
3 is easily explained by contact of the carbonate water with
4 younger rocks containing gypsum and the back right deposits.

5 And Randy Bassett, who has also been -- is
6 qualified by the State Engineer's office as an expert in
7 geochemistry, did some modeling of that area. First sampled
8 a lot of wells and springs in the area and then did some
9 geochemical modeling. And the difference in chemistry is
10 explained very easily by dissolution of gypsum from these
11 younger rocks as well as other evaporite minerals, one
12 including bromine, bromine-bearing halide, and then mixing of
13 some local recharge to change the isotopic composition.

14 And this source area has favorable geology and
15 favorable hydraulic head in contrast to the Weiser Wash area.
16 I just already said this. I don't need to repeat it. Slide
17 35.

18 So I'm going to talk a little bit about isotopic
19 chemistry or composition of waters, waters, H₂O. It's got
20 hydrogen and oxygen. There's two hydrogen isotopes. The
21 heavier one is deuterium and the lighter one is just called
22 hydrogen or protium. And then oxygen has two isotopes, O18
23 and O16. And it's very easy to sample and measure for these
24 isotopes in the water. And there's a pretty good data base

Page 559

1 on this. Stable isotopes in water has been used for decades
2 as a tool to understand hydrology as well as other processes.
3 It's a very commonly and well-accepted technique.

4 And, as I said a while ago, in order to match the
5 isotopic composition of the Rogers and Blue Point discharge,
6 based on water discharging from California Wash and Garnet
7 Valley, we need to produce a -- mix it with a water that's
8 isotopic heavier because the spring discharge is heavier than
9 the carbonate waters that were in California and Garnet
10 Valley.

11 And one of the comments that we received was that
12 the discharge that we see could be described or could be
13 produced by evaporation of the water from the carbonate
14 aquifer, which I disagree with, but it doesn't really matter,
15 because we do have an explanation.

16 But here's what is termed the global meteoric
17 water line. You plot the oxygen isotopic composition versus
18 the hydrogen isotopic composition shown on the X and Y axes
19 of these plots. And the blue diamonds towards the lower end
20 of the line, say, between deuterium compositions of, say,
21 minus 80 down to minus 100 per mil applaud on the meteoric
22 water line.

23 The meteoric water line is a line that shows a
24 relationship between the hydrogen and oxygen isotopes in

Page 560

1 precipitation. And it varies around the world. But this is
2 a fairly standard way to display these data and it allows you
3 to point out differences in composition as well as look at
4 processes such as evaporation.

5 When you get to the lighter end, which means more
6 negative values, we're looking at water that has been exposed
7 to cooler temperatures in the atmosphere. In contrast, if
8 it's up towards the upper end, that indicates warmer
9 temperatures. And I'll show that again in another slide or
10 figure.

11 Evaporation can occur during the recharge
12 process. It can occur as precipitation is occurring. It can
13 occur after discharge occurs. The commenter had suggested
14 that evaporation was occurring in the groundwater system,
15 basically waters up close to the water table was evaporating
16 from the water table. At least that was my interpretation of
17 his comments. And we do not think that is taking place.

18 Randy Bassett plotted the composition of Rogers
19 and Blue Point Springs on this in the black circles. And
20 just slightly more positive or slightly heavier composition
21 than the waters in California, sampled in California and
22 California Wash and valley. And there are other springs that
23 plot a more positive or heavier compositions from some of the
24 evaporative springs in the area.

1 Slide 38 is again showing on a global perspective
2 the left most panel for the global meteoric water line
3 showing the composition of the precipitation samples. Again,
4 showing it at the upper end of that, we're looking at warmer
5 temperatures in contrast to colder temperatures at the
6 southern end. And in the southern Nevada area, the yellow
7 composition of precipitation is in the minus 13, minus 14
8 range. There is a paper published by a geochemist at Mark
9 Tibble International Labs where they sample lots of
10 groundwaters and that's what they found. So that's about in
11 the same area that the samples that we're looking at.

12 When evaporation occurs, the composition of both
13 the oxygen, which is the upper curve on this upper panel, and
14 hydrogen change with time. You start off with your original
15 water composition shown to the left end of those curves. And
16 with evaporation the composition changes. And basically
17 what's happening is the lighter isotopes, the hydrogen in
18 contrast to deuterium, in O16 in contrast to O18 evaporate
19 more readily because they're lighter. They evaporate off the
20 water surface. And it changes the composition in the
21 remaining water. And so when you plot these together against
22 each other, you get a progression as shown in the lower panel
23 on the right. So we're looking at low evaporation close to
24 the global meteoric water line. And with increasing

1 evaporation we get a shift off of that line at a lower slope
2 than what we see for the global line. And we do not see
3 evidence of this in the Rogers and Blue Point data.

4 So here's the geologic map of the area. This is
5 a map produced by Page and others showing Muddy Mountains
6 area. Rogers and Blue Point Springs are located along the
7 Rogers Spring fault towards the eastern end of this block.
8 This block contains carbonate rocks exposed at the surface in
9 this area and then a cover of younger rocks. And underneath
10 this cover of younger rocks are carbonate rocks. So we've
11 got carbonate aquifer rocks present in this area. This is
12 California Wash to the northwest of that area.

13 So what I'm trying to show here is we've got
14 carbonate rocks present in outcrop as well as under this
15 younger cover that extends over to the Rogers Spring fault
16 and it's terminated by that fault on the southeastern side.

17 So here's a couple of cross-sections.
18 Unfortunately they don't go right through the Rogers and Blue
19 Point area. But these, again, were produced by Rick Page.
20 And we're going to -- What I want to show here is that in
21 California Wash and so forth, this is section FF prime, which
22 extends from the west side of the Sheep range across in to
23 the area where there's a bend in the section and then across
24 to the southeast, north of the Muddy Mountains where the

1 springs are located.

2 But it shows carbonate rock. The carbonate
3 aquifer that is thrust on top of younger sedimentary rocks,
4 cretaceous and Jurassic rocks that are exposed in the Valley
5 of Fire. So colored in green are those younger rocks. And
6 Valley of Fire is in this general location that I'm pointing
7 at there underneath the word mountains.

8 And then we see over -- I take back what I had
9 said. The section line that's shown on the map inset is a
10 little incorrect. It's actually further to the south. And
11 it does cross Rogers and Blue Point Spring. They show Blue
12 Point I think right here at the Rogers Spring fault,
13 discharging from carbonate rocks present.

14 And then there's the original aquifer plate, the
15 lower plate of the thrust, at depth. And in between the two,
16 like I said, are the Jurassic and cretaceous sedimentary
17 rocks that are exposed at Valley of Fire.

18 Section GG prime runs to the southwest of FF
19 prime. And basically it's showing the same type of thing.
20 The carbonate rocks being thrust on top of the younger
21 Mesozoic, Jurassic, cretaceous rocks with carbonate aquifer
22 present at depth.

23 The depth of the lower sheet of the thrust is
24 approximately five kilometers. It's pretty deep.

1 When we look at a section that runs from the
2 Weiser Wash area, which is on the southern side of the Mormon
3 Mountains, runs across and goes across Rogers and Blue Point,
4 we don't have that upper thrust sheet present. All that is
5 present in the carbonate rocks is the lower sheet. And,
6 again, its depth is fairly deep. It's not as deep as the
7 other, but two or three kilometers in this area. And, again,
8 is to the right end of this section shown in the green colors
9 are the Valley of Fire sediment exposures. And then to the
10 right of that is the upper thrust sheet that I was describing
11 before present in the other sections.

12 So why do I think that there's not a pathway for
13 flow from Weiser Wash? Weiser Wash would be in approximately
14 this area. There are carbonates present. That water could
15 move to the south in the carbonate rocks and then come up
16 along the Rogers Spring fault from depth.

17 One reason is that permeability data on
18 carbonates as well as lots of other rocks in the area, those
19 data show the permeability decreased with depth and these
20 data are collected from aquifer testing, primarily pumping
21 test but also including slug testing, that was put together
22 by Wayne Belcher of the USGS as part of the modeling work
23 that the USGS was doing for the Death Valley system.

24 We had -- When I was working on the project with

1 IT, we had put together similar figures. And what you see is
2 most easily seen when you look at the higher values is that
3 there's a decrease in the number of higher value measurements
4 as you get to deeper and deeper depths of measurement.

5 I've highlighted on here in blue the measurements
6 made in carbonate rocks. And you see that same trend is not
7 as steep a trend as you get in basin fill where the alluvial
8 sediments, basin fill sediments are more compressible. But
9 you still get this same trend and it's because of the weight
10 of the overlying rocks closing the fractures that are the
11 source of the permeability in the aquifer.

12 There's a large spread in this when you're
13 looking at words of magnitude difference or change in the
14 data of particular depth. But the trend is definitely there.
15 If you -- One way to approach this would be to calculate a
16 geometric mean of the data by depth and look at that trend.
17 And you would see a trend that runs approximately as I'm
18 showing you here. So depth of 2,000, 3,000 meters, which is
19 the depth of that lower sheet, we're looking at
20 permeabilities that are orders of magnitude lower than what
21 they are in shallower settings.

22 There had been a comment about our modeling that
23 said that there's a disagreement about this. One was that
24 Wayne Belcher disagreed with it. And, interestingly enough,

1 he put this same trend in DV-1 or he was involved with DV-1
2 and put it in to DV-2. The model that the USGS put together
3 for DOE of the Death Valley Flow System is a comment that
4 Keith Halford disagreed with it. Interestingly enough, Keith
5 was doing DV-3, version three of the Death Valley model. And
6 instead of putting a relationship like this, he did something
7 much more drastic. He had, I think, the upper 500 meters of
8 the carbonate aquifer as being permeable and below that
9 impermeable. There was about a six order magnitude
10 difference in permeability in his model as you went from the
11 upper 500 feet of the aquifer to everything below that. So
12 he recognized that there's a decrease in permeability with
13 depth. He just expressed it a different way than I do.

14 So long and short, my opinion is that lower part
15 of the thrust sheet or the lower presence of the carbonate
16 aquifer below the Muddy Mountains is too imperme -- has too
17 low permeability to transmit much water.

18 I also think that head data suggests that
19 California Wash and Garnet Valley are the source of the
20 spring water. The springs are shown here to the right of the
21 map. They have elevations of 1,562 feet and 1,576 feet. And
22 what this map shows, it heads in California Wash or Garnet
23 Valley or 1800 feet or higher that there's a gradient for
24 flow to the southeast or east. The flow is perpendicular to

1 the contour lines and we're looking at flow moving directly
2 towards the springs.

3 In contrast, Weiser Wash is located up to the
4 north. There's a yellow triangle in this area. That does
5 not represent why the EH-3 or EH-7 wells, but they're in the
6 same general location. And their heads are around 1540, 1560
7 feet. So they're at approximately the same head as the
8 springs are.

9 And in between here is an area of lower heads.
10 And I'll show that on this figure. This is showing the most
11 recent measurement of heads in numerous wells in this area.
12 Rogers and Blue Point Spring are shown here. And, as I said
13 before, the heads in California Wash are conservatively
14 higher, providing the gradient for flow in this direction in
15 to the upper thrust sheet to discharge at the northeastern
16 end of the Muddy Mountains.

17 And, again, Weiser Wash samples would be
18 approximately at some point above the -- the area on this
19 figure. And they're at the same approximate and are actually
20 a little bit lower than Rogers and Blue Point Springs.

21 There's a well that USGS had put in that is being
22 monitored to look for water level changes. Nothing has
23 really been seen in that that can be interpreted. We
24 generally see, if we look at the spring locations, a decrease

1 in head as we move toward Rogers and Blue Point in these
2 springs. So, basically, flow is coming in in the upper
3 thrust sheet, reaching the Rogers Spring fault and then
4 moving along the fault to discharge at Rogers and Blue Point
5 Springs and the other associated springs.

6 We did some simulations with our three
7 dimensional flow model of the area. The outline of that is
8 shown here. The model area is shown in white. And this is
9 the southern end of our model. And basically what we did to
10 this was to backtrack particles from the discharge point at
11 the springs and see where the particles according to the
12 model came from. And we see a path that runs to the west
13 toward the recharge areas in the Sheep mountains, the Sheep
14 range. That's not to say that these areas up in here if we
15 had pumping in these areas we wouldn't affect these. And
16 I'll talk about this in more detail.

17 But in order to affect spring discharge, we're
18 not forced -- we're not having to pump within this source
19 area for the springs. Pumping in other areas will also
20 affect the springs. And, again, this is a section cut
21 through our geological frame model showing the pathway near
22 the sheet. If this section had been in a slightly different
23 area, you would have seen that upper sheet continue over this
24 area. That's just a function. We happened to cut this to an

Page 569

1 area where the Mesozoic rocks are exposed at land surface.
 2 So I think there is a hydraulic connection
 3 between the Rogers and Blue Point Springs in the carbonate
 4 aquifer and thus the carbonate aquifer in California Wash and
 5 Garnet Valley and thus for the aquifer in the up gradient
 6 areas. I'm going to classify this as a limited connection.
 7 There's a significant gradient, as Sue Braumiller pointed out
 8 yesterday for flow from those basins to the springs.
 9 One thing of interest is there's a well that the
 10 USGS had put in called the Buffington Pockets well that went
 11 through the upper sheet carbonates, and the carbonates are
 12 dry in that well.
 13 HEARING OFFICER FAIRBANK: Mr. Waddell, I don't
 14 mean to interrupt, but --
 15 UNIDENTIFIED SPEAKER: Can we move the
 16 demonstrative -- We're at an angle where we can't see.
 17 HEARING OFFICER FAIRBANK: Yes. Thank you.
 18 UNIDENTIFIED SPEAKER: Thank you.
 19 HEARING OFFICER FAIRBANK: Thank you,
 20 Mr. Taggart.
 21 THE WITNESS: That's just at one point the water
 22 levels in the wash are in California Wash and Garnet Valley
 23 need to be high enough to go over that lip. We think that
 24 that's the case in many areas, but pumping lower levels to

Page 570

1 that lip, it's going to have -- impact some spring discharge.
 2 We don't know enough about the area to really discuss that
 3 except to say that it's a concern.
 4 So we need additional data on the connection.
 5 And I think that additional water monitoring wells need to be
 6 put in to the upper plate to see what's going on with water
 7 levels in the upper plate as they may impact the discharge
 8 from the springs.
 9 Moving on to aquifer recovery. I already went
 10 through hydrographs showing that prior to Order 1169 we had
 11 declining water levels due to pumping from the carbonates and
 12 that subsequent to cessation of pumping in MX-5 we see
 13 recovery and it looks like we're seeing water levels starting
 14 to decline again. And that's of concern. The recovery of
 15 water levels pretty quickly after pumping in MX-5 stopped.
 16 But we're continuing to see declines.
 17 The further away we are from the production, the
 18 greater the delay. But it's a very small delay. Their
 19 response in the wells of great distance was very quick. And
 20 I'll get in to this in more detail in a minute. But when we
 21 simulated the effects of longer term pumping and asked the
 22 question if we move pumping from the alluvium along the Muddy
 23 River to the carbonate aquifer, say, in Garnet and --
 24 primarily Garnet Valley, is that going to provide much

Page 571

1 benefit?
 2 And what the model showed -- And the model does
 3 have limitation. But what the model showed is that it will
 4 delay the effects, which is what you would expect. But it
 5 does not prevent them. And this is consistent with
 6 conclusions that SNWA reached.
 7 And, again, the hydraulic connectedness is a
 8 primary factor in determining whether or not there will be
 9 impacts from additional pumping. And that's a real thing
 10 that needs to be demonstrated before significant pumping can
 11 occur in the areas.
 12 HEARING OFFICER FAIRBANK: Yes, Ms. Baldwin.
 13 MS. BALDWIN: We have an objection to Mr. Waddell
 14 testifying about the opinions of the geological survey
 15 scientist during his power point. It's hearsay. It's --
 16 (The court reporter interrupts)
 17 MS. BALDWIN: Should I come up to the mic?
 18 HEARING OFFICER FAIRBANK: If you would,
 19 actually, that would be great because then I don't have to
 20 repeat what you say for everyone listening on the internet.
 21 MS. BALDWIN: This is Beth Baldwin for the Moapa
 22 Band of Paiutes. We're going to object to Mr. Waddell
 23 testifying to the opinions of the geological survey scientist
 24 contained in the power point referenced by this slide. It's

Page 572

1 hearsay to the extent he's using it to bolster his own
 2 opinion. Those scientists have not been presented by the
 3 park service as experts. They're not here to testify and be
 4 cross-examined. So if he has opinions about the data, that's
 5 one thing. But he can't just be a conduit for their opinion,
 6 well, they agree with me, that's hearsay.
 7 MS. GLASGOW: Yes, it is hearsay. But it goes to
 8 the weight, not the admissibility. The witness is allowed to
 9 have relied upon other people for his own judgment, which is
 10 what he's been testifying to is that his judgments are in
 11 alignment with people that he's relied upon. So to our mind
 12 he's adopted these judgments himself and therefore is
 13 testifying about his opinions as to the work that he did.
 14 HEARING OFFICER FAIRBANK: Thank you,
 15 Ms. Baldwin. Your objection is noted and the State Engineer
 16 will take note of that objection and we'll assign the
 17 appropriate weight to those references and reliances on work
 18 of others that are not here to testify for themselves. Thank
 19 you.
 20 MS. BALDWIN: Thank you.
 21 THE WITNESS: I am primarily going to be
 22 presenting data from this presentation --
 23 HEARING OFFICER FAIRBANK: Mr. Waddell, make sure
 24 your mic is on. Thank you.

Page 573

1 THE WITNESS: I'm primarily going to be
2 presenting data from this presentation that was authored by
3 Tracie Jackson, Joe Fenelon, and Keith Halford. This was
4 presented at a Nevada Water Resource Association meeting. I
5 actually became aware of this presentation after I became
6 aware of some of the work that Dr. Halford had done in this
7 respect.

8 And I'll skip ahead just real quick to the next
9 slide. I mentioned earlier that I served on a peer review
10 panel for modeling that the Department of Energy was doing at
11 Ranier Mesa, which is one of the weapons testing areas on the
12 NNSS. And part of that model had to do with how recharge was
13 addressed in the model. And so there was presentation of
14 information related to water levels in the Ranier Mesa area
15 that had been provided to the Department of Energy contractor
16 from the USGS.

17 And so, again, in the context of Ranier Mesa,
18 there are measurements and water levels that show rising
19 water levels in this area, in response, primarily to the
20 2004-2005 winter precip event. The well that had the
21 greatest response was in a granite. Granites have low
22 porosity. There's not a lot of storage for water, so the
23 only way to take that water is by increasing water level. So
24 that's why it's most sensitive in this well.

Page 574

1 But what you see was a rising trend that started
2 prior to this period of record that's shown here in
3 2004-2005. Subsequent to that, the trend increases in slope
4 and then begins to flatten out and then we would expect that
5 it would drop off as the tail end of this curve shows.

6 There's some carbonate wells shown in blue which
7 showed a similar type of response of rising water levels
8 prior to 2004-2005, an increase in slope and then a
9 flattening out and a recovery starting until the 2011 wet
10 winter where we see a similar pattern but smaller magnitude
11 development. And that's also appearing in two of the wells.

12 So I was first introduced to this concept as part
13 of that peer review. And I and other peer reviewers deemed
14 that to be an acceptable appropriate model for the recharge
15 processes of what's occurring, that it is sporadic, it occurs
16 in association to wet winters. And, in this particular
17 instance, we see rapid responses and then levels starting to
18 decline again.

19 So I'll return back to the other slide, slide 48,
20 which shows wells on the west side of the Sheep range and in
21 Indian Springs. The Sheep range is the western -- at the
22 western edge of Coyote Spring Valley, basically is the
23 western boundary. And we see immediately to the west in the
24 Corn Creek Spring area that water levels have been increasing

Page 575

1 through time. We see more attenuated effects of the
2 2004-2005 recharge event. And that's because it's in an area
3 that's not as immediate to recharge as Ranier Mesa. Ranier
4 Mesa is the highest point on the test site. It gets the
5 greatest amount of snow fall. And it is one of the primary
6 recharge areas. But we do see water levels increasing
7 through this period of record shown here.

8 Moving over to Devil's Hole. Devil's Hole is
9 part of the Death Valley Flow System. Prior to the 2004-2005
10 recharge event, we had declining water levels that's
11 attributed to pumping in the Amargosa Desert. And then
12 following that wet winter, water levels start rising again.
13 So we're seeing the effect of that recharge at that time. So
14 this is one where we go from a period where water levels are
15 responding to pumping to one where water levels are
16 responding to increase -- an increase in recharge over a
17 short period of time.

18 There are several hydrographs in northern -- in
19 Yucca Flat shown on slide 49, all with rising water levels
20 over the period of record.

21 I had mentioned previously the well that had the
22 dissolution feature with one or two foot open interval. And
23 that's UE-10-J. It responded very quickly to that recharge
24 event.

Page 576

1 And what we primarily see at this location is
2 response to recharge event of tailing off, response to
3 recharge event and then, again, tailing off. So it's not a
4 nice continuous increase in water level but one where we can
5 pick out the individual recharge events such as the well in
6 the Lower White River Flow System where we see the 2004-5 --
7 2004-2005 recharge event and then response from that.

8 Move a little bit further to the south, again, in
9 Yucca Flat, and we see rising water levels for the period of
10 record. We look over on the western side, we see rising
11 water levels through this period of record.

12 So around the NNSS or Nevada Test Site, which is
13 a well documented pattern of rising water levels over the
14 last few decades. In areas where pumping has occurred, and
15 this is in Las Vegas Valley, we see declining water levels, a
16 recharge event, declining water levels, a recharge event,
17 declining water levels. This is an area where pumping is
18 affecting water levels. So you see the effect of the
19 recharge, you see the effect of the pumping being repeated
20 and repeated.

21 Moving in to different areas, and this is within
22 the area that we modeled. Well EH-6 shows seasonal effects
23 from seasonal pumping and rising water levels. Basin fill
24 well shows a similar pattern. This is down in the southern

Page 577

1 part of the flow system, the BM-ONCO-2 well, which is one of
2 the clastic aquifers, not the carbonates. Rising water
3 levels. PW-2 in Basin 221, shorter period of record, but we
4 see the same kinds of things.

5 Dry Lake Valley, rising water levels. Garden
6 Valley, rising water levels. And there's some other stuff
7 going on. I expect the question is going to come up when we
8 did this did we look at all the wells and did we find
9 examples of wells going up and wells going down. I did not
10 go do an exhaustive search for all the wells to see what
11 their pattern is. But we see many, many instances, at least
12 on the test site, and almost all the instances of rising
13 water levels when we look in these other areas, it's less
14 clear because there aren't as many wells with reducing rising
15 water levels.

16 So what determines when recharge occurs? What
17 Tim Mayer testified to yesterday is that there are three
18 avenues that precipitation can take, I guess, before -- or
19 two avenues before it becomes recharge. One is that you have
20 to satisfy the runoff. If it rains, for example, you get
21 runoff that occurs. And so that water is not available to
22 infiltrate the soils. It's runoff.

23 The second thing is the water that is available
24 to infiltrate the soils has to overcome a deficit. We're in

Page 579

1 area five radioactive waste management unit in Frenchman.
2 These were deep borings. He did chloride balance
3 determinations trying to measure what recharge was in those
4 environments, and again found the same kind of thing. If you
5 have a deep boring -- I'm talking hundreds of feet -- below a
6 channel, he saw some evidence of recharge occurring in that
7 location because flow was concentrated in the channel, move
8 out of those areas and just slightly higher elevations but in
9 non-channel environments recharge was not occurring. This
10 was over long periods of time. I have forgotten the time
11 frame for this. But thousands of years.

12 There were also some wells that were put in
13 Fortymile a little bit further down gradient that were close
14 enough to the channel that we could see changes in water
15 levels. There were changes that we saw with the sporadic
16 runoff events at Fortymile Wash. Fortymile Wash is a huge
17 channel. If you're driving up to Yucca Mountain, there is an
18 area that is probably one or two-tenths of a mile across the
19 channel. You drive down in to it, you drive across the
20 channel, and then you drive up the other side. There's some
21 large flows that occur in Fortymile Wash but very
22 sporadically. So the recharge is a sporadic process.

23 The stable isotopic data indicate that recharge
24 occurs from cold water, occurs from snow melt, not summer

Page 578

1 an arid environment. The soils dry out. The permeability of
2 soils is very low at low water contents. So you can't get
3 very much movement until you get some water in the soils so
4 that infiltration can occur. So that's number two.

5 And then after you overcome that deficit, then
6 water can start entering the soils and move to deeper,
7 greater depths and potentially become recharge.

8 I agree with that general model that he
9 described.

10 And just some studies that I'm aware of related
11 to this, Dick French, a couple of decades ago, he was a
12 researcher at Desert Research Institute instrumented some
13 shallow borings in stream channel Fortymile Wash coming down
14 off of Paiute Mesa and instrumented some more upland
15 locations just outside the channel and found that recharge
16 did sporadically occur with the sporadic runoff events in
17 Fortymile Canyon in the canyon -- in the wash itself, the
18 channel deposits. But when you got up to the upland areas,
19 you did not get recharge occurring. So the precip by itself
20 was not sufficient to cause recharge, but the collection of
21 water in to the channels did provide enough water for
22 recharge to occur -- or infiltration. Not instrument. The
23 water table.

24 Scott Tyler did a study in association with the

Page 580

1 precip. We're looking at a process of having a sufficient
2 snow pack that you can fill up the pore spaces down to a
3 depth that prevents evaporation from removing that water.
4 And admit that that's not a great depth. But then it has to
5 have enough water to continue downward because as it moves
6 downward it's going to spread out and you'll end up with
7 residual water in the soils and in the fractures that can't
8 move down any further until the next recharge pulse or
9 infiltration pulse occurs.

10 So the data indicate that as the groundwater
11 chemistry and other data that the recharge that we're seeing
12 is winter precipitation is basically the snow melt.

13 MS. GLASGOW: Dr. Waddell, I just wanted to let
14 you know that you have about 35 more minutes.

15 THE WITNESS: Thank you.

16 MS. GLASGOW: You're welcome.

17 THE WITNESS: And so this information on winter
18 precip, importance of winter precip is a concept that I've
19 been aware of for decades or was a fellow researcher at the
20 USGS that was doing recharge specifically looking at summer
21 versus winter recharge and mountain environments,
22 particularly to try to come up with the processes. So I for
23 a long period of time I've been a believer in, at least in
24 Nevada, of sporadic recharge associated with winter precip.

Page 581

1 The Halford model is similar. And what this
2 represents is data collected from or obtained from the Noah
3 site. I'm sorry. This is from the Western Regional Time
4 Center. But basically precipitation data and it's looking at
5 precipitation during the winter months, October through
6 March. And you'll notice that the cut-off on this is five
7 inches. What this model -- And this is not mine. This is
8 Halford's -- is that you need five or six inches of winter
9 precipitation in order to get a precip -- or a recharge
10 again.

11 The 2004-2005 precip as shown here, that was a
12 major recharge event. Not just infiltration but recharge.
13 When you see that in hydrographs, essentially many, many,
14 many hydrographs that were looked at, this is the 2011 one
15 that shows up in some but not all hydrographs.

16 But this period, what this shows is that when you
17 look at winter precip over five inches, that in the early
18 part of the century you get relatively few of these higher
19 winter precip episodes. And then starting at approximately
20 1970 the frequency of those increases and then we get these
21 really whoppers like the 2004-2005.

22 And, again, this is Keith's interpretation, not
23 mine, just for the record. But he interpreted the period of
24 record from the beginning of the century up to approximately

Page 582

1 1970 as a dry period and the time after that a wet period
2 because there's a higher number of these higher winter precip
3 events. And this is his explanation for why we're seeing
4 rising water levels. It's consistent with research that I've
5 been aware of for a long period of time. And it's consistent
6 with the geochemical data. And I think, you know, there can
7 be arguments about what this threshold value should be. But
8 I think it's a -- it's a valid model for when recharge occurs
9 and what allows it to occur. It's an increase. It's a high
10 amount of precipitation over the winter months and then, in
11 my opinion, the snow melt process after that.

12 So just revisiting, we see in our flow system
13 declining water levels over, you know, the period of record
14 with a precip or recharge event, the 2004-2005 showing in
15 there, the effects of Order 1169 pumping that can affect the
16 record shows after that with our CSVM-5, for example, showing
17 up as an example of where we have rising water levels during
18 this process and continuing. And you will recall that I
19 classified all of these except for this as connected or
20 highly connected to the spring area. CSVM-5 I classified as
21 not connected. I think it is in a different flow regime than
22 the other wells. By being not connected, it's not connected
23 to pumping from the carbonate aquifer.

24 So moving on to annual quantity of pumping. I

Page 583

1 was asked to run a model, our model, to come up with an
2 estimate to do that. I refused to do that because I knew the
3 shortcomings in the model. So I did not provide an answer to
4 the State Engineer's office except to say that it was
5 something less than approximately 14,000 acre-feet a year,
6 which was the pumping during the Order 1169 test.

7 I think there are questions about, you know,
8 whenever you pump you're going to have impacts. That's not a
9 debatable issue. Somebody has to set a limit. It sounds
10 like the limit might be set to protecting senior water rights
11 in consideration of ecological constraints of the model base.
12 To me that is reasonable.

13 One of the questions that ought to be part of the
14 considerations is whether or not your evidence data will be
15 delivered. If the concept is that you can have a natural
16 system, you can pump it, water levels will go down and you'll
17 start capturing water from the discharge areas and boundaries
18 and you'll reach a new state of equilibrium, which is
19 basically a new steady state. And the rates of impact or
20 rates are captured and not continue to increase. It doesn't
21 look like we're at a new steady state yet of equilibrium.

22 If we don't reach that, what will happen is
23 discharge will continue to go down to hopefully at some point
24 if we do reach an equilibrium, but potentially we won't. It

Page 584

1 depends on how much water is being pumped and how much water
2 can be induced to flow across, say, barriers, like the Las
3 Vegas Valley shear zone to replace that water. But we're not
4 at a point yet, in my opinion, of being at equilibrium.

5 We talked about -- I showed many examples where
6 water levels are continuing to go down. There's some wells
7 where it looks like things are flattening out after the end
8 of the test. But it looks like what happens over a longer
9 period of time is that they flatten out and then they're
10 starting to decline again.

11 We ran our model as part of this exercise out 500
12 years. And, again, I don't put a lot -- I wouldn't put a lot
13 of stock in this 500 years. But our model predicts that
14 after 500 years we're still not at equilibrium. Take that
15 with, you know -- I recognize that the model has some issues
16 that need to be fixed.

17 And so, you know, are the current discharge rates
18 acceptable? That's not my decision. That's yours.

19 I'm going to discuss similar modeling results.

20 As I've indicated, we have received comments about the model,
21 heard statements that the model should not be used. And I
22 agree that there are some things the model should not be used
23 for. But let me discuss the process that's gone on. We
24 early on, 2001, 2002, developed a model that was specifically

Page 585

1 for the Coyote Spring Valley hearing, recognition that it was
2 an estimate but it wasn't based on as good a data set as we
3 would have liked. It had some shortcomings. It was used for
4 that particular use and that was it. And there was
5 recognition of it needing to be improved.

6 So, in approximately 2010 or so, National Park
7 Service came up with funding to develop a new model, which we
8 did. And it used a lot of additional information and
9 modeling tools that we did not have available in 2000,
10 2001. Our calibration data set was halfway -- went through
11 halfway through the Order 1169 test. So we got the first
12 part of the test. We didn't get the last part of the test.

13 So I'm going to talk about this a little bit.
14 But we provided the modeling report. We provided the
15 modeling data sets for anybody who wanted to use that model
16 to test the model and evaluate its performance. And we
17 received comments from SNWA. They pointed out in a very
18 generous fashion that our report didn't have as much
19 information as it should have. They pointed out some other
20 things that should be looked at. Very useful set of
21 comments. We received other comments that were kind of like
22 we don't like your model. One was a description of what we
23 did but didn't really go through an evaluation of it. But
24 the model has been out there for people to take a look at

Page 586

1 since approximately 2012. And they can run the model,
2 whatever. In fact, Argonne National Lab has used the model
3 to make some predictions of pumping in the valley.

4 We built the geologic framework for the model
5 based upon surficial mapping, cross-sections, well control,
6 physics. We built in independent discharge so we can look at
7 the effects of pumping on stream discharge, stream aquifer
8 interactions. We calibrated using PEST, which is an
9 automated calibration tool to come up with unbiased aquifer
10 parameters.

11 I already talked about the decrease in
12 permeability and the depth. One of the things it does not
13 have in it is the decrease in storage, specific storage of
14 depth, which I think is an important thing that is needed.

15 This is the area that we covered in the model.
16 The flow system we're interested in is at the western edge,
17 this portion in here. But we also include Lower Meadow
18 Valley Wash, Tule, the Virgin Valley.

19 I'll point out that the calibration data or data
20 for constrained calibration in this area, especially with
21 respect to pumping effects, were much -- many fewer data
22 points than what we had available in this area. So in terms
23 of reliability, this is -- has higher reliability but still
24 has shortcomings.

Page 587

1 27 hydrostratigraphic units because of all the
2 fault, different thrust faults in the area, in order to
3 capture the detail of the geology, we have 18 computational
4 layers. So it's an 18-layer model. Layers being thinner at
5 the top and increasing as we go deeper.

6 So there's the surficial geologic map that
7 constrains the Framework model. In the left panel and the
8 right panel are the locations of the cross-sections and where
9 we had geophysical control to constrain our geological
10 Framework model.

11 These are just a couple of examples. This is a
12 section put together by Rick Page. And this is the same
13 section, at least part of it, put together in our Framework
14 model. The white area in here are the locate crystalline
15 rocks that we did not map or didn't assimilate as a separate
16 unit. But you can see that it captures the geometries that
17 are depicted in the cross-sections very nicely. So that's
18 one section. Here's another. Here the carbonates in blue.
19 Here the carbonates shown in the cross-section.

20 The Framework model does a good job of matching
21 the data as interpreted by Rick Page in his cross-section and
22 based on geophysics and well control.

23 A little bit further down -- We talked about the
24 thrust sheet earlier. Here's the thrust sheet with

Page 588

1 overturned rocks. So, you know, a lot of work went in to
2 developing this Framework model.

3 We've got head dependent discharge that occurs.
4 These are where we're simulating evapotranspiration. There
5 was a question earlier about where you could pump if you
6 wanted to capture water from ET. This shows you where ET is
7 occurring. There's a little area of ET downstream of Rogers
8 and Blue Point Springs, which I showed you. It's not very
9 extensive. Primarily, we're talking about the areas that
10 we're concerned about. If we're pumping over here, here's
11 where you can capture ET and extreme flow.

12 The right panel shows our extreme routing systems
13 so that we can simulate what the effects of capture are on
14 the stream flow.

15 Just some of the results. This is water table
16 map pre-development. I mentioned the low gradient through
17 Coyote Spring Valley down in to hidden Garnet. So we see
18 here the gradient increases when we get in to the northern
19 part of Coyote Spring Valley. Once we get up in to the
20 volcanic area, lower permeability, higher recharge, gradients
21 are much higher.

22 And we also simulated halfway through the 1169
23 pumping, this is -- I can't read what the limitation is on
24 that color range. But we ran a simulation with and a

Page 589

1 simulation without the MX-5 pumping, subtracted the two to
2 show where we were simulating the extent of drawdown at that
3 time.

4 Notice we did not -- This had extended down in to
5 hidden Garnet Valley. We under predicted the amounts of
6 drawdown and the extent at least at that point in time.

7 When we ran pumping in this area for a longer
8 period of time, it extends further down and runs all the way
9 to the Las Vegas Valley shear zone. It has connectivity
10 within the carbonate aquifer all the way down.

11 So I think the model does have utility. I say
12 here to evaluate the extent of pumping effects. In the short
13 term, I think it will under predict what the extent is going
14 to be based upon the Order 1169. In the long term, I think
15 it does a good job.

16 We can only develop an approximate estimate of
17 the magnitude. We underestimated drawdown and we
18 underestimated impacts on decreases in the spring discharge.
19 So you have to use the result knowing that that is a
20 shortcoming.

21 We can evaluate flow paths because I think we do
22 a good job of matching the pre-development flow. I would not
23 use it to develop accurate estimates. How much are we
24 impacting Pederson Spring. I can't do that. Can I come up

Page 590

1 with a safe yield number? I can't do that. So that would be
2 a misuse of the model.

3 I think that we can improve it. But there's a
4 lot of work that's gone in to it. It's got a lot of
5 capabilities. There's new data out there. Lincoln County,
6 Vidler has said we did not incorporate the data that they had
7 developed in to it. That's correct. We got that data too
8 late to include in our model. It's still not in there.

9 I think, and I've made this recommendation
10 before, that there needs to be a model that can be used by
11 the State Engineer's office to answer some of these
12 questions. I don't care who develops it. But I think it
13 needs to be put together in a group fashion, transparent.
14 Everybody knows what's going in to the model as it's being
15 put in. Everybody understands shortcomings. Everybody is,
16 you know, a participant in that process. How that gets put
17 together is something the State Engineer can decide. But I
18 think it needs to be something that would be very useful that
19 everybody is involved in. It can be my model. It could be
20 somebody's else model. I'm trying to retire, so I don't
21 care.

22 This is a slide that's out of place. I forgot to
23 mention it. Surrounding areas -- I covered part of this.
24 Water levels are rising because I think there's been an

Page 591

1 increase in recharge since approximately 1970 based upon
2 Halford's work. Within the Lower White River Flow System,
3 water levels are primarily declining. And I think that's
4 because of pumping from the carbonate aquifer. I don't
5 think --

6 (The court reporter interrupts)

7 THE WITNESS: I don't think we're approaching a
8 new equilibrium.

9 HEARING OFFICER FAIRBANK: And just as a
10 reminder, make sure you're speaking in to the microphone,
11 because not only does it help the court reporter, but it also
12 helps those that are remotely listening.

13 THE WITNESS: Okay. So we did some simulations
14 to look at the effects of moving pumping from the Muddy River
15 Springs area and the alluvial pumping along the Muddy River
16 in to different areas. There were three different scenarios
17 that we put together that did that in different fashions in
18 scenario two and three. Scenario one is kind of a baseline.
19 The total amount of pumping was the pumping at the time of
20 Order 1169, not the current level. So be aware of that.

21 This slide, slide 69, shows changes that were
22 made in the distribution of pumping. The panel on the left
23 has a different area, Coyote Spring Valley shows the decline
24 and the pumping within Coyote Spring Valley as the pumping is

Page 592

1 moved further to the south within the carbonate aquifer.

2 There's the Muddy River Springs area shown on
3 there as well. There's a decrease in total pumping as you go
4 from scenario one to scenario three, basically being shifted
5 down in to Garnet Valley and California Wash.

6 The right panel shows the redistribution from the
7 Muddy River alluvium in to the carbonate aquifer. The
8 alluvial pumping is in the brownish color. Carbonate is in
9 the yellow. And then the total is in green. And as you go
10 from simulation one to three, the alluvial pumping drops off
11 and the carbonate pumping is increased and primarily down to
12 the south.

13 This map just shows the locations of the
14 simulated wells. You have to look at it pretty carefully to
15 kind of see the details of it. But that's provided in our
16 report.

17 So we simulated the effects. We looked at
18 impacts from simulated discharge in the Muddy River Springs
19 area and along the river. And those are shown here. Be
20 aware as you look at this. And it's kind of hard to tell,
21 that not all of these figures run from zero up. On this page
22 they both do. But we're showing that in the bottom scale
23 it's hard to read those from zero to 500 years. So we're
24 primarily interested in the first part of this.

Page 593

1 The model predicts that there will be decreases
 2 in spring discharge as a result of either pumping under
 3 scenario one at 14,000 acre-feet per year and change as well
 4 as the other. But as we move from scenario one to scenario
 5 three, the results aren't that much different. We get
 6 quicker results and quicker impacts at early time with
 7 scenario one, more delayed as more and more pumpage is moved
 8 to the south, but only by a small amount.
 9 When you look at Rogers and Blue Point, you know,
 10 we're predicting that there is, you know, a change, but it's
 11 not something that is a drastic change unless we get below
 12 that lip that I said may exist.
 13 This is stream flow. So impacts on water rights.
 14 People diverting from the stream. And we see similar kinds
 15 of things, similar results from all three simulations with --
 16 because we're -- here we're looking at the effects of moving.
 17 Pumping adjacent to the springs we see a greater delay than
 18 what we see with the springs. But we're primarily seeing a
 19 delay, not a total change -- change in the total impact.
 20 So my conclusion is that if pumping is moved
 21 there will be temporary benefits but at some time the things
 22 are going to catch up with us. I say this, but I want to
 23 emphasize that our model under predicted the rate at which
 24 discharge spread from Order 1169. So I think we're

Page 594

1 predicting longer delays than will actually occur.
 2 I think it's important -- This gets back to this
 3 connectivity thing, that if there are ideas of moving pumping
 4 in to less well-connected areas, there needs to be a
 5 demonstration that they are less well connected and that
 6 there aren't impacts. I don't think that CSAMT surveys
 7 provide you information on that brief connectedness to the
 8 extent that we would like.
 9 Capture zones. Moapa Band of Paiutes has stated
 10 that pumping in California Wash or at least most of
 11 California Wash is not going to impact the Muddy River
 12 Springs area because it's in a different capture zone, that
 13 California Wash is in the capture zone for Las Vegas Valley
 14 pumping, not in the capture zoning for the Muddy River
 15 Springs.
 16 A lot of people make this mistake. How can I be
 17 affecting somebody that's down gradient from me? I can
 18 impact somebody down gradient from me if I pump water because
 19 that water is no longer available to flow to them. But if
 20 I'm side gradient or I'm down gradient from them and I pump,
 21 my pumping isn't going to affect that area, that discharge
 22 area. That's a surface water concept. You can take water
 23 downstream from another user from a stream and not impact the
 24 upstream user. You cannot do that in groundwater because

Page 595

1 your pumping will cause declines in water levels to people up
 2 gradient from you or side gradient from you and decrease the
 3 discharge or deepens -- increases the pumping expenses.
 4 So, in my view, this evaluation that was done
 5 provides no useful information to you. One, it was based on
 6 a model that is interesting but not a calibrated model. It
 7 doesn't do a good job of returning flow system. But then it
 8 uses a concept that is invalid. A lot of people make the
 9 same mistake.
 10 And just a simple illustration. This is out of a
 11 book by Stan Lowman showing the effects of well interference.
 12 In this particular example it's how can we simulate using the
 13 Theis equation and impermeable boundary. So no flow across
 14 this boundary. Here's a capture zone, here's a capture zone.
 15 We can't get flow across it because we have this no-flow
 16 boundary. It's a simulated no-flow boundary.
 17 But, if you look at this lower diagram, the
 18 pumping at this well goes across that boundary in to the area
 19 of the other well and causes drawdown in the other well.
 20 Similarly, the reverse is true. So the total drawdown is the
 21 sum of these two drawdown curves. If you're looking at a
 22 discharge area, it's the same kind of thing. You have to sum
 23 the effects of pumping from all the wells. The presence of
 24 this boundary in quotes it has no effect.

Page 596

1 And this next slide is from the Theis modeling
 2 that CSI did. I'm using just an example of the same kind of
 3 thing. Pumping of two different wells. I believe it was
 4 MX-5 and Arrow Canyon. And calculating by Theis what the
 5 drawdown cones associated with this are. They add them
 6 together correctly and we develop a groundwater divide
 7 between the two wells. So to the right side of this divide
 8 is the capture zone for the canyon. To the left of it is the
 9 capture zone from MX-5. Different capture zones. But the
 10 two wells are affecting each other. The capture zone has
 11 nothing to do with the -- how far the extent of pumping
 12 impacts goes.
 13 So to quickly summarize, I really like the idea
 14 of joint administrative unit. I had argued in a hearing
 15 related to pumping in the Death Valley Flow System that even
 16 though there are different hydrogeologic areas, different
 17 basins, those basins will impact each other when pumping
 18 occurs. And I urge the State Engineer's office to manage
 19 those as a collective groundwater system because that's what
 20 it is. So I'm really happy that this is happening. It's
 21 going to require continued collection of data. I think that
 22 long-term production shouldn't be allowed unless there has
 23 been a demonstration that it's not going to impact
 24 groundwater discharge in the springs area or along the river.

1 And in areas -- And this is getting in to Rogers and Blue
 2 Point, we know that there's not a strong connection between
 3 those two, but it's a very important resource. And
 4 monitoring will be needed to make sure that resource isn't
 5 affected.
 6 Next conclusion is that water levels are
 7 declining in the carbonate aquifer, a large area, while
 8 they're rising in other areas in the same climatic regime. I
 9 think this is because of existing pumping from the carbonate
 10 aquifer and needs to be recognized in decisions.
 11 I kind of already stated this. Rogers and Blue
 12 Point are fed by water from the carbonate aquifer. They're
 13 connected but not a strong connection to the aquifer in
 14 California Wash and Garnet Valley. But monitoring is needed
 15 to see if there are changes that might impact those springs.
 16 And then, finally, moving pumping from the
 17 sensitive areas, the Muddy River Springs area and the Muddy
 18 River, is going to help for a short period of time, but
 19 eventually the impacts will be the same. Thank you.
 20 MS. GLASGOW: Thank you. That concludes our
 21 presentation.
 22 HEARING OFFICER FAIRBANK: Okay. Thank you. So,
 23 let's see, we will go ahead and take a lunch break and we
 24 will reconvene at 1:00 p.m. Thank you.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

1 (Lunch recess was taken)
 2 STATE OF NEVADA)
)ss.
 3 COUNTY OF WASHOE)
 4
 5 I, CHRISTY Y. JOYCE, Official Certified Court
 6 Reporter for the State of Nevada, Department of Conservation
 7 and Natural Resources, Division of Water Resources, do hereby
 8 certify:
 9 That on Wednesday, the 25th day of September,
 10 2019, I was present at the Legislative Counsel Bureau, Carson
 11 City, Nevada, for the purpose of reporting in verbatim
 12 stenotype notes the within-entitled public hearing;
 13 That the foregoing transcript, consisting of
 14 pages 489 through 597, inclusive, includes a full, true and
 15 correct transcription of my stenotype notes of said public
 16 hearing.
 17
 18 Dated at Reno, Nevada, this 26th day of
 19 September, 2019.
 20
 21
 22
 23
 24

CHRISTY Y. JOYCE, CCR #625

	573:13	alignment (1) 572:11	523:6;553:16	550:18,24;551:10;
#	adjacent (1) 593:17	Allison (1) 491:13.5	appearing (2) 522:11;574:11	553:4,13,14,16;554:2,
#625 (2)	adjustment (1) 527:5	allow (2) 551:13,14	applaud (1) 559:21	14;555:1;556:6,7;
489:22.5;598:22.5	ADMINISTRATION (2) 489:6;493:4	allowed (2) 572:8;596:22	applications (2) 500:23;501:10	557:10,15,21,21,22;
A	administrative (3) 503:18;508:4;596:14	allowing (1) 553:14	applied (1) 506:12	558:7,8,14,15;560:24;
AA (1) 520:13	admissibility (1) 572:8	allows (3) 540:1;560:2;582:9	approach (1) 565:15	561:6,11;562:4,6,9,11,
able (1) 507:12	admit (1) 580:4	alluvial (6) 495:20;514:22;	approaching (1) 591:7	12,19,23;564:2,7,14,
above (1) 567:18	admitted (1) 498:4	565:7;591:15;592:8,10	appropriate (2) 572:17;574:14	18;567:4,9,11,18;
absence (1) 517:14	adopted (1) 572:12	alluvium (4) 523:13;525:13;	approximate (3) 555:16;567:19;	568:7,8,19,23,24;
absolute (1) 540:1	affect (7) 514:3;544:5;568:15,	570:22;592:7	589:16	569:1;570:2;573:14,
acceptable (2) 574:14;584:18	17,20;582:15;594:21	Almost (4) 511:24;512:6;	approximately (17) 500:22;511:23;	19;574:24;575:2;
according (5) 520:20;522:20;	affected (1) 597:5	515:15;577:12	514:19;519:1;526:3;	576:17,22;579:1,18;
528:18;556:18;568:11	affecting (3) 576:18;594:17;	along (20) 495:21;506:14,15,	543:17;563:24;564:13;	582:20;586:15,20,22;
accurate (1) 589:23	596:10	16;515:6;522:14;	565:17;567:7,18;	587:2,14;588:7,20;
acre (1) 531:2	affects (1) 513:16	525:2;526:11;530:20;	581:19,24;583:5;	589:7;591:15,23;
acre-feet (4) 553:19,24;583:5;	again (43) 493:8;495:1;507:23;	541:11;550:5;555:19;	585:6;586:1;591:1	592:2,19;594:12,21,22;
593:3	511:11,24;514:8;	556:8;562:6;564:16;	aquifer (56) 503:15;509:12,15,	595:18,22;596:24;
across (34) 505:13;511:8;	515:3;518:12;519:2;	568:4;570:22;591:15;	17,20;510:2;511:8;	597:7,17
512:10;517:15,16;	520:4;521:4,10,21;	592:19;596:24	513:9,15,19,21;514:22;	areas (50) 495:6;499:20,21;
533:18,24;534:9,11,12;	522:2,12,23;524:17;	alteration (1) 512:17	516:17;517:18;519:6;	501:2;506:10;508:5;
537:2,5;538:13;540:2;	526:15;536:8;538:23;	although (2) 524:10;531:20	523:23;524:5;528:16,	509:2,9,9;512:4;515:2;
542:16;543:4;545:8,	541:14;542:22;548:20;	Amargosa (5) 501:10;506:11;	17;529:8;530:22;	516:4,13;519:6;
23;547:7;549:6;551:6;	560:9;561:1,3;562:19;	530:11;531:8;575:11	531:12,12;532:2;	521:20;523:10,24;
553:9,10;554:1;	564:6,7;567:17;	amount (7) 507:10;516:1;554:4;	534:8;540:17;544:3;	524:7;526:14,17;
562:22,23;564:3,3;	568:20;570:14;571:7;	575:5;582:10;591:19;	549:22;553:17;557:24;	529:18;534:20;541:11;
579:18,19;584:2;	573:17;574:18;575:12;	593:8	559:14;562:11;563:3,	550:5,12;556:4;
595:13,15,18	576:3,8;579:4;581:10,	amounts (1) 589:5	14,21;564:20;565:11;	557:24;568:13,14,15,
Acting (1) 490:5	22;584:10,12	analyses (1) 532:4	566:8,11,16;569:4,4,5;	19;569:6,24;571:11;
action (1) 500:14	against (2) 507:22;561:21	analysis (1) 530:6	570:9,23;582:23;	573:11;575:6;576:14,
actually (11) 498:1;511:21;	ago (5) 505:18;531:9;	ancient (2) 547:18,18	586:7,9;589:10;591:4;	21;577:13;578:18;
513:24;531:12;553:19;	536:13;559:4;578:11	and- (2) 491:4,5,13	592:1,7;597:7,10,12,13	579:8;583:17;588:9;
557:1;563:10;567:19;	agree (8) 528:5,12,21;529:1;	Angeles (1) 491:9.5	aquifers (2) 532:1;577:2	590:23;591:16;594:4;
571:19;573:5;594:1	544:21;572:6;578:8;	angle (1) 569:16	534:8;540:17;544:3;	596:16;597:1,8,17
Adam (1) 490:6	584:22	annual (1) 582:24	549:22;553:17;557:24;	Argonne (1) 586:2
adamant (1) 508:11	agreement (1) 540:7	anomalous (1) 527:1	559:14;562:11;563:3,	argued (1) 596:14
add (1) 596:5	ahead (5) 493:7;494:13;555:7;	apex (1) 555:23	14,21;564:20;565:11;	argument (5) 512:13;540:12;
addition (4) 495:23;500:22;	573:8;597:23	appear (2)	566:8,11,16;569:4,4,5;	542:5;544:18;546:6
512:3;544:13	aid (1) 503:1		570:9,23;582:23;	arguments (3) 505:21;508:19;582:7
additional (6) 503:23;525:20;	Air (1) 518:13		586:7,9;589:10;591:4;	arid (1) 578:1
570:4,5;571:9;585:8	AKA (1) 489:11.5		592:1,7;597:7,10,12,13	arise (1) 502:18
addressed (1)	Alex (1) 491:15.5		ARE (157) 489:8,5,11;495:20,	Arizona (1) 507:1
			21;496:22;498:9,12;	arm (1) 555:16
			499:20;501:3,7;	Army (1) 530:7
			503:10,23;505:16,18;	around (7) 498:18,23;514:10;
			506:8;508:9,10,13,23;	551:22;560:1;567:6;
			515:6,17;517:11;	576:12
			519:3,20;520:7,10;	Arrow (10) 518:24;519:2,16;
			521:17,18;523:3;	521:14;523:15;525:19;
			524:1,6,21;527:18;	532:7;543:14;549:19;
			528:11;530:24;531:3;	596:4
			533:23;534:24;537:1,	Arrowhead (1)
			18;538:1,9,11,18,21,	
			23;539:5,7,9,13,21;	
			540:8,16,21;541:10,14,	
			24;542:3,8,9,10,15,16,	
			21;543:5;544:17;	
			545:12,13,15,16,18;	
			546:1,15,17,20;547:1,	
			9;548:4,5,11;549:3,18;	

555:24 arsenic (1) 521:8 Ash (3) 530:22;531:2;547:22 aside (3) 500:7;543:19;545:1 aspects (1) 503:9 assess (1) 506:6 assign (1) 572:16 assignments (1) 498:17 assimilate (1) 587:15 assist (2) 501:13;531:7 associated (19) 501:8;514:2,9; 522:18,21;524:12,15; 525:22;533:1;535:14; 544:11;546:24;548:12; 550:7;555:24;557:1; 568:5;580:24;596:5 Association (3) 573:4;574:16;578:24 assumed (1) 554:11 assumption (1) 534:5 assumptions (1) 507:18 atmosphere (1) 560:7 attenuated (4) 523:14;524:10,23; 575:1 attributed (1) 575:11 authored (1) 573:2 automated (1) 586:9 available (11) 493:19;518:14; 532:15;539:1;540:12; 554:6;577:21,23; 585:9;586:22;594:19 avenues (2) 577:18,19 average (3) 504:11;541:12; 556:18 averaged (1) 542:22 aware (10) 501:22;514:12; 552:16;573:5,6; 578:10;580:19;582:5; 591:20;592:20 away (2)	535:13;570:17 axes (1) 559:18 B back (14) 504:17;508:10; 509:1;514:18,19; 534:18;543:11;546:22; 548:1;555:8;558:4; 563:8;574:19;594:2 backtrack (1) 568:10 backwards (1) 533:6 bad (1) 514:7 balance (2) 503:12;579:2 Baldwin (8) 491:17;571:12,13, 17,21,21;572:15,20 Band (8) 491:17;532:11; 552:2,18;553:23; 554:20;571:22;594:9 Barnes (1) 490:9 barrier (20) 509:14;511:7,13; 512:12;520:12;532:19; 539:24;540:1,3,4,5; 543:2,3;544:8,15; 545:9,21,22,24;552:12 barriers (2) 531:21;584:2 base (4) 520:7;557:16; 558:24;583:11 based (17) 500:16;520:8; 527:14;539:22;543:6; 544:7,7;553:6;554:21; 557:10;559:6;585:2; 586:5;587:22;589:14; 591:1;595:5 baseline (1) 591:18 basic (1) 528:9 basically (26) 498:20;499:8,23; 500:21;507:6;510:16; 515:19,22;525:15,16; 526:16;536:5;538:8; 540:7;547:7,24; 560:15;561:16;563:19; 568:2,9;574:22; 580:12;581:4;583:19; 592:4 BASIN (25) 489:8,9,9.5,10,10.5,	12;490:15.5;507:15; 510:2;513:12;523:23; 524:1,3,4;533:6,8; 536:20;538:18;541:18; 546:10,24;565:7,8; 576:23;577:3 basins (4) 544:8;569:8;596:17, 17 basis (2) 509:8;537:9 Bassett (2) 558:5;560:18 BB (1) 520:13 beat (1) 518:4 Beatty (1) 506:11 became (5) 499:23;503:12; 552:16;573:5,5 become (1) 578:7 becomes (1) 577:19 Bedroc (1) 491:20 began (1) 519:17 beginning (3) 519:20;525:18; 581:24 begins (1) 574:4 behalf (1) 494:19 behaves (1) 527:8 behest (2) 496:11;497:17 Belaustegui (1) 491:6 Belcher (2) 564:22;565:24 believer (1) 580:23 below (5) 566:8,11,16;579:5; 593:11 bend (1) 562:23 Benedict (1) 490:10 beneficial (1) 554:24 benefit (1) 571:1 benefits (1) 593:21 Beth (2) 491:17;571:21 better (1)	522:8 Biologic (1) 491:23 bit (29) 498:11;503:11,16; 518:7;522:14;523:7; 525:24;527:10;530:3, 12,12;532:19;537:4; 538:6;541:8;543:17, 24;546:11;547:5; 548:5,24;556:2,15; 558:18;567:20;576:8; 579:13;585:13;587:23 BLACK (3) 489:8;534:24;560:19 Bliss (1) 490:15 block (40) 512:8,10;520:11; 522:16,24;525:3; 527:17;528:4,8,15,17, 20,20;529:2,20;530:17, 20;532:19;533:5,18,20, 22,24;534:3,10,11,12, 17;551:3,5,6,7,11,11, 12,14,16;555:19;562:7, 8 blocks (2) 529:5;533:1 blue (35) 500:12;516:14; 535:1;536:15,18; 555:13,15,22;556:2,10, 21;557:12,16,19;559:5, 19;560:19;562:3,6,18; 563:11,11;564:3; 565:5;567:12,20; 568:1,4;569:3;574:6; 587:18;588:8;593:9; 597:1,11 BM-DL-2 (1) 532:10 BM-ONCO-2 (1) 577:1 board (1) 514:10 bolster (1) 572:1 Bonanza (1) 531:16 book (1) 595:11 bore (1) 529:10 boring (1) 579:5 borings (2) 578:13;579:2 both (12) 514:16;520:13; 521:19;524:6;533:22; 535:20;544:10;552:11; 553:11;556:4;561:12;	592:22 bottom (2) 525:22;592:22 boulder (2) 546:23;547:16 boundaries (3) 505:8;548:9;583:17 boundary (17) 503:18;505:12,23; 506:18;508:2;534:18; 537:13,14,22;553:6; 574:23;595:13,14,16, 16,18,24 bounded (1) 520:12 boxes (1) 541:1 Bradley (1) 491:9 Braumiller (2) 542:11;569:7 break (7) 527:6;535:16; 543:14;555:4,7,9; 597:23 Bredehoeft (2) 504:15,16 Bridget (1) 490:15 brief (1) 594:7 briefly (3) 497:21;508:7;509:5 bring (2) 512:18;516:14 bringing (1) 554:7 bromine (1) 558:12 bromine-bearing (1) 558:12 brownish (1) 592:8 Brownstein (1) 491:8.5 budget (3) 505:15;506:21;517:9 budgets (2) 505:10;506:22 Buffington (1) 569:10 built (2) 586:4,6 bullet (6) 503:20;504:10; 509:23;512:17;514:5, 14 bulletin (1) 515:14 bullets (1) 502:11 Bureau (2) 501:6;598:10
--	---	--	--	---

business (2) 500:6,8	588:11,13;589:16,21, 24;590:3,10,17,19; 594:16,17,22;595:12	493:1;598:10	556:14,19,22	clay (2) 513:14,19
C	Canyon (15) 519:1,2,16;521:15; 523:15;525:19;532:7; 543:14;547:16,17; 549:19;578:17,17; 596:4,8	Carst (1) 496:15	chamber (6) 547:23,23;548:1,11, 13;551:9	clear (2) 540:4;577:14
calcite (2) 510:18;513:6	capabilities (1) 590:5	case (1) 569:24	change (17) 501:10;504:24; 505:3,4;507:19,21; 519:19;526:4;533:4; 558:13;561:14;565:13; 593:3,10,11,19,19	clearly (1) 527:8
calculate (1) 565:15	CAPITOL (1) 489:21	casing (1) 525:10	changed (2) 501:19;549:20	climatic (2) 503:20;597:8
calculated (4) 541:10,22;553:24; 554:14	capture (20) 503:14;504:4,9,13, 20;507:20;587:3; 588:6,11,13;594:9,12, 13,14;595:14,14;596:8, 9,9,10	catch (1) 593:22	changes (14) 501:17,21;503:17; 515:11;518:6;524:4; 532:21;561:16,20; 567:22;579:14,15; 591:21;597:15	close (7) 521:22;538:22; 541:24;551:6;560:15; 561:23;579:13
calculating (1) 596:4	captured (1) 583:20	cause (4) 519:13;557:6; 578:20;595:1	caused (1) 546:3	closely (1) 538:17
calculation (3) 554:8,9;556:19	captures (1) 587:16	causes (3) 542:23;552:12; 595:19	causing (1) 539:10	closer (1) 538:20
calculations (1) 554:1	capturing (3) 504:23,23;583:17	cave (1) 510:16	cave (1) 510:16	closing (2) 499:9;565:10
Caldera (8) 547:13,13,15,17,19, 22;548:2,5	carbonate (70) 509:15,17,19,24; 511:16;513:8,19,21,23; 514:2,2;517:17; 518:11;519:6;520:16; 523:13;524:5;528:15, 16,19;529:5,20;530:8, 22;531:11;532:7; 533:1,2,5,7;536:19; 538:10;539:8,10,18; 540:17;549:22;553:16; 557:24;558:3;559:9, 13;562:8,10,11,14; 563:2,2,13,20,21; 564:5,15;565:6;566:8, 15;569:3,4;570:23; 574:6;582:23;589:10; 591:4;592:1,7,8,11; 597:7,9,12	caves (1) 510:19	Caviglia (1) 491:10.5	closure (1) 500:14
calderas (2) 547:18;548:20	carbonates (21) 498:24;510:7,12,14, 23;511:6,17;513:13, 13;524:3;525:14; 536:10,23;564:14,18; 569:11,11;570:11; 577:2;587:18,19	cavities (1) 499:13	CCR (3) 489:22,22.5; 598:22.5	clues (1) 532:21
calibrate (2) 507:22;525:13	care (2) 590:12,21	CCR (3) 489:22,22.5; 598:22.5	celsius (1) 548:14	Cold (2) 507:3;579:24
calibrated (4) 507:7,7;586:8;595:6	careful (2) 534:14;546:18	Center (4) 491:23;554:10,13; 581:4	Center (4) 491:23;554:10,13; 581:4	colder (1) 561:5
calibration (5) 547:11;585:10; 586:9,19,20	carefully (1) 592:14	centers (1) 547:19	centers (1) 547:19	collected (4) 511:13;529:15; 564:20;581:2
CALIFORNIA (21) 489:10.5;491:9.5; 523:9;557:23;559:6,9; 560:21,21,22;562:12, 21;566:19,22;567:13; 569:4,22;592:5; 594:10,11,13;597:14	Carl (1) 557:9	central (6) 543:12;544:24; 545:12;548:20,21; 550:17	channels (1) 578:13,15,18;579:6, 7,14,17,19,20	collection (2) 578:20;596:21
call (1) 537:19	carrying (1) 551:8	century (2) 581:18,24	channel (9) 578:13,15,18;579:6, 7,14,17,19,20	collective (1) 596:19
called (11) 494:10,19;495:1; 498:15;499:3;507:8; 530:7;547:12,16; 558:21;569:10	Carson (5) 489:23.5;491:4,14.5;	certain (3) 504:3;513:1;525:17	channels (1) 578:21	color (2) 588:24;592:8
came (4) 501:5;532:10; 568:12;585:7	care (2) 590:12,21	certainly (12) 511:14;512:12; 514:24;515:5;516:5; 517:12;526:7,18; 529:16;531:16,20; 532:6	characteristics (2) 524:22;526:18	Colorado (3) 499:5;505:20;517:18
camera (1) 510:15	careful (2) 534:14;546:18	century (2) 581:18,24	cheek (3) 503:19;534:23; 554:19	colored (1) 563:5
cameras (1) 510:21	carefully (1) 592:14	center (4) 491:23;554:10,13; 581:4	chemistry (9) 516:12,16;518:1; 557:18;558:1,2,9,19; 580:11	colors (1) 564:8
can (51) 494:13;506:1,1,13; 510:5;515:11;519:12; 526:7;529:7;532:21, 24;534:8,11,12;536:19, 21;541:1;546:21; 556:5;560:11,12,12; 567:23;569:15;571:10; 576:4;577:18;578:4,6; 580:2;582:6,15; 583:15,16;584:2; 586:1,6;587:16;	care (2) 590:12,21	centers (1) 547:19	Chief (2) 490:8,11	combination (3) 495:8;518:16;554:9
	careful (2) 534:14;546:18	central (6) 543:12;544:24; 545:12;548:20,21; 550:17	chloride (1) 579:2	coming (12) 500:23;505:13; 516:2;529:9,16;531:2; 548:16;549:6;551:22; 552:10;568:2;578:13
	carefully (1) 592:14	century (2) 581:18,24	chock (1) 556:16	comment (6) 506:23;508:7;534:2; 552:23;565:22;566:3
	Carl (1) 557:9	center (4) 491:23;554:10,13; 581:4	Christi (1) 490:13.5	commenter (1) 560:13
	carrying (1) 551:8	centers (1) 547:19	CHRISTY (3) 489:22;598:5,22.5	comments (6) 559:11;560:17; 584:20;585:17,21,21
	Carson (5) 489:23.5;491:4,14.5;	central (6) 543:12;544:24; 545:12;548:20,21; 550:17	circles (1) 560:19	committee (1) 500:13
		century (2) 581:18,24	City (7) 489:23.5;491:4,14.5, 21;493:1;553:18; 598:11	common (2) 541:20;552:3
		certain (3) 504:3;513:1;525:17	claim (4) 528:9,14;534:3; 536:1	Commonly (4) 510:21;512:22; 513:11;559:3
		certainly (12) 511:14;512:12; 514:24;515:5;516:5; 517:12;526:7,18; 529:16;531:16,20; 532:6	claims (2) 527:16;552:18	
		century (2) 581:18,24	class (1) 544:15	
		center (4) 491:23;554:10,13; 581:4	classified (3) 542:19;582:19,20	
		centers (1) 547:19	classify (4) 527:13,14,24;569:6	
		central (6) 543:12;544:24; 545:12;548:20,21; 550:17	clastic (1) 577:2	
		century (2) 581:18,24		
		certain (3) 504:3;513:1;525:17		
		certainly (12) 511:14;512:12; 514:24;515:5;516:5; 517:12;526:7,18; 529:16;531:16,20; 532:6		
		center (4) 491:23;554:10,13; 581:4		
		centers (1) 547:19		
		central (6) 543:12;544:24; 545:12;548:20,21; 550:17		
		century (2) 581:18,24		
		certain (3) 504:3;513:1;525:17		
		certainly (12) 511:14;512:12; 514:24;515:5;516:5; 517:12;526:7,18; 529:16;531:16,20; 532:6		
		center (4) 491:23;554:10,13; 581:4		
		centers (1) 547:19		
		central (6) 543:12;544:24; 545:12;548:20,21; 550:17		
		century (2) 581:18,24		
		certain (3) 504:3;513:1;525:17		
		certainly (12) 511:14;512:12; 514:24;515:5;516:5; 517:12;526:7,18; 529:16;531:16,20; 532:6		
		center (4) 491:23;554:10,13; 581:4		
		centers (1) 547:19		
		central (6) 543:12;544:24; 545:12;548:20,21; 550:17		
		century (2) 581:18,24		
		certain (3) 504:3;513:1;525:17		
		certainly (12) 511:14;512:12; 514:24;515:5;516:5; 517:12;526:7,18; 529:16;531:16,20; 532:6		
		center (4) 491:23;554:10,13; 581:4		
		centers (1) 547:19		
		central (6) 543:12;544:24; 545:12;548:20,21; 550:17		
		century (2) 581:18,24		
		certain (3) 504:3;513:1;525:17		
		certainly (12) 511:14;512:12; 514:24;515:5;516:5; 517:12;526:7,18; 529:16;531:16,20; 532:6		
		center (4) 491:23;554:10,13; 581:4		
		centers (1) 547:19		
		central (6) 543:12;544:24; 545:12;548:20,21; 550:17		
		century (2) 581:18,24		
		certain (3) 504:3;513:1;525:17		
		certainly (12) 511:14;512:12; 514:24;515:5;516:5; 517:12;526:7,18; 529:16;531:16,20; 532:6		
		center (4) 491:23;554:10,13; 581:4		
		centers (1) 547:19		
		central (6) 543:12;544:24; 545:12;548:20,21; 550:17		
		century (2) 581:18,24		
		certain (3) 504:3;513:1;525:17		
		certainly (12) 511:14;512:12; 514:24;515:5;516:5; 517:12;526:7,18; 529:16;531:16,20; 532:6		
		center (4) 491:23;554:10,13; 581:4		
		centers (1) 547:19		
		central (6) 543:12;544:24; 545:12;548:20,21; 550:17		
		century (2) 581:18,24		
		certain (3) 504:3;513:1;525:17		
		certainly (12) 511:14;512:12; 514:24;515:5;516:5; 517:12;526:7,18; 529:16;531:16,20; 532:6		
		center (4) 491:23;554:10,13; 581:4		
		centers (1) 547:19		
		central (6) 543:12;544:24; 545:12;548:20,21; 550:17		
		century (2) 581:18,24		
		certain (3) 504:3;513:1;525:17		
		certainly (12) 511:14;512:12; 514:24;515:5;516:5; 517:12;526:7,18; 529:16;531:16,20; 532:6		
		center (4) 491:23;554:10,13; 581:4		
		centers (1) 547:19		
		central (6) 543:12;544:24; 545:12;548:20,21; 550:17		
		century (2) 581:18,24		
		certain (3) 504:3;513:1;525:17		
		certainly (12) 511:14;512:12; 514:24;515:5;516:5; 517:12;526:7,18; 529:16;531:16,20; 532:6		
		center (4) 491:23;554:10,13; 581:4		
		centers (1) 547:19		
		central (6) 543:12;544:24; 545:12;548:20,21; 550:17		
		century (2) 581:18,24		
		certain (3) 504:3;513:1;525:17		
		certainly (12) 511:14;512:12; 514:24;515:5;516:5; 517:12;526:7,18; 529:16;531:16,20; 532:6		
		center (4) 491:23;554:10,13; 581:4		
		centers (1) 547:19		
		central (6) 543:12;544:24; 545:12;548:20,21; 550:17		
		century (2) 581:18,24		
		certain (3) 504:3;513:1;525:17		
		certainly (12) 511:14;512:12; 514:24;515:5;516:5; 517:12;526:7,18; 529:16;531:16,20; 532:6		
		center (4) 491:23;554:10,13; 581:4		
		centers (1) 547:19		
		central (6) 543:12;544:24; 545:12;548:20,21; 550:17		
		century (2) 581:18,24		
		certain (3) 504:3;513:1;525:17		
		certainly (12) 511:14;512:12; 514:24;515:5;516:5; 517:12;526:7,18; 529:16;531:16,20; 532:6		
		center (4) 491:23;554:10,13; 581:4		
		centers (1) 547:19		
		central (6) 543:12;544:24; 545:12;548:20,21; 550:17		
		century (2) 581:18,24		
		certain (3) 504:3;513:1;525:17		
		certainly (12) 511:14;512:12; 514:24;515:5;516:5; 517:12;526:7,18; 529:16;531:16,20; 532:6		
		center (4) 491:23;554:10,13; 581:4		
		centers (1) 547:19		
		central (6) 543:12;544:24; 545:12;548:20,21; 550:17		
		century (2) 581:18,24		
		certain (3) 504:3;513:1;525:17		
		certainly (12) 511:14;512:12; 514:24;515:5;516:5; 517:12;526:7,18; 529:16;531:16,20; 532:6		
		center (4) 491:23;5		

Company (9) 491:13.5;494:10; 495:1,6,16;499:3; 500:9,10;507:3	cones (1) 596:5	495:5;499:3	copies (3) 501:21;502:5,18	552:8,9;574:24
compared (2) 524:3,11	confused (1) 546:23	contact (2) 513:12;558:3	copy (2) 496:3;497:10	cretaceous (4) 513:23;563:4,16,21
compiled (1) 532:2	conjunction (1) 500:2	contained (1) 571:24	core (1) 529:14	critical (1) 508:4
complete (1) 526:5	connected (31) 509:4,5,5,9,13; 519:6;521:16,19; 523:11,23;524:19,19; 526:16;527:13,14,15, 20,23;528:1,3,5,13; 533:22;542:19;582:19, 20,21,22,22;594:5; 597:13	containing (1) 558:4	Corn (4) 501:7;552:8,9; 574:24	croops (1) 515:4
completed (2) 498:13;523:13	connects (15) 508:5;509:3,11,18; 514:4,13;516:17,23; 517:1,4;524:6,9; 526:21;571:7;594:7	contains (1) 562:8	corner (1) 539:7	cross (4) 502:5;509:18; 520:10;563:11
completely (1) 509:16	connecting (1) 550:5	contaminant (1) 495:8	corollary (1) 504:11	crossed (1) 520:13
Complex (7) 547:13,13,15,16,22; 548:2;549:13	connection (11) 509:10;523:3; 526:21;528:8,10; 551:1;569:2,6;570:4; 597:2,13	contamination (1) 499:9	Corporation (3) 499:6,17,23	cross-examined (1) 572:4
complexes (1) 548:9	connectivity (4) 533:17;544:6;589:9; 594:3	content (2) 536:22;547:20	corrected (1) 502:6	cross-section (3) 542:16;587:19,21
composition (15) 557:11;558:13,19; 559:5,17,18;560:3,18, 20;561:3,7,12,15,16,20	CONSERVATION (2) 489:2;598:6	contents (1) 578:2	corrections (1) 501:16	cross-sections (4) 562:17;586:5;587:8, 17
compositions (2) 559:20;560:23	conservatively (1) 567:13	context (4) 530:13;535:1;552:2; 573:17	corrective (1) 500:14	crystalline (1) 587:14
compressible (1) 565:8	considerable (1) 554:4	continually (1) 515:15	correctly (1) 596:6	CSAMT (9) 520:8,13,14,15; 532:20;534:4;536:7, 24;594:6
computational (1) 587:3	considerably (1) 542:1	continuation (1) 527:6	corridor (1) 542:17	CSI (16) 491:6,8,5;520:8,11; 522:15,24;524:24; 527:16;528:18;532:23; 538:2,4,21;540:7; 551:4;596:2
computer (7) 495:9,17;498:19; 501:1;503:3;505:1; 507:6	CONSERVATION (2) 489:2;598:6	continue (6) 526:14;555:11; 568:23;580:5;583:20, 23	Counsel (1) 598:10	CSI's (1) 515:7
concentrate (3) 506:20;507:23;538:6	conservatively (1) 567:13	Continued (5) 491:1.5;500:5; 519:17,18;596:21	County (9) 491:12;535:4,8; 536:7,24;551:6,17; 590:5;598:3	CSV-2 (1) 522:4
concentrated (1) 579:7	considerable (1) 554:4	continuing (6) 517:12;543:21; 549:15;570:16;582:18; 584:6	Countysic (1) 539:14	CSV-3 (2) 523:12,13
concentration (1) 495:7	considerably (1) 542:1	continuity (3) 509:12,21;517:1	couple (11) 493:6;498:15; 503:13;505:18;515:15; 519:18;542:14;555:15; 562:17;578:11;587:11	CSV-1 (2) 520:6,10
concept (9) 504:3,15;505:12; 511:24;574:12;580:18; 583:15;594:22;595:8	consideration (4) 494:2;509:2;542:15; 583:11	continuous (3) 518:19;543:22;576:4	court (6) 493:20;494:4; 571:16;591:6,11;598:5	CSV-2 (8) 522:13;527:20; 533:21;534:10;543:10; 549:15;550:15;551:7
concepts (1) 503:14	considerations (1) 583:14	contour (4) 538:17,22;539:5; 567:1	cover (3) 562:9,10,15	CSV-3 (2) 526:9;527:24
conceptual (7) 505:2;517:7,22; 539:22;543:19,24; 554:18	consistent (3) 571:5;582:4,5	contract (4) 496:11;499:14,18; 500:6	covered (3) 498:20;586:15; 590:23	CSV-4 (5) 524:8;528:2;535:5; 541:2,9
concern (3) 540:17;570:3,14	consisting (1) 598:13	contractor (3) 499:8;500:1;573:15	COYOTE (37) 489:7.5;500:24; 501:2;504:18;515:8, 19;516:9;518:11; 526:10;536:3;538:3; 540:9,20,21;542:4,18; 543:13,21;544:2,19,23; 545:13;546:9;548:19; 549:10,12,23;550:7,13, 22,23;574:22;585:1; 588:17,19;591:23,24	CSV-5 (10) 526:24;528:5; 541:23;542:19;543:7; 544:17;550:2,8; 582:16,20
concerned (2) 553:15;588:10	constrained (1) 586:20	contracts (1) 533:14	creates (1) 556:6	CSV-6 (1) 521:21
concludes (1) 597:20	constrains (1) 587:7	contrast (7) 553:23;558:15; 560:7;561:5,18,18; 567:3	creating (1) 523:17	current (3) 554:11;584:17; 591:20
conclusion (2) 593:20;597:6	constraint (1) 504:21	contributing (3) 550:23,24;551:23	Creek (6) 501:7;513:24;514:3;	curve (2) 561:13;574:5
conclusions (1) 571:6	constraints (1) 583:11	control (3) 586:5;587:9,22		curves (2) 561:15;595:21
conductivity (1) 536:17	constructed (4) 504:1;510:10;531:9; 539:2	conventional (1) 554:18		cut (2)
conduit (1) 572:5	construction (1) 557:1	cooler (1) 560:7		
	consulting (2)	Cooper (1) 490:13.5		

568:20,24 cut-off (1) 581:6 cuttings (1) 529:14 CVF-2 (1) 541:9	decided (1) 502:16 decision (1) 584:18 decisions (1) 597:10 decline (23) 519:10,12,13,14,14; 520:24;521:2,10,23; 522:2,10;523:5,16,17, 19;524:13;525:20; 535:14;549:18;570:14; 574:18;584:10;591:23 declines (2) 570:16;595:1 declining (13) 521:3;535:12,21,22; 536:4;570:11;575:10; 576:15,16,17;582:13; 591:3;597:7 decrease (13) 519:5;525:21; 528:12;536:17;543:16; 549:11;565:3;566:12; 567:24;586:11,13; 592:3;595:2 decreased (2) 556:24;564:19 decreases (3) 528:11;589:18;593:1 deemed (1) 574:13 deep (7) 536:12;539:18; 563:24;564:6,6;579:2, 5 deepened (2) 510:9,13 deepens (1) 595:3 deeper (6) 538:10;539:10; 565:4,4;578:6;587:5 deficit (2) 577:24;578:5 define (1) 512:10 defined (1) 526:2 defines (1) 528:7 defining (1) 544:15 definite (2) 526:19;533:4 definitely (2) 532:24;565:14 definition (1) 555:1 degree (3) 526:20;528:10; 533:17 degrees (10)	548:14,23;549:1,8, 15,16,19;550:15,16,17 delay (5) 570:18,18;571:4; 593:17,19 delayed (1) 593:7 delays (1) 594:1 delivered (1) 583:15 demonstrate (2) 516:23;517:3 demonstrated (3) 533:18;534:4;571:10 demonstrates (2) 516:20;550:21 demonstration (2) 594:5;596:23 demonstrative (1) 569:16 DEPARTMENT (6) 489:2;493:23;499:7; 573:10,15;598:6 dependent (1) 588:3 depends (3) 511:7;517:9;584:1 depicted (2) 548:10;587:17 depletion (3) 503:15;504:9,13 deposits (2) 558:4;578:18 depth (19) 510:13;520:17; 533:3;544:3;563:15, 22,23;564:6,16,19; 565:14,16,18,19; 566:13;580:3,4; 586:12,14 depths (3) 520:17;565:4;578:7 Deputy (1) 490:6.5 describe (1) 504:4 described (3) 513:22;559:12;578:9 describes (1) 500:20 describing (3) 496:19,20;564:10 description (2) 513:24;585:22 Desert (6) 500:3;501:10; 506:11;557:8;575:11; 578:12 design (1) 530:18 designed (1) 508:11	detail (5) 532:19;555:21; 568:16;570:20;587:3 details (5) 511:2;530:2,9; 531:13;592:15 detected (1) 514:6 detectible (1) 529:18 determinations (1) 579:3 determined (2) 515:22;530:6 determines (2) 509:11;577:16 determining (1) 571:8 deuterium (4) 502:8;558:21; 559:20;561:18 develop (5) 553:3;585:7;589:16, 23;596:6 developed (7) 506:4;510:2;522:7; 528:23;545:23;584:24; 590:7 developing (2) 506:4;588:2 development (1) 574:11 develops (1) 590:12 Devil's (3) 501:11;575:8,8 diagram (3) 535:5;537:11;595:17 diamonds (1) 559:19 Dick (1) 578:11 differ (1) 527:19 difference (5) 537:9;549:9;558:9; 565:13;566:10 differences (1) 560:3 different (36) 495:6,8,21;506:16; 508:5,13;512:20; 514:3;524:2,2;527:12; 534:19;535:7,17,17; 537:6,6;543:6;548:6; 550:3;558:1;566:13; 568:22;576:21;582:21; 587:2;591:16,16,17,23; 593:5;594:12;596:3,9, 16,16 differentiating (1) 508:22 differently (3)	508:18,18;527:8 difficult (4) 525:4;526:19; 540:24;556:12 dimensional (1) 568:7 Direct (2) 492:4;494:23 direction (2) 497:7;567:14 directly (1) 567:1 disagree (3) 537:24;550:10; 559:14 disagree (2) 565:24;566:4 disagreement (1) 565:23 disappeared (1) 525:16 discharge (49) 504:22,23;505:2,3,6, 22;506:1,14,18,20; 507:24;516:13;517:18; 542:8;546:1;552:13; 553:16;556:4,15,19,21, 24;557:1,19,22;559:5, 8,12;560:13;567:15; 568:4,10,17;570:1,7; 583:17,23;584:17; 586:6,7;588:3;589:18; 592:18;593:2,24; 594:21;595:3,22; 596:24 discharged (1) 517:11 discharges (2) 545:24;556:14 discharging (6) 505:17;557:8,12,15; 559:6;563:13 discuss (9) 503:13,19;504:15; 519:12;532:18;555:13; 570:2;584:19,23 discussed (3) 524:24;535:2;538:4 discussion (10) 502:7,8,20;503:20, 24;504:3,9;505:18; 511:5;512:19 displacement (1) 545:7 displacements (1) 533:13 display (1) 560:2 displays (2) 547:3,4 dissolution (6) 510:8,22;513:11,14; 558:10;575:22
--	--	--	--	---

distance (5) 519:22;541:15; 542:22;549:5;570:19	Dr (8) 494:1,3,8;498:6; 555:2,10;573:6;580:13	498:24;499:1; 520:21;522:16;527:9; 11;528:9;532:1;543:1; 544:12;546:9;566:24	566:21;579:8	512:1,8;530:2,16
distances (1) 512:22	drastic (2) 566:7;593:11	east/west (1) 539:16	else (1) 590:20	error (4) 505:11;506:22; 518:8;544:1
distinct (1) 547:8	draw (1) 535:9	eastern (11) 528:3;533:20;538:8, 12,16;549:12;550:12, 22;551:4,10;562:7	elsewhere (1) 529:23	erupt (2) 547:20,21
distinctly (1) 520:19	drawdown (8) 512:7;589:2,6,17; 595:19,20,21;596:5	edges (2) 558:23	employed (2) 494:9,10	escarpment (1) 555:18
distribution (2) 496:8;591:22	draws (1) 535:11	edge (3) 555:19;574:22; 586:16	empty (1) 547:24	especially (2) 536:10;586:20
District (3) 491:12.5,18.5; 552:22	drew (2) 535:12,13	edges (2) 530:20,21	encounter (1) 514:8	Esq (11) 491:3.5,5,7,9,10.5, 14,15.5,17,18.5,20,21
Diversity (1) 491:23.5	drill (2) 513:12;514:7	effect (11) 493:16;507:16; 508:20;511:9,13; 524:20;543:2;575:13; 576:18,19;595:24	end (18) 522:1;523:20; 538:16;548:1;551:5; 559:19;560:5,8;561:4, 6,15;562:7;564:8; 567:16;568:9;574:5; 580:6;584:7	essentially (1) 581:13
diverting (1) 593:14	drive (3) 579:19,19,20	effects (33) 495:17,18;496:7; 503:21;504:4;506:19; 507:9,19,20;508:14,23; 509:14;514:11;518:21; 519:11;522:9;523:2; 524:7;527:21;570:21; 571:4;575:1;576:22; 582:15;586:7,21; 588:13;589:12;591:14; 592:17;593:16;595:11, 23	ended (2) 493:11;553:5	estimate (4) 553:19;583:2;585:2; 589:16
divide (7) 544:1,6,7,7,9;596:6,7	driving (1) 579:17	effort (3) 506:24;532:1;553:3	Energy (4) 491:10.5;499:7; 573:10,15	estimated (1) 553:4
DIVISION (2) 489:3;598:7	drop (1) 574:5	EH-3 (3) 513:18;557:17;567:5	Engineer (10) 490:5,6,5,9,5,15.5; 493:10,11;508:1; 525:7;572:15;590:17	estimates (7) 504:24;505:12,19; 506:4;517:9;553:3; 589:23
document (6) 496:24;497:3,3,13, 21,22	drops (1) 592:10	EH-4 (3) 541:23;542:18; 549:19	Engineer's (8) 495:18;504:17; 508:20;540:14;558:6; 583:4;590:11;596:18	estimation (1) 507:8
documented (1) 576:13	dry (5) 536:19;569:12; 577:5;578:1;582:1	EH-6 (1) 576:22	enhance (1) 528:24	ET (6) 508:8;524:20;588:6, 6,7,11
DOE (3) 499:16;500:9;566:3	due (4) 517:14;519:15; 534:13;570:11	EH-7 (3) 513:18;557:17;567:5	enough (12) 533:2;536:11;543:9; 551:12,14;565:24; 566:4;569:23;570:2; 578:21;579:14;580:5	evaluate (4) 531:10;585:16; 589:12,21
dolomites (1) 510:7	duly (1) 494:20	eight (2) 501:23;531:15	entering (1) 578:6	evaluation (2) 585:23;595:4
dome (1) 548:6	during (10) 502:22;521:6; 525:11;529:9;535:22; 560:11;571:15;581:5; 582:17;583:6	either (9) 501:5;518:17; 528:24;530:17;535:23; 542:20;543:10;544:12; 593:2	entirety (2) 497:18;498:20	evaporate (2) 561:18,19
domes (1) 548:7	DV-1 (2) 566:1,1	elbow (2) 543:1,15	entitled (1) 497:14	evaporating (1) 560:15
done (10) 493:6;500:13;506:7; 530:5;535:16;537:17; 543:23;550:4;573:6; 595:4	DV-2 (1) 566:2	electrical (1) 532:21	entering (1) 578:6	evaporation (9) 559:13;560:4,11,14; 561:12,16,23;562:1; 580:3
Donnelly (1) 491:23.5	DV-3 (1) 566:5	elevated (1) 549:12	entirety (2) 497:18;498:20	evaporative (1) 560:24
down (55) 506:11;510:15,21; 515:9,20,20;517:10,23; 519:2;523:21;524:17; 525:18;526:15;530:12, 13,21;532:8;538:18; 541:22;542:18;543:9, 13,21;544:16;548:19; 549:2,6,15;550:2,12, 17;551:8,9,21;559:21; 576:24;577:9;578:13; 579:13,19;580:2,8; 583:16,23;584:6; 587:23;588:17;589:4, 8,10;592:5,11;594:17, 18,20	E	elevations (2)	environment (1) 578:1	evaporative (1) 560:24
downstream (2) 588:7;594:23	earlier (9) 503:12;520:22; 531:18,23;540:11; 552:15;573:9;587:24; 588:5	EH-6 (1) 576:22	environmental (3) 495:5;499:3,7	evaporite (1) 558:11
downward (5) 520:3;522:12;524:5; 580:5,6	Early (10) 518:12,15,23;522:5; 531:9,10;534:21; 581:17;584:24;593:6	EH-7 (3) 513:18;557:17;567:5	environments (4) 512:20;579:4,9; 580:21	evapotranspiration (5) 506:5;514:16,24; 546:2;588:4
	Earth (1) 555:22	eight (2) 501:23;531:15	episodes (1) 581:19	even (3) 542:15;554:15; 596:15
	easier (1) 525:24	either (9) 501:5;518:17; 528:24;530:17;535:23; 542:20;543:10;544:12; 593:2	equation (1) 595:13	event (18) 519:7,15;522:10,10; 524:12;525:20;526:13; 573:20;575:2,10,24; 576:2,3,7,16,16; 581:12;582:14
	easily (4) 529:17;558:3,10; 565:2	elbow (2) 543:1,15	equilibrium (6) 583:18,21,24;584:4, 14;591:8	events (5) 519:8;576:5;578:16; 579:16;582:3
	east (12)	elevated (1) 549:12	equipment (1) 522:8	eventually (1) 597:19

everybody (6) 509:8;527:2;590:14, 15,15,19	experiment (1) 507:6	596:11	FF (2) 562:21;563:18	496:9;498:19,21; 500:21;501:1,8;504:1; 506:2,8,15;508:3; 509:21;512:14,16; 514:14,18,23;517:7,11, 12,14,18,20,20,21; 520:12;529:8;531:19, 24,24;533:15;534:14, 19;537:14,22;539:3, 23;540:1,6,9;542:16; 543:4,11;545:21; 550:5,8,9,11,13,23,24; 551:13,14,19,22,23,24; 552:13;553:6,12,16,20, 24;554:9,12,12,14; 556:3;557:3;564:13; 566:3,24,24;567:1,14; 568:2,7;569:8;575:9; 576:6;577:1;579:7; 582:12,21;584:2; 586:16;588:11,14; 589:21,22;591:2; 593:13;594:19;595:7, 13,15;596:15
everyone (1) 571:20	expert (3) 494:1;503:1;558:6	Farber (1) 491:8.5	field (1) 506:5	flowing (1) 553:19
everyone's (1) 493:9	experts (1) 572:3	Fahrenheit (2) 548:23;549:8	figure (7) 539:8;540:22; 545:19;548:17;560:10; 567:10,19	flows (4) 545:21;551:6;556:4; 579:21
everywhere (1) 541:17	explained (2) 558:3,10	fashion (2) 585:18;590:13	figures (2) 565:1;592:21	flume (2) 556:16;557:4
evidence (7) 498:2;505:22; 544:16;554:18;562:3; 579:6;583:14	explanation (2) 559:15;582:3	fashions (1) 591:17	fill (15) 510:2;512:17,18; 513:12;523:23;524:1, 3,4;533:6,8;536:20; 565:7,8;576:23;580:2	flux (1) 553:22
ex (1) 504:16	explosion (1) 499:13	fault (52) 509:18;511:9;512:8, 10;520:9;522:16,22; 528:7,22,22,24;529:1, 2,15,16,20,22;530:17, 20,20;531:20;533:13, 19;537:10,11,12,13,19, 21,22;538:1,16,19; 539:14,17;545:7,20; 546:4,8,8;555:20,24; 556:1,9;562:7,15,16; 563:12;564:16;568:3, 4;587:2	filled (2) 513:6,14	fluxes (3) 505:12,23;506:18
Examination (2) 492:4;494:23	explosively (1) 547:21	faulted (1) 512:24	filled (2) 513:6,14	following (5) 519:10;522:10; 523:18;524:16;575:12
examined (1) 494:21	explosion (1) 513:10;560:6;562:8; 563:4,17;569:1	faulting (18) 509:13,16,22;513:1; 522:18,19;533:1; 538:23;539:9,20; 540:8;545:2,2,16; 546:19,22,24;547:7	final (2) 514:5;551:18	follows (1) 494:21
example (11) 505:17;511:11; 527:22;528:10;530:15; 534:15;577:20;582:16, 17;595:12;596:2	exposures (2) 513:1;564:9	faults (31) 509:15;511:6,8,12; 512:10,12,15,19,20,21, 21;513:6;520:8,16; 522:17,21;529:5,24; 530:17;531:5,7; 539:22;540:5,8;545:3, 5,11;546:13;547:8; 551:13;587:2	finally (4) 516:21;526:23; 553:7;597:16	font (1) 540:23
examples (8) 503:23;509:4,6; 511:8;521:13;577:9; 584:5;587:11	expressed (1) 566:13	favorable (2) 558:14,15	find (6) 513:13;529:11,13; 540:22;544:24;577:8	foot (2) 541:6;575:22
except (3) 570:3;582:19;583:4	extended (1) 589:4	feature (3) 547:19;555:23; 575:22	finding (1) 552:23	Force (1) 518:13
exceptions (2) 510:1,6	extending (2) 546:11;550:15	features (5) 510:8,23;513:11,15; 556:7	Fire (4) 563:5,6,17;564:9	forced (1) 568:18
excess (3) 505:20;554:5,21	extends (4) 539:6;562:15,22; 589:8	fed (1) 597:12	first (19) 494:20;498:14; 501:23;503:11;504:7, 10;506:10;509:11; 513:2;514:14;529:3; 549:19;550:20;552:5, 15;558:7;574:12; 585:11;592:24	foregoing (1) 598:13
excuse (1) 509:24	extensive (1) 588:9	feet (13) 510:17;531:2;532:5; 541:5;551:21,22; 554:3;566:11,21,21,23; 567:7;579:5	fish (1) 501:6	forget (1) 540:3
exercise (1) 584:11	extent (7) 572:1;589:2,6,12,13; 594:8;596:11	fellow (1) 580:19	five (10) 541:3,4,6,15;542:2; 563:24;579:1;581:6,8, 17	forgot (2) 502:4;590:22
exhaustive (1) 577:10	extreme (2) 588:11,12	Fenelon (1) 573:3	fix (1) 557:3	forgotten (1) 579:10
Exhibit (5) 496:4;497:11;504:2; 525:7;552:17	eye (2) 535:11,12	few (4) 530:5;556:6;576:14; 581:18	fixed (2) 505:3;584:16	form (1) 535:7
exhibits (4) 493:11,11,13;498:3	face (1) 497:19	fewer (1) 586:21	Flangas (1) 491:15.5	forms (1) 546:8
exist (2) 520:23;593:12	facility (2) 521:8;557:2		Flat (7) 512:3;518:22;520:1; 523:14;525:15;575:19; 576:9	forth (4) 495:10;504:21; 506:6;562:21
existing (1) 597:9	fact (6) 531:11;535:13; 540:13;548:8,10;586:2		flatley (1) 490:7.5	
expanded (1) 525:23	factor (1) 571:8		flatten (2) 574:4;584:9	
expect (4) 553:9;571:4;574:4; 577:7	failure (1) 525:10		flattening (2) 574:9;584:7	
expected (1) 557:3	FAIRBANK (18) 489:4;490:3;493:3, 17;494:12;498:3; 555:2,6,10;569:13,17, 19;571:12,18;572:14, 23;591:9;597:22		flattens (1) 526:15	
expense (1) 510:22	fairly (6) 518:22;521:7;522:5; 523:14;560:2;564:6		FLOW (100) 489:7;493:5;495:22;	
expenses (1) 595:3	fall (2) 548:1;575:5			
experience (4) 498:12;499:19; 500:16,20	far (1)			

fortunately (1) 512:3	517:24;577:5	geophysical (1) 587:9	grains (1) 510:4	527:22
Fortymile (6) 578:13,17;579:13, 16,16,21	GARNET (18) 489:9;515:9,20; 523:9;543:22;557:24; 559:6,9;566:19,22; 569:5,22;570:23,24; 588:17;589:5;592:5; 597:14	geophysics (1) 587:22	granite (1) 573:21	hand (1) 527:24
found (8) 507:17;509:9; 510:15;513:20;532:4; 561:10;578:15;579:4	Geotrans (1) 499:3	gets (5) 505:8;545:23;575:4; 590:16;594:2	Granites (1) 573:21	handout (1) 518:7
four (5) 500:15;503:8; 541:13,13;543:17	Gary (1) 496:15	GG (1) 563:18	gravel (1) 510:2	happen (3) 510:20;514:6;583:22
four-fold (1) 519:2	general (10) 520:7;522:15; 528:11;529:4;533:14; 539:13;555:20;563:6; 567:6;578:8	gives (1) 516:16	gravity (7) 538:2,9,12,18,23,24; 539:11	happened (1) 568:24
fourth (1) 532:16	generally (4) 503:8;510:4;543:20; 567:24	glad (2) 498:13;503:7	great (4) 555:5;570:19; 571:19;580:4	happening (2) 561:17;596:20
fracture (4) 512:17,18;529:13,19	generate (2) 508:16;515:10	Glasgow (19) 491:22;492:4; 493:14,15,18,21,21,22; 494:8,12,15,24;498:1, 5,6;572:7;580:13,16; 597:20	greater (7) 510:13;532:5;554:2; 555:21;570:18;578:7; 593:17	happens (1) 584:8
fractured (3) 498:22;511:3;512:24	generated (3) 514:17;515:16; 527:18	G-l-a-s-g-o-w (1) 493:22	greatest (2) 573:21;575:5	happy (1) 596:20
fractures (6) 511:1,2;513:5; 533:11;565:10;580:7	generates (5) 508:9;515:1,7,8; 516:3	global (5) 559:16;561:1,2,24; 562:2	greatly (1) 524:10	hard (8) 517:15,16;520:5; 525:21;546:17;547:11; 592:20,23
fracturing (6) 509:22;510:24; 514:9;522:18,18; 528:23	generating (1) 515:16	goes (5) 538:13;564:3;572:7; 595:18;596:12	green (3) 563:5;564:8;592:9	Harrill (1) 552:24
frame (2) 568:21;579:11	generous (1) 585:18	good (22) 493:22;494:3; 503:14;505:7;506:4; 507:21;511:11;520:15; 532:20;533:8,14,15; 536:9;542:7;548:16; 555:3;558:24;585:2; 587:20;589:15,22; 595:7	Greg (1) 491:18.5	head (8) 542:24;551:21; 557:21;558:15;566:18; 567:7;568:1;588:3
framework (6) 586:4;587:7,10,13, 20;588:2	geochemical (3) 557:9;558:9;582:6	Google (1) 555:22	groundwater (12) 495:7;541:17;544:1; 545:24;552:13;554:11; 560:14;580:10;594:24; 596:6,19,24	heads (6) 551:20;566:22; 567:6,9,11,13
French (1) 578:11	geochemist (1) 561:8	gouge (1) 528:23	groundwaters (1) 561:10	heard (1) 584:21
Frenchman (1) 579:1	geochemistry (1) 558:7	GPM (1) 531:16	group (1) 590:13	HEARING (30) 489:4,15,16;490:3,5, 8;493:3,4,17;494:12; 498:3;500:23;501:4,9; 504:18;555:2,6,10; 569:13,17,19;571:12, 18;572:14,23;585:1; 591:9;596:14;597:22; 598:12,16
frequency (1) 581:20	geographic (4) 498:9;503:18; 509:21;534:18	gradient (45) 515:18,21;516:3,9, 10;517:5,13,20;527:9; 530:13,22;531:4,18; 538:11,21;539:5,11; 541:3,9,11,15,17,18,20, 20,22;543:11,11,16; 545:23;553:8,8; 566:23;567:14;569:5, 7;579:13;588:16,18; 594:17,18,20,20;595:2, 2	guess (5) 496:16;525:5; 540:17;554:19;577:18	hearsay (4) 571:15;572:1,6,7
full (1) 598:14	geohydrology (2) 500:18;503:10	gouge (1) 528:23	guesses (1) 505:14	heat (6) 548:11,14,16;551:8, 10;554:10
function (1) 568:24	geologic (5) 516:24;545:1;562:4; 586:4;587:6	gauge (1) 528:23	guide (1) 553:3	heavier (7) 502:11,14;558:21; 559:8,8;560:20,23
funding (1) 585:7	Geological (7) 498:14;500:3; 555:18;568:21;571:14, 23;587:9	GPM (1) 531:16	gypsum (2) 558:4,10	Hello (1) 493:22
further (26) 516:10;518:7; 526:24;527:9;530:12, 12,13;537:4;538:4,7, 11,20;541:8,21; 543:21;546:11;547:5; 556:12;563:10;570:17; 576:8;579:13;580:8; 587:23;589:8;592:1	geologist (3) 503:2;537:15,17	gradient (45) 515:18,21;516:3,9, 10;517:5,13,20;527:9; 530:13,22;531:4,18; 538:11,21;539:5,11; 541:3,9,11,15,17,18,20, 20,22;543:11,11,16; 545:23;553:8,8; 566:23;567:14;569:5, 7;579:13;588:16,18; 594:17,18,20,20;595:2, 2	H	help (4) 506:6;553:3;591:11; 597:18
furthance (1) 496:11	geology (10) 498:18;516:21,24; 518:2;532:22;537:7; 552:21;557:20;558:14; 587:3	gradients (14) 516:1,4,6;517:20; 534:11,12;540:11,21, 23;542:1,6;544:19; 551:18;588:20	H2O (1) 558:19	helped (2) 508:22;530:18
G	geometric (1) 565:16	graduate (1) 498:13	habitat (1) 556:6	helps (1) 591:12
gained (1) 499:19	geometries (1) 587:16		half (1) 556:14	hereby (1) 598:7
gap (1) 556:24	geometry (1) 534:14		Halford (4) 566:4;573:3,6;581:1	here's (10) 520:9;550:8;559:16; 562:4,17;587:18,24; 588:10;595:14,14
Garden (2)	geomorphic (1) 555:23		Halford's (2) 581:8;591:2	Herrema (1)
			halfway (4) 521:24;585:10,11; 588:22	
			halide (1) 558:12	
			hallmarks (1)	

491:9 hiatus (1) 513:9 HIDDEN (5) 489:9.5;502:3; 543:21;588:17;589:5 high (21) 505:19;510:1;516:2; 517:13;522:22;528:20; 529:3;531:1;532:15; 533:2,17;534:6; 538:11,21;541:20; 545:17,22;547:20,20; 569:23;582:9 higher (23) 516:6,10;519:1,18; 525:13;527:10;533:5, 6;540:21;541:11; 542:23;543:15;565:2, 3;566:23;567:14; 579:8;581:18;582:2,2; 586:23;588:20,21 highest (2) 544:11;575:4 highlighted (1) 565:5 highlighting (1) 556:9 highly (2) 533:22;582:20 highway (3) 522:14;525:3;526:11 himself (1) 572:12 hint (1) 520:3 hired (6) 495:11,14,16,16; 500:24;553:2 history (1) 518:11 hits (1) 545:22 Hole (3) 501:11;575:8,8 hopefully (1) 583:23 horse (1) 518:4 horst (1) 528:20 hot (1) 548:14 hottest (1) 548:22 hours (1) 555:3 Housekeeping (1) 493:15 HRT (1) 525:8 huge (1) 579:16	hundred (3) 549:15,16;550:16 hundreds (1) 579:5 Hyatt (1) 491:8.5 hydraulic (15) 515:18,21,21,24; 517:5;533:9,12; 534:11;544:18;546:14; 551:1;557:20;558:15; 569:2;571:7 hydrogen (7) 558:20,20,22; 559:18,24;561:14,17 hydrogeologic (1) 596:16 hydrogeologist (3) 499:14,24;503:3 Hydrogeology (1) 500:16 hydrograph (14) 501:24;518:22; 519:4;523:14;525:5; 526:8,15,24;527:12,21; 535:3;542:24;556:13, 21 HYDROGRAPHIC (8) 489:7.5,8.5,9.5,10, 10.5,11.5;543:6;550:3 hydrographs (11) 518:5;520:2;523:8; 524:22;525:6;526:18; 570:10;575:18;581:13, 14,15 hydrologic (1) 536:21 Hydrologist (2) 490:12.5;552:24 hydrologists (1) 552:14 Hydrology (10) 490:11;495:7; 498:18;532:22;534:10; 546:14,15;548:15; 553:1;559:2 hydrostratigraphic (1) 587:1	544:14;552:6 Ike's (1) 552:15 illustration (1) 595:10 image (1) 555:22 imagery (1) 506:6 immediate (1) 575:3 immediately (3) 511:24;512:6;574:23 impact (12) 501:11;515:1;570:1, 7;583:19;593:19; 594:11,18,23;596:17, 23;597:15 impacted (1) 554:22 impacting (1) 589:24 impacts (9) 571:9;583:8;589:18; 592:18;593:6,13; 594:6;596:12;597:19 impede (1) 540:9 impediment (5) 539:23,24;540:1,2; 543:3 impediments (2) 512:15;540:6 imperme (1) 566:16 impermeable (11) 528:15,16,18;529:6; 534:1,1,3;551:4,16; 566:9;595:13 importance (1) 580:18 important (15) 504:10,22;510:24; 511:2,4;516:15; 518:10;548:8,15; 550:19,20;551:2; 586:14;594:2;597:3 improve (2) 522:7;590:3 improved (1) 585:5 inches (3) 581:7,8,17 include (2) 586:17;590:8 included (4) 501:3;509:2;534:21; 540:15 includes (1) 598:14 including (5) 512:5;532:8;554:14; 558:12;564:21	inclusion (1) 499:18 inclusive (1) 598:14 incorporate (1) 590:6 incorrect (1) 563:10 increase (21) 521:9;523:4,17; 524:11,14;525:11; 526:11,13;535:13,21; 536:16;556:5;557:3,4; 574:8;575:16,16; 576:4;582:9;583:20; 591:1 increased (3) 507:11;521:1;592:11 increases (5) 523:19;574:3; 581:20;588:18;595:3 increasing (8) 527:7;535:24;536:1; 561:24;573:23;574:24; 575:6;587:5 incredible (1) 513:2 independent (1) 586:6 in-depth (1) 543:23 Indian (5) 552:7,9,18;554:20; 574:21 Indians (2) 552:3;553:23 indicate (2) 579:23;580:10 indicated (3) 541:3;545:16;584:20 indicates (6) 513:20;534:1; 538:10;539:8;541:7; 560:8 indicating (2) 523:3;537:22 indication (2) 531:20;553:12 indications (1) 552:5 indicative (2) 536:15;544:20 individual (1) 576:5 induced (1) 584:2 infiltrate (2) 577:22,24 infiltration (4) 578:4,22;580:9; 581:12 inflow (1) 506:15	information (23) 496:18;508:7; 510:11;511:16;516:12, 16;527:10;531:5; 532:2;533:12,16; 534:5,16;535:6;536:8, 9,21;573:14;580:17; 585:8,19;594:7;595:5 informed (1) 499:16 initial (2) 532:12;535:20 initiation (5) 519:20;521:1,2,3; 523:15,18 injected (2) 511:20;531:12 injection (3) 511:18,21,22 input (1) 496:14 inset (2) 501:24;563:9 insistent (1) 508:17 installed (1) 511:15 instance (2) 502:12;574:17 instances (5) 501:4;529:14,21; 577:11,12 instant (1) 547:23 instead (3) 508:15;524:18;566:6 Institute (3) 500:3;557:9;578:12 instrument (1) 578:22 instrumentation (1) 506:5 instrumented (3) 512:10;578:12,14 intensively (1) 512:24 interactions (1) 586:8 interest (3) 516:8;524:8;569:9 interested (3) 506:19;586:16; 592:24 interesting (1) 595:6 Interestingly (3) 543:9;565:24;566:4 interference (1) 595:11 Interim (2) 495:12;497:15 Interior (1) 493:23
	I			
	idea (4) 504:19;505:7;542:7; 596:13 ideas (1) 594:3 identified (1) 552:6 identify (1) 502:24 III (1) 489:17 Ike (2)			

International (1) 561:9	job (6) 498:14;532:20; 587:20;589:15,22; 595:7	20;595:22;596:2; 597:11	493:6;494:7;500:12; 503:13;506:3;576:14; 585:12	15;579:15;582:4,13, 17;583:16;584:6; 590:24;591:3;595:1; 597:6
internet (1) 571:20	Joe (1) 573:3	kinds (2) 577:4;593:14	late (2) 519:17;590:8	Levi (1) 490:10.5
interpret (1) 534:15	John (2) 504:14,16	King (1) 531:16	later (6) 499:16,23;516:19; 525:23;527:10;534:16	lighter (5) 502:10;558:21; 560:5;561:17,19
interpretation (14) 527:19;534:7;537:7, 8,14;538:2,15;550:9; 551:1;552:3;554:17, 20;560:16;581:22	joined (1) 499:6	knew (1) 583:2	lateral (9) 545:3,6,10,16,20; 546:4,13,20;547:5	liked (1) 585:3
interpreted (8) 520:12;522:24; 539:14;546:11;550:5; 567:23;581:23;587:21	joint (4) 503:18;508:3;509:2; 596:14	knowing (2) 511:1;589:19	Launch (1) 547:13	likely (5) 539:9,20;540:5; 543:1;557:15
interrupt (2) 494:13;569:14	Jon (1) 490:12	known (2) 548:5;551:19	Laura (2) 491:20,21	likes (1) 537:18
interrupts (3) 493:20;571:16;591:6	JOYCE (3) 489:22;598:5,22.5	knows (3) 537:18;552:21; 590:14	Layers (2) 587:4,4	limestone (1) 510:7
interval (2) 510:16;575:22	JR (1) 492:3	Konikow (1) 504:8	leading (2) 538:18;542:18	limestones (1) 546:23
intervene (1) 517:17	judgment (1) 572:9	Kryder (1) 490:10.5	Leake (1) 504:8	limit (2) 583:9,10
into (1) 530:2	judgments (2) 572:10,12	L	least (11) 523:22;535:12; 544:2;545:11;552:5; 560:16;577:11;580:23; 587:13;589:6;594:10	limitation (2) 571:3;588:23
introduce (2) 494:4;498:2	July (3) 496:9,23;497:15	L-4 (1) 541:4	leave (1) 553:14	limited (1) 569:6
introduced (1) 574:12	Junior (3) 494:2,7,18	Lab (1) 586:2	leaving (1) 505:6	limiting (1) 517:18
introductory (1) 496:20	Jurassic (3) 563:4,16,21	labeling (1) 548:22	left (12) 499:2;530:19;535:5; 545:20;546:4,20; 547:5;561:2,15;587:7; 591:22;596:8	Lincoln (10) 491:12;535:4,8; 536:7,24;539:14; 548:17;551:6,17;590:5
invalid (3) 534:7;554:19;595:8	Justina (1) 491:10.5	laboratories (1) 500:2	leave (1) 553:14	line (20) 493:12;518:18; 520:21;535:9,11; 537:3,5,12;550:13; 551:6;559:17,20,22,23, 23;561:2,24;562:1,2; 563:9
investigation (3) 499:12;520:17;533:3	K	Labs (1) 561:9	leaving (1) 505:6	lines (10) 520:13,18;537:5,10; 538:4,17,22;539:5; 554:13;567:1
investigations (1) 495:9	Kane (28) 524:9;528:2;534:20; 535:2,5;536:2;537:2, 20;538:7,8;540:9,14, 20;541:2;543:8;545:4; 546:5,16;547:12,14,15; 548:16,21,23;550:12, 21,22;551:20	Lake (6) 496:21;505:17,21; 555:17;556:4;577:5	level (17) 508:9;514:15; 515:17;517:2;524:4; 526:11,13;527:11; 535:10,12;538:12,24; 553:7;567:22;573:23; 576:4;591:20	lip (3) 569:23;570:1;593:12
involved (5) 498:16;506:24; 507:24;566:1;590:19	Jurassic (3) 563:4,16,21	Land (2) 501:6;569:1	Legislative (1) 598:10	list (2) 509:22;532:6
involvement (1) 500:8	Justina (1) 491:10.5	landmark (1) 552:6	less (9) 504:22;526:21; 529:17;542:5,10; 577:13;583:5;594:4,5	listed (4) 499:13;509:12; 532:4;540:23
irrelevant (1) 504:13	Karen (4) 491:14,22;493:21,22	Lane (1) 489:23	level (17) 508:9;514:15; 515:17;517:2;524:4; 526:11,13;527:11; 535:10,12;538:12,24; 553:7;567:22;573:23; 576:4;591:20	listening (2) 571:20;591:12
isotopes (7) 502:8;558:20,22,24; 559:1,24;561:17	Keith (3) 566:4,4;573:3	language (1) 542:11	levels (78) 502:20;503:23; 512:4;519:5,11,12,24; 520:24;521:4,9;522:2, 5,10,11;523:16,17,18, 21;524:12,13,17; 525:12,12,13,18,22; 527:5,7;535:21,22; 536:4;543:12,15; 544:7,10,10,12;569:22, 24;570:7,11,13,15; 573:14,18,19;574:7,17, 24;575:6,10,12,14,15, 19;576:9,11,13,15,16, 17,18,23;577:3,5,6,13,	lists (1) 504:14
isotopic (8) 557:11;558:13,18; 559:5,8,17,18;579:23	Keith's (1) 581:22	large (11) 500:8;509:9;512:2, 22;547:21;548:3,10; 554:14;565:12;579:21; 597:7	level (17) 508:9;514:15; 515:17;517:2;524:4; 526:11,13;527:11; 535:10,12;538:12,24; 553:7;567:22;573:23; 576:4;591:20	lithologic (1) 509:12
isotopically (3) 502:10,11,14	Kent (2) 491:7;494:6	largely (1) 504:12	level (17) 508:9;514:15; 515:17;517:2;524:4; 526:11,13;527:11; 535:10,12;538:12,24; 553:7;567:22;573:23; 576:4;591:20	little (38) 498:11;503:11,16; 512:11;516:10;518:7; 525:4,24;527:10; 530:3,12,12;532:19;
issue (1) 583:9	key (2) 499:14,24	larger (4) 505:15;541:10; 542:17;554:16	level (17) 508:9;514:15; 515:17;517:2;524:4; 526:11,13;527:11; 535:10,12;538:12,24; 553:7;567:22;573:23; 576:4;591:20	
issues (1) 584:15	kilometers (3) 545:7;563:24;564:7	largest (1) 505:11	level (17) 508:9;514:15; 515:17;517:2;524:4; 526:11,13;527:11; 535:10,12;538:12,24; 553:7;567:22;573:23; 576:4;591:20	
J	kind (29) 500:11;503:19; 515:5;519:24;520:1,5; 521:21;524:13;525:21; 534:22;535:11;536:22; 543:22;544:11;546:17; 547:10,11;548:21,21; 555:23;557:2;579:4; 585:21;591:18;592:15,	Las (19) 491:21;517:15; 534:21,23;545:5; 552:1,3,20,21,22; 553:18,20;554:10,23, 24;576:15;584:2; 589:9;594:13	level (17) 508:9;514:15; 515:17;517:2;524:4; 526:11,13;527:11; 535:10,12;538:12,24; 553:7;567:22;573:23; 576:4;591:20	
Jackson (1) 573:3		last (7)		
Jim (1) 552:24				

534:16;537:4;538:6; 541:8;543:14,17,24; 546:11;547:4;548:5, 24;556:2,11,14,14,18, 22;558:18;563:10; 567:20;576:8;579:13; 585:13;587:23;588:7	looks (8) 521:3;522:1,4;526:8; 536:18;570:13;584:7,8	maintained (1) 500:8	544:3;555:3	meteoric (5) 559:16,21,23;561:2, 24
local (1) 558:13	Los (1) 491:9.5	maintains (1) 551:4	Mayer (4) 503:21;518:24; 541:24;577:17	meter (1) 541:6
locate (2) 537:4;587:14	lot (27) 508:8;510:3,5,14,19; 513:5,14;516:2;519:8; 522:5;531:16;532:7; 537:17;546:1;548:11, 14;553:10;558:8; 573:22;584:12,12; 585:8;588:1;590:4,4; 594:16;595:8	major (2) 507:15;581:12	Mead (5) 496:21;505:17,21; 555:17;556:5	meters (3) 541:6;565:18;566:7
located (16) 512:8;520:6,20; 522:13;525:2;526:9, 24;527:20;530:8,11; 536:3;555:16,23; 562:6;563:1;567:3	lots (4) 495:6;546:21;561:9; 564:18	makes (2) 531:6;548:16	Meadow (1) 586:17	mic (2) 571:17;572:24
location (27) 495:19;502:1,2,4,6, 21;510:12;511:14; 514:7;518:7;522:15; 523:23;536:22;538:19, 24;539:15,17;549:22; 551:8;555:16,20,24; 556:1;563:6;567:6; 576:1;579:7	Low (31) 491:6.5;514:9; 515:18,21,24;516:3,5; 517:5,13,21;522:23; 523:1;528:21;529:5; 531:4,18;534:6,12; 538:9;543:16;544:13; 546:2;552:4,19; 553:21;561:23;566:17; 573:21;578:2,2;588:16	manage (1) 596:18	Meadows (2) 530:23;531:2	MICHELINE (2) 489:4;490:3
locations (7) 502:14;556:6; 557:14;567:24;578:15; 587:8;592:13	LOWER (41) 489:6.5;493:5; 495:22;496:8;508:3; 516:7;528:22;531:19; 533:5,7;541:9;542:1,3, 12,14;543:12,18; 544:15,18,20,22,22; 551:23;559:19;561:22; 562:1;563:15,23; 564:5;565:19,20; 566:14,15;567:9,20; 569:24;576:6;586:17; 588:20;591:2;595:17	MANAGEMENT (4) 489:6.5;501:7;507:2; 579:1	mean (7) 505:4;527:13; 528:13;529:17;543:4; 565:16;569:14	Michelle (1) 490:9
long (10) 513:9;514:15; 535:10;540:13;541:14; 566:14;579:10;580:23; 582:5;589:14	map (21) 501:24,24;502:2,3; 513:3;520:7,7,20; 545:12,15;546:16; 555:18;562:4,5;563:9; 566:21,22;587:6,15; 588:16;592:13	manager (2) 499:5,17	meaning (2) 530:12;547:18	microphone (1) 591:10
longer (6) 526:14;570:21; 584:8;589:7;594:1,19	maps (1) 512:24	manual (1) 518:16	means (3) 523:24;541:4;560:5	mid (1) 515:19
long-term (1) 596:22	March (1) 581:6	many (11) 510:21;529:20; 569:24;577:11,11,14; 581:13,13,14;584:5; 586:21	measure (8) 506:1,1,13,18;533:9; 534:11;558:23;579:3	mid-seventies (2) 531:10,10
look (27) 495:17;497:21; 498:17;512:24;513:4; 518:13;535:10;545:15; 553:7;560:3;564:1; 565:2,16;567:22,24; 576:10;577:8,13; 581:17;583:21;585:24; 586:6;591:14;592:14, 20;593:9;595:17	Lowman (1) 595:11	mapped (2) 545:11;547:8	measured (6) 506:17;533:4;541:3; 544:12;548:18,23	might (10) 503:16;517:19; 520:3;531:7;536:18; 537:16,19;539:15; 583:10;597:15
looked (5) 508:18;514:18; 581:14;585:20;592:17	Ltd (1) 491:3	mapping (2) 546:20;586:5	measurement (7) 518:23;522:6;527:5; 548:24;549:2;565:4; 567:11	mil (1) 559:21
looking (27) 504:19;515:18; 518:20;520:1;527:3; 538:21;541:12,15; 548:12;549:8,14,21; 553:21;555:21;556:18; 560:6;561:4,11,23; 565:13,19;567:1; 580:1,20;581:4; 593:16;595:21	luck (1) 514:7	maps (1) 512:24	measuring (5) 506:2,15,15;556:15; 557:2	mile (1) 579:18
	lunch (2) 597:23;598:1	Mark (1) 561:8	medium (1) 511:3	miles (6) 512:7,22,22;530:5, 13,16
	LWFSX (1) 537:13	marked (3) 493:10,12;496:4	meeting (1) 573:4	mind (2) 508:4;572:11
	Lynn (1) 504:8	match (1) 559:4	Melissa (1) 490:7.5	mindful (1) 515:12
	M	matches (1) 524:13	melt (3) 579:24;580:12; 582:11	mine (2) 581:7,23
	MacKenzie (1) 491:13.5	matching (2) 587:20;589:22	mention (2) 516:18;590:23	minerals (2) 513:7;558:11
	magma (7) 547:19,23,23;548:1, 10,13;551:9	matrix (4) 509:24;510:1,3; 533:11	mentioned (12) 518:6;530:1;531:8, 18,23;534:9,21; 536:14;540:11;573:9; 575:21;588:16	minor (1) 501:21
	magnitude (7) 542:2,14;565:13,20; 566:9;574:10;589:17	MATTER (3) 489:6;493:4;559:14	Mercury (1) 530:9	minus (12) 541:4,5,7,13,16; 542:2,21;543:17; 559:21,21;561:7,7
		matters (1) 493:15	Mesa (8) 500:14;548:4; 573:11,14,17;575:3,4; 578:14	minute (3) 555:18;557:12; 570:20
		may (16) 509:15;514:3,10; 517:12,14;534:13; 536:1;540:8;541:11; 543:24;544:1;545:16; 552:14;555:10;570:7; 593:12	Mesozoic (2) 563:21;569:1	minutes (1) 580:14
		maybe (4) 532:16;534:11;	mess (1) 502:17	mischaracterized (1) 551:17

mixing (1) 558:12	Morrison (1) 491:18.5	24;562:5,24;566:16; 567:16;570:22;591:14, 15;592:2,7,18;594:11, 14;597:17,17	need (12) 501:22;503:13; 504:20;506:20;515:12; 558:16;559:7;569:23; 570:4,5;581:8;584:16	553:11;562:24;567:4
MOAPA (10) 489:11.5;491:17,18; 532:11;552:2,18; 553:23;554:20;571:21; 594:9	Most (12) 498:16;517:8,10; 519:8;525:16;531:19; 547:13;561:2;565:2; 567:10;573:24;594:10	multiple (1) 515:12	needed (4) 502:2;586:14;597:4, 14	northeast (3) 531:3;539:12;547:15
model (72) 498:19;501:1;504:1; 505:1,2;507:1,7,12; 517:22;522:20;531:24, 24;539:3,22;543:19, 24;554:18;566:2,5,10; 568:7,8,9,12,21;571:2, 2,3;573:12,13;574:14; 578:8;581:1,7;582:8; 583:1,1,3,11;584:11, 13,15,20,21,22,24; 585:7,15,16,22,24; 586:1,2,4,15;587:4,7, 10,14,20;588:2; 589:11;590:2,8,10,14, 19,20;593:1,23;595:6,6	Mountain (8) 498:17,19,23,24; 499:20;548:4;579:17; 580:21	must (1) 537:10	needing (1) 585:5	northeastern (2) 506:24;567:15
modeled (1) 576:22	MOUNTAINS (10) 489:8.5;534:24; 552:10;562:5,24; 563:7;564:3;566:16; 567:16;568:13	MX (2) 518:12,13	needs (8) 496:22;534:4; 571:10;590:10,13,18; 594:4;597:10	northern (19) 516:9;517:13; 526:10;537:13;540:21; 542:3;544:19,20,23; 545:23;548:19;549:10, 23;551:5;552:8,9; 555:19;575:18;588:18
modeling (22) 495:9;496:18;497:6; 500:13;503:3;504:21; 506:24;507:4;532:10; 553:3,18;554:10; 558:7,9;564:22; 565:22;573:10;584:19; 585:9,14,15;596:1	mouth (1) 543:7	MX-4 (15) 501:24;502:1,4,5; 518:7,10;519:2,3,22, 22;521:1,14;522:5; 527:22;532:7	negative (1) 560:6	northwest (6) 537:3,6;539:6;545:6; 549:5;562:12
models (1) 517:7	move (18) 496:17;502:2,4,16, 21;541:21;547:3; 550:2;552:13;564:15; 568:1;569:15;570:22; 576:8;578:6;579:7; 580:8;593:4	MX-5 (33) 508:23;519:18,20, 20,22;521:1,12,19,22, 23;522:14;523:4,18, 20;524:6,16;526:6,20; 527:19;528:10;530:24; 532:6;533:18,22; 534:10;535:23;542:20; 545:13;570:12,15; 589:1;596:4,9	NEVADA (26) 489:1,22.5,23.5; 491:4,7.5,11,14.5,16; 498:16;499:9;500:17, 17;506:8;510:9; 511:12;525:7;553:1,2; 561:6;573:4;576:12; 580:24;598:2,6,11,18	northwestern (4) 539:7;547:14;550:6; 556:10
moderate (2) 539:5,11	moved (5) 512:21;553:1;592:1; 593:7,20	N	new (9) 522:8;527:3;557:1; 583:18,19,21;585:7; 590:5;591:8	notation (1) 541:1
modified (2) 496:18;507:9	movement (8) 498:22;531:11,11; 547:6,7;550:17; 553:10;578:3	N-1 (1) 539:4	next (11) 493:12;505:9; 509:22,23;512:17; 515:14,18;573:8; 580:8;596:1;597:6	note (3) 536:4;551:18;572:16
moment (1) 553:15	moves (2) 510:24;580:5	N-2 (2) 538:16;539:4	nice (5) 509:19;515:16; 518:19;553:8;576:4	noted (4) 510:17;540:17,18; 572:15
Monday (1) 512:19	moving (23) 495:19;515:23; 517:10;531:5,6; 532:18;540:19;541:8; 542:7;543:20;549:17; 550:21;554:1;567:1; 568:4;570:9;575:8; 576:21;582:24;591:14; 593:16;594:3;597:16	name (5) 493:21;494:4,6,7; 537:16	nicely (2) 521:11;587:17	notes (2) 598:12,15
monitored (1) 567:22	much (36) 498:5;505:13,15,17; 506:15;508:19;509:15; 511:9;514:20,21; 515:22;516:6,6,7,7; 517:19,21;520:22; 526:19;529:17,17; 541:10;542:7,12,12; 566:7,17;570:24; 578:3;584:1,1;585:18; 586:21;588:21;589:23; 593:5	naming (1) 537:18	NIPS (2) 573:12;576:12	notice (3) 519:13;581:6;589:4
months (3) 511:23;581:5;582:10	mu (1) 511:9;514:20,21; 515:22;516:6,6,7,7; 517:19,21;520:22; 526:19;529:17,17; 541:10;542:7,12,12; 566:7,17;570:24; 578:3;584:1,1;585:18; 586:21;588:21;589:23; 593:5	Narrow (1) 547:17	Noah (1) 581:2	noticed (1) 519:4
more (24) 495:20;515:17; 518:19;523:6;526:19; 531:21;532:19;543:4; 556:11;557:11;560:5, 20,23;561:19;565:8; 566:7;568:16;570:20; 575:1;578:14;580:14; 593:7,7,7	MUDDY (37) 489:11;495:19,21; 501:3;513:24;514:3, 19;515:6,6;517:11; 519:3;521:17,18; 523:3;524:6,20; 530:24;533:23;541:24; 542:8;545:14;550:18,	National (18) 491:22;493:7,24; 494:20;495:11,15; 496:21;497:14,23; 500:2,17,24;501:5; 508:11;553:2;555:14; 585:6;586:2	noise (4) 518:23;522:6; 525:16;556:15	notify (1) 501:20
Mormon (1) 564:2		Natural (4) 489:2;504:12; 583:15;598:7	noisy (1) 556:18	NPS (4) 496:4;497:10;498:2, 3
morning (2) 493:22;494:3		Navajo (2) 507:1,4	non-basin (1) 546:21	nuclides (2) 511:17,20
		NCA (1) 491:15.5	non-channel (1) 579:9	Number (15) 496:4;497:11;502:3; 505:2,7;512:2;525:7; 532:11,13;553:4; 554:16;565:3;578:4; 582:2;590:1
		near (8) 506:11;530:4; 536:15;538:7;552:19, 20;555:16;568:21	normal (5) 509:16;512:20; 539:22;545:2;546:8	numbering (1) 502:17
		necessarily (3) 517:6;528:13;537:24	normally (1) 537:15	Numbers (6) 498:2;502:18; 505:16;535:19;541:18; 553:21
		necessary (3) 516:23,24;518:3	North (16) 491:21;512:7;538:7; 541:2,14;542:6,10; 543:12,16;545:19; 547:5,17;551:5;	numerous (2) 500:2;567:11
				NV (1) 491:10.5
				Nye (1) 489:23
				O
				O16 (2) 558:23;561:18
				O18 (2) 558:22;561:18

Oasis (1) 506:10	One (77) 501:7,9;502:10; 503:19;506:10,18,23; 507:4,13;508:1;509:7, 19;511:18;514:13; 515:22;518:5;519:9; 520:5,6;521:10; 522:24;524:8;525:1; 527:1,8;528:2;529:11; 532:8,11;534:20,22; 535:8;537:1;538:12; 544:21;545:4;546:5; 547:2,3,4,16;551:1; 552:15;554:8;556:6, 14;558:11,21,21; 559:11;564:17;565:15, 23;569:9,21;572:5; 573:11;575:5,14,15,22; 576:4;577:1,19; 579:18;581:14;583:13; 585:22;586:12;587:18; 591:18;592:4,10; 593:3,4,7;595:5	otherwise (1) 526:2	P	500:1;590:16
object (1) 571:22	ought (2) 552:21;583:13	out (49) 502:15,20;504:8; 508:14,20;509:9; 510:14;512:1;513:17; 517:19;525:7,21; 526:15;529:11,21; 531:2,16;532:10,14,17; 533:19;547:2,10,22; 548:16;549:6;550:21; 551:19,23;556:22; 557:20;560:3;569:7; 574:4,9;576:5;578:1; 579:8;580:6;584:7,9, 11;585:17,19,24; 586:19;590:5,22; 595:10	pack (1) 580:2	participating (1) 555:14
objection (3) 571:13;572:15,16	ones (2) 532:5,10	outcrop (4) 537:1;539:7,8; 562:14	packet (1) 502:21	particles (2) 568:10,11
obtained (1) 581:2	only (7) 507:15;519:22; 532:22;573:23;589:16; 591:11;593:8	outcropped (1) 547:9	PAGE (13) 492:2;497:19;502:3, 7,12,17,18;540:24; 562:5,19;587:12,21; 592:21	particular (6) 506:8;507:13; 565:14;574:16;585:4; 595:12
obviously (2) 524:1,23	oOo- (2) 489:5;493:2	outline (2) 503:7;568:7	Pages (2) 489:17.5;598:14	particularly (1) 580:22
occur (14) 504:5;551:13,15,19; 560:11,12,13;571:11; 578:4,16,22;579:21; 582:9;594:1	open (1) 575:22	outlining (1) 547:12	Pahranagat (5) 505:13;545:19; 546:3;547:4;549:6	parts (2) 495:21;526:7
occurred (3) 519:15;545:13; 576:14	opinion (6) 520:15;566:14; 572:2,5;582:11;584:4	outside (1) 578:15	Paiute (6) 548:4;552:3,18; 553:23;554:20;578:14	path (2) 550:9;568:12
occurring (13) 505:22;519:21; 526:12;542:17;546:2; 549:2;560:12,14; 574:15;578:19;579:6, 9;588:7	opinions (4) 571:14,23;572:4,13	over (22) 506:21;512:21; 539:6;541:10;542:22; 556:14,22;562:15; 563:8;568:23;569:23; 575:8,16,20;576:10,13; 579:10;581:17;582:10, 13;584:8;588:10	Paiutes (4) 491:17;532:11; 571:22;594:9	paths (2) 550:5;589:21
occurs (11) 560:13;561:12; 574:15;577:16,21; 579:24,24;580:9; 582:8;588:3;596:18	opposed (1) 539:24	overall (1) 526:7	Paleozoic (4) 513:20,21;514:2; 546:19	pathway (3) 543:22;564:12; 568:21
O'Connor (1) 491:5	ORDER (37) 489:16;495:12; 497:15;498:7;502:16; 508:6,12;509:8; 515:14;517:3,22; 519:17;521:6,14,19; 522:11;524:15;525:11, 22;526:3;535:14,22; 536:5;540:13;542:14; 559:4;566:9;568:17; 570:10;581:9;582:15; 583:6;585:11;587:2; 589:14;591:20;593:24	overcome (2) 577:24;578:5	panel (10) 539:7;561:2,13,22; 573:10;587:7,8; 588:12;591:22;592:6	Patrick (1) 491:23.5
October (1) 581:5	orders (2) 542:2;565:20	overestimate (2) 505:4,5	Paper (3) 504:8;552:7;561:8	pattern (5) 514:23;574:10; 576:13,24;577:11
off (15) 500:11;505:20; 512:5;519:21,24; 521:2;552:10;561:14, 19;562:1;574:5;576:2, 3;578:14;592:10	original (2) 561:14;563:14	overlain (1) 513:23	paper (3) 504:8;552:7;561:8	Paul (1) 491:3.5
Office (10) 493:23;495:18; 499:5;504:17;508:20; 540:14;558:6;583:4; 590:11;596:18	others (14) 504:15;524:11,14; 526:5;534:20;538:3; 545:12;546:10,16; 556:11;557:9;558:1; 562:5;572:18	overlying (3) 525:14;547:24; 565:10	parallel (3) 522:21;528:22;529:1	Peabody (2) 507:3,14
OFFICER (19) 489:4;490:3,5,8; 493:3,17;494:12; 498:3;555:2,6,10; 569:13,17,19;571:12, 18;572:14,23;591:9; 597:22		overriding (1) 509:1	param (1) 507:7	Pederson (1) 589:24
Official (1) 598:5		overturn (1) 588:1	parameters (1) 586:10	peer (5) 500:13,15;573:9; 574:13,13
offset (1) 509:16		own (2) 572:1,9	Park (20) 491:22;493:7,24; 494:20;495:12,15; 496:12,21;497:4,14,23; 498:7;500:24;501:5; 508:11;516:15;553:2; 555:14;572:3;585:6	penetrates (1) 522:15
often (1) 510:21		oxygen (6) 502:7;558:20,22; 559:17,24;561:13	part (53) 499:11,11;504:10; 506:24;513:8,15; 515:19;516:9;517:8, 13;518:15,23;521:12; 525:17,23;526:10; 529:21;532:1;540:19; 542:3;543:12;544:2,2, 19,20,23,24;546:9; 548:19,20,21;549:10, 22;550:6,12,17,22; 554:8;564:22;566:14; 573:12;574:12;575:9; 577:1;581:18;583:13; 584:11;585:12,12; 587:13;588:19;590:23; 592:24	penetrating (1) 533:19
old (2) 513:5;530:7			paper (3) 504:8;552:7;561:8	people (9) 501:20;515:4;572:9, 11;585:24;593:14; 594:16;595:1,8
older (3) 512:21;517:7;546:21			parallel (3) 522:21;528:22;529:1	per (6) 532:6;541:6,6;554:3; 559:21;593:3
Once (1) 588:19			parameter (1) 507:7	percent (1) 507:11
			parameters (1) 586:10	Perfect (1) 555:6
			Park (20) 491:22;493:7,24; 494:20;495:12,15; 496:12,21;497:4,14,23; 498:7;500:24;501:5; 508:11;516:15;553:2; 555:14;572:3;585:6	perform (1) 495:16
			paper (3) 504:8;552:7;561:8	performance (1) 585:16
			parallel (3) 522:21;528:22;529:1	performed (3) 497:8;532:3;536:7
			panel (10) 539:7;561:2,13,22; 573:10;587:7,8; 588:12;591:22;592:6	perhaps (1) 522:7
			paper (3) 504:8;552:7;561:8	period (25) 514:19;518:15; 520:1,22;521:7; 525:20;535:22;574:2; 575:7,14,17,20;576:9, 11;577:3;580:23;
			parallel (3) 522:21;528:22;529:1	
			parameter (1) 507:7	
			parameters (1) 586:10	
			Park (20) 491:22;493:7,24; 494:20;495:12,15; 496:12,21;497:4,14,23; 498:7;500:24;501:5; 508:11;516:15;553:2; 555:14;572:3;585:6	
			part (53) 499:11,11;504:10; 506:24;513:8,15; 515:19;516:9;517:8, 13;518:15,23;521:12; 525:17,23;526:10; 529:21;532:1;540:19; 542:3;543:12;544:2,2, 19,20,23,24;546:9; 548:19,20,21;549:10, 22;550:6,12,17,22; 554:8;564:22;566:14; 573:12;574:12;575:9; 577:1;581:18;583:13; 584:11;585:12,12; 587:13;588:19;590:23; 592:24	
			participant (2)	

581:16,23;582:1,1,5, 13;584:9;589:8;597:18 periods (1) 579:10 permeabilities (1) 565:20 permeability (43) 509:23;510:1,3; 513:4;514:6,8,9,10; 515:23;522:20,21,22, 23;523:1;528:19,21, 24;529:3,6,23;531:17; 532:16;534:7,17; 544:13,15,16,22;545:8, 21;546:3;552:4,12,19; 564:17,19;565:11; 566:10,12,17;578:1; 586:12;588:20 permeable (9) 529:13,21;531:21; 534:13;542:5;551:12, 14;553:13;566:8 perpendicular (3) 522:23;528:21; 566:24 perspective (1) 561:1 pertaining (1) 540:14 peruse (1) 497:2 PEST (2) 507:8;586:8 Peterson (1) 491:14 Pete's (1) 545:15 phase (1) 508:15 Phelps (1) 538:3 physics (1) 586:6 pick (5) 520:16;525:21; 539:17;546:17;576:5 picked (6) 530:14;536:11; 538:19,23;539:18; 552:15 picking (1) 532:20 place (4) 523:5;555:5;560:17; 590:22 placed (2) 512:2;513:10 plants (2) 506:6;515:5 plate (5) 512:23;563:14,15; 570:6,7 plays (1)	531:22 please (2) 494:3;496:6 plot (4) 525:4;559:17; 560:23;561:21 plots (2) 525:8;559:19 plotted (1) 560:18 pm (1) 597:24 Pockets (1) 569:10 point (50) 495:11;501:13,17; 502:4;516:14;520:5; 525:17;529:17;535:1; 547:2,10;555:12,13,15, 22;556:2,10,21;557:12, 16,19,19;559:5;560:3, 19;562:3,6,19;563:11, 12;564:3;567:12,18, 20;568:1,4,10;569:3, 21;571:15,24;575:4; 583:23;584:4;586:19; 588:8;589:6;593:9; 597:2,12 pointed (3) 569:7;585:17,19 pointing (1) 563:6 points (1) 586:22 poorly (1) 528:1 population (1) 532:14 pore (1) 580:2 pores (1) 513:14 porosity (1) 573:22 PORTION (2) 489:8;586:17 positive (2) 560:20,23 post (1) 536:5 potentially (3) 542:13;578:7;583:24 power (5) 501:13,17;515:5; 571:15,24 precip (12) 573:20;578:19; 580:1,18,18,24;581:9, 11,17,19;582:2,14 precipitated (1) 510:18 precipitation (12) 502:9;513:6;560:1,	12;561:3,7;577:18; 580:12;581:4,5,9; 582:10 pre-development (3) 504:12;588:16; 589:22 predict (2) 529:11;589:13 predicted (3) 507:19;589:5;593:23 predicting (2) 593:10;594:1 prediction (1) 496:7 predictions (1) 586:3 predicts (2) 584:13;593:1 preparation (1) 518:8 prepare (4) 495:23,24;497:16; 498:18 prepared (13) 496:10,11,19,20; 497:3,4,7,9,16,18,22; 501:12;532:24 preparing (1) 498:7 presence (4) 546:6,13;566:15; 595:23 present (18) 499:1;520:17;523:8; 527:7;539:15;544:14; 545:3;548:4;556:8; 562:11,14;563:13,22; 564:4,5,11,14;598:10 presentation (17) 501:13,17,19,21; 502:13,16,19,22,22; 503:8;534:22;535:4; 572:22;573:2,5,13; 597:21 presented (4) 523:12;535:7;572:2; 573:4 presenting (4) 494:1;503:22; 572:22;573:2 pretty (15) 503:14;505:3;506:2, 13;519:5;521:9,21; 527:1;540:1;541:19, 20;558:24;563:24; 570:15;592:14 prevent (2) 514:10;571:5 prevents (1) 580:3 previous (1) 540:13 previously (2)	503:22;575:21 primarily (11) 564:20;570:24; 572:21;573:1,19; 576:1;588:9;591:3; 592:11,24;593:18 primary (3) 545:4;571:8;575:5 prime (5) 520:13,14;562:21; 563:18,19 principles (1) 504:11 printed (2) 502:21;540:24 prior (7) 498:6;521:23;536:6; 570:10;574:2,8;575:9 probably (5) 512:11;527:5; 528:22;531:21;579:18 problems (1) 556:16 proceed (1) 494:14 PROCEEDINGS (4) 489:14;493:5,13; 516:8 process (11) 499:9;507:24; 540:19;555:14;560:12; 579:22;580:1;582:11, 18;584:23;590:16 processes (4) 559:2;560:4;574:15; 580:22 produce (2) 539:23;559:7 produced (8) 510:19;525:9; 531:15;535:4;536:14; 559:13;562:5,19 production (4) 545:14;554:11; 570:17;596:22 productive (1) 522:17 productivity (2) 531:14;533:19 Professional (2) 490:9.5;552:6 profile (3) 538:17;539:16; 541:11 profiles (6) 532:23,24;536:13; 538:13,23;539:4 program (2) 518:14;530:19 progression (1) 561:22 project (7) 498:17;499:11,17,	22,24;500:9;564:24 projects (1) 498:15 propagate (1) 517:23 properties (4) 524:2;533:9,12; 546:14 proposal (3) 499:6,14,18 proposals (1) 501:10 proposed (2) 557:8,23 protecting (2) 496:22;583:10 protium (1) 558:22 protocols (1) 522:6 provide (10) 495:23;496:1;511:6; 532:21;533:12;534:4; 570:24;578:21;583:3; 594:7 provided (7) 508:6;535:4;538:1; 573:15;585:14,14; 592:15 provides (9) 509:20;516:12; 518:19;533:15;534:16; 536:8,9;543:2;595:5 providing (3) 495:24;512:12; 567:14 PUBLIC (3) 489:15;598:12,15 published (2) 538:3;561:8 pull (1) 512:1 pull-apart (1) 546:10 pulled (1) 532:11 pulling (1) 511:19 Pullman (2) 557:9;558:1 pulse (4) 520:24;527:4;580:8, 9 pump (11) 512:1;515:4,8;524:1; 554:6;568:18;583:8, 16;588:5;594:18,20 pumpage (1) 593:7 pumped (5) 511:23;515:15; 519:23;549:19;584:1 pumper (1)
---	---	--	---	---

507:15 pumping (134) 495:19,20;496:8,14, 17;504:4;506:20; 507:3,9,13,14,16,20; 508:8,10,12,12,13,14, 15,16,18,23,24;511:19, 22;514:11,16,20,21,22; 515:3,7,10,14;517:2, 23;518:11;519:1,15,18, 20;521:6,10,12,14,14, 15,23,24;522:11;523:4, 15,18;524:15,16,20; 525:19;526:6,20; 527:18;529:9;530:1,4, 5,7,14,15,15,18; 535:23;542:20,20; 545:13;554:13,22; 564:20;568:15,19; 569:24;570:11,12,15, 21,22;571:9,10;575:11, 15;576:14,17,19,23; 582:15,23,24;583:6; 586:3,7,21;588:10,23; 589:1,7,12;591:4,14, 15,19,19,22,24,24; 592:3,8,10,11;593:2, 17,20;594:3,10,14,21; 595:1,3,18,23;596:3, 11,15,17;597:9,16 purchased (1) 499:4 purpose (1) 598:11 push (1) 510:6 put (30) 496:16;501:1;507:2; 511:18;516:19,21; 518:12;520:8;531:23; 532:12;540:24;548:17; 554:24;564:21;565:1; 566:1,2,2;567:21; 569:10;570:6;579:12; 584:12,12;587:12,13; 590:13,15,16;591:17 putting (2) 502:1;566:6 PW-2 (1) 577:3	517:24;519:21; 570:15;575:23;596:13 quite (5) 522:14;523:7; 540:13;551:19;557:5 quote (1) 504:8 quotes (1) 595:24	503:13;504:20; 507:15,18,21;508:19; 511:9,20;516:12; 539:17;544:5;546:12; 556:19;559:14;567:23; 570:2;581:21;585:23; 596:13,20 reason (6) 499:17;517:6; 522:17;554:7;555:13; 564:17 reasonable (3) 505:15;541:16; 583:12 reasons (1) 524:23 rebid (1) 500:6 recalibrate (1) 507:12 recall (4) 502:9;511:23; 531:13;582:18 received (4) 559:11;584:20; 585:17,21 recent (3) 506:12;523:6;567:11 recently (1) 500:12 recess (1) 598:1 recharge (66) 504:12,20,23,24; 505:4,5,19,19,24; 506:17,23;507:5,10,18; 519:7,8,15;520:24; 522:9;524:12;525:20; 526:13;527:4;558:13; 560:11;568:13;573:12; 574:14;575:2,3,6,10, 13,16,23;576:2,3,5,7, 16,16,19;577:16,19; 578:7,15,19,20,22; 579:3,6,9,22,23;580:8, 11,20,21,24;581:9,12, 12;582:8,14;588:20; 591:1 recognition (2) 585:1,5 Recognize (3) 528:16;541:10; 584:15 recognized (2) 566:12;597:10 recognizing (1) 511:3 recommend (1) 534:22 recommendation (3) 507:23;553:6;590:9 recommendations (2) 503:17;508:2	recommending (1) 508:22 reconvene (1) 597:24 record (27) 515:12;518:15; 519:9;520:14,22; 523:6,20;525:6,23; 526:4,12;527:6;536:5; 555:8;556:17,23,24; 574:2;575:7,20; 576:10,11;577:3; 581:23,24;582:13,16 recovery (14) 519:21,24;521:3; 522:1,3,11;523:5,20; 524:15;531:13;570:9, 13,14;574:9 red (6) 502:5;513:14,19; 520:10;536:21;537:12 redistribution (1) 592:6 reducing (1) 577:14 reference (1) 493:9 referenced (1) 571:24 references (2) 504:14;572:17 referred (1) 538:2 refused (1) 583:2 regime (2) 582:21;597:8 region (2) 529:4;545:5 regional (5) 498:18,21;500:21; 553:1;581:3 regressions (1) 535:18 Reilly (2) 545:12;546:16 related (14) 496:14;497:6; 500:23;501:9;503:10; 507:2;508:12;509:3, 23;514:5;551:3; 573:14;578:10;596:15 relationship (2) 559:24;566:6 relatively (1) 581:18 released (2) 530:3,10 reliability (2) 586:23,23 reliable (1) 506:13 reliances (1)	572:17 relied (2) 572:9,11 remain (1) 549:12 remainder (1) 534:24 remaining (1) 561:21 remember (2) 513:18;553:4 reminder (1) 591:10 remotely (1) 591:12 removed (1) 503:15 removing (1) 580:3 Reno (4) 491:7,5,11,16; 598:18 repeat (2) 558:16;571:20 repeated (2) 576:19,20 replace (1) 584:3 report (13) 496:10;497:17,18; 504:2;525:8;530:2; 532:10,12;535:19; 538:1;585:14,18; 592:16 REPORTED (2) 489:21;533:24 reporter (6) 493:20;494:5; 571:16;591:6,11;598:6 REPORTERS (2) 489:21,21.5 reporting (1) 598:11 reports (5) 495:23;496:1; 497:15;498:7;524:24 represent (2) 497:22;567:5 representing (2) 493:24;520:10 represents (1) 581:2 request (1) 496:16 require (1) 596:21 required (1) 501:5 research (5) 498:22;500:3;557:9; 578:12;582:4 researcher (3) 504:16;578:12;
Q	R			
qualified (3) 502:24;503:2;558:6 quantity (1) 582:24 quick (4) 519:4;532:9;570:19; 573:8 quicker (2) 593:6,6 quickly (5)	radioactive (1) 579:1 radionuclide (1) 531:11 radionuclides (1) 498:22 rains (1) 577:20 ran (7) 507:8;510:15; 536:24;539:16;584:11; 588:24;589:7 Randy (2) 558:5;560:18 range (14) 543:2,14,15,15; 544:9;546:10,21,24; 561:8;562:22;568:14; 574:20,21;588:24 Ranier (6) 500:14;573:11,14, 17;575:3,3 rapid (1) 574:17 rate (7) 504:12;505:5;507:5, 10;519:1,19;593:23 rates (5) 505:24;507:18; 583:19,20;584:17 ratings (1) 515:21 reach (3) 583:18,22,24 reached (2) 549:13;571:6 reaching (1) 568:3 read (10) 496:6;502:11; 504:10;535:19;540:24; 541:1;543:10;550:14; 588:23;592:23 readily (2) 532:15;561:19 real (4) 508:7;532:9;571:9; 573:8 Realize (1) 519:22 really (20)			

580:19 residual (1) 580:7 resistivity (8) 532:21;533:4,5,6,7, 7;534:6;536:17 resource (5) 495:9;499:7;573:4; 597:3,4 RESOURCES (6) 489:2,3;496:21,22; 598:7,7 respect (5) 512:18;516:14; 524:8;573:7;586:21 respond (1) 495:12 responded (2) 522:8;575:23 responding (5) 533:10,11;552:18; 575:15,16 response (23) 497:14;508:9; 512:11;515:1,2;519:4; 525:16;526:1;527:12, 18;534:9;537:6; 541:19;542:24;543:6; 550:3;570:19;573:19, 21;574:7;576:2,2,7 responses (17) 504:13;511:10; 514:15;515:17;517:2; 518:20;520:1;521:22; 523:10,14;524:2,10; 530:4,6,14,15;574:17 responsible (1) 545:17 result (2) 589:19;593:2 resulted (2) 521:8;544:22 results (8) 507:21;509:8;538:5; 584:19;588:15;593:5, 6,15 resurgent (2) 548:6,7 retire (1) 590:20 return (2) 536:4;574:19 returning (1) 595:7 reverse (1) 595:20 review (3) 500:13;573:9;574:13 reviewer (1) 500:15 reviewers (2) 500:15;574:13 revisiting (1)	582:12 ribbon (1) 500:13 RICHARD (4) 492:3;494:1,6,18 Rick (3) 562:19;587:12,21 right (20) 526:11;535:6,16; 537:13;539:7;545:6, 10,15;546:13;558:4; 561:23;562:18;563:12; 564:8,10;566:20; 587:8;588:12;592:6; 596:7 rights (4) 501:8;554:21; 583:10;593:13 rising (20) 503:23;527:4; 573:18;574:1,7; 575:12,19;576:9,10,13, 23;577:2,5,6,12,14; 582:4,17;590:24;597:8 RIVER (48) 489:7,11;493:5; 495:19,21,22;496:9; 501:3;505:20;506:14; 508:3;514:19,23; 515:6,6;517:10,11,18; 519:3;521:17,18; 523:3;524:6,20; 530:24;531:19;533:23; 541:24;542:9;545:14, 21;550:18,24;551:23; 570:23;576:6;591:2, 14,15;592:2,7,18,19; 594:11,14;596:24; 597:17,18 rivers (2) 506:14,15 road (1) 556:10 Robison (2) 491:6,7 rock (23) 509:24,24;510:11; 511:16;513:20;515:24; 516:5;520:16;528:15, 20;529:5,21;531:6,21; 532:17;533:7,11,13; 539:18;544:13;547:24; 548:14;563:2 rocks (37) 498:23;510:4; 512:21;513:5,9,10,13, 23;516:3,7;517:17; 536:17;538:10;546:19; 558:4,11;562:8,9,10, 10,11,14;563:3,4,5,13, 17,20,21;564:5,15,18; 565:6,10;569:1; 587:15;588:1	Rogers (34) 516:14;535:1; 555:13,15,19;556:1,3, 9,10,13;557:12,16,19; 559:5;560:18;562:3,6, 7,15,18;563:11,12; 564:3,16;567:12,20; 568:1,3,4;569:3;588:7; 593:9;597:1,11 role (3) 512:15,19;531:22 routing (1) 588:12 row (1) 511:5 run (9) 508:21,21;511:15; 529:8;530:19;535:18; 583:1;586:1;592:21 running (2) 511:17;515:4 runoff (5) 577:20,21,22; 578:16;579:16 runs (10) 522:21;545:6;546:4, 22;563:18;564:1,3; 565:17;568:12;589:8	541:18;579:6,15 saying (3) 514:21;549:20;554:4 scale (1) 592:22 scenario (8) 591:18,18;592:4,4; 593:3,4,4,7 scenarios (1) 591:16 school (1) 498:14 Schreck (1) 491:8.5 Schroeder (2) 491:20,21 scientific (1) 541:1 scientist (2) 571:15,23 scientists (1) 572:2 Scott (1) 578:24 search (1) 577:10 seasonal (30) 508:8,8,13,15,16; 514:15,16,23;515:1,1, 7,9,10,10,11,13;517:2; 518:20;519:11;521:13, 18,23;522:9;523:2; 524:20;526:1;527:21; 542:20;576:22,23 seasonally (1) 515:8 second (3) 502:12;554:9;577:23 secondary (1) 514:8 Section (15) 490:8,11;496:19,20; 562:21,23;563:9,18; 564:1,8;568:20,22; 587:12,13,18 sections (3) 496:13;497:5;564:11 Security (1) 500:18 sediment (2) 536:19;564:9 sedimentary (2) 563:3,16 sediments (6) 536:16,16,20; 552:19;565:8,8 seeing (13) 514:11;523:16; 524:19,21;526:6,20; 553:8;557:5;570:13; 575:13;580:11;582:3; 593:18 seem (2)	505:14;530:4 seems (1) 526:14 segments (2) 535:17,18 selected (1) 500:15 send (1) 510:21 Senior (3) 490:12.5;553:15; 583:10 sense (2) 529:4;531:6 sensitive (2) 573:24;597:17 separate (4) 508:14,17;542:24; 587:15 SEPTEMBER (4) 489:18.5;493:1; 598:9,19 series (1) 548:3 serve (1) 504:21 served (2) 500:12;573:9 Service (19) 491:22;493:7,24; 494:20;495:12,15; 496:12,21;497:4,23; 501:1,6,6;508:11; 516:15;553:2;555:14; 572:3;585:7 Services (3) 497:14;498:7;499:8 serving (2) 499:23;512:15 SESSION (2) 489:17.5;493:1 set (11) 500:6;507:22; 518:19;535:3;536:2; 540:12;583:9,10; 585:2,10,20 sets (4) 496:14,18;549:9; 585:15 settings (1) 565:21 seven (2) 511:23;512:7 seventies (2) 549:7;550:1 several (4) 506:7;530:13;547:8; 575:18 shallow (3) 536:10;544:2;578:13 shallower (1) 565:21 shaped (1)
		S		
		safe (1) 590:1 same (34) 498:8;502:12,13,18; 508:15;512:8,9; 514:23;520:6;521:21; 526:12;530:23;535:6, 7;536:5;539:13;549:4; 550:4;561:11;563:19; 565:6,9;566:1;567:6,7, 19;577:4;579:4; 587:12;595:9,22; 596:2;597:8,19 sample (2) 558:23;561:9 sampled (2) 558:7;560:21 samples (4) 557:16;561:3,11; 567:17 Sandstone (1) 507:1 satellite (1) 506:6 satisfy (1) 577:20 saturated (1) 536:20 saw (12) 512:11;514:24; 517:23;520:18,18,24; 521:14;522:4;527:22;		

508:18 Sharp (3) 491:6;521:9;525:11 Shaw (1) 499:23 shear (24) 515:20;516:2; 517:16;545:5,20; 546:3,5,7,20;547:4,7; 549:6;552:4,9,11,20; 553:5,9,10,11,13; 554:1;584:3;589:9 Sheep (6) 544:9;562:22; 568:13,13;574:20,21 sheer (1) 505:14 sheet (18) 493:8,18;512:23,23; 513:1;563:23;564:4,5, 10;565:19;566:15; 567:15;568:3,22,23; 569:11;587:24,24 sheets (1) 493:10 shift (1) 562:1 shifted (1) 592:4 short (10) 502:8;504:8;518:20; 519:22;521:7;549:5; 566:14;575:17;589:12; 597:18 shortcoming (1) 589:20 shortcomings (4) 583:3;585:3;586:24; 590:15 shorter (2) 520:22;577:3 Shorthand (1) 489:21.5 shortly (1) 499:4 show (23) 511:13;516:18; 521:5;525:23;527:9, 17;532:15;534:13,15; 536:20;537:6;543:11; 550:11,13;555:17; 560:9;562:13,20; 563:11;564:19;567:10; 573:18;589:2 showed (9) 520:14;527:20; 532:6;554:2;571:2,3; 574:7;584:5;588:8 showing (19) 519:5;523:10;525:7; 526:8,22;548:18; 561:1,3,4;562:5; 563:19;565:18;567:10;	568:21;570:10;582:14, 16;592:22;595:11 shown (26) 502:5;518:18; 521:21;526:10;532:23; 535:6,24;537:1,11; 559:18;561:15,22; 563:9;564:8;566:20; 567:12;568:8,8;574:2, 6;575:7,19;581:11; 587:19;592:2,19 shows (29) 502:1;520:19; 521:11;522:9,9; 523:13,22;533:13; 536:18;538:8;545:11; 546:19;554:12;559:23; 563:2;566:22;574:5, 20;576:22,24;581:15, 16;582:16;588:6,12; 591:21,23;592:6,13 shut (2) 505:20;521:2 shutdown (1) 521:24 side (41) 522:16;525:3; 527:17;528:3,7,24; 530:17;533:20,22; 537:2;538:8,12; 539:11;543:1;545:23; 546:7,9;547:14; 549:12,24;550:3; 551:5,7,10,11,13; 552:8,9,11;553:11,11; 556:10;562:16,22; 564:2;574:20;576:10; 579:20;594:20;595:2; 596:7 sides (1) 552:11 signal (12) 508:10,12,16,18; 515:7,9,10,16;517:23; 521:18;533:23;551:15 signals (3) 514:17;527:18,23 signature (4) 496:23;497:19; 521:12;539:11 significant (14) 511:13;519:5,9; 531:22;532:13,14; 540:4;543:5;545:8; 546:14,15;552:23; 569:7;571:10 sign-in (3) 493:8,9,18 signing (2) 493:16,19 signs (1) 514:13 silica (1)	547:20 similar (22) 493:6;503:21; 519:14;521:22;522:4; 523:9,14;524:10; 526:8;537:3;549:20, 21;550:6;557:18; 565:1;574:7,10; 576:24;581:1;584:19; 593:14,15 similarly (3) 497:10;538:20; 595:20 simple (1) 595:10 simulate (2) 588:13;595:12 simulated (6) 570:21;588:22; 592:14,17,18;595:16 simulating (2) 588:4;589:2 simulation (4) 496:19;588:24; 589:1;592:10 simulations (10) 495:17;496:14,15; 497:8;507:8,17,19; 568:6;591:13;593:15 Site (19) 498:16,18;499:10, 19;500:17,18,20; 510:10;511:12;512:5; 529:10;530:11;531:8, 9;548:3;575:4;576:12; 577:12;581:3 sites (3) 499:9,12;506:7 sitting (2) 548:11;551:9 six (3) 542:21;566:9;581:8 six-inch (1) 531:15 skip (3) 525:1;541:22;573:8 slide (23) 501:23;502:15,20; 504:7,7;505:9;518:9; 521:6;526:9;532:18; 535:19;558:16;560:9; 561:1;571:24;573:9; 574:19,19;575:19; 590:22;591:21,21; 596:1 slides (1) 518:5 slightly (7) 510:13;535:7,24; 560:20,20;568:22; 579:8 slip (6) 545:3,4,7,10,20;	546:7 slope (15) 519:14,19;521:2; 523:4,19;524:14,15; 526:4;535:14,21; 536:4,6;562:1;574:3,8 slow (1) 557:2 slug (1) 564:21 small (6) 500:6;510:4,16; 540:23;570:18;593:8 smaller (1) 574:10 snow (5) 575:5;579:24;580:2, 12;582:11 SNWA (6) 491:3;518:17;525:9; 552:22;571:6;585:17 SNWA's (1) 552:17 soils (7) 577:22,24;578:1,2,3, 6;580:7 Solicitor (1) 493:23 somebody (6) 513:2;554:6,22; 583:9;594:17,18 somebody's (1) 590:20 sometimes (1) 540:3 somewhat (3) 503:21;539:15;541:9 somewhere (1) 505:6 sorry (3) 494:13;551:17;581:3 sort (3) 497:2,9;502:24 sounds (2) 540:1;583:9 source (9) 521:16;557:15,22, 23;558:2,14;565:11; 566:19;568:18 sources (7) 505:9,11;515:12; 516:13;521:16;527:23; 557:7 south (29) 516:11;517:12; 518:8;522:14;523:7; 527:20;530:8;532:8; 533:21;538:4,20; 540:22;541:21;543:9, 13,20;544:4;545:22; 546:8;549:11,15; 550:15;553:11;563:10; 564:15;576:8;592:1,	12;593:8 southeast (8) 519:3;537:5;539:6; 542:18;545:6;553:12; 562:24;566:24 southeastern (3) 537:2;546:7;562:16 southern (11) 506:7;517:8;544:1, 24;552:8,11;561:6,6; 564:2;568:9;576:24 southward (1) 515:19 southwest (8) 528:2;536:3;537:4; 541:8;548:24;556:3, 12;563:18 Southwestern (3) 500:16;539:11; 551:21 spaced (1) 538:17 spaces (1) 580:2 SPEAKER (2) 569:15,18 speaking (1) 591:10 special (1) 496:8 specific (2) 531:5;586:13 specifically (11) 495:14,18,20; 496:13;497:6;498:23; 500:17;518:6;539:21; 580:20;584:24 specified (1) 507:10 spell (1) 494:4 spelled (1) 494:7 sporadic (5) 574:15;578:16; 579:15,22;580:24 sporadically (2) 578:16;579:22 spread (3) 565:12;580:6;593:24 SPRING (96) 489:7.5;500:24; 501:2;504:18;506:2; 515:8,19;516:9; 518:11;524:9;526:10; 528:2,11;533:23; 534:20;535:1,2;536:3; 537:2,20;538:3,7,9; 540:9,9,15,20,20,21; 541:24;542:4,9,18,21; 543:8,13,21;544:2,19, 23;545:4,13;546:5,9, 17;547:14,15;548:17,
---	---	--	---	--

19,21;549:3,10,13,18, 24;550:7,12,13,18,21, 22,23,23;551:20; 552:10;555:20,22; 556:1,3,3,9,13,22; 559:8;562:7,15; 563:11,12;564:16; 566:20;567:12,24; 568:3,17;570:1; 574:22,24;582:20; 585:1;588:17,19; 589:18,24;591:23,24; 593:2	525:7;540:14;554:12; 558:6;572:15;583:4, 18,19,21;590:11,17; 596:18;598:2,6	578:10	supportive (2) 517:6;518:1	576:2,3
SPRINGS (64) 489:11;495:20; 501:3;515:6;516:15; 517:11;519:3;521:17, 18;523:3;524:6,21; 527:18;530:24;544:11; 545:15;547:12;549:2; 550:18,24;551:20; 552:7,8,10;555:13,15, 22;556:8,11;557:8,10, 13,13;558:8;560:19,22, 24;562:6;563:1; 566:20;567:2,8,20; 568:2,5,5,11,19,20; 569:3,8;570:8;574:21; 588:8;591:15;592:2, 18;593:17,18;594:12, 15;596:24;597:15,17	stated (2) 594:9;597:11	study (4) 541:18;543:23; 557:10;578:24	sure (7) 508:19;537:13; 541:23;553:20;572:23; 591:10;597:4	talk (14) 503:11,16,17; 515:17;518:5;529:3; 534:19,24;549:1; 552:1;557:11;558:18; 568:16;585:13
squared (2) 532:6;554:3	statement (3) 502:9;526:19;543:6	stuff (9) 497:9;515:5;534:15; 536:22;537:18;544:11; 547:12;556:17;577:6	surface (7) 536:15;545:24; 552:13;561:20;562:8; 569:1;594:22	talked (10) 503:22;505:24; 518:2;530:3;541:24; 545:1;552:19;584:5; 586:11;587:23
ss (1) 598:2.5	statements (2) 552:2;584:21	subcontractor (1) 500:9	surficial (2) 586:5;587:6	talking (6) 509:14;526:17; 540:4;549:14;579:5; 588:9
stabilizes (1) 557:4	steady (3) 554:12;583:19,21	subject (1) 510:7	surprised (1) 509:7	talks (1) 535:9
stable (3) 522:5;559:1;579:23	steep (1) 565:7	subjects (1) 502:24	surrounding (2) 501:2;590:23	tapered (1) 500:11
Stan (2) 504:8;595:11	stenotype (2) 598:12,15	submit (1) 499:6	Survey (6) 498:15;500:4; 538:15;539:4;571:14, 23	team (2) 500:7,10
standard (1) 560:2	still (15) 493:19;500:8; 503:15;505:16;519:11; 524:9;526:1,5;549:12, 16;553:21;565:9; 584:14;586:23;590:8	submitted (1) 510:5	surveys (5) 506:14;529:8,8; 536:24;594:6	Tech (5) 494:11;495:2,5; 499:4,5
start (9) 493:7;522:12; 523:15;524:17;525:12; 561:14;575:12;578:6; 583:17	stock (1) 584:13	subsequent (3) 493:10;570:12;574:3	Susan (1) 537:19	technique (11) 506:13;507:8; 520:15,18;533:3,10,15; 536:9,11;539:19;559:3
started (8) 499:22;501:18; 502:23;503:6;519:1; 521:10;526:3;574:1	stopped (2) 521:6;570:15	substantial (1) 507:10	swear (1) 494:13	techniques (1) 506:4
starting (10) 520:3;522:2;523:6, 21;525:18;570:13; 574:9,17;581:19; 584:10	storage (4) 504:13;573:22; 586:13,13	substantiated (1) 542:6	swift (1) 509:10	tells (2) 516:6;551:16
starts (2) 526:12,15	story (1) 521:21	subtracted (1) 589:1	sworn (2) 494:16,20	temperature (12) 516:18;529:8; 548:22;549:4,9,20,21; 550:4,6,8,15,16
STATE (23) 489:1;490:5,6,5; 493:10,11;495:18; 504:17;508:1,20;	stream (7) 578:13;586:7,7; 588:14;593:13,14; 594:23	successfully (1) 507:12	synoptic (1) 506:14	temperatures (11) 548:12,18;549:7,11, 18,24;550:7;560:7,9; 561:5,5
	streams (1) 507:20	sudden (1) 557:4	SYSTEM (45) 489:7;493:5;495:22; 496:9;498:21;500:21; 501:9;505:6,8;506:9; 508:3;509:21;510:16; 511:4;512:14,14; 514:14;517:8,11,19; 531:19,24;534:14,19; 537:15,23;545:21; 551:24;552:7;553:20; 554:15,15;560:14; 564:23;566:3;575:9; 576:6;577:1;582:12; 583:16;586:16;591:2; 595:7;596:15,19	temporary (1) 593:21
	stress (1) 512:20	Sue (2) 542:11;569:7	ten (7) 541:5,6,13,16;542:1, 21;543:17	tend (1) 547:21
	stresses (2) 515:13;521:16	sufficient (6) 516:22;517:3,6; 518:2;578:20;580:1	tends (1) 556:17	ten-minute (1) 555:7
	stretches (1) 506:16	suggest (1) 554:18	ten (2) 512:22;530:16	tens (2) 512:22;530:16
	strike (7) 522:22;545:3,4,7,10, 20;546:7	suggested (3) 557:14;558:2;560:13	term (7) 518:20;524:18; 535:10;539:24;570:21; 589:13,14	termed (2) 544:14;559:16
	strikes (1) 545:16	suggests (1) 566:18	terminated (1) 562:16	termination (1)
	strong (3) 553:8;597:2,13	Suite (1) 489:23		
	structural (18) 520:11,21;522:16, 24;525:3;527:17; 528:4,7,14;532:19; 533:24;534:17;551:3, 11,11,12,14,16	Sullivan (1) 490:6	T	
	structurally (1) 528:20	sum (2) 595:21,22	table (4) 560:15,16;578:23; 588:15	
	structure (3) 536:10;543:1;546:10	summarize (1) 596:13	tables (1) 497:8	
	structures (1) 529:19	summary (2) 502:19;504:6	Taggart (4) 491:3,3,3,5;569:20	
	studies (1)	summer (3) 515:4;579:24;580:20	tail (1) 574:5	
		Supervising (1) 490:9.5	tailoring (2)	
		Supervisor (1) 490:14		
		supplies (1) 518:13		
		supply (1) 530:8		
		support (1) 501:5		

537:21 terminology (2) 540:16;541:4 terms (8) 505:15;506:19; 508:22;509:4;511:4; 518:20;553:22;586:22 tertiary (1) 547:18 Test (38) 498:16,18;499:10, 12,19;500:17,20; 507:16;508:6,10,21; 510:10;511:12,15; 512:5;515:14;517:23; 519:17;521:6;522:1; 525:11;529:10;530:1, 7,18,19;535:15;548:3; 564:21;575:4;576:12; 577:12;583:6;584:8; 585:11,12,12,16 testified (5) 494:21;504:17; 518:24;522:15;577:17 testify (2) 572:3,18 testifying (4) 571:14,23;572:10,13 testimony (4) 495:24;501:13; 503:2,6 testing (11) 499:20,21,24;521:1; 522:1;529:8;535:23; 536:8;564:20,21; 573:11 tests (3) 511:8;532:2;534:9 Tetra (5) 494:11;495:1,5; 499:4,5 theirs (1) 535:9 Theis (3) 595:13;596:1,4 Theis' (1) 504:11 thereafter (1) 499:4 therefore (1) 572:12 thick (2) 509:20;510:17 thinner (2) 509:16;587:4 third (6) 493:3;502:15; 503:20;539:16;547:6, 16 though (3) 542:15;548:8;596:16 thought (1) 498:20	thousand (1) 548:13 thousands (1) 579:11 three (20) 504:7;510:17; 534:19;535:17;541:4, 5,7,16;542:1,21;564:7; 566:5;568:6;577:17; 591:16,18;592:4,10; 593:5,15 three-dimensional (1) 531:24 threshold (1) 582:7 throughout (3) 508:10,13;509:21 thrust (18) 512:19,21,23,23; 545:2;546:19;563:3, 15,20,23;564:4,10; 566:15;567:15;568:3; 587:2,24,24 thus (2) 569:4,5 Tibble (1) 561:9 Tim (6) 490:4,5;491:5; 503:21;518:24;541:24; 577:17 Timber (1) 548:4 times (7) 511:14;541:5,6,13, 16;542:1,21 title (1) 496:6 titled (1) 496:7 today (6) 493:3,24;495:24; 501:12;503:1;514:24 together (19) 496:16;501:1;502:2; 507:2;516:19;520:8; 531:23;538:22;548:18; 561:21;564:21;565:1; 566:2;587:12,13; 590:13,17;591:17; 596:6 tongue (3) 503:19;534:23; 554:19 took (1) 496:17 tool (2) 559:2;586:9 tools (1) 585:9 top (6) 513:10;514:1;515:3; 563:3,20;587:5	total (6) 591:19;592:3,9; 593:19,19;595:20 toward (4) 539:6;549:18;568:1, 13 towards (7) 511:22;523:20; 546:11;559:19;560:8; 562:7;567:2 tracer (5) 511:15;530:11; 531:8,10;548:16 tracers (3) 511:19,20;512:1 Tracie (1) 573:3 tran (1) 541:4 TRANSCRIPT (2) 489:14;598:13 transcription (1) 598:15 transducer (4) 518:18;521:11; 522:8;523:2 Transducers (1) 512:2 transmission (1) 531:22 transmissive (5) 530:23;531:1; 532:17;542:10,10 transmissivities (2) 532:5;544:20 transmissivity (8) 515:24;516:3,7; 532:2,12;542:13; 544:22;545:17 transmit (1) 566:17 transmitted (3) 524:4,7;533:23 transmitting (1) 528:17 transparent (1) 590:13 transport (3) 495:8;551:9;554:10 traveling (1) 531:3 treating (1) 553:5 treatment (1) 521:8 trend (15) 520:3;535:10,21,24; 537:3,5;565:6,7,9,14, 16,17;566:1;574:1,3 trends (2) 537:1;556:20 triangle (1) 567:4	tritium (1) 531:12 true (2) 595:20;598:14 try (5) 521:5;525:12;540:2, 3;580:22 trying (6) 503:8;512:13; 520:16;562:13;579:3; 590:20 tufts (1) 498:23 Tule (1) 586:18 turn (2) 521:15;529:21 turned (3) 508:20;512:6;519:21 turns (1) 546:8 two (37) 502:14;505:11; 510:17;511:17,21; 515:22,23;519:6; 521:13;537:5,10,11; 538:13;539:4;541:12; 542:2;543:7;544:8; 549:9;550:19;555:3; 557:7;558:20,22; 563:15;564:7;574:11; 575:22;577:19;578:4; 589:1;591:18;595:21; 596:3,7,10;597:3 two-tenths (1) 579:18 Tyler (1) 578:24 type (3) 556:7;563:19;574:7 types (1) 521:22 typical (1) 541:19 typically (1) 549:1	under (6) 497:7;562:14;589:5, 13;593:2,23 underestimated (2) 589:17,18 underflow (1) 544:3 underground (4) 499:12,13,21,24 underlie (2) 498:24;510:12 underneath (2) 562:9;563:7 understands (1) 590:15 understood (2) 501:12;510:11 unfavorable (2) 557:20,21 unfortunately (3) 525:4;526:4;562:18 UNIDENTIFIED (2) 569:15,18 unit (7) 500:14;503:18; 509:3;544:15;579:1; 587:16;596:14 units (2) 541:5;587:1 unless (2) 593:11;596:22 unsaturated (1) 536:15 up (64) 500:23;501:5; 502:17;504:6;512:18; 516:14;520:14,16; 521:11;523:15;525:17; 530:14,22;532:6,21; 533:2;536:11,15,18,21; 538:19,23;539:17,18; 541:2,14;545:11; 546:4,17,19;547:8; 548:1,4;549:23;551:5, 5;552:15;553:5;560:8, 15;564:15;567:3; 568:14;569:5;571:17; 577:7,9;578:18; 579:17,20;580:2,6,22; 581:15,24;582:17; 583:1;585:7;586:9; 588:19;589:24;592:21; 593:22;595:1 upland (2) 578:14,18 upon (12) 500:16;520:8; 539:22;543:6;553:6; 554:21;557:10;572:9, 11;586:5;589:14;591:1 UPPER (24) 489:11,5;512:23,23; 513:1,8,15;532:9;
U				
UE-10-J (2) 510:13;575:23 unaware (1) 504:16 unbiased (1) 586:9 uncertain (1) 539:16 uncertainty (3) 505:9,16,23 unclear (1) 514:1 unconnected (1) 509:5				

<p>549:7,21;550:1;560:8; 561:4,13,13;564:4,10; 566:7,11;567:15; 568:2,23;569:11; 570:6,7 upstream (1) 594:24 urge (1) 596:18 use (10) 504:1;509:4;539:2, 24;543:2;554:24; 585:4,15;589:19,23 used (9) 547:23;554:11; 559:1;584:21,22; 585:3,8;586:2;590:10 useful (5) 536:8;539:1;585:20; 590:18;595:5 user (2) 594:23,24 uses (1) 595:8 USGS (16) 499:2;504:9,16; 506:7;518:17;530:3,5; 531:9;552:24;564:22, 23;566:2;567:21; 569:10;573:16;580:20 using (13) 504:4;506:5,5;507:7; 520:7;542:11;553:5, 24;554:9;572:1;586:8; 595:12;596:2 utility (1) 589:11</p>	<p>563:4,6,17;564:9,23; 566:3,5,19,23;569:5, 22;570:24;574:22; 575:9;576:15;577:5,6; 584:3;585:1;586:3,18, 18;588:17,19;589:5,9; 591:23,24;592:5; 594:13;596:15;597:14 valuable (1) 508:6 value (4) 553:5;554:2;565:3; 582:7 values (3) 549:14;560:6;565:2 varies (1) 560:1 various (1) 533:15 Vegas (19) 491:21;517:16; 534:21,23;545:5; 552:1,4,20,21,22; 553:18,20;554:10,23, 24;576:15;584:3; 589:9;594:13 vegetation (2) 556:5,17 verbatim (1) 598:11 version (1) 566:5 versus (3) 512:20;559:17; 580:21 vicinity (6) 498:19;499:13; 512:3;530:4;531:15; 557:14 Vidler (14) 491:13.5;516:19; 524:24;532:24;535:4, 5,8;536:7,24;539:14; 548:17;550:4;551:17; 590:6 Vidler's (1) 544:18 view (2) 505:11;595:4 Virgin (1) 586:18 volcanic (6) 510:10;513:13; 516:5;547:18,19; 588:20 volcanics (2) 546:23;547:1 volcano (1) 547:24 VOLUME (2) 489:17;547:21</p>	<p style="text-align: center;">W</p> <p>W-1 (3) 536:2;541:2;548:23 WADDELL (14) 492:3;494:1,3,6,8, 18;498:6;555:2,10; 569:13;571:13,22; 572:23;580:13 W-a-d-d-e-l-l (1) 494:7 walls (1) 510:18 warm (4) 549:1,2,3;550:17 warmer (2) 560:8;561:4 WASH (36) 489:10.5;523:9; 537:2,2;547:15; 557:15,21,23;558:2,15; 559:6;560:22;562:12, 21;564:2,13,13;566:19, 22;567:3,13,17;569:4, 22,22;578:13,17; 579:16,16,21;586:18; 592:5;594:10,11,13; 597:14 WASHOE (1) 598:3 waste (1) 579:1 watch (1) 513:17 watched (1) 531:13 WATER (216) 489:3;491:12.5,13.5, 18.5;495:9;501:8; 502:8,20;503:11,23; 505:1,5,9,13,15,17,20; 506:21;507:2,3,14; 508:9;510:5,14,19,24; 512:4;514:15;515:4, 15,16,22;516:1,12,13, 16;517:2,8,9,10,15; 518:1,13;519:5,11,12; 520:24;521:3,9;522:2, 5,10,11;523:16,17,17, 21;524:4,11,13,16; 525:12,12,13,18,19,22; 526:11,13;527:4,7,11; 528:17;529:9,12,16; 530:8;531:2,3,22; 535:10,12,21,22;536:4, 16,22;540:19;542:7; 543:12,15,20;544:7,10, 10;545:22;546:1; 547:20;548:16,22; 549:1,2,3,6,7,17,21; 550:21;551:4,10; 552:10,22;553:7,10,14;</p>	<p>554:1,4,5,21,21,23; 557:7,12,15;558:3,24; 559:1,6,7,13,17,22,23; 560:6,15,16;561:2,15, 20,21,24;564:14; 566:17,20;567:22; 569:21;570:5,6,11,13, 15;573:4,14,18,19,22, 23,23;574:7,24;575:6, 10,12,14,15,19;576:4, 9,11,13,15,16,17,18,23; 577:2,5,6,13,15,21,23; 578:2,3,6,21,21,23; 579:14,24;580:3,5,7; 582:4,13,17;583:10,16, 17;584:1,1,3,6;588:6, 15;590:24;591:3; 593:13;594:18,19,22, 22;595:1;597:6,12; 598:7 waters (7) 517:20;557:18; 558:19,19;559:9; 560:15,21 way (9) 508:21;528:11; 532:8;560:2;565:15; 566:13;573:23;589:8, 10 Wayne (2) 564:22;565:24 weak (1) 528:8 weapons (1) 573:11 WEDNESDAY (3) 489:18.5;493:1; 598:9 weight (3) 565:9;572:8,17 Weiser (10) 537:20;557:15,21; 558:2,15;564:2,13,13; 567:3,17 welcome (1) 580:16 well-accepted (1) 559:3 well-connected (1) 594:4 wells (57) 496:16;510:22; 511:17,22;512:2,9; 514:11;515:7,9; 518:12;521:15;523:12; 527:2,9,16;529:7; 531:14,15;532:3,8,13, 14,16;535:20;541:12, 15;542:24;543:7,18; 545:14;548:18;549:9, 13;550:6;552:19; 557:13;558:8;567:5, 11;570:5,19;574:6,11,</p>	<p>20;577:8,9,9,10,14; 579:12;582:22;584:6; 592:14;595:23;596:3, 7,10 west (15) 520:9,11,13;525:3; 527:1;528:10;533:21; 538:11;544:9,12; 550:3;562:22;568:12; 574:20,23 Western (13) 507:3;527:17;528:6; 549:24;550:9;551:7, 11;574:21,22,23; 576:10;581:3;586:16 wet (7) 523:16;524:12; 525:19;574:9,16; 575:12;582:1 what's (10) 513:16;525:5;538:6; 543:23;544:14;550:19; 561:17;570:6;574:15; 590:14 whenever (1) 583:8 WHITE (13) 489:7;493:5;495:22; 496:9;508:3;517:10; 531:19;545:21;551:23; 568:8;576:6;587:14; 591:2 whole (1) 510:5 whoppers (1) 581:21 Wildlife (1) 501:6 Wilson (1) 490:4.5 win (1) 500:7 Winograd (2) 544:14;552:6 winter (16) 523:16;524:12; 573:20;574:10;575:12; 580:12,17,18,21,24; 581:5,8,17,19;582:2,10 winters (1) 574:16 WITHIN (20) 489:7;500:21;501:2, 8;510:3,23;514:13,19; 520:17;529:2,4,19; 530:4;533:3;568:18; 576:21;589:10;591:2, 24;592:1 within-entitled (1) 598:12 without (2) 513:23;589:1 WITNESS (17)</p>
V				
<p>valid (2) 512:13;582:8 VALLEY (120) 489:7,5,9,10,11,5; 491:18;498:21;500:21, 24;501:2,8;504:18; 505:13;506:10;515:8, 9,19,20;516:9;517:16, 24;518:11;524:9; 526:10;528:3;534:20, 21,23;535:2;536:3; 537:20;538:3,7,9; 540:9,10,15,20,20,22; 542:4,18;543:8,13,21, 22;544:2,19,21,23; 545:4,5,13;546:5,9,12, 17;547:14;548:17,19, 21;549:6,10,13,24; 550:7,12,13,22,22,23, 23;551:20,21,23;552:1, 4,7,20,21,22;553:20; 554:15,23,24;557:24; 559:7,10;560:22;</p>				

492:2;494:1,6,10,14, 16,19;555:5,12; 569:21;572:8,21; 573:1;580:15,17; 591:7,13 women (1) 537:18 won (3) 499:15,17;500:10 wonder (1) 513:2 word (2) 543:3;563:7 words (1) 565:13 work (18) 495:1;498:16;499:8, 15;500:5,7,10;501:7; 520:8;521:8;537:17; 564:22;572:13,17; 573:6;588:1;590:4; 591:2 worked (5) 498:8,8;500:1;522:7; 552:24 working (2) 498:15;564:24 works (1) 495:6 world (1) 560:1 woven (1) 503:9 wrap (1) 504:6 written (1) 496:15 wrong (1) 502:5	Yucca (9) 498:17,19,23,24; 499:20;512:3;575:19; 576:9;579:17 <hr/> Z <hr/> zero (3) 553:5;592:21,23 zone (34) 505:14;510:15; 515:20;516:2;517:16; 528:23;529:22;545:5, 20;546:3,7,20;547:4,7; 549:7;552:4,9,11,20; 553:5,9,10,11,13; 554:1;584:3;589:9; 594:12,13;595:14,14; 596:8,9,10 zones (6) 504:4;529:13,19; 546:6;594:9;596:9 zoning (1) 594:14 <hr/> 1 <hr/> 1 (2) 530:7;535:6 1,562 (1) 566:21 1,576 (1) 566:21 1.6 (1) 556:19 1:00 (1) 597:24 10:34 (1) 555:8 100 (1) 559:21 100,000 (2) 532:5;554:3 106 (2) 549:1,15 107 (1) 489:23 1169 (27) 508:6,10,12;509:8; 515:14;517:3,23; 519:17;521:6,14,19; 522:11;524:15;525:11, 22;526:3;535:14,22; 536:5;570:10;582:15; 583:6;585:11;588:22; 589:14;591:20;593:24 12 (1) 500:5 123 (1) 489:23 12-year (1) 499:22 13 (1)	561:7 130 (1) 548:23 1303 (5) 489:16;493:5; 495:12;497:15;498:8 136 (1) 548:23 14 (1) 561:7 14,000 (2) 583:5;593:3 1540 (1) 567:6 1560 (1) 567:6 16 (1) 526:9 17 (1) 531:1 18 (2) 561:6;587:3 18,000 (1) 531:2 1800 (1) 566:23 1880 (1) 551:22 18-layer (1) 587:4 1910 (1) 514:20 1920 (1) 514:20 1940 (1) 504:11 1970 (3) 581:20;582:1;591:1 1977 (1) 498:14 1985 (1) 499:2 1991 (1) 499:5 1998 (1) 518:24 <hr/> 2 <hr/> 2 (4) 496:4;498:2,3;504:2 2,000 (2) 548:13;565:18 2000 (1) 585:9 2001 (3) 500:22;584:24; 585:10 2002 (1) 584:24 2004-2005 (15) 519:7;520:23; 523:16;524:12;525:19;	526:13;573:20;574:3, 8;575:2,9;576:7; 581:11,21;582:14 2004-5 (1) 576:6 2005 (1) 522:9 2010 (2) 519:17;585:6 2011 (2) 574:9;581:14 2012 (1) 586:1 2013 (3) 504:1;519:19;556:23 2018 (1) 525:8 2019 (7) 489:18.5;493:1; 496:9,23;497:15; 598:10,19 21 (1) 532:18 210 (1) 489:8 215 (1) 489:9 216 (1) 489:9.5 217 (1) 489:10 218 (1) 489:11 219 (1) 489:12 221 (1) 577:3 228 (1) 525:8 25 (4) 489:18.5;493:1; 532:3,14 25th (1) 598:9 26th (1) 598:18 27 (1) 587:1 <hr/> 3 <hr/> 3 (3) 497:11;498:2,3 3,000 (1) 565:18 30 (2) 532:3;549:8 3200 (1) 551:20 334 (1) 493:12 35 (2) 558:17;580:14	36 (1) 502:7 38 (1) 561:1 3rd (2) 496:9,23 <hr/> 4 <hr/> 40 (1) 549:8 40,000 (1) 553:24 48 (1) 574:19 489 (2) 489:17.5;598:14 49 (1) 575:19 494 (1) 492:4 <hr/> 5 <hr/> 5 (1) 556:22 50 (1) 507:11 500 (6) 566:7,11;584:11,13, 14;592:23 597 (1) 598:14 598 (1) 489:17.5 <hr/> 6 <hr/> 69 (1) 591:21 <hr/> 7 <hr/> 700 (1) 553:19 76 (1) 550:8 77 (1) 550:7 775882-5322 (1) 489:24 <hr/> 8 <hr/> 80 (1) 559:21 89 (1) 550:17 89706 (1) 489:23.5 <hr/> 9 <hr/>
Y				
year (4) 499:16;500:12; 583:5;593:3 years (13) 500:5,10;506:3,12; 515:16;519:18;539:1; 554:24;579:11;584:12, 13,14;592:23 yellow (3) 561:6;567:4;592:9 yesterday (4) 518:24;542:11; 569:8;577:17 yesterday's (1) 493:18 yield (1) 590:1 younger (10) 513:10;514:2;558:4, 11;562:9,10,15;563:3, 5,20				

9 (1)
552:17
90 (2)
549:14,18
900 (1)
531:16
99 (1)
550:15

In The Matter Of:

*DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES*

*Vol. III
September 25, 2019*

*Capitol Reporters
123 W. Nye Lane, Ste 107

Carson City, Nevada 89706*

Original File 092519waterFINAL pm.txt
Min-U-Script® with Word Index

SE ROA 53212

JA_17609

Page 599

1 STATE OF NEVADA
 2 DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
 3 DIVISION OF WATER RESOURCES
 4 BEFORE MICHELINE N. FAIRBANK, HEARING OFFICER
 5
 6
 7 IN THE MATTER OF THE ADMINISTRATION
 AND MANAGEMENT OF THE LOWER
 8 WHITE RIVER FLOW SYSTEM WITHIN
 COYOTE SPRING VALLEY HYDROGRAPHIC
 9 BASIN (210), A PORTION OF BLACK
 MOUNTAINS AREA HYDROGRAPHIC
 10 BASIN (215), GARNET VALLEY
 HYDROGRAPHIC BASIN (216), HIDDEN
 11 VALLEY HYDROGRAPHIC BASIN (217),
 CALIFORNIA WASH HYDROGRAPHIC BASIN
 12 (218), AND MUDDY RIVER SPRINGS AREA
 (AKA UPPER MOAPA VALLEY HYDROGRAPHIC
 13 BASIN (219)).

14
 15 TRANSCRIPT OF PROCEEDINGS
 16 PUBLIC HEARING
 17 HEARING ON ORDER 1303
 18 VOLUME III
 19 (P.M. SESSION, PAGES 599-693)
 20
 21 WEDNESDAY, SEPTEMBER 25, 2019
 22
 23
 24 Reported by: Kathy Terhune, RPR

Page 601

1 APPEARANCES:
 2 For NV Energy: Justina Caviglia, Esq.
 Reno, Nevada
 3
 4 For Lincoln County
 Water District
 -and-
 5 Vidler Water Company: Allison MacKenzie
 By: Karen Peterson, Esq.
 Carson City, Nevada
 6
 7 For Moapa Band of Paiutes: Beth Baldwin, Esq.
 8 For NCA: Alex Flangas, Esq.
 Reno, Nevada
 9
 10 For Moapa Valley
 Water District: Greg Morrison, Esq.
 11
 12 For Bedroc: Schroeder Law
 By: Laura Schroeder, Esq.
 13 For City of North Las Vegas: Schroeder Law
 By: Laura Schroeder, Esq.
 14
 15 For National Park Service: Karen Glasgow, Esq.
 16
 17 For Center for Biologic
 Diversity: Patrick Donnelly, Esq.
 18 For U.S. Fish and Wildlife: Luke Miller, Esq.
 Ass. Regional Solicitor
 Sacramento, CA
 19 For Muddy Valley Irrigation
 Company: Steve King, Esq.
 20
 21
 22
 23
 24

Page 600

1 APPEARANCES:
 2 Micheline N. Fairbank,
 Hearing Officer
 3
 4 Tim Wilson,
 Acting State Engineer
 5 Adam Sullivan,
 Deputy State Engineer
 6
 7 Melissa Flatley,
 Chief of the Hearing Officer Section
 8 Michelle Barnes,
 Supervising Professional Engineer
 9
 10 Levi Kryder,
 Chief of the Hydrology Section
 11 John Benedict,
 Hydrologist
 12
 13 Christi Cooper,
 Geologist
 14 Bridget Bliss,
 Basin Engineer
 15
 16 For SNWA: Taggart & Taggart, Ltd.
 By: Paul G. Taggart, Esq.
 Carson City, Nevada
 -and-
 18 Tim O'Connor, Esq.
 19 For CSI: Robison, Belaustegui, Sharp
 & Low
 By: Kent R. Robison, Esq.
 Reno, Nevada
 21
 22 For CSI: Brownstein Hyatt Farber
 Schreck
 By: Brad Herrema, Esq.
 Los Angeles, California
 23
 24

Page 602

1
 2
 3
 4
 5 By Mr. Herrema 604
 6 By Ms. Baldwin 615
 7 By Mr. Taggart 624
 8 By Ms. Peterson 636
 9 By Ms. Schroeder 645
 10 By Mr. Donnelly 651
 11 By Mr. King 658
 12 By Ms. Caviglia 660
 13 By Ms. Barnes 661
 14 By Ms. Cooper 663
 15 By Mr. Benedict 664
 16 By Mr. Sullivan 668
 17 RECROSS
 18 By Mr. Herrema 672
 19 By Ms. Baldwin 675
 20 By Mr. Taggart 681
 21 By Mr. Morrison 687
 22 By Ms. Peterson 689
 23
 24

Page 603

1 SEPTEMBER 25, 2019; 1:00 P.M.; CARSON CITY, NEVADA.
2
3 -000-
4
5 HEARING OFFICER FAIRBANK: Okay. Let's go
6 ahead and go back on the record. And so, we'll go
7 ahead and start the opportunity for cross-examination
8 and questions.
9 And we will commence -- start with Coyote
10 Springs Investments.
11 And again, we've had several parties that have
12 indicated that they're not going to be participating in
13 cross-examination today, and so, I've adjusted the time
14 schedule so each of the participants will have
15 16 minutes for their cross-examination. And then,
16 again, if there's time at the end of today, then we can
17 go ahead and see about maybe allowing a second round of
18 questions.
19 Go ahead and proceed, Mr. Herrema.
20
21 RICHARD K. WADDELL, JR.,
22 called as a witness herein by the National
23 Park Service, having been previously duly
24 sworn, was examined and testified as follows:

Page 604

1 CROSS-EXAMINATION
2 BY MR. HERREMA:
3 Q. Good afternoon, Dr. Waddell.
4 A. Good afternoon.
5 Q. I'm Brad Herrema. I'm counsel for CSI. I have
6 with me at the table Emilia Cargill who is a General
7 Counsel for CSI. And I have handful of questions. I'm
8 going to try to do as much as I can with my 16 minutes.
9 So, I'm going to try to move quickly. But, I would
10 like to get your full answers to each of the questions.
11 First, you stated in your presentation that
12 discharge has the smallest -- excuse me -- has the
13 smallest amount of uncertainty.
14 What do you use to measure groundwater outflow
15 from a system? Can --
16 A. I want to make sure I understand your question.
17 When you talk about groundwater outflow, are you
18 talking about outflow across a boundary, or you talking
19 about outflow to the surface?
20 Q. How would you measure either?
21 A. Well, the outflow across a boundary really
22 can't be measured. You can estimate it based upon
23 estimates of the transmissivity of the aquifer and
24 gradient. But, there's a lot of uncertainty in the

Page 605

1 transmissivity values. Same answer for inflows. But,
2 whereas say discharge to a spring, you can, depending
3 on that, the discharge rate from the spring, use
4 different techniques. If it's a large capacity spring
5 that results in spring flow, you can build a flume or
6 other type of measurement, strike them on the stream
7 and measure the flow with that technique.
8 If it's a very small stream -- a very small
9 discharging spring, you can estimate it -- I'm sorry --
10 measure it through a bucket and stopwatch method, if
11 you will, where you capture the discharge from the
12 spring over a certain period of time, measure that
13 volume, and divide it by the amount of time.
14 So, you know, it depends really on what the
15 characteristics of that spring discharge are. If
16 you're interested in discharge into a river, you would
17 do like the USGS did with their synoptic study that
18 they performed on the river where you set up stations
19 along the river and make measurements at those stations
20 either by measuring water velocity cross-sectional area
21 and integrating that to get a value, or you -- if you
22 have a gauging station with a flume or weir or
23 something like that, you can use those data. But, you
24 do that at different points along the stream so that

Page 606

1 you can see changes. And the concept typically is to
2 measure those several times and average out the years.
3 Q. Okay. Thank you. I'd like to move on to some
4 questions about your model.
5 Looking at the 2012 report on development of
6 your model, there's a table 3-4. It's average annual
7 evapotranspiration discharge by hydrographic area. Do
8 you recall that?
9 A. I do not, but I think I've got a copy of it
10 here.
11 Q. Okay. The report states that -- or that table
12 states that there's 4000-acre-feet per year of
13 evapotranspiration in Muddy River Springs area, there's
14 2000-acre-feet per year of evapotranspiration in Black
15 Mountains area, 6000-acre-feet per year of
16 evapotranspiration in California Wash which totals
17 12,000-acre-feet per year. And this references a 2008
18 USGS study.
19 Do you know if these were predevelopment
20 evapotranspiration rates, or they were current in 2008?
21 A. They were current in 2008.
22 Q. Your 2012 report also states that flow in
23 Coyote Spring Valley comes from a combination of
24 recharging in Delamar Mountains and underflow at the

Page 607

1 northern most end of Coyote Spring Valley, and the flow
2 continues south through carbonate rocks. Some of the
3 groundwater flow discharges into the Muddy River either
4 through the Muddy River Springs and some regional
5 groundwater flow likely to continue southeast into
6 California Wash.
7 Are you suggesting that there are two flow
8 paths through Coyote Spring Valley, one toward Muddy
9 River Springs and the other toward Hidden and Garnet
10 Valleys?
11 A. I'm suggesting that the flow to the south in
12 Coyote Spring Valley, some of that goes towards the
13 Muddy River Springs area. I don't -- I would answer
14 yeah, there are -- there are at least two flow paths,
15 but they're three-dimensional flow tubes, if you will.
16 So, you can't necessarily draw a line on a map and say
17 to the east of this line that all goes to Muddy River
18 Spring and to west of it, it goes further to the south.
19 But, in essence I'm saying there are two areas
20 that that flow goes to.
21 Q. Okay. A review of your 2012 report indicated
22 that you did one steady-state and two transient
23 calibrations. Could you explain why you performed two
24 transient calibrations?

Page 608

1 A. I -- my recollection -- and I haven't reviewed
2 that report in that kind of detail, but let me first
3 answer your unasked question about the state of the
4 study. We wanted to get a base model base so it would
5 be consistent with the estimated fluxes across the
6 external boundaries, the estimated recharge rate so
7 that it calculates the discharge and the distribution
8 of water levels throughout the model. My recollection
9 is that for the transient calibrations we did one
10 calibration process with longer time steps that didn't
11 look at the pumping affects in as much detail. And
12 then another one was shorter time steps to get
13 additional tempo information. But I -- I -- that was a
14 long time ago, and I don't recall that detail.
15 Q. Okay.
16 A. I can check the report if you'd like.
17 Q. Not right now, thank you.
18 Review of that model report shows that
19 simulated flow at the Muddy River near the Moapa Gauge
20 goes up to 15 CFS less than observed. Was that Moapa
21 Gauge considered during the model calibration?
22 A. It was, yes.
23 Q. And could correcting for simulated flow at the
24 Moapa Gauge change any of the opinions that you

Page 609

1 presented today?
2 A. It would change the output that I showed you
3 with respect to discharge rates into the river along
4 the different stretches of the river. It would not
5 really change my conclusion that we would be looking at
6 similar effect just delayed with movement of pumping
7 from the regular area down into the southern part of
8 the flow system.
9 Q. For the simulations that you discussed today,
10 did you update the calibration of the model with any
11 data collected since December 2011?
12 A. We did not.
13 Q. So, the updated model that you presented today
14 and you refer to in your report, does it include any
15 form of recalibration using data collected after
16 December, 2011?
17 A. No, it does not.
18 Q. Are you able to provide any estimate of
19 accuracy of your model for the recent simulations based
20 on that 2012 calibration?
21 A. It's going to depend upon the area that you're
22 looking at. In terms of the amount of drawdown, my
23 recollection is that we were -- the model estimated
24 about half of what was measured, but it varied on which

Page 610

1 well you were looking at. So, in some wells, it would
2 match better than it did in others.
3 With respect to the flow, I don't recall the
4 detail about how much we estimated decline at Pederson
5 Springs versus what was measured with something less
6 than that. I just don't recall.
7 Q. Something less than half?
8 A. I didn't -- I said less than that.
9 Q. Okay.
10 A. Less than what was simulated. I'm not saying
11 that correctly. I don't know how to -- I don't have
12 the information to say how much that model simulation
13 was off in front of me.
14 Q. Okay. You have said that continued development
15 of the model should include changes in recharge and the
16 implementation of structural features. Would either of
17 these elements effect the underestimated impact of
18 Order 1169 pumping?
19 A. By themselves? I think if we added some
20 additional structure -- you had mentioned the mismatch
21 at one of the gages where water bypassed -- in the
22 model bypassed that gage location to discharge further
23 downgradient. A structure in there that would keep
24 that flow would provide a better match.

Page 611

1 So, yeah, increasing structure and that kind of
2 stuff would, I think, be an improvement to the model.
3 I don't think that's sufficient. The changes in
4 recharge that I had in mind was putting in the
5 transient recharge data set so that we could simulate
6 the increases in water levels from the 2004, 2005
7 recharge event. So, we had a process for simulating
8 that change that was observed in the data. That
9 currently does not exist in the model.
10 Q. In regard to the faults that are included in
11 the 2000 -- I'll call them the 2012 model. Should we
12 call it the updated 2012? You haven't added any faults
13 since 2012, correct?
14 A. That is correct.
15 Q. In regard to the 2012 model, is it correct that
16 the only faults that were simulated in that model is
17 the Coyote Spring Valley and the Muddy River Springs
18 area? Are the Kane Springs Wash faults and the White
19 Narrows fault?
20 A. That's my recollection, yes.
21 Q. And could additional faults be added to the
22 model based on the recent geophysics work that CSI and
23 Vidler had commissioned?
24 A. Additional faults could be added in the Coyote

Page 612

1 Spring Valley, yes.
2 Q. And if you added those faults into the model,
3 would the model then need to be recalibrated?
4 A. Yes.
5 Q. Would the addition of the faults allow you to
6 better understand -- I'm sorry -- to better estimate
7 the predicted drawdown in water levels that you stated
8 were underestimated?
9 A. I don't think they testified that we
10 underestimated water levels. We underestimated the
11 amount of drawdown. And the additional faults will
12 change the distribution of the estimated drawdown.
13 Q. Okay. So, the addition of faults would allow
14 you to better estimate the predicted drawdown in water
15 levels which you said were underestimated?
16 A. With other changes, yes.
17 Q. If I could turn attention to slide 19. Do you
18 have your slides in front of you? Could you pull that
19 one up? Thank you.
20 This slide includes different suggestions about
21 how you might evaluate the permeability within a fault
22 block. Did you do any of that analysis in the Coyote
23 Springs Valley?
24 A. This slide does not provide suggestions about

Page 613

1 how would they -- we'd estimate that. I was using this
2 slide to say that in other areas where this type of
3 information has been collected, the information
4 indicates that the fault blocks are not impermeable.
5 Q. So temperature and flow testing or tracer
6 testing is not something that you could do in the
7 Coyote Spring Valley to analyze the fault block there?
8 A. No, it could be. I was just -- I thought you
9 had mischaracterized what this slide said. But, yes,
10 that type of work could be done.
11 Q. Did you do any of that type of analysis in
12 Coyote Springs Valley?
13 A. No.
14 Q. Would you recommend that it be done?
15 A. I would recommendation additional work. I
16 wouldn't necessarily recommend, for example, tracer
17 testing in Coyote Spring Valley.
18 Q. There is additional work you would recommend?
19 A. I think --
20 Q. To characterize that fault system? I'm sorry.
21 A. I think additional drilling and hydrologic
22 testing looking at the amount of attenuation of the
23 drawdown signal across the fault would provide useful
24 information.

Page 614

1 Q. Do you have an opinion as to whether MX-5 and
2 MX-4 wells are completed within the structural block or
3 within the damaged area or fractured area associated
4 with normal faulting?
5 A. I think that whole area has been -- has
6 enhanced permeability. Whether or not it's due to the
7 normal faulting associated with the lateral extent of
8 your canyon range and the subsurface or whether it's
9 due to the right lateral movement of a shear zone that
10 runs from that area towards the Muddy River Springs
11 area, I'm not sure about.
12 In CSI's presentation the response to one of
13 the questions was that MX-5 penetrated the fault on the
14 east side of that block. I did not go back and look at
15 the log to see if there was evidence for a fault at
16 MX-5.
17 Q. Okay.
18 A. So, I -- you know, they -- those wells could be
19 within the damage zone, but I have not looked at that
20 carefully to provide you an answer accurate answer.
21 MR. HERREMA: Okay. Thank you. I heard my
22 buzzer. Thanks.
23 HEARING OFFICER FAIRBANK: Thank you. Next is
24 Luke Miller, Fish and Wildlife Service. I see that

Page 615

1 they have the no questions.
2 Moapa Band of Paiute Indians.
3
4 CROSS-EXAMINATION
5 BY MS. BALDWIN:
6 Q. Good afternoon. I'm Beth Baldwin, attorney for
7 the Moapa Band of Paiute. And with me is Lyna Tanner,
8 our local counsel.
9 Mr. Waddell, I'm going to try to follow the
10 general order of your PowerPoint with my questions.
11 So, I'm going to refer to the slides when I ask the
12 questions. We may get out of order, but that's my
13 general intent.
14 So, starting with slide number seven. So,
15 you've listed five I guess factors that you look at
16 when examining hydraulic connectedness. Is it fair to
17 say that geology is the most important?
18 A. What I indicated on this slide is that
19 continuity of the geologic unit, or the active unit, is
20 so high importance that it's -- you have to have that
21 continuity. But, just having that continuity does not
22 indicate that there is connectedness.
23 Q. Okay. And then, so, would low hydraulic
24 gradient and water chemistry then be the least

Page 616

1 important? I'm just trying to understand if there's a
2 hierarchy here or not necessarily.
3 A. As I explained, you can have high -- I mean
4 low hydraulic gradient in rock that is not highly
5 permeable. There's just not a lot of water movement
6 through it. So, by itself it's not sufficient to
7 indicate a high connectedness.
8 Groundwater chemistry provides information that
9 you can use to -- I'm looking for the right word -- to
10 show some type of connection, but, by itself, not the
11 quality of that connection.
12 Q. Okay. Going ahead to slide ten, this is the
13 hydrograph for CSVM-6. I'm having trouble reading the
14 dates on the X axis. Is there an Order 1169 response
15 in this hydrograph in your opinion, and if so, when is
16 it beginning?
17 A. There is a response in -- give me just a
18 minute. Let me see if I can read the date.
19 Q. They're very small. My best guess is 2013,
20 but, I can't really tell for sure.
21 A. Are you asking for a response from initiation
22 of the test or --
23 Q. Yeah.
24 A. -- the ending of the test?

Page 617

1 Q. Roughly, yeah.
2 A. It looks to me like it's the latter part of
3 2010. There's a declining water level prior to that
4 that's part of the seasonal effect.
5 Q. Okay. All right. Thank you.
6 Moving ahead to slide 23. This is Kane Springs
7 Valley. These are the hydrographs for KMW-1 and
8 CSVM-4. It looks like there's this dip in 2014. Do
9 you know why? Did you have an opinion why?
10 A. You asked about a dip?
11 Q. Well, it looks like there's a drop in the water
12 levels around 2014. Again, I'm having trouble reading
13 that exact. So, that might not be the right date.
14 A. No. It looks to me like the affects of pumping
15 continued past the end of MX-5 pumping, which was early
16 2013. On the hydrograph for CSVM-4 there's a gap in
17 data, so, it's -- you can't really say much about it.
18 Q. Okay. Thanks.
19 A. But it's -- the pumping over, you know, the
20 two-year period and then the delay because of the
21 result of the attenuation of affects delayed the start
22 of recovery.
23 Q. Okay. Going to slide 28, this is titled Las
24 Vegas Valley. I'm confused whether you're proposing to

Page 618

1 include Las Vegas Valley in the Lower White River Flow
2 System or not?
3 A. I am not proposing to include it.
4 Q. Okay.
5 A. That was my tongue in cheek recommendation.
6 Q. So, I believe in -- somewhere in your report
7 and you're talking about your modeling results, the
8 simulations you did for this proceeding, that you did
9 notice drawdown in Las Vegas Valley way out in the
10 future. Do you recall if that's?
11 A. We did not simulate Las Vegas Valley. The
12 model simulated that there would be drawdown affects
13 that extended to the boundary of the model but was
14 along the Las Vegas Valley shear zone.
15 Q. Okay. So, it goes just the boundary?
16 A. That's correct.
17 Q. And I think -- I believe your opinion was that
18 not much water flows across that shear zone, the Las
19 Vegas Valley shear zone; is that correct?
20 A. That is correct.
21 Q. And I don't want to misstate this, but I
22 believe you also said that it's the -- there's a low
23 hydraulic gradient?
24 A. I didn't find evidence of a high gradient

Page 619

1 across that.
2 Q. Okay.
3 A. I don't believe I testified or wrote that it
4 was -- that the low flow was because of the low
5 gradient. I think that there is a permeability change
6 associated with the shear zone that limits the flow
7 across the shear zone.
8 There were questions earlier about changes to
9 the model that I would make if we were doing additional
10 calibration, and one of those changes would be to
11 change that boundary condition in the model from a no
12 flow boundary to independent boundary.
13 Q. And I'm not a scientist, so these questions
14 might be off base. But, if there's a low hydraulic
15 gradient, how does that impact the measure of
16 transmissivity? Or does it not impact it?
17 A. It depends on how you're trying to measure
18 transmissivity.
19 Q. Okay.
20 A. There's -- the standard, commonly implemented
21 way is to run an acra test. Drill wells, you hopefully
22 -- or you should drill observation wells, or have
23 available observation wells. You pump a well and look
24 at the drawdown that occurs in the surrounding wells.

Page 620

1 And you develop a model of that drawdown experiment and
2 back calculate transmissivity storage coefficient. So,
3 that's one way.
4 The other way, if you know the discharge
5 through that area -- and I will stress again, if you
6 know it, then you can measure the gradient and
7 calculate the transmissivity.
8 Q. But we don't -- we don't know flow. I believe
9 you testified that that's something we don't actually
10 know, but it's presumed to be low?
11 A. That is correct. We do not know the flow.
12 This would not be a good location to use this other
13 approach.
14 Q. Okay. So, let's talk a little bit about Rogers
15 and Blue Point Springs. Looking at slides 32 and 33,
16 which are the hydrographs, I see mean annual discharge
17 at Rogers is 1.63 CFS, and then at Blue Point it's
18 .52 CFS. But I have a total of 2.15 CFS; is that
19 correct?
20 A. That sounds right.
21 Q. I think your report you mentioned 2.25, and I
22 realize it's, you know, one-tenth of a difference, but,
23 is there a reason why the figures differ?
24 A. Not that I know of. I'm not sure which report

Page 621

1 you're referring to, but --
2 Q. It's when you're talking about the 500 years in
3 the future. It was simulated change. I think you said
4 it drops from 2.25 down to 2.0. But, if the current
5 discharge is 2.15, then it would -- that's a
6 difference?
7 A. That is probably the reason.
8 Q. Okay. Okay.
9 A. It was not intentional.
10 Q. Okay. Thank you.
11 So, on slide 34, we're talking about the source
12 of the water that discharges at Rogers and Blue Point
13 Springs. Did you look at heat as a tracer or
14 temperature as a tracer?
15 A. I did not. I know that because the
16 temperatures is warm --
17 Q. How warm are we talking?
18 A. My memory is somewhere in the low '90s, but
19 they didn't do an analysis of that. That typically
20 suggests to a hydrologist that the water has gone at
21 some depth, and I didn't do any calculations of depth.
22 I know that people have suggested using the internal
23 gradient or an average thermal gradient. Gradients
24 make that calculation, and I think that's appropriate

Page 622

1 in some areas. I don't think it's appropriate in the
2 Muddy River Springs area to do that. But no, I did
3 not.
4 Q. Would the temperature and the correlation that
5 it's coming from depth support Wiser Wash as a
6 potential source?
7 A. I think it would be a similar situation as flow
8 from California Wash.
9 Q. So, doesn't tell us one way or the other, in
10 your opinion?
11 A. I haven't looked at it in that detail, but, I
12 don't believe so.
13 Q. Okay. Going onto slide 36, the isotope
14 analysis. Does temperature play a role in isotopic
15 composition?
16 A. It -- the temperature of the recharge certainly
17 does. At the temperatures that we're talking about,
18 we're not looking at changes in the composition through
19 mineralogical changes which have been documented to a
20 period that requires higher temperatures. But, the
21 primary influence of temperature here would be in
22 looking at it and trying to estimate what the
23 temperature at recharge was, that recharge source.
24 Q. Okay. Slide 37, you're showing us the Global

Page 623

1 Meteoric Water Line, and it generally goes from the
2 lower left to the upper right more or less.
3 What if we have a situation where as oxygen-18
4 gets heavier and deuterium is getting lighter, what
5 would that tell us about the water?
6 A. That may suggest mineralogic changes, but I --
7 I'd have to say I don't know.
8 Q. Okay. That's fair.
9 Going into slide 36, and it's your opinion
10 there's a hydraulic connection between Rogers and Blue
11 Point Springs and the carbonate aquifer beneath
12 California Wash?
13 A. That is correct.
14 Q. And is that different from the opinion the Park
15 Service offered in 2013?
16 A. I'm not familiar with what they offered.
17 Q. Were you a part of the 2013 report that they
18 prepared in the Order 1169?
19 A. I was part of that, yes. I don't recall what
20 they would have said.
21 Q. Going ahead. Talking about the water levels,
22 slide -- starting on slide 48. Actually slide 15.
23 At the bottom of the Spring Mountain hydrograph
24 it looks like there's two wells that are either

Page 624

1 declining or holding stable?
2 A. Excuse me. Which slide?
3 Q. Slide 15. Sorry. So, at the bottom right of
4 the hydrograph it looks like there's two wells, and one
5 is holding stable. The water levels are stable. And
6 another it looks like they're declining? Is that -- is
7 that accurate?
8 A. Yes.
9 Q. Do you have an explanation or an opinion why?
10 A. I wouldn't want to speculate. The BLM well is
11 down on the, you know, lower elevation close to where
12 there may be pumping. So, it may be associated with
13 that. I didn't want to speculate, but I just did.
14 Q. That's fair enough.
15 MS. BALDWIN: I think that's that my buzzer.
16 Thank you.
17 HEARING OFFICER FAIRBANK: Yes, thank you.
18 Next is Southern Nevada Water Authority, Las
19 Vegas Valley Water District.
20
21 CROSS-EXAMINATION
22 BY MR. TAGGART:
23 Q. Good afternoon, Dr. Waddell.
24 A. Good afternoon.

Page 625

1 Q. My name is Paul Taggart. I represent the
2 Southern Nevada Water District and the Las Vegas Valley
3 Water District, and I had some questions for you.
4 First, how long have you been involved in
5 analyzing the hydrogeology of the Lower White River
6 Flow System
7 A. I -- my first involvement was in approximately
8 2001.
9 Q. And at that time, were you involved in the
10 hearings involving CSI's applications for new
11 groundwater applications in Coyote Spring Valley?
12 A. Yes.
13 Q. And at that time, were you concerned about the
14 impact of pumping water in Coyote Spring Valley on
15 Rogers and Blue Point Spring and the Muddy River
16 itself?
17 A. I was concerned about the effect of pumping not
18 on Rogers and Blue Point, but on the springs in the
19 Muddy River Springs area and also on the Muddy River.
20 Q. And during that hearing did you make those
21 concerns known to the state engineer?
22 A. I haven't reviewed the transcript, but, I
23 believe I did.
24 Q. Okay. And as a result of the pumping test that

Page 626

1 was in result of Order 1169, were some of your concerns
2 validated, or how would you describe that?
3 A. Yes, I would say they were validated. A lot of
4 those concerns had previous develop -- previously
5 developed from observing the impact of pumping of Arrow
6 Canyon wells, wells in Coyote Spring Valley. So, we
7 knew that there was a hydraulic connection, but, the
8 pumping test provided additional information on impacts
9 on the springs, as well as water levels in the springs
10 area.
11 Q. I have a number of questions for you about the
12 proposal that Mr. Reich made. Were you here during his
13 testimony?
14 A. Yes, I was.
15 Q. And the questions I'm going to ask you now,
16 are -- I'm going to ask you to, if you can, base the
17 answers on your analysis of the geology, the hydrology,
18 as opposed to the groundwater model. So, I'll -- I'd
19 like you to just tell me if these conclusions can be
20 made based upon your analysis of that other
21 information. And the reason I say that is because I
22 know -- I have a couple of questions about your model,
23 too. But, since you've indicated some concerns about
24 the calibration of it, I just want to be clear about

Page 627

1 whether you're relying on that or not in some of your
2 answers. Does that -- does that make sense?
3 A. It makes perfect sense. I prefer, you know, if
4 there are data to support the conclusion that's a much
5 stronger base than relying on a model.
6 Q. Okay. And so, this line of questions I want
7 you to rely on the data itself. Okay?
8 So, you said during your testimony that the
9 geologic structures that Mr. Reich identified and
10 plotted on his figure ten, that you didn't think that
11 they were impermeable; is that -- is that accurate?
12 A. Yes, it is.
13 Q. Okay. And it's true that you said that the
14 resistivity data that you relied upon, while it's
15 useful for identifying fractures, it's not useful for
16 identifying hydrologic properties; is that fair?
17 A. No. What I said was that the geophysical data
18 are useful for identifying faults, the effect of faults
19 and displacement of the carbonates. But, it does not
20 provide information on fractures --
21 Q. Okay.
22 A. -- that are present.
23 Q. I'm sorry. That was my mistake on faults.
24 But, do you disagree with Mr. Reich to the

Page 628

1 extent you rely upon the resistivity data as a basis
2 for there being a hydrologic barrier in that location?
3 Was it wrong to use resistivity data for that
4 conclusion, if that's how he used it?
5 A. I think that you can use the mapping of faults
6 to hypothesize that there may be -- I will use my
7 term -- impediment to flow across the fault. But, that
8 it's necessary to do hydrologic work to establish
9 whether that's indeed true.
10 Q. Okay. Now, did you also on hear testimony
11 about new recharge estimates that were made in the
12 Sheep Range by Mr. Reich and others on behalf of CSI?
13 A. I did.
14 Q. Okay. And would that recharge estimate fall
15 within this category of recharge parameters that you
16 tested with the pest product and determined that the
17 recharge really isn't a significant factor in drawdown
18 generally, and the changes in recharge values aren't as
19 significant as other factors are in how drawdown
20 occurs?
21 A. Yes, but, let me make clear so that there's not
22 confusion. That modeling and testing that I did, was
23 in a different area. But what that testing showed me
24 was that I could develop different models with

Page 629

1 different assumptions, and I looked not only at
2 recharge but some other assumptions. I went through a
3 recalibration step with each of those models and
4 determined that the predicted affects varied very
5 little.
6 Q. Okay. And do you think the state engineer
7 should determine what the long-term quantity of
8 groundwater that can be pumped without impacting senior
9 rights or the public interest? Did you think that
10 water budget should play a significant role, or analyst
11 data should play a significant role in that?
12 A. I think -- and again, to avoid confusion, I'm
13 going to say analytic data is not chemical data. But,
14 I think hydrologic data where pumping is done and
15 observations are made of discharge -- affects on
16 discharge rates, your water levels is much more valid.
17 Q. Now, I'd like to ask you about the hydrologic
18 information regarding CSI-1, -3, and -4, the three
19 wells. And in your testimony you talked about your
20 analysis of hydrographs of certain monitor wells in
21 Coyote Spring Valley, and I want to ask you about how
22 that analysis informs your view of these three wells.
23 So, I've put out on the table there, that's
24 copy of SNWA's Exhibit Number -- can't remember. It's

Page 630

1 our rebuttal report. And do you see that?
2 A. I see it, yes.
3 Q. Okay. And on figure five -- I'm sorry, figure
4 2-5 on page 9, there is a set of hydrographs that
5 include CSI-1e, CSI-3, and CSI-4, and at -- and at the
6 bottom is also the CSVM-1. Do you see that?
7 A. I do.
8 Q. Okay. My question for you is, do you believe
9 that pumping can occur at CSI-1, -3 or -4 wells,
10 without impacting the Muddy River Springs?
11 A. No.
12 Q. And do you believe that the hydrographs for
13 CSI-1, -3 and -4 reflect a signal from the pumping at
14 MX-5 during the 1169 pumping test?
15 A. I believe that -- excuse me. I believe that
16 the hydrographs are complicated by pumping that was
17 ongoing during that test that had the seasonal
18 signature to it. But, the declines in wells levels
19 that occurred during the period of MX-5 pumping
20 indicate that that pumping from MX-5 affected water
21 levels in CS-1, -2, and -3.
22 Q. Okay. I asked about CS-1, -3, and -4.
23 A. I'm sorry. One, three, and four.
24 Q. And there's been some questions about CSVM-5.

Page 631

1 Are you familiar with that monitor well?
2 A. Yes.
3 Q. Okay. And is it fair to say it's on the fan,
4 alluvial fan coming down from the Sheep Range?
5 A. Yes.
6 Q. And that's on the west side of Coyote Spring
7 Valley?
8 A. Yes.
9 Q. And I believe your testimony was that that
10 hydrograph does not show a signal from the pump test --
11 pumping test that Order 1169 allowed?
12 A. That's correct.
13 Q. Do you have an opinion on whether a large
14 quantity of water could be developed at that -- at that
15 well, or at that block area?
16 A. I don't have sufficient information to give an
17 opinion.
18 Q. Okay. Did you hear the testimony of
19 Ms. Braumiller yesterday for the Fish and Wildlife
20 Service?
21 A. Yes.
22 Q. And do you recall her answer and question about
23 CSVN-5 and it's hydrologic condition?
24 A. I remember her answering a question, but I

Page 632

1 don't remember what her answer was.
2 Q. All right. The -- the -- okay.
3 Could you turn to slide 45 from your
4 PowerPoint, please?
5 And my question has to do with the opinion that
6 you have regarding a flow path through the Glendale
7 Thrust in this area and from which Rogers and Blue
8 Point emanate. Okay? And is that a fair summation so
9 far of your view, that there is some flow that occurs
10 through this location, and that's where the Rogers and
11 Blue Point source water is?
12 A. Yes.
13 Q. Okay. Do you believe that there's significant
14 water going through that flow path in addition to the
15 water that is daylighting, if you will, at Rogers and
16 Blue Point?
17 A. No.
18 Q. Now, I'd like to ask you couple of questions
19 about the model results. Now, slide 65, and that's
20 just one I'm particularly excited about, "The Proper
21 Uses of Models."
22 So, I understand your testimony, I think, so,
23 I'll ask you to confirm it. Your model you feel isn't
24 appropriate for quantitative assessments or actual

Page 633

1 numbers in terms of calculations of drawdown at certain
2 locations; is that fair?
3 A. That is fair, yes.
4 Q. But, would you agree that it can be used to
5 test trends or general conceptual models that
6 hydrologist and hydrogeologists have about this area?
7 A. Oh, absolutely.
8 Q. Okay. And so my questions are going to be
9 along those lines. And specifically, if you turn to
10 page 73, I think it is in your slides, and there's
11 actually a couple of figures in your report.
12 But -- and you may have already said this, but,
13 the fact that -- well, let me slow down.
14 Slide 73, on the right panel is a projection of
15 simulated capture flow near Glendale from the Muddy
16 River, correct?
17 A. Yes. What it is shown here is our simulated
18 flow in the Muddy River at those locations.
19 Q. Okay.
20 A. The decline in flow is what happens.
21 Q. Yeah, the figure -- I wanted to ask about the
22 figure that's in your report, but I'm running short of
23 time, so I'm going to -- I'm just going to ask you a
24 couple questions about it.

Page 634

1 When we look at the simulations that are shown
2 in your report and the impact on specifically Muddy
3 River flows at Glendale, would you agree that
4 regardless of where the wells are located and the
5 pumping's located, portions of carbonate wells versus
6 alluvial wells which vary through the three
7 simulations, that really doesn't make much difference
8 where the well -- wells are located or where the
9 pumping's located, generally the same amount of
10 drawdown occurs at the Muddy River Springs area?
11 A. That's correct.
12 Q. And that -- is it fair to conclude from your
13 model that groundwater pumping in the Lower White River
14 Flow System ultimately captures Muddy River flow?
15 A. Yes.
16 Q. And also that that would, regardless of whether
17 it's carbonate, pumping or alluvial pumping, ultimately
18 in your model simulations river flow is captured?
19 A. Yes. I want to make sure that there's not a
20 misinterpretation that I'm saying that the capture is
21 on one, one basis. I don't think I can say that.
22 Q. Okay.
23 A. For example, along the Muddy River, not only
24 would flow be captured but it's evapotranspiration

Page 635

1 would decrease because of lower omanda take (phonetic),
2 so you capture it from a different source.
3 Q. Okay.
4 A. There's also a possibility of increasing inflow
5 I think a small amount into the lower -- the flow
6 system. I'm sorry. But that that's probably would be
7 insignificant.
8 Q. You're talking about potentially inducing flow
9 through boundaries or that sort of thing?
10 A. That's correct.
11 Q. And so, that's a relatively minor additional
12 capture?
13 A. Yes.
14 Q. And other than that, is it just river flow that
15 can be captured?
16 A. River flow and evapotranspiration.
17 Q. Now, is it possible to capture ET in the Muddy
18 River area without also capturing discharge from the
19 Muddy River itself?
20 A. Not in my opinion, no.
21 Q. Okay. One last question is, were you present
22 for the questions yesterday about the Big Muddy Spring
23 that Ms. Braumiller was answering?
24 A. I was.

Page 636

1 Q. Would you agree or disagree with this
2 statement? That the general hydrological consensus is
3 that the Big Muddy Spring is sourced from the same
4 sources as the Muddy River itself?
5 A. I don't think I have looked at that enough to
6 provide an opinion.
7 MR. TAGGERT: All right. Thank you.
8 HEARING OFFICER FAIRBANK: Up next, Vidler
9 Water Company and Lincoln County?
10
11 CROSS-EXAMINATION
12 BY MS. PETERSON:
13 Q. Good afternoon, Dr. Waddell. Karen Pederson
14 representing Lincoln County Water District and Vidler
15 Water Company.
16 A. Good afternoon.
17 Q. Good afternoon. And in your early testimony
18 this morning regarding Kane Springs Valley, I was under
19 the impression that you had read State Engineer's
20 Ruling 5712, which was the 2007 ruling from Kane
21 Springs.
22 A. I have read a small portion of that, yes.
23 Q. All right. And did you read the portion of the
24 ruling where the state engineer indicated that because

Page 637

1 of the water level changes between Kane Spring Valley,
2 Coyote Spring Valley, and the other portions of the
3 basins covered under Order 1169, that the marked
4 difference had supported the probability of a low
5 permeability structure or change in lithology between
6 Kane Spring Valley and the southern part of Coyote
7 Spring Valley? Do you remember that?
8 A. I remember reading that section, yes.
9 Q. All right. And in that same paragraph the
10 National Park Service at that time was wanting Kane
11 Spring Valley to be part of the Order 1169 proceedings,
12 do you recall that?
13 A. Yes.
14 Q. All right. And this -- the state engineer
15 determined based upon those findings that he made
16 regarding the elevation, the different elevations and
17 the probability of the low permeability structure
18 that -- and the quantity of water granted by the
19 applications, that he would not include Kane Spring
20 Valley in the Order 1169 proceedings. Do you recall
21 that?
22 A. Yes.
23 Q. And then directing your attention to slide 24.
24 You indicated based upon the recent CSAMT work,

Page 638

1 that you agreed that the two lines shown represent
2 different geology; is that correct?
3 A. That is correct.
4 Q. And that you didn't necessarily disagree that
5 there is a fault there? Do you recall that?
6 A. Yes.
7 Q. And you indicated that it was an impediment to
8 flow?
9 A. I indicated that I believed there are
10 impediments to flow in northern Coyote Spring Valley.
11 I don't think I testified that I thought that that
12 fault was an impediment to flow. It might be an
13 impediment to flow, but, I don't think the evidence
14 says that that particular fault is.
15 Q. Do you think that that could be the low
16 probability structure or the change in lithology that
17 the State Engineer referenced in his ruling 5712?
18 A. I don't know what the State Engineer was
19 thinking when he said that.
20 Q. Is there any evidence that you've provided in
21 this proceeding that shows that there is a change
22 from -- with regard to Kane Spring Valley within --
23 including it in Order 1169, that would change the
24 findings that the State Engineer made in Ruling 5712?

Page 639

1 A. I believe there is, yes.
2 Q. And what is that?
3 A. I think it's the observed water level response
4 in those two wells to pumping of MX-5 during the 1169
5 testing.
6 Q. Okay. And we'll get to that.
7 I did want to ask you a question about your
8 model. The model, did you simulate Kane Spring's
9 pumping in your model?
10 A. We did.
11 Q. And was it a thousand acre-feet?
12 A. I think so. But I would have to check. On the
13 order of that, yes.
14 Q. And there was drawdown at Muddy -- the Muddy
15 River Springs area from the Kane pumping?
16 A. I did not investigate that.
17 Q. So, your model simulated the Kane pumping, but
18 you did not investigate whether there was any impact or
19 drawdown at the Muddy River Springs area from the Kane
20 Spring's pumping?
21 A. We did not simulate that. Now, we could have
22 done that by running simulation with that pumping, and
23 then a second simulation absent that pumping, and then
24 comparing the two results, but we did not do that.

Page 640

1 Q. Did you do any simulations of Kane pumping for
2 drawdown at Rogers and Blue Point?
3 A. No.
4 Q. And then direct your attention to slide 23.
5 You just had some questions about what you -- what you
6 have showing here in your hydrograph.
7 The MX-5 test started November 2010, and ended
8 in March 2013; is that correct?
9 A. I don't recall the exact dates, but that sounds
10 correct.
11 Q. All right. And your yellow dots that you show
12 in your hydrograph here, they start approximately nine
13 months after the MX pumping starts?
14 A. Correct.
15 Q. And what is the explanation for that delay?
16 A. There was testimony yesterday by Ms. Braumiller
17 and then testimony by me today that we both believe
18 that there's a decrease in transmissivity as you move
19 further north in Coyote Spring Valley, and that lower
20 transmissivity delays the transmission of affects to
21 the location of these wells.
22 Q. And then you show water levels don't start
23 recovery until the beginning of 2015; is that correct?
24 A. I don't believe that's correct, no. It looks

Page 641

1 like it occurs -- starts to occur before that.
2 Q. And when do you have it occurring?
3 A. For KW-1, early in 2014. And for the other
4 well there's a gap in the data at that location. It
5 looks like based on a limited number of data points,
6 recovery was occurring later in 2014, but then changed
7 into a declining trend.
8 Q. Is there any reason why drawdown and recovery
9 responses would be different?
10 A. Yes.
11 Q. And what is that?
12 A. When pumping occurs for a period of time, you
13 get a response curve that shows faster drawdown and
14 slower recovery. It's because of the depletion in
15 amount of water stored in the aquifer, and the lower
16 gradient that exists during the recovery phase.
17 There was a paper prepared by Stan Leake of the
18 USGS in Arizona that evaluated this through a modeling
19 exercise and showed very significant affects. We saw
20 those same affects in our model of the aquifer in that
21 Black Mesa area in Arizona. Because it's a function at
22 how long the well is pumped in terms of the different
23 apparent behavior in the draw -- initial drawdown and
24 the late recovery responses.

Page 642

1 Q. Did you do any analysis of the affects of
2 pumping the Arrow Canyon wells?
3 A. No.
4 Q. And in Appendix B of your report you -- well,
5 on page 15 of your report you indicate there was
6 pumping and you included for Kane, Tule, and Virgin
7 River Valley. Do you recall that in your report?
8 A. I do.
9 Q. And in Appendix B, we don't see any rate of
10 pumping for Kane, Tule, and Virgin River Valley?
11 A. You're referring to the table that we provided?
12 Q. Yes.
13 A. That's correct. I believe it's correct. I
14 haven't -- reviewed that. But this table was intended
15 to provide with the changes in pumping for the three
16 scenarios. And the pumping in those other valleys was
17 maintained I believe at the rates that we used for
18 scenario one in our, approximately -- I think 2012
19 report on affects of pumping that had seven different
20 scenarios. But, it was not modified in this report,
21 and would not have impacted results from this report.
22 Q. The Kane -- the Kane, the Tule, and the Virgin
23 River Valley pumping would not have impacted the
24 results of your report?

Page 643

1 A. I'm sorry. The Kane would have, yes.
2 Q. Okay. But I thought you said you didn't -- you
3 I didn't know -- well, you simulated pumping, you
4 didn't know what the results were at the Muddy Springs
5 area? Okay.
6 A. Correct.
7 Q. All right. Is there any where in your report
8 where the affects of the Kane pumping are described or
9 quantified?
10 A. I think all we showed were on some maps of
11 drawdowns, that there was drawdown associated with the
12 pumping of the Kane Spring wells and that drawdown
13 extended into Coyote Spring Valley.
14 Q. But, of course, with your model, you wouldn't
15 be able to have any kind of precise quantification of
16 that that you could rely on; is that fair?
17 A. That's fair, yes.
18 Q. And if Kane should be included in the Order
19 1169 proceedings, shouldn't Dry Lake, Delamar,
20 Pahrnagat Valley, Cave, Garden, all the way up the
21 pipeline to Ely, shouldn't they all be included?
22 A. I would say at some point the line has to be
23 drawn. We have evidence from the responses in those
24 two wells to the MX-5 pumping, as well as the other

Page 644

1 evidence that I presented earlier today, that there's a
2 close association of Kane Spring Valley discharge with
3 Coyote Spring Valley. And it's my opinion that pumping
4 in the carbonate in Kane Spring Valley would effect
5 water levels in Coyote Spring Valley.
6 I have not investigated whether or not that
7 that would be -- if you could test it by pumping only
8 Kane Spring Valley and no other wells, then you would
9 detect that at the Muddy River Springs. My opinion is
10 that you wouldn't, but, that in combination with the
11 other pumping, you would see affects.
12 Q. And this -- that would be based on your model?
13 A. No.
14 Q. And if you could look at slide 27. You made
15 some statements there based on the water levels you
16 have at the bottom of the slide there. One of them you
17 said was a 3200-foot spring at the head of the valley.
18 Isn't it correct that that's sort of a spring in the
19 Delamar Mountain?
20 A. My recollection is -- it's for a spring that's
21 at the northeastern end of the valley.
22 Q. Which spring?
23 A. I couldn't tell you.
24 Q. And would you agree that the 1880-foot

Page 645

1 reference there to the water level at the southwest end
2 of the valley is for the carbonate monitoring well,
3 KMW-1?
4 A. It probably is, yes.
5 Q. And then one of the statements that you made in
6 your report which is Exhibit 2, I believe it was on
7 page 22, you indicate the model predicts that the
8 carbonate aquifer at the Kane Spring Valley and Coyote
9 Spring Valley are connected. Do you recall that
10 statement?
11 A. I don't remember it specifically, but, it
12 sounds like something that we would put in.
13 Q. And wouldn't you agree that connections such as
14 your indicating -- well, such as between Kane Spring
15 Valley and Coyote Spring Valley are built into models
16 by their authors?
17 A. Would you repeat that question?
18 Q. Would you agree that connections such as
19 between Kane Spring Valley and Coyote Spring Valley are
20 built into models by their authors?
21 A. I would agree. I don't know if you would say
22 that we were guided in how we built our framework model
23 based upon the work of Rick Page and the geologic maps
24 I had available for the area.

Page 646

1 MS. PETERSON: This you.
2 HEARING OFFICER FAIRBANK: Thank you. Next
3 City of North Las Vegas.
4
5 CROSS-EXAMINATION
6 BY MS. SCHROEDER:
7 Q. Hello. I'm Laura Schroeder. I represent the
8 City of North Las Vegas, and I am just going to ask you
9 for some clarifications.
10 And in doing that, I'm going to have you look
11 at your slide 40 in comparison to 41, because I'm
12 wanting to understand better how you explained the --
13 how the water -- the source waters get to those
14 springs. Because when I look at 41 in my simple lawyer
15 way, it looks like it's an easier path than when I'm
16 looking at 40 to get the water there.
17 That's the one question. Why are we trying the
18 more difficult path? And I'll let -- I'll start with
19 that one.
20 A. Thank you for giving me one at a time. Yeah,
21 there's a thrust fault to that area that has permanent
22 rocks in the -- up a thrust sheet that extends over a
23 large area in the mountains.
24 Q. So we're looking at 40?

Page 647

1 A. That is correct.
2 Q. The thrust? Okay.
3 A. And because of -- there is a cover of other
4 rocks on top of that thrust sheet. So, you don't see
5 it at the surface, but it's likely present at depth. I
6 would say we've got to drill a hole to confirm that.
7 It's consistent with the geology that has been mapped.
8 The cross-sections that are drawn, you know,
9 one of these sections goes through an area that's a
10 window in that thrust sheet so you see the underlying
11 rocks, the Jurassic and the Crustaceous rocks that are
12 colored in green. So, there's a hole there that the
13 water would have to flow around. The hole in the
14 carbonate thrust sheet, and this section just happens
15 to go through that hole. So, it's the opinion of the
16 geologist, Rick Page, that that thrust sheet is present
17 in other place. There's also mapping by Bill Bohannon
18 that indicates the same thing.
19 But a thrust sheet is not everywhere
20 continuous. So, it looks more complicated as a result
21 of that. The deeper pathway in carbonates is depicted
22 on the section. Shows it's, you know, more continuous.
23 But, the problem is getting flow through that is
24 because of its great depth, the permeability's low.

Page 648

1 And therefore, not much water can move through that
2 pathway, you know, to the fault, and then up that
3 fault. So, I don't believe that the lower carbonates
4 are transmitting a significant amount of water. But
5 that the younger thrust sheet is.
6 Q. And is that different than your report? Did
7 your report suggest that it went through the carbonate
8 and then this is now your opinion that it goes through
9 that sedimentary layer?
10 A. Which report are you referring to?
11 Q. Well, I don't have the page in front me, but
12 I -- my understanding was that the source waters for
13 those springs was the carbonate, but now I think you're
14 telling me it's the sedimentary layer?
15 A. No. The -- our geochemical report, which was
16 one of the appendices. Talks about water being in
17 contact not only with the carbonates, but also the
18 these younger sediments. Sedimentary rocks that have
19 the gypsum and other type minerals. So, geochemistry
20 is tell us that it's in contact with both.
21 Q. Okay. So, when -- so, your conclusion then is
22 that the source waters for those springs -- what is
23 that pathway then? What is that flow pathway?
24 A. It's eastward from the carbonate aquifer that

Page 649

1 is beneath California Wash in Garnet Valley, into the
2 upper thrust sheet and flowing towards the east. Along
3 the way it either is in contact with or mixes with
4 water that's been in contact with the younger sediment
5 and rocks. It reenters, if you will, or continues in
6 the carbonate until it reaches the Rogers Springs fault
7 in that area, and then has to go to discharge along
8 that fault line.
9 Q. Okay. Thank you. I have no other questions.
10 Oh, I do have one.
11 Another point that I didn't understand. You
12 talk about a lip, and I didn't understand where this
13 lip was. So, is that the thrust? Or where is this lip
14 that is preventing or influencing the flow?
15 A. What I had said was that in the Buffington
16 Pockets well, which went through carbonate rock, the
17 upper thrust of this upper thrust sheet.
18 Q. Uh-hum.
19 A. Into rocks below that. Carbonate's at that
20 location are not saturated. Groundwater is not up this
21 high. So, water's not passing from the carbonate
22 aquifer to the west into that upper thrust sheet or
23 flowing through that upper thrust sheet at that
24 location.

Page 650

1 Q. So, do we know any elevations for what that lip
2 would be at?
3 A. We would know at that location what the
4 elevation of the base of the carbonate thrust sheet is.
5 I don't know that offhand.
6 Q. Okay. And so would this be then a logical
7 monitoring place for us to look at in terms of further
8 testing?
9 A. No.
10 Q. No? I guess I would like to know -- because
11 you did talk about helping us with going into the
12 future or different monitoring places that would be
13 most helpful. What is your opinion about some places
14 that you would suggest the State Engineer look at or
15 that would be helpful?
16 A. I haven't looked at that. In order to come up
17 with a recommendation like that it'd be necessary to
18 take a much more detailed look at the geologic mapping
19 in that area and look at the elevations of the -- that
20 contact where it's exposed to try to get an idea --
21 better idea of the geometry of that thrust sheet and
22 come up with locations for it.
23 MS. SCHROEDER: Thank you, sir.
24 HEARING OFFICER FAIRBANK: Next is Center for

Page 651

1 Biologic Diversity.
2 MR. DONNELLY: Will you remind me how much time
3 we have?
4 HEARING OFFICER FAIRBANK: 16 minutes.
5 MR. DONNELLY: Thank you.
6
7 CROSS-EXAMINATION
8 BY MR. DONNELLY:
9 Q. Patrick Donnelly, Center for Biological
10 Diversity. Few questions about pumping.
11 Do you observe that carbonate levels are going
12 up -- carbonate water levels are going up in areas
13 distant from active pumping; is that accurate?
14 A. It is not only carbonate, but, water levels and
15 other lithologies as well of.
16 Q. Okay. And you have observed a downward trend
17 on carbonate levels within the the Lower White River
18 Flow System?
19 A. In almost all areas, yes.
20 Q. Does this imply that existing pumping is
21 causing declining carbonate aquifer levels in more of
22 wherever you're the closest?
23 A. That's my interpretation, yes.
24 Q. And you've observed a downward trend on spring

Page 652

1 discharge as well?
2 A. Yes.
3 Q. Does this imply that the state of declining
4 water levels will mean continued declines in spring
5 discharge at the status quo pumping level?
6 A. For at least some time, yes. I can't estimate
7 how long.
8 Q. Okay. Now, you stated that within 500 years,
9 according to simulations you ran, the system at pumping
10 levels of 14,500-acre-feet per year will not reach
11 equilibrium; is that correct?
12 A. Those were the results of the simulation.
13 Again, the 1169 pumping test demonstrated that the
14 pressure response is transmit much faster than
15 simulated by the model.
16 So, in reality it would be some period. It
17 would be faster than what the model simulated, but, I
18 can't tell you when.
19 Q. The drawdown would be faster?
20 A. I was trying to say that if equilibrium were to
21 be reached it would occur sooner --
22 Q. Oh.
23 A. -- than predicted by the model.
24 Q. Okay. But it will be hundreds of years most

Page 653

1 likely?
2 A. I don't want to --
3 Q. That's fine.
4 A. -- speculate on that.
5 Q. And your simulations showed that throughout
6 that period of time before reaching equilibrium spring
7 discharge will continue to decline at Rogers and Blue
8 Point and in the Muddy River Springs area?
9 A. That's what the simulation showed, yes.
10 Q. You ran your model at 14,500-acre-feet per
11 year, correct?
12 A. That's correct.
13 Q. And we just stated just a few minutes ago that
14 current pumping, which is 9318-acre-feet per year, at
15 least from 2015 to 2017 -- although it may be different
16 at this exact moment -- also shows decreases in spring
17 discharge?
18 A. That's correct.
19 Q. In your report you deined to provide an
20 estimated number of sustainable yield for reasons
21 you've explained, and instead said that it should be
22 somewhere below 14,500, correct?
23 A. That is correct.
24 Q. Given that what we just stated, that current

Page 654

1 pumping is showing current decreases at spring
2 discharge. Shouldn't it likely also be below current
3 pumping levels, 9318?
4 A. I would say that the recent data showed that
5 levels are continuing to decline. That would suggest
6 it ought to be less than the current amount, but, you
7 know, continued monitoring would be prudent.
8 Q. Indeed. We can all agree to that.
9 I want to switch tracks a bit.
10 In your role as a hydrologist, you have had an
11 opportunity to visit many desert springs?
12 A. I don't know what you mean by many. I have
13 toured the Muddy River Springs area.
14 Q. Okay.
15 A. I've been to Rogers and Blue Point Springs.
16 I've been to springs in the Death Valley System.
17 Q. You've been to a desert spring or two?
18 A. Yes.
19 Q. Okay. And have you observed not as a
20 biologist, but just as an observer of desert spring
21 systems wildlife in those springs? For instance, fish,
22 invertebrates, et cetera?
23 A. I have, yes.
24 Q. Have you been to Blue Point Spring?

Page 655

1 A. I have.
2 Q. So, in your report you mentioned that Blue
3 Point Spring is home to three endemic springsnails; is
4 that correct?
5 A. The report says that, that's something that
6 Gary Karst wrote.
7 Q. Okay. And the report also mentions that one of
8 those snails was recently petitioned for the Endangered
9 Species Act; is that correct?
10 A. I believe so, yes.
11 Q. In slide 32 to 33 of your presentation, you
12 have hydrographs for Blue Point and Rogers Springs. I
13 believe I have those numbers correct.
14 So, I'm wondering if you observe a trend in
15 spring discharge in these springs over the past several
16 years with regard to mean annual discharge, for
17 instance?
18 A. Rogers Springs, which I think -- it appears
19 that after approximately 2009, discharge rates are
20 lower, but, I'm hesitant to conclude that a discharge
21 has actually decreased. If you look at the period in
22 2008, there's a rapid decline in discharge that I think
23 is probably not due to actual changes in discharge,
24 but, maybe changes in the discharge system.

Page 656

1 I think you're probably familiar with the
2 spring monitoring that took place in the Muddy River
3 Springs area in this year -- through the years with
4 those gages, and there had been -- put up slide 33,
5 which shows Blue Point Spring, and there's a gap in the
6 data, which I understand is during a period of
7 reconstruction of measuring apparatus because of the
8 leakage around that.
9 So, it does look like things may have --
10 discharge rates may have gone down, but there are other
11 factors that need to be checked out, and I have not
12 done that.
13 Q. Okay. But, without assigning causation, we can
14 say that discharge right now is below the historic
15 average?
16 A. I would say that measurements are.
17 Q. Measurements. Thank you. Yes. Measuring
18 desert springs is a tricky art perhaps.
19 In your report you say that reduction or
20 cessation of spring discharge on federal lands would
21 have an adverse impact on sensitive habitat and
22 species; is that correct?
23 A. I believe the report says that. It sounds like
24 something that Gary Karst wrote.

Page 657

1 Q. So, if spring discharge is below historic norms
2 here as you attested just moments ago over the model
3 simulation, spring discharge will continue to decline
4 at Blue Point in spring, based on the piece that you
5 said Mr. Karst wrote, we can expect impacts to biota at
6 Blue Point Spring?
7 A. I'm not a biologist, and I don't know what the
8 sensitivity of the biota are at discharge. So, I won't
9 answer.
10 Q. Okay. But, your report does say that reduction
11 of spring discharge would have adverse impact on the
12 species?
13 A. It does say that. And what it doesn't state,
14 just so that there's clarification, is how much
15 discharge it's anticipating to occur.
16 Q. Sure. Okay.
17 MR. DONNELLY: I have no more questions, thank
18 you.
19 HEARING OFFICER FAIRBANK: Next would be
20 Georgia Pacific, Republic.
21 MR. HARRISON: No questions.
22 HEARING OFFICER FAIRBANK: Okay. Same,
23 questions? Muddy Valley Irrigation Company.
24

Page 658

1 CROSS-EXAMINATION
2 BY MR. KING:
3 Q. Good afternoon, Dr. Waddell. I'm Steve king.
4 I represent Muddy Valley Irrigation Company.
5 A. Good afternoon.
6 Q. Several questions. I believe you testified
7 that you're aware of a published response, Fourth Turn
8 Report's yet to be released noted, USGS. I believe it
9 was titled the Amargosa Tracer Site Report; is that
10 correct?
11 A. I didn't say that. I don't know that title at
12 all.
13 Q. I'm just asking the questions from my notes,
14 sir. But associated with Amargosa Tracer Site Report
15 on USGS?
16 A. What I had talked about was -- and let me ask
17 you a question. Are you referring to the pumping that
18 I was describing that happened in Yucca Flat with PR61
19 number two?
20 Q. I don't have an answer for -- let me perhaps
21 ask a better question.
22 I believe that you stated that you felt that
23 the Fourth reports by the USGS would show a pumping
24 response further west, perhaps to the Amargosa or Ash

Page 659

1 Springs area from pumping within the Lower White River
2 Flow System, would that be inaccurate?
3 A. No. I did discuss pumping that took place
4 during a tracer test at ER61 number two. And that
5 pumping responses were observed in that area extending
6 to the south and then to the southwest. The report
7 that I referred to has not yet received direct approval
8 from USGS. So, I don't know if it will be coming out,
9 but, I assume that it will.
10 And that work was documenting pressure
11 responses from that pumping extended to the Amargosa
12 tracer site. I did not say that it concluded, that
13 those responses extended to the Ash Meadows area, and
14 it's certainly not from pumping in the Lower White
15 River System.
16 Q. Very good. In fact, that explanation is the
17 answer to my next question, if you knew or were aware
18 of a possible release date for that report to the
19 public?
20 A. I do not.
21 Q. Thank you.
22 HEARING OFFICER FAIRBANK: Nevada Energy.
23 ///
24 ///

Page 660

1 CROSS-EXAMINATION
2 BY MS. CAVIGLIA:
3 Q. Good afternoon, Dr. Waddell. My name is
4 Justina Caviglia, and I represent Nevada Energy. I
5 believe you stated that you estimate there's
6 approximately 2500-acre-feet of groundwater that is
7 being discharged to Lake Mead and the Colorado River;
8 is that correct?
9 A. I don't recall making that statement, no.
10 Q. Okay. I thought that that's what that stated.
11 Was it groundwater discharge, or was it surface water
12 discharge that is making its way to Lake Mead?
13 A. I do not think I talked about any amount
14 discharging to Lake Mead. What I did talk about was
15 that in the past decade or so, there were estimates of
16 leakage or recharge into the flow system. And when I
17 asked where that water was going, it wasn't going to
18 the Muddy River Springs area. The response was it's
19 discharging into the Colorado River or to Lake Mead.
20 But I don't recall stating an amount.
21 Q. Okay. Was there anything in the model that
22 estimated that --
23 A. No.
24 Q. -- by chance?

Page 661

1 If there was water that was being discharged --
2 groundwater into that area, could that be captures by
3 pumping without affecting the Muddy River flows?
4 A. I believe it would be possible to put a well
5 close to the lake and pump it and capture water from
6 the lake. The permeability between the are of Rogers
7 and Blue Point Spring and the lake are fairly low
8 permeability as sediments. There are salt deposits in
9 that area. Which indicates there's not a lot
10 groundwater movement. So, it's pretty low prem, but
11 dry. If you put a well there, I didn't think you'll be
12 capturing water out the carbonate system.
13 MS. CAVIGLIA: Thank you. I have no further
14 questions.
15 HEARING OFFICER FAIRBANK: We'll go ahead and
16 open it up to questions from the staff of Division of
17 Water Resources and the State Engineer.
18 MS. BARNES: Michelle Barnes, for the record.
19
20 EXAMINATION
21 BY MS. BARNES:
22 Q. I was wondering for the plot shown on slide 37,
23 use to generate this from Appendix A, table three of
24 the report. Do you have the standard deviations for that

Page 662

1 data?
2 A. I'm sorry, do I have what?
3 Q. The standard deviations from the laboratory
4 analysis?
5 A. I don't know that I do.
6 Q. Okay. Then I'm a little unclear on I guess
7 your perception of recharge. You had mentioned at the
8 beginning of your talk that the pest analysis shows --
9 depending upon the current variable input, that there
10 may be little impact on recharge within a model. But
11 then you talked about changing your Tetra Tech Model to
12 include transient recharge. Can you clarify for me?
13 A. Yes. What I was -- the point I was trying to
14 make is that typically it is a lot of uncertainty in
15 recharge rates, estimates of recharge rates. And the
16 question that I was trying to answer with respect to
17 that particular model was does that uncertainty effect
18 decisions based on or made from modeling results?
19 And so, I looked at the sensitivity of modeling
20 results to changing our estimate of recharge rate and
21 found out that the management decisions wouldn't
22 change.
23 That's a separate question than putting
24 transient recharge into a model to allow you to better

Page 663

1 match the observed changes in water levels.
2 You know, everybody who talks from the
3 hydrographs is talking about this recharge bump 2014,
4 2005. And without putting a mechanism in the model to
5 allow that to occur in simulations, we really can't
6 match those. And so improve the calibration process to
7 include that mechanism. Those were the changes I
8 was -- one of the changes I was talking about
9 implementing.
10 MS. BARNES: Thank you.
11 MS. COOPER: Christie Cooper for the record.
12
13 EXAMINATION
14 BY MS. COOPER:
15 Q. Just for some clarification on your opinion, do
16 you think that by using more recent total pumpage
17 values -- which I'm not going to throw out a number but
18 would just be less in your simulation -- would that
19 change the outcome of your simulation?
20 A. I missed part of your question. If we used
21 updated pumping values would that change the output?
22 Q. Yes.
23 A. Yes, it would.
24 Q. Can you elaborate onto how?

Page 664

1 A. Well, perhaps I answered to hastily. When we
2 did the simulations that were recorded in our report
3 earlier this year, we updated our pumping rates based
4 upon data on the State Engineer's website. So, those
5 were updated from our 2012 modeling data sets.
6 So, I should have answered we've already done
7 that. Going forward, if we change the numbers, the
8 pumping, yeah, it would change the results.
9 But, you bring up a point, that, you know, the
10 simulation or the model at the time we started those
11 three scenarios was based upon lower pumping rate and
12 then that pumping rate was bumped up to the 14, 5.
13 So, you know, part of that bump-up is why you
14 started seeing -- I mean, I think there are responses
15 that would be occurring regardless of whether we did
16 the increase in discharge rates. But, by increasing
17 that, it increased the amount predicted change.
18 MS. COOPER: Thank you.
19
20 EXAMINATION
21 BY MR. BENEDICT:
22 Q. I'm sorry clarify that a little bit further.
23 So, if you were to use pumpage, which I think now is
24 more like 10,000 acre-feet, then the captures also

Page 665

1 would be proportionately less?
2 A. To make sure I understand the question, if
3 instead of using 14, 5 we used something around 10,000?
4 Q. Yeah.
5 A. Yes, it would decrease the simulate effect.
6 MR. BENEDICT: I'm sorry. John Benedict. For
7 the record. I had a couple questions.
8 Q. So, early on in your discussion you suggested
9 that seasonal responses could be seen in the record and
10 ascribed them as I think to the Muddy River area
11 predominantly, and I just wanted you to elaborate on
12 that. When it -- whether I misheard that, or whether
13 that was during a period of time when most the pumping
14 occurred there. I think you also ascribed it both
15 pumping and ET. So, I want -- do you want to may be
16 talk a little bit about that seasonal response, and
17 it's relationship to pumpage and ET?
18 A. Okay. To ask for further clarification, I had
19 mentioned looking at discharge records at one of the
20 Muddy River gages. We had went back to about 1910. Is
21 that what your question's about?
22 Q. I don't that. I think what I heard was I think
23 you suggested that the seasonal responses and water
24 levels in monitoring wells or --

Page 666

1 A. Okay.
2 Q. -- groundwater wells showed seasonality and you
3 seemed to imply that it was vectored towards Muddy
4 River Springs area, but, I may have misinterpreted
5 that. So, I just wanted to get your thoughts on the
6 cause and effect I guess for that seasonal variation,
7 whether it's a function of some specific pumpage within
8 the region or any and all pumping?
9 A. Okay. I was looking at a hydrograph that went
10 further -- furthest back in time, and I think it was
11 MX-4. And we saw seasonal affects in that well. I did
12 not go see if there was seasonal pumping occurring in
13 Garnet Valley at that time. But because of the
14 proximity to Muddy River Springs area, I guess I would
15 say I interpreted that to be driven by pumping and ET
16 in the Muddy River Springs area. But you raise a good
17 point. If seasonal pumping were occurring in Garnet
18 Valley, that could be an input as well.
19 Q. Okay. I'm curious -- next to -- kind of
20 shifting gears to Black Mountain area and talking about
21 temperature, as I recall, Blue Point and Rogers are
22 warmer springs; is that correct?
23 A. That's my understanding, yes.
24 Q. Could that be used as a tracer to talk about or

Page 667

1 describe or maybe refine whether the aquifer system
2 that drive that water was from the deeper carbonate or
3 from a carbonate that's thrust in there? I don't
4 know exactly what those depths are, but I'm curious
5 about what pathway would cause that water to be what I
6 think is probably warmer than Garnet Valley California
7 Wash water?
8 A. I have not looked at it, the temperatures in
9 comparison to Garnet, California. It certainly could
10 be useful information. You know, if what you say is
11 correct, that it's warmer than what we see in
12 California and Garnet Valley, that would certainly be
13 something to take a careful look at.
14 Q. And my last question, in terms of discharge in
15 the Black Mountain area, do you have an opinion on the
16 amount of discharge that exists within that basin? I
17 know we've got discharge measurements on the springs.
18 Do you -- do you or does your model simulate simply
19 that discharge as being another discharge in the Black
20 Mountain area? Or do have you an opinion on that?
21 A. The model is set up to calculate from the
22 modeling result what the flux is into the lake. But,
23 that calculated number is going to be very dependent
24 upon what the assumed permeability was, sediments and

Page 668

1 rocks and near the lake are. And that's an area -- I
2 mean, I would say that's uncertain. We know that the
3 permeability is low enough that we see a barrier
4 effect. In other words, the springs are at the
5 elevation you are because the water can't flow out the
6 base of the carbonate, at least in my interpretation,
7 into the sediments.
8 And so, we're probably looking at a similar
9 gradient within the sediments and rocks between the
10 fault line and the lake. And it's probably something
11 similar to what the surface to base gradient is. But,
12 I don't think that there is a large volume of water
13 moving in that area. But, you know, the model does
14 calculate it. I just don't know what it is, off my
15 hand.
16 MR. BENETICT: Thank you.
17
18 EXAMINATION
19 BY MR. SULLIVAN:
20 Q. Good afternoon, Dr. Waddell. My name's
21 Adam Sullivan.
22 A. Good afternoon.
23 Q. I want your concluding recommendations. Is
24 that the State Engineer employ regional model to guide

Page 669

1 management decisions that you provided in your
2 slideshow. And you're also really careful to point out
3 the appropriate uses and limitations of a model. And
4 in your testimony you generally put a lot of weight on
5 the actual data over model simulations.
6 So, my question is, given the amount of
7 hydrologic and geologic data that we have for this
8 region that continues to be collected, could you expand
9 on that recommendation, or explain why what you think a
10 model would give us, how that would improve our
11 understanding of the system?
12 A. Excuse me -- I'd be glad to.
13 First, the statement that was part of my
14 presentation. The use of a model was the Tetra Tech
15 2012 model as it currently stands, that clearly needs
16 some additional work to improve it based upon -- I
17 mean, what we learned through the Order 1169 test, as
18 well as just a -- modelers, or at least modelers I
19 respect always have an uneasy feeling. You know, are
20 we good enough at this point, and even when I was
21 doing -- you know, finishing up that model I was like
22 this could be improved. We knew that from our
23 calibration.
24 But, I think that additional work can improve

Page 670

1 the calibration. We've gotten good comments from
2 reviewers. We've learned a lot in terms of data.
3 The -- what the data can't tell you without having a
4 calculation tool is what's going to happen longer term.
5 It tells you what's happening now. It helps you set
6 the framework for constraining the model. But, if
7 we're making predictions with it, we'd be done in the
8 context of not obeying, say, throughout the domain that
9 you're interested in, mass balance constraints versus
10 law, these types of things the model does provide to
11 you. So, I do think that models are -- can be quite
12 useful for, you know, helping guide management
13 decisions. But, they have to be a model that it -- it
14 has to be a model that you're comfortable with its
15 performance, that it's a good representation of the
16 system, that it matches observations better than my
17 existing model does.
18 There will be uncertainty in the model. I
19 mean, we cannot know everything. And if you're trying
20 to make management decisions based upon your existing
21 database, you're going to be making errors in that as
22 well. Because you can't know everything.
23 But, the model puts it in the construct that
24 obeys the flow loss, which are important constraints.

Page 671

1 It also tells you what you don't know, and it gives you
2 a tool that you can look at the affects of not knowing
3 things that -- otherwise, we're just looking at data,
4 my gut tells me this or my gut, you know? It's a tool.
5 Not to be, you know, viewed as a tool. They can be
6 very useful.
7 MR. SULLIVAN: Thank you.
8 HEARING OFFICER FAIRBANK: Okay. So, we've
9 been going for close to two hours, so, let's go ahead
10 and take a break, and we'll reconvene at 3:00. And
11 we'll open it up for some additional questions by
12 participants. Thank you.
13 (Recess.)
14 HEARING OFFICER FAIRBANK: Let's go ahead and
15 go back on the record. All right.
16 All right. So, what we're going to go ahead
17 and is we'll open it back up for additional questions
18 by the participants, and we're going to go ahead and
19 give everyone seven minutes. Get my chair situated so
20 I can keep track.
21 All right. And we'll go ahead and start again,
22 back with Coyote Spring Investments.
23 MR. HERREMA: Thank you.
24 ///

Page 672

1 RE CROSS EXAMINATION
2 BY MR. HERREMA:
3 Q. Brad Herrema for CSI. Dr. Waddell, just a few
4 more questions.
5 First, do you recall during your exchange with
6 Mr. Donnelly, you've indicated that something he quoted
7 sounded like something that Gary Karst wrote?
8 A. I remember -- excuse me.
9 Q. You responded a couple times I think. Okay?
10 Do you recall which particular documents or writings
11 Mr. Donnelly was referring to?
12 A. I don't remember exactly what he was saying,
13 but, I think it was probably our report prediction if
14 effects of changing special distribution pumping in the
15 Lower White River Flow System.
16 Q. Who is Gary Karst?
17 A. Gary Karst is an employee of the National Park
18 Service who is stationed in Las Vegas and has been
19 working for the Park Service. So, these particular
20 questions.
21 Q. And which particular portions of this report
22 did he write?
23 A. Sorry to be eating up your time.
24 He wrote it looks like a large part of section

Page 673

1 1.0, and at least parts of section 1.1, the setting.
2 Looks like he wrote section 1.2. Or at least parts of
3 it. And then section 3.2.
4 Q. Okay. So is the work in those sections, are
5 those your conclusions or are they Mr. Karst's
6 conclusions?
7 A. Those are my conclusions.
8 Q. But, Mr. Karst did them for you?
9 A. I answered on top of you.
10 Q. Whose work is this? I'm sorry. Go ahead.
11 A. I was going to say would you restate your
12 question?
13 Q. What's written in those particular sections,
14 section 1.0, 1.1, 1.2, 3.2 of your July 3rd, 2019,
15 report, are those sections your conclusions or
16 Mr. Karst's conclusions?
17 A. I don't know if I would classify those as
18 conclusions as opposed to statements, kind of setting
19 the background. They don't appear to be conclusions
20 from the work that I did.
21 Q. Okay. In regard to the recharge from Sheep
22 Range, have you done any analysis of that recharge?
23 Recharge from the Sheep Range to the Coyote Spring
24 Valley?

Page 674

1 A. We did back in -- in support of the 2012 model,
2 but, we did not revisit those estimates.
3 Q. So, you haven't done any work on Sheep Range
4 recharge since 2012 or earlier?
5 A. We have not.
6 Q. Okay. In response to a question from
7 Mr. Taggart, you indicated that groundwater pumping in
8 the Lower White River Flow System captures Muddy River
9 flow. Do you recall that?
10 A. Yes.
11 Q. What is the mechanism for that capture? Does
12 the pumping pull water out of the river toward the
13 wells?
14 A. It lowers the water level in the groundwater
15 system beneath the river or adjacent to the river which
16 pulls water from the river. It doesn't pull it to the
17 well. It's, you know, contributing to the pumping,
18 but, it reduces the flow in the river.
19 Q. Changes the gradient between the groundwater
20 and the river?
21 A. That's correct.
22 Q. Okay. Groundwater pumping affects other
23 discharges from the lower labor of closest to them
24 besides river flow; isn't that correct? Such as

Page 675

1 evapotranspiration?
2 A. Yes.
3 Q. And even groundwater subflow?
4 A. It will effect groundwater subflow, yes.
5 Q. If I could turn your attention to slide 54?
6 Where is the station -- the weather stations located
7 from which this data comes from?
8 A. I don't know where the station or stations are.
9 These are data downloaded from the website.
10 Q. Do you know which website?
11 A. It's listed at the bottom. Western Regional
12 Climate Center, 2015, and there's a link at the right
13 end.
14 Q. Is this data specific to the Lower White River
15 Flow System?
16 A. No.
17 Q. You don't know exactly where it's specific to?
18 A. I do not.
19 MR. HERREMA: Thank you.
20 HEARING OFFICER FAIRBANK: Thank you. United
21 States Fish and Wildlife Service. And the Moapa --
22 MS. BALDWIN: Tribe.
23 RE CROSS EXAMINATION
24 BY MS. BALDWIN:

Page 676

1 Q. Hello, again.
2 A. Hello.
3 Q. Since we're on this slide, which is slide 54, I
4 do have a question about this one, as well.
5 This -- if I'm not mistaken this graph is taken
6 from the USGS PowerPoint that was Appendix A to your
7 rebuttal?
8 A. That's correct.
9 Q. And it was entitled, "What Drought? Water
10 levels on the rise in Southern Nevada.?"
11 A. That's correct.
12 Q. Okay.
13 Is it correct that when the USGS produced this
14 chart, it was in the context of trying to define a
15 steady state for the Death Valley Flow System?
16 A. No, I don't believe it was.
17 Q. I'm looking -- unfortunately, the Appendix does
18 not have page numbers, but, I'm looking at a slide
19 entitled, "How do we define steady state?" Then it
20 says, "Steady State. Water levels do not change over a
21 period of time. What is that period of time?
22 DVRFS" -- which is Death Valley -- "Assume steady state
23 is on a century scale." And then it appears to
24 reproduce that same chart; would you agree?

Page 677

1 A. That's the same presentation, yes.
2 Q. Yes, okay. Do you have any opinions on whether
3 there's a similar century scale steady state in the
4 Lower White River Flow System?
5 A. I think the first question is, is there a
6 century steady state?
7 Q. Yes.
8 A. The -- provide more information on your first
9 question about was this done to develop a steady state
10 model. This was done to develop -- help in the
11 development of the transient model of what's called DV3
12 or Death Valley three. And the concept is that there
13 is an approximate steady state. It's not absolute.
14 You know, you're trying to develop a model which has a
15 good representation of average conditions,
16 predevelopment, and to use that for doing transient
17 calibration simulations from that point on. And
18 there's a process of going back and forth between
19 calibrating the -- and quote "steady state" in
20 transient.
21 Q. So, these are -- it's an approximation, and
22 therefore, up for debate, subject to new information?
23 A. Certainly.
24 Q. Do you have any opinion on whether groundwater

Page 678

1 levels could be responding to previous climate
2 variability in that there's some sort of time lag
3 between when the hydrographs respond to wet conditions
4 and dry conditions?
5 A. Oh, I think there is. That was the reason I
6 started off by describing what was going on up there
7 near Mesa, which is known to be a new charge area and
8 showing the quick response that occur there. And then
9 moving to other areas that have slower responses, and
10 it's due to the time it takes for things to work their
11 way through the system.
12 A part of the recharge model -- we haven't
13 talked about SeriesSEE today. Thank you.
14 Q. And we're not going to.
15 A. Good. There is a recharge capability within
16 SeriesSEE that has two components to it. One of those
17 is the response to wet precipitation that you can put
18 in. And then the other is a long-term drainage from
19 the system, such as from springs that are a long
20 distance away from the recharge areas. And so, the
21 concept is that the -- or the simplification is that
22 the discharge in the spring areas doesn't change
23 quickly to changes in what goes on in the recharge
24 area.

Page 679

1 Q. I think I have at least one other question.
2 Do you agree that a decline in water levels is
3 not necessarily drawdown?
4 A. It certainly can be other causes, yes.
5 Q. And in your opinion, what would water level
6 trends look like in the Lower White River Flow System
7 in the absence of pumping?
8 A. I think water levels would be rising.
9 Q. Why?
10 A. Because there's been a change from drier
11 conditions to wetter conditions, and the system will
12 respond to that.
13 Q. Okay. I'm looking now at slide 74, where you
14 talk about the effect of moving water rights between
15 alluvial and carbonate wells.
16 You propose that areas should demonstrate that
17 they are -- there should be a demonstration in an area
18 is not connected with the Muddy River Springs area
19 prior to permitting long-term use of the water. That's
20 per -- that's an accurate statement of your opinion?
21 It's the second bullet point.
22 A. Just for you reading to make it short. I wrote
23 it the way I intended to, yes.
24 Q. What kind of test -- what would that test look

Page 680

1 like and what kind of result would you expect to see to
2 demonstrate no connection?
3 A. What I would recommend is that there be a
4 pumping test that has a different pumping schedule than
5 the seasonal pumping schedule that occurs elsewhere so
6 that you have a separate signal to detect. That there
7 be good monitoring in the vicinity of the pump well,
8 certainly between the area of the well and the
9 well-connected parts of Coyote Spring Valley. If your
10 talking Coyote Spring Valley.
11 And if the -- if that pumping shows a quick
12 response in those monitoring wells in areas that are
13 well-connected, you basically established that there is
14 connection, and you can terminate the test and expense
15 associated with that.
16 Otherwise, if it takes -- you know, in talking
17 about in terms of several months, I think what
18 Braumiller had suggested was a several month long test.
19 Once you see a responses in areas that you know are
20 connected, you basically got information that you need.
21 But, additional testing would be required. Longer term
22 pumping would be required if the response isn't seen
23 until you're satisfied that it's not connected. There
24 may be, you know, three or so. Kind of thing that a

Page 681

1 calibrated flow model would help you answer.
2 MS. BALDWIN: Thank you.
3 HEARING OFFICER FAIRBANK: Southern Nevada
4 Water Authority, Las Vegas Valley Water District.
5
6 RE CROSS EXAMINATION
7 BY MR. TAGGART:
8 Q. Good afternoon.
9 A. Good afternoon.
10 Q. We're getting there. Just a couple of follow
11 up questions.
12 And your model simulated 14,000-acre-feet of
13 pumping. Some questions were presented to you about
14 what if your model had simulated pumping at levels that
15 are more like what's occurring now as opposed to what
16 was occurring during the pump test. And I -- and so my
17 question is, even at lower pumping volumes -- and I
18 think the hypothetical was 14,000 instead of that being
19 10,000 -- there would still be captured stream flow
20 from -- demonstrated in your model; is that a air
21 statement?
22 A. Yes.
23 Q. And the -- and the bulk of that pumping would
24 be capturing Muddy River stream flow?

Page 682

1 A. I'd have to look at how much of the model
2 simulated stream flow versus ET.
3 Q. Uh-hum.
4 A. So, I would know.
5 Q. Okay. Oh, I didn't mean --
6 A. I can't answer.
7 Q. But in the long term -- and in the long term,
8 would your answer be different, like at equilibrium?
9 Strike that. And I do that because I don't have a lot
10 of time.
11 So, could you go to slide number 56?
12 Okay. And your last two bullets there indicate
13 the conditions at a new equilibrium condition or before
14 a new equilibrium condition. And so, is it -- is it
15 your testimony that currently we are not in an
16 equilibrium condition, and therefore, the last bullet
17 on your slide here is the condition we're in?
18 A. No. The last bullet is intended to address the
19 situation where new equilibrium can't be obtained.
20 Q. Okay.
21 A. So, that, you know, your rate of capture isn't
22 sufficient to sustain the pumping.
23 Q. Okay.
24 A. So, eventually it will stop capture.

Page 683

1 Q. Okay. But the bullet before that, at an
2 equilibrium condition, all pumping would be capturing
3 discharge with an equal relationship. Every drop of
4 pumping would be capturing river flow at equilibrium?
5 A. I would say not -- you asked a similar question
6 before. Not -- I can't say every drop because you're
7 going to be increasing flow into the system through the
8 boundaries, and part of what you're capturing is ET.
9 But, it's primarily going to be capturing ET and stream
10 flow.
11 Q. Okay. Now, if you could look in the -- at the
12 bind I put on your dais there. And this is from SNWA
13 Exhibit 9, the 2000 SNWA rebuttal report. And there's
14 a figure 3-3 there. And I want to ask you a few
15 questions about that.
16 During your testimony you talked about the
17 current trends in water levels, and my question is
18 going to be whether this information here is consistent
19 with your own view.
20 So, in the top panel is CSDM1, which is Coyote
21 Spring Valley Monitoring Well Number 1. And you see on
22 the right-hand side there, there's a -- there's a
23 trendline.
24 A. Yes.

Page 684

1 Q. Is that trendline consistent with what you
2 found in Coyote Spring Valley at monitor wells as well?
3 A. I would say, yes.
4 Q. Okay. And I don't want to test you here, but,
5 is it generally your testimony that in Coyote Spring
6 Valley, Garnet Valley, which is shown in the second
7 panel, and then below that California Wash, that this
8 is the type of declining trend we're seeing currently
9 in water levels in those three areas?
10 A. Yes.
11 Q. Okay. Now, what I'd look you to look at is, is
12 there's a single piece of paper there that I've given
13 to you which is SNWA Exhibit 81. Do you see that?
14 A. I do.
15 Q. Have you -- have you reviewed hydrograph of
16 EH-4 at all in preparation for your testimony?
17 A. Yes.
18 Q. Okay. So at the -- and EH-4 is -- is it fair
19 to say it's a monitor well that monitors water levels
20 close to the Warm Spring West area and is sometimes
21 used by folks as an index well for changes to stream
22 flow related to changes in water level?
23 A. I agree.
24 Q. Okay. So, what I -- what I want to ask you

Page 685

1 about is, is the trend, the current trend in EH-4 and
2 given your testimony, would you be expecting based on
3 precipitation trends for water levels to -- if that was
4 the exclusive factor, water levels would be rising,
5 currently, right? And when I ask you that, you can
6 look at the second panel from the bottom, which shows
7 precipitation. Shows in 2017 a little bit more than a
8 70 percent of the average. In 2019 a major -- or not a
9 major. I'll just say a 150 percent precip events.
10 Would you normally expect those kind of precipitation
11 events to effect a hydrograph?
12 A. I don't know if they're sufficient in magnitude
13 to effect it. My concept of recharge is similar to Tim
14 Mayer's. It takes a certain amount of water to match
15 the other needs for the soil, and that until you
16 overcome that, you're not going to get a recharge.
17 Q. Okay.
18 A. That's general sense.
19 Q. Do you have any reason to believe that the
20 declining trend you saw in other areas of the Lower
21 Flow System is not also occurring at EH-4?
22 A. I have no reason to believe that.
23 Q. So, the same. You think your opinion -- you're
24 viewing the same condition as -- existing at EH-4 as

Page 686

1 the rest of the area?
2 A. That's correct.
3 Q. All right. Now, there was some questions about
4 modeling, and I appreciate you're -- you are a modeler
5 and modelers love to model. The -- but, the question
6 that I have for you is, at this time, do you think
7 there's sufficient empirical data at hand for the State
8 Engineer to use to limit permanent other water uses at
9 this time instead of waiting for a new calibrated
10 groundwater model? Do you understand my question?
11 A. I understand your question.
12 Q. Well, I'm -- and I just -- sometimes we feel
13 constrained to wait for more tools to make decisions.
14 But, given that we had a pump test 1169 pump being
15 tested 1169, and all the talk about all this evidence,
16 is that sufficient evidence for the State Engineer to
17 use to make decisions?
18 A. Well, I think it is. The reason I was
19 hesitating is it depends on what the nature of that
20 decision is.
21 If it is to not allow additional pumping, I
22 think the information is sufficient. If it's to decide
23 upon a rate at a lower rate that would be a safe yield,
24 I don't think it is sufficient.

Page 687

1 Q. Okay.
2 A. Depends what the answer is, the question you
3 are trying to answer.
4 Q. All right. Thank you very much.
5 HEARING OFFICER FAIRBANK: Moapa Valley Water
6 District.
7 RE CROSS EXAMINATION
8 BY MR. MORRISON:
9 Q. Good afternoon, Dr. Waddell. I'm Greg Morison
10 with Moapa Valley Water District. I know it's the end
11 of what's certainly been a very long day, so I have
12 what I think are just a couple of softballs for you.
13 We'll see.
14 A little bit earlier in your cross-examination
15 you were asked by Ms. Peterson from Lincoln/Vidler
16 about Ruling 5712. Do you recall that interaction?
17 A. I do.
18 Q. I just want to follow up a little bit on that.
19 In your recollection of Ruling 5712, do you remember
20 whether the State Engineer found evidence of a
21 hydrologic connection between Kane Springs Valley and
22 Coyote Springs Valley?
23 A. That's my recollection, yes.
24 Q. If I told you that the exact words were that

Page 688

1 evidence indicates a strong hydrologic connection,
2 would you have any reason to doubt that those are
3 accurate words?
4 A. No.
5 Q. All right.
6 In the bi-op, Fish and Wildlife Services --
7 A. Let me --
8 Q. Sorry.
9 A. His definition of hydrologic connection or
10 strong might be different than mine. But, it's my
11 belief, my interpretation that there is a hydrologic
12 connection. You know, I think there's connections and
13 not the strong connection I showed for other wells.
14 Strong isn't the word I used. But.
15 Q. Okay. Thanks.
16 On the bi-op that led up to Rule 5712, Didn't
17 that bi-op evaluate a thousand acre-feet of pumping; is
18 that accurate?
19 A. I don't recall.
20 Q. Okay. Did you know if any further biological
21 opinions have been requested or issued regarding
22 Lincoln/Vidler applications or Kane Springs Valley
23 pumping?
24 A. No, I do not.

Page 689

1 MR. MORRISON: All right. That's all I have.
2 Thank you.
3 HEARING OFFICER FAIRBANK: Vidler Water.
4
5 RE CROSS-EXAMINATION
6 BY MS. PETERSON:
7 Q. Hi, Dr. Waddell. Just a couple.
8 Do you recall the -- sorry. Karen Peterson
9 representing Lincoln County Water District and Vidler
10 Water Company.
11 We had a discussion with regard to slide 23
12 about drawdown and recovery. Do you remember that?
13 A. Yes.
14 Q. And you referenced Mr. Leake in I believe a
15 paper that he had prepared?
16 A. I remember that. I messed up my presentation
17 +though, so.
18 Q. Yeah, we don't need the slide?
19 A. Okay.
20 Q. I'm just asking you if you remember that. Do
21 you -- we can't find reference. So, were wondering if
22 you could provide some more information about that?
23 Like the paper, or the journal?
24 A. It was a USGS publication. And I would have to

Page 690

1 search for a reference for you, but, I'd be happy to do
2 that.
3 Q. Okay. And then I'm just trying to understand
4 the drought position I guess of the Park Service.
5 And would you agree that the Bureau of
6 Reclamation has repeatedly stated that we are in the
7 20th year of the largest drought in history? Would you
8 agree with that?
9 A. Have no reason to dispute it. I don't know
10 what they've said.
11 Q. You didn't know what they say. Are you aware
12 that water purveyors, local governments, SNWA, they're
13 all preparing drought contingency plans?
14 A. I was not aware of that, but, it doesn't
15 surprise me.
16 Q. Okay.
17 MS. PETERSON: I don't have any other further
18 questions. Thank you.
19 HEARING OFFICER FAIRBANK: Thank you.
20 City of North Las Vegas.
21 MS. SCHROEDER: No more questions.
22 HEARING OFFICER FAIRBANK: Okay. No further
23 questions.
24 Center for Biological Diversity. No additional

1 questions.
 2 Georgia Pacific. Thank you. No additional
 3 questions.
 4 Muddy Valley Irrigation Company?
 5 MR. KING: No questions.
 6 HEARING OFFICER FAIRBANK: So being no
 7 additional questions, Nevada Energy, see no additional
 8 questions.
 9 Okay. Then at this point I'll go ahead and
 10 open it back up to the State Engineer staff if there's
 11 any additional questions. All right.
 12 All right. So we'll go ahead and open it back
 13 up just for few extra minutes for other participants.
 14 If they haven't any additional questions, I'll go ahead
 15 and go back to Coyote Spring Investments. Did you guys
 16 have any additional questions?
 17 MR. HERREMA: Not at this time.
 18 HEARING OFFICER FAIRBANK: Not at this time.
 19 And the Tribe, do you have any additional
 20 questions at this time?
 21 MS. BALDWIN: No.
 22 HEARING OFFICER FAIRBANK: Southern Nevada
 23 Water Authority, do you have any additional questions?
 24 MR. TAGGERT: No.

1 HEARING OFFICER FAIRBANK: Maybe I'm going to
 2 just make this easy. Does anybody have any additional
 3 questions?
 4 All right. Nobody's jumping up, so we're going
 5 to go ahead and conclude today's hearing. Thank you
 6 very much for everyone. All right. We will see you
 7 tomorrow morning.
 8
 9
 10 (3:35 p.m. conclusion.)
 11
 12
 13
 14
 15
 16
 17
 18
 19
 20
 21
 22
 23
 24

1
 2 CERTIFICATE
 3
 4 STATE OF NEVADA)
 5)SS.
 6 CARSON CITY)
 7
 8 I, Kathy Terhune, CCR 209, do hereby certify
 9 that I reported the foregoing proceedings; that the
 10 same is a true and correct rough draft as reflected by
 11 my original machine shorthand notes taken at said time
 12 and place, Pages 599-693.
 13
 14 Dated at Carson City, Nevada, this
 15 26th day of September, 2019.
 16
 17
 18 _____
 19 CCR #209
 20
 21
 22
 23
 24

	addition (3) 612:5,13;632:14	allow (5) 612:5,13;662:24; 663:5;686:21	642:4,9;661:23; 676:6,17	632:24
#	additional (27) 608:13;610:20; 611:21,24;612:11; 613:15,18,21;619:9; 626:8;635:11;669:16, 24;671:11,17;680:21; 686:21;690:24;691:2, 7,7,11,14,16,19,23; 692:2	allowed (1) 631:11	applications (4) 625:10,11;637:19; 688:22	assigning (1) 656:13
#209 (1) 693:19		allowing (1) 603:17	appreciate (1) 686:4	associated (7) 614:3,7;619:6; 624:12;643:11;658:14; 680:15
/		alluvial (4) 631:4;634:6,17; 679:15	approach (1) 620:13	association (1) 644:2
/// (3) 659:23,24;671:24		almost (1) 651:19	appropriate (4) 621:24;622:1; 632:24;669:3	assume (2) 659:9;676:22
+	address (1) 682:18	along (8) 605:19,24;609:3; 618:14;633:9;634:23; 649:2,7	approval (1) 659:7	assumed (1) 667:24
+though (1) 689:17	adjacent (1) 674:15	although (1) 653:15	approximate (1) 677:13	assumptions (2) 629:1,2
A	adjusted (1) 603:13	always (1) 669:19	approximately (5) 625:7;640:12; 642:18;655:19;660:6	attention (4) 612:17;637:23; 640:4;675:5
able (2) 609:18;643:15	ADMINISTRATION (1) 599:7	Amargosa (4) 658:9,14,24;659:11	approximation (1) 677:21	attenuation (2) 613:22;617:21
absence (1) 679:7	adverse (2) 656:21;657:11	amount (16) 604:13;605:13; 609:22;612:11;613:22; 634:9;635:5;641:15; 648:4;654:6;660:13, 20;664:17;667:16; 669:6;685:14	aquifer (9) 604:23;623:11; 641:15,20;645:8; 648:24;649:22;651:21; 667:1	attested (1) 657:2
absent (1) 639:23	affected (1) 630:20	analyst (1) 629:10	AREA (59) 599:12;605:20; 606:7,13,15;607:13; 609:7,21;611:18; 614:3,3,5,10,11;620:5; 622:2;625:19;626:10; 628:23;631:15;632:7; 633:6;634:10;635:18; 639:15,19;641:21; 643:5;645:24;646:21, 23;647:9;649:7; 650:19;653:8;654:13; 656:3;659:1,5,13; 660:18;661:2,9; 665:10;666:4,14,16,20; 667:15,20;668:1,13; 678:7,24;679:17,18; 680:8;684:20;686:1	attorney (1) 615:6
absolute (1) 677:13	affecting (1) 661:3	analytic (1) 629:13	analyze (1) 613:7	Authority (3) 624:18;681:4;691:23
absolutely (1) 633:7	affects (16) 608:11;617:14,21; 618:12;629:4,15; 640:20;641:19,20; 642:1,19;643:8; 644:11;666:11;671:2; 674:22	analyzing (1) 625:5	Angeles (1) 600:23	authors (2) 645:16,20
access (1) 616:14	afternoon (16) 604:3,4;615:6; 624:23,24;636:13,16, 17;658:3,5;660:3; 668:20,22;681:8,9; 687:9	annual (3) 606:6;620:16;655:16	answered (3) 664:1,6;673:9	available (2) 619:23;645:24
according (1) 652:9	again (8) 603:11,16;617:12; 620:5;629:12;652:13; 671:21;676:1	anticipating (1) 657:15	Arizona (2) 641:18,21	average (6) 606:2,6;621:23; 656:15;677:15;685:8
accuracy (1) 609:19	ago (3) 608:14;653:13;657:2	apparatus (1) 656:7	around (4) 617:12;647:13; 656:8;665:3	avoid (1) 629:12
accurate (7) 614:20;624:7; 627:11;651:13;679:20; 688:3,18	agree (13) 633:4;634:3;636:1; 644:24;645:13,18,21; 654:8;676:24;679:2; 684:23;690:5,8	apparent (1) 641:23	Arrow (2) 626:5;642:2	aware (4) 658:7;659:17; 690:11,14
acra (1) 619:21	agreed (1) 638:1	appear (1) 673:19	art (1) 656:18	away (2) 622:9;678:20
acre-feet (3) 639:11;664:24; 688:17	ahead (18) 603:6,7,17,19; 616:12;617:6;623:21; 661:15;671:9,14,16,18, 21;673:10;691:9,12, 14;692:5	APPEARANCES (2) 600:1;601:1	ascribed (2) 665:10,14	back (13) 603:6;614:14;620:2; 665:20;666:10;671:15, 17,22;674:1;677:18; 691:10,12,15
across (8) 604:18,21;608:5; 613:23;618:18;619:1, 7;628:7	air (1) 681:20	appears (2) 655:18;676:23	Ash (2) 658:24;659:13	background (1) 673:19
Act (1) 655:9	Alex (1) 601:8	appendices (1) 648:16	assessments (1)	balance (1) 670:9
Acting (1) 600:4	Allison (1) 601:5	Appendix (5)		Baldwin (10) 601:7;602:6,19; 615:5,6;624:15; 675:22,24;681:2; 691:21
active (2) 615:19;651:13				Band (3) 601:7;615:2,7
actual (3) 632:24;655:23;669:5				Barnes (5) 600:8;602:13; 661:18,18,21
actually (4) 620:9;623:22; 633:11;655:21				BARNS (1)
Adam (2) 600:5;668:21				
added (5) 610:19;611:12,21, 24;612:2				

B

663:10 barrier (2) 628:2;668:3 base (8) 608:4,4;619:14; 626:16;627:5;650:4; 668:6,11 based (17) 604:22;609:19; 611:22;626:20;637:15, 24;641:5;644:12,15; 645:23;657:4;662:18; 664:3,11;669:16; 670:20;685:2 basically (2) 680:13,20 BASIN (5) 599:9,10,11,13; 667:16 basins (1) 637:3 basis (2) 628:1;634:21 beginning (3) 616:16;640:23;662:8 behalf (1) 628:12 behavior (1) 641:23 Belaustegui (1) 600:19 belief (1) 688:11 below (6) 649:19;653:22; 654:2;656:14;657:1; 684:7 beneath (3) 623:11;649:1;674:15 Benedict (5) 600:11;602:15; 664:21;665:6,6 BENETICT (1) 668:16 besides (1) 674:24 best (1) 616:19 Beth (2) 601:7;615:6 better (10) 610:2,24;612:6,6,14; 646:12;650:21;658:21; 662:24;670:16 Big (2) 635:22;636:3 Bill (1) 647:17 bind (1) 683:12 Biologic (1) 651:1 Biological (3)	651:9;688:20;690:24 biologist (2) 654:20;657:7 bi-op (3) 688:6,16,17 biota (2) 657:5,8 bit (7) 620:14;654:9; 664:22;665:16;685:7; 687:14,18 BLACK (6) 599:9;606:14; 641:21;666:20;667:15, 19 Bliss (1) 600:14 BLM (1) 624:10 block (5) 612:22;613:7;614:2, 14;631:15 blocks (1) 613:4 Blue (20) 620:15,17;621:12; 623:10;625:15,18; 632:7,11,16;640:2; 653:7;654:15,24; 655:2,12;656:5;657:4, 6;661:7;666:21 Bohannon (1) 647:17 both (3) 640:17;648:20; 665:14 bottom (6) 623:23;624:3;630:6; 644:16;675:11;685:6 boundaries (3) 608:6;635:9;683:8 boundary (7) 604:18,21;618:13, 15;619:11,12,12 Brad (2) 604:5;672:3 Braumiller (4) 631:19;635:23; 640:16;680:18 break (1) 671:10 Bridget (1) 600:14 bring (1) 664:9 bucket (1) 605:10 budget (1) 629:10 Buffington (1) 649:15 build (1) 605:5	built (3) 645:15,20,22 bulk (1) 681:23 bullet (4) 679:21;682:16,18; 683:1 bullets (1) 682:12 bump (1) 663:3 bumped (1) 664:12 bump-up (1) 664:13 Bureau (1) 690:5 buzzer (2) 614:22;624:15 bypassed (2) 610:21,22	633:4;634:21;635:15; 648:1;654:8;656:13; 657:5;662:12;663:24; 669:24;670:11;671:2, 5,20;678:17;679:4; 680:14;685:5 canyon (3) 614:8;626:6;642:2 capability (1) 678:15 capacity (1) 605:4 capture (10) 605:11;633:15; 634:20;635:2,12,17; 661:5;674:11;682:21, 24 captured (4) 634:18,24;635:15; 681:19 captures (4) 634:14;661:2; 664:24;674:8 capturing (7) 635:18;661:12; 681:24;683:2,4,8,9 carbonate (25) 607:2;623:11;634:5, 17;644:4;645:2,8; 647:14;648:7,13,24; 649:6,16,21;650:4; 651:11,12,14,17,21; 661:12;667:2,3;668:6; 679:15 carbonates (4) 627:19;647:21; 648:3,17 Carbonate's (1) 649:19 careful (2) 667:13;669:2 carefully (1) 614:20 Cargill (1) 604:6 Carson (5) 600:17;601:6;603:1; 693:6,14 category (1) 628:15 causation (1) 656:13 cause (2) 666:6;667:5 causes (1) 679:4 causing (1) 651:21 Cave (1) 643:20 Caviglia (5) 601:2;602:12;660:2, 4;661:13	CCR (2) 693:8,19 Center (4) 650:24;651:9; 675:12;690:24 century (3) 676:23;677:3,6 certain (4) 605:12;629:20; 633:1;685:14 certainly (8) 622:16;659:14; 667:9,12;677:23; 679:4;680:8;687:11 CERTIFICATE (1) 693:2 certify (1) 693:8 cessation (1) 656:20 cetera (1) 654:22 CFS (4) 608:20;620:17,18,18 chair (1) 671:19 chance (1) 660:24 change (21) 608:24;609:2,5; 611:8;612:12;619:5, 11;621:3;637:5; 638:16,21,23;662:22; 663:19,21;664:7,8,17; 676:20;678:22;679:10 changed (1) 641:6 changes (21) 606:1;610:15;611:3; 612:16;619:8,10; 622:18,19;623:6; 628:18;637:1;642:15; 655:23,24;663:1,7,8; 674:19;678:23;684:21, 22 changing (3) 662:11,20;672:14 characteristics (1) 605:15 characterize (1) 613:20 charge (1) 678:7 chart (2) 676:14,24 check (2) 608:16;639:12 checked (1) 656:11 cheek (1) 618:5 chemical (1) 629:13
		C		
		CA (1) 601:18 calculate (4) 620:2,7;667:21; 668:14 calculated (1) 667:23 calculates (1) 608:7 calculation (2) 621:24;670:4 calculations (2) 621:21;633:1 calibrated (2) 681:1;686:9 calibrating (1) 677:19 calibration (10) 608:10,21;609:10, 20;619:10;626:24; 663:6;669:23;670:1; 677:17 calibrations (3) 607:23,24;608:9 California (10) 600:23;606:16; 607:6;622:8;623:12; 649:1;667:6,9,12; 684:7 call (2) 611:11,12 called (2) 603:22;677:11 can (37) 603:16;604:8,15,22; 605:2,5,9,23;606:1; 608:16;616:3,9,18; 620:6;626:16,19; 628:5;629:8;630:9;		

chemistry (2) 615:24;616:8	complicated (2) 630:16;647:20	670:6	687:22;691:15	629:11,13,13,14;641:4, 5;654:4;656:6;662:1; 664:4,5;669:5,7;670:2, 3;671:3;675:7,9,14; 686:7
Chief (2) 600:7,10	components (1) 678:16	constraints (2) 670:9,24	cross-examination (12) 603:7,13,15;604:1; 615:4;624:21;636:11; 646:5;651:7;658:1; 660:1;687:14	database (1) 670:21
Christie (1) 663:11	composition (2) 622:15,18	construct (1) 670:23	cross-sectional (1) 605:20	date (3) 616:18;617:13; 659:18
City (9) 600:17;601:6,13; 603:1;646:3,8;690:20; 693:6,14	concept (4) 606:1;677:12; 678:21;685:13	contact (5) 648:17,20;649:3,4; 650:20	cross-sections (1) 647:8	Dated (1) 693:14
clarification (3) 657:14;663:15; 665:18	conceptual (1) 633:5	context (2) 670:8;676:14	Crustaceous (1) 647:11	dates (2) 616:14;640:9
clarifications (1) 646:9	concerned (2) 625:13,17	contingency (1) 690:13	CS-1 (2) 630:21,22	day (2) 687:11;693:15
clarify (2) 662:12;664:22	concerns (4) 625:21;626:1,4,23	continue (3) 607:5;653:7;657:3	CSAMT (1) 637:24	daylighting (1) 632:15
classify (1) 673:17	conclude (3) 634:12;655:20;692:5	continued (4) 610:14;617:15; 652:4;654:7	CSDM1 (1) 683:20	Death (4) 654:16;676:15,22; 677:12
clear (2) 626:24;628:21	concluded (1) 659:12	continues (3) 607:2;649:5;669:8	CSI (6) 600:19;604:5,7; 611:22;628:12;672:3	debate (1) 677:22
clearly (1) 669:15	concluding (1) 668:23	continuing (1) 654:5	CSI-1 (3) 629:18;630:9,13	decade (1) 660:15
Climate (2) 675:12;678:1	conclusion (5) 609:5;627:4;628:4; 648:21;692:10	continuity (3) 615:19,21,21	CSI-1e (1) 630:5	December (2) 609:11,16
close (5) 624:11;644:2;661:5; 671:9;684:20	conclusions (8) 626:19;673:5,6,7,15, 16,18,19	continuous (2) 647:20,22	CSI-3 (1) 630:5	decide (1) 686:22
closest (2) 651:22;674:23	condition (8) 619:11;631:23; 682:13,14,16,17;683:2; 685:24	contributing (1) 674:17	CSI-4 (1) 630:5	decision (1) 686:20
coefficient (1) 620:2	Cooper (5) 602:14;663:11,11, 14;664:18	Cooper (5) 602:14;663:11,11, 14;664:18	CSI's (2) 614:12;625:10	decisions (7) 662:18,21;669:1; 670:13,20;686:13,17
collected (4) 609:11,15;613:3; 669:8	conditions (6) 677:15;678:3,4; 679:11,11;682:13	copy (2) 606:9;629:24	CSVM-1 (1) 630:6	decline (7) 610:4;633:20;653:7; 654:5;655:22;657:3; 679:2
Colorado (2) 660:7,19	confirm (2) 632:23;647:6	correcting (1) 608:23	CSVM-4 (2) 617:8,16	declines (2) 630:18;652:4
colored (1) 647:12	confused (1) 617:24	correctly (1) 610:11	CSVM-5 (2) 630:24;631:23	declining (8) 617:3;624:1,6;641:7; 651:21;652:3;684:8; 685:20
combination (2) 606:23;644:10	confusion (2) 628:22;629:12	correlation (1) 622:4	CSVM-6 (1) 616:13	decrease (3) 635:1;640:18;665:5
comfortable (1) 670:14	connected (4) 645:9;679:18; 680:20,23	counsel (3) 604:5,7;615:8	curious (2) 666:19;667:4	decreased (1) 655:21
coming (3) 622:5;631:4;659:8	connectedness (3) 615:16,22;616:7	County (3) 636:9,14;689:9	current (11) 606:20,21;621:4; 653:14,24;654:1,2,6; 662:9;683:17;685:1	decreases (2) 653:16;654:1
commence (1) 603:9	connection (11) 616:10,11;623:10; 626:7;680:2,14; 687:21;688:1,9,12,13	couple (9) 626:22;632:18; 633:11,24;665:7; 672:9;681:10;687:12; 689:7	currently (5) 611:9;669:15; 682:15;684:8;685:5	deeper (2) 647:21;667:2
comments (1) 670:1	connections (3) 645:13,18;688:12	course (1) 643:14	curve (1) 641:13	define (2) 676:14,19
commissioned (1) 611:23	consensus (1) 636:2	cover (1) 647:3	D	definition (1) 688:9
commonly (1) 619:20	CONSERVATION (1) 599:2	covered (1) 637:3	dais (1) 683:12	deined (1) 653:19
Company (7) 601:5;636:9,15; 657:23;658:4;689:10; 691:4	considered (1) 608:21	Coyote (35) 603:9;606:23;607:1, 8,12;611:17,24; 612:22;613:7,12,17; 625:11,14;626:6; 629:21;631:6;637:2,6; 638:10;640:19;643:13; 644:3,5;645:8,15,19; 671:22;673:23;680:9, 10;683:20;684:2,5;	damage (1) 614:19	Delamar (3) 606:24;643:19; 644:19
comparing (1) 639:24	consistent (4) 608:5;647:7;683:18; 684:1		damaged (1) 614:3	delay (2) 617:20;640:15
comparison (2) 646:11;667:9	constrained (1) 686:13		data (32) 605:23;609:11,15; 611:5,8;617:17;627:4, 7,14,17;628:1,3;	
completed (1) 614:2	constraining (1)			

delayed (2) 609:6;617:21	620:23	690:24	613:21	663:24;665:11
delays (1) 640:20	difference (4) 620:22;621:6;634:7; 637:4	divide (1) 605:13	drive (1) 667:2	elements (1) 610:17
demonstrate (2) 679:16;680:2	differ (20) 605:4,24;609:4; 612:20;623:14;628:23, 24;629:1;635:2; 637:16;638:2;641:9, 22;642:19;648:6; 650:12;653:15;680:4; 682:8;688:10	DIVISION (2) 599:3;661:16	driven (1) 666:15	elevation (4) 624:11;637:16; 650:4;668:5
demonstrated (2) 652:13;681:20	difficult (1) 646:18	documented (1) 622:19	drop (3) 617:11;683:3,6	elevations (3) 637:16;650:1,19
demonstration (1) 679:17	dip (2) 617:8,10	documenting (1) 659:10	drops (1) 621:4	elsewhere (1) 680:5
DEPARTMENT (1) 599:2	direct (2) 640:4;659:7	documents (1) 672:10	Drought (4) 676:9;690:4,7,13	Ely (1) 643:21
depend (1) 609:21	directing (1) 637:23	domain (1) 670:8	Dry (3) 643:19;661:11;678:4	emanate (1) 632:8
dependent (1) 667:23	disagree (3) 627:24;636:1;638:4	done (11) 613:10,14;629:14; 639:22;656:12;664:6; 670:7;673:22;674:3; 677:9,10	due (4) 614:6,9;655:23; 678:10	Emilia (1) 604:6
depending (2) 605:2;662:9	discharge (49) 604:12;605:2,3,11, 15,16;606:7;608:7; 609:3;610:22;620:4, 16;621:5;629:15,16; 635:18;644:2;649:7; 652:1,5;653:7,17; 654:2;655:15,16,19,20, 22,23,24;656:10,14,20; 657:1,3,8,11,15; 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3	Donnelly (9) 601:16;602:10; 651:2,5,8,9;657:17; 672:6,11	duly (1) 603:23	empirical (1) 686:7
depends (4) 605:14;619:17; 686:19;687:2	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3	dots (1) 640:11	during (15) 608:21;625:20; 626:12;627:8;630:14, 17,19;639:4;641:16; 656:6;659:4;665:13; 672:5;681:16;683:16	employ (1) 668:24
depicted (1) 647:21	disagreed (1) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3	doubt (1) 688:2	DV3 (1) 677:11	employee (1) 672:17
depletion (1) 641:14	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3	down (6) 609:7;621:4;624:11; 631:4;633:13;656:10	DVRFS (1) 676:22	end (7) 603:16;607:1; 617:15;644:21;645:1; 675:13;687:10
deposits (1) 661:8	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3	downgradient (1) 610:23	E	Endangered (1) 655:8
depth (5) 621:21,21;622:5; 647:5,24	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3	downloaded (1) 675:9	earlier (5) 619:8;644:1;664:3; 674:4;687:14	ended (1) 640:7
depths (1) 667:4	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3	downward (2) 651:16,24	early (4) 617:15;636:17; 641:3;665:8	endemic (1) 655:3
describe (2) 626:2;667:1	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3	Dr (9) 604:3;624:23; 636:13;658:3;660:3; 668:20;672:3;687:9; 689:7	easier (1) 646:15	ending (1) 616:24
described (1) 643:8	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3	draft (1) 693:10	east (3) 607:17;614:14;649:2	Energy (4) 601:2;659:22;660:4; 691:7
describing (2) 658:18;678:6	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3	drainage (1) 678:18	eastward (1) 648:24	Engineer (15) 600:4;625:21;629:6; 636:24;637:14;638:17, 18,24;650:14;661:17; 668:24;686:8,16; 687:20;691:10
desert (4) 654:11,17,20;656:18	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3	draw (2) 607:16;641:23	easy (1) 692:2	Engineer's (2) 636:19;664:4
detail (5) 608:2,11,14;610:4; 622:11	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3	drawdown (25) 609:22;612:7,11,12, 14;613:23;618:9,12; 619:24;620:1;628:17, 19;633:1;634:10; 639:14,19;640:2; 641:8,13,23;643:11,12; 652:19;679:3;689:12	eating (1) 672:23	enhanced (1) 614:6
detailed (1) 650:18	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3	drawdowns (1) 643:11	effect (14) 609:6;610:17;617:4; 625:17;627:18;644:4; 662:17;665:5;666:6; 668:4;675:4;679:14; 685:11,13	enough (4) 624:14;636:5;668:3; 669:20
detect (2) 644:9;680:6	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3	drier (1) 679:10	EH-4 (5) 684:16,18;685:1,21, 24	entitled (2) 676:9,19
determine (1) 629:7	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3	Drill (3) 619:21,22;647:6	either (6) 604:20;605:20; 607:3;610:16;623:24; 649:3	equal (1) 683:3
determined (3) 628:16;629:4;637:15	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3	drilling (1)	elaborate (2)	equilibrium (10) 652:11,20;653:6; 682:8,13,14,16,19; 683:2,4
deuterium (1) 623:4	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3			ER61 (1) 659:4
develop (6) 620:1;626:4;628:24; 677:9,10,14	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3			errors (1) 670:21
developed (2) 626:5;631:14	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3			Esq (9)
development (3) 606:5;610:14;677:11	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3			
deviations (2) 661:24;662:3	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3			
differ (1)	disagrees (3) 660:11,12;664:16; 665:19;667:14,16,17, 19,19;678:22;683:3			

600:18,20;601:2,7,8, 10,12,16,17 essence (1) 607:19 establish (1) 628:8 established (1) 680:13 estimate (11) 604:22;605:9; 609:18;612:6,14; 613:1;622:22;628:14; 652:6;660:5;662:20 estimated (7) 608:5,6;609:23; 610:4;612:12;653:20; 660:22 estimates (5) 604:23;628:11; 660:15;662:15;674:2 ET (8) 635:17;654:22; 665:15,17;666:15; 682:2;683:8,9 evaluate (2) 612:21;688:17 evaluated (1) 641:18 evapotranspiration (8) 606:7,13,14,16,20; 634:24;635:16;675:1 even (3) 669:20;675:3;681:17 event (1) 611:7 events (2) 685:9,11 eventually (1) 682:24 everybody (1) 663:2 everyone (2) 671:19;692:6 everywhere (1) 647:19 evidence (10) 614:15;618:24; 638:13,20;643:23; 644:1;686:15,16; 687:20;688:1 exact (4) 617:13;640:9; 653:16;687:24 exactly (3) 667:4;672:12;675:17 EXAMINATION (8) 661:20;663:13; 664:20;668:18;672:1; 675:23;681:6;687:7 examined (1) 603:24 examining (1) 615:16	example (2) 613:16;634:23 exchange (1) 672:5 excited (1) 632:20 exclusive (1) 685:4 excuse (5) 604:12;624:2; 630:15;669:12;672:8 exercise (1) 641:19 Exhibit (4) 629:24;645:6; 683:13;684:13 exist (1) 611:9 existing (4) 651:20;670:17,20; 685:24 exists (2) 641:16;667:16 expand (1) 669:8 expect (3) 657:5;680:1;685:10 expecting (1) 685:2 expense (1) 680:14 experiment (1) 620:1 explain (2) 607:23;669:9 explained (3) 616:3;646:12;653:21 explanation (3) 624:9;640:15;659:16 exposed (1) 650:20 extended (4) 618:13;643:13; 659:11,13 extending (1) 659:5 extends (1) 646:22 extent (2) 614:7;628:1 external (1) 608:6 extra (1) 691:13	656:11 fair (12) 615:16;623:8; 624:14;627:16;631:3; 632:8;633:2,3;634:12; 643:16,17;684:18 FAIRBANK (25) 599:4;600:2;603:5; 614:23;624:17;636:8; 646:2;650:24;651:4; 657:19,22;659:22; 661:15;671:8,14; 675:20;681:3;687:5; 689:3;690:19,22; 691:6,18,22;692:1 fairly (1) 661:7 fall (1) 628:14 familiar (3) 623:16;631:1;656:1 fan (2) 631:3,4 far (1) 632:9 faster (4) 641:13;652:14,17,19 fault (18) 611:19;612:21; 613:4,7,20,23;614:13, 15;628:7;638:5,12,14; 646:21;648:2,3;649:6, 8;668:10 faulting (2) 614:4,7 faults (14) 611:10,12,16,18,21, 24;612:2,5,11,13; 627:18,18,23;628:5 features (1) 610:16 federal (1) 656:20 feel (2) 632:23;686:12 feeling (1) 669:19 felt (1) 658:22 Few (5) 651:10;653:13; 672:3;683:14;691:13 figure (6) 627:10;630:3,3; 633:21,22;683:14 figures (2) 620:23;633:11 find (2) 618:24;689:21 findings (2) 637:15;638:24 fine (1) 653:3	finishing (1) 669:21 First (8) 604:11;608:2;625:4, 7;669:13;672:5;677:5, 8 Fish (6) 601:17;614:24; 631:19;654:21;675:21; 688:6 five (2) 615:15;630:3 Flangas (1) 601:8 Flat (1) 658:18 FLOW (72) 599:8;605:5,7; 606:22;607:1,3,5,7,11, 14,15,20;608:19,23; 609:8;610:3,24;613:5; 618:1;619:4,6,12; 620:8,11;622:7;625:6; 628:7;632:6,9,14; 633:15,18,20;634:14, 14,18,24;635:5,8,14, 16;638:8,10,12,13; 647:13,23;648:23; 649:14;651:18;659:2; 660:16;668:5;670:24; 672:15;674:8,9,18,24; 675:15;676:15;677:4; 679:6;681:1,19,24; 682:2;683:4,7,10; 684:22;685:21 flowing (2) 649:2,23 flows (3) 618:18;634:3;661:3 flume (2) 605:5,22 flux (1) 667:22 fluxes (1) 608:5 folks (1) 684:21 follow (3) 615:9;681:10;687:18 follows (1) 603:24 foregoing (1) 693:9 form (1) 609:15 forth (1) 677:18 forward (1) 664:7 found (3) 662:21;684:2;687:20 four (1) 630:23	Fourth (2) 658:7,23 fractured (1) 614:3 fractures (2) 627:15,20 framework (2) 645:22;670:6 front (3) 610:13;612:18; 648:11 full (1) 604:10 function (2) 641:21;666:7 further (12) 607:18;610:22; 640:19;650:7;658:24; 661:13;664:22;665:18; 666:10;688:20;690:17, 22 furthest (1) 666:10 future (3) 618:10;621:3;650:12
G				
				gage (1) 610:22 gages (3) 610:21;656:4;665:20 gap (3) 617:16;641:4;656:5 Garden (1) 643:20 GARNET (9) 599:10;607:9;649:1; 666:13,17;667:6,9,12; 684:6 Gary (5) 655:6;656:24;672:7, 16,17 Gauge (3) 608:19,21,24 gauging (1) 605:22 gears (1) 666:20 General (6) 604:6;615:10,13; 633:5;636:2;685:18 generally (5) 623:1;628:18;634:9; 669:4;684:5 generate (1) 661:23 geochemical (1) 648:15 geochemistry (1) 648:19 geologic (5) 615:19;627:9;

645:23;650:18;669:7 Geologist (2) 600:13;647:16 geology (4) 615:17;626:17; 638:2;647:7 geometry (1) 650:21 geophysical (1) 627:17 geophysics (1) 611:22 Georgia (2) 657:20;691:2 gets (1) 623:4 Given (5) 653:24;669:6; 684:12;685:2;686:14 gives (1) 671:1 giving (1) 646:20 glad (1) 669:12 Glendale (3) 632:6;633:15;634:3 Global (1) 622:24 goes (10) 607:12,17,18,20; 608:20;618:15;623:1; 647:9;648:8;678:23 Good (25) 604:3,4;615:6; 620:12;624:23,24; 636:13,16,17;658:3,5; 659:16;660:3;666:16; 668:20,22;669:20; 670:1,15;677:15; 678:15;680:7;681:8,9; 687:9 governments (1) 690:12 gradient (14) 604:24;615:24; 616:4;618:23,24; 619:5,15;620:6; 621:23,23;641:16; 668:9,11;674:19 Gradients (1) 621:23 granted (1) 637:18 graph (1) 676:5 great (1) 647:24 green (1) 647:12 Greg (2) 601:10;687:9 groundwater (23)	604:14,17;607:3,5; 616:8;625:11;626:18; 629:8;634:13;649:20; 660:6,11;661:2,10; 666:2;674:7,14,19,22; 675:3,4;677:24;686:10 guess (7) 615:15;616:19; 650:10;662:6;666:6, 14;690:4 guide (2) 668:24;670:12 guided (1) 645:22 gut (2) 671:4,4 guys (1) 691:15 gypsum (1) 648:19	heat (1) 621:13 heavier (1) 623:4 Hello (3) 646:7;676:1,2 help (2) 677:10;681:1 helpful (2) 650:13,15 helping (2) 650:11;670:12 helps (1) 670:5 hereby (1) 693:8 herein (1) 603:22 Herrema (11) 602:5,18;603:19; 604:2,5;614:21; 671:23;672:2,3; 675:19;691:17 hesitant (1) 655:20 hesitating (1) 686:19 Hi (1) 689:7 Hidden (1) 607:9 hierarchy (1) 616:2 high (5) 615:20;616:3,7; 618:24;649:21 higher (1) 622:20 highly (1) 616:4 historic (2) 656:14;657:1 history (1) 690:7 holding (2) 624:1,5 hole (4) 647:6,12,13,15 home (1) 655:3 hopefully (1) 619:21 hours (1) 671:9 hundreds (1) 652:24 hydraulic (7) 615:16,23;616:4; 618:23;619:14;623:10; 626:7 hydrogeologists (1) 633:6 hydrogeology (1)	625:5 hydrograph (11) 616:13,15;617:16; 623:23;624:4;631:10; 640:6,12;666:9; 684:15;685:11 HYDROGRAPHIC (2) 599:11;606:7 hydrographs (9) 617:7;620:16; 629:20;630:4,12,16; 655:12;663:3;678:3 hydrologic (12) 613:21;627:16; 628:2,8;629:14,17; 631:23;669:7;687:21; 688:1,9,11 hydrological (1) 636:2 hydrologist (3) 621:20;633:6;654:10 Hydrology (2) 600:10;626:17 hypothesize (1) 628:6 hypothetical (1) 681:18	importance (1) 615:20 important (3) 615:17;616:1;670:24 impression (1) 636:19 improve (4) 663:6;669:10,16,24 improved (1) 669:22 improvement (1) 611:2 inaccurate (1) 659:2 include (8) 609:14;610:15; 618:1,3;630:5;637:19; 662:12;663:7 included (4) 611:10;642:6; 643:18,21 includes (1) 612:20 including (1) 638:23 increase (1) 664:16 increased (1) 664:17 increases (1) 611:6 increasing (4) 611:1;635:4;664:16; 683:7 indeed (2) 628:9;654:8 independent (1) 619:12 index (1) 684:21 Indians (1) 615:2 indicate (6) 615:22;616:7; 630:20;642:5;645:7; 682:12 indicated (10) 603:12;607:21; 615:18;626:23;636:24; 637:24;638:7,9;672:6; 674:7 indicates (4) 613:4;647:18;661:9; 688:1 indicating (1) 645:14 inducing (1) 635:8 inflow (1) 635:4 inflows (1) 605:1 influence (1)	
	H				
	habitat (1) 656:21 half (2) 609:24;610:7 hand (2) 668:15;686:7 handful (1) 604:7 happen (1) 670:4 happened (1) 658:18 happening (1) 670:5 happens (2) 633:20;647:14 happy (1) 690:1 HARRISON (1) 657:21 hastily (1) 664:1 head (1) 644:17 hear (2) 628:10;631:18 heard (2) 614:21;665:22 HEARING (29) 599:4,17,18;600:7; 603:5;614:23;624:17; 625:20;636:8;646:2; 650:24;651:4;657:19, 22;659:22;661:15; 671:8,14;675:20; 681:3;687:5;689:3; 690:19,22;691:6,18,22; 692:1,5 hearings (1) 625:10	hesitant (1) 655:20 hesitating (1) 686:19 Hi (1) 689:7 Hidden (1) 607:9 hierarchy (1) 616:2 high (5) 615:20;616:3,7; 618:24;649:21 higher (1) 622:20 highly (1) 616:4 historic (2) 656:14;657:1 history (1) 690:7 holding (2) 624:1,5 hole (4) 647:6,12,13,15 home (1) 655:3 hopefully (1) 619:21 hours (1) 671:9 hundreds (1) 652:24 hydraulic (7) 615:16,23;616:4; 618:23;619:14;623:10; 626:7 hydrogeologists (1) 633:6 hydrogeology (1)	I	idea (2) 650:20,21 identified (1) 627:9 identifying (3) 627:15,16,18 III (1) 599:19 impact (10) 610:17;619:15,16; 625:14;626:5;634:2; 639:18;656:21;657:11; 662:10 impacted (2) 642:21,23 impacting (2) 629:8;630:10 impacts (2) 626:8;657:5 impediment (4) 628:7;638:7,12,13 impediments (1) 638:10 impermeable (2) 613:4;627:11 implementation (1) 610:16 implemented (1) 619:20 implementing (1) 663:9 imply (3) 651:20;652:3;666:3	idea (2) 650:20,21 identified (1) 627:9 identifying (3) 627:15,16,18 III (1) 599:19 impact (10) 610:17;619:15,16; 625:14;626:5;634:2; 639:18;656:21;657:11; 662:10 impacted (2) 642:21,23 impacting (2) 629:8;630:10 impacts (2) 626:8;657:5 impediment (4) 628:7;638:7,12,13 impediments (1) 638:10 impermeable (2) 613:4;627:11 implementation (1) 610:16 implemented (1) 619:20 implementing (1) 663:9 imply (3) 651:20;652:3;666:3

622:21 influencing (1) 649:14 information (18) 608:13;610:12; 613:3,3,24;616:8; 626:8,21;627:20; 629:18;631:16;667:10; 677:8,22;680:20; 683:18;686:22;689:22 informs (1) 629:22 initial (1) 641:23 initiation (1) 616:21 input (2) 662:9;666:18 insignificant (1) 635:7 instance (2) 654:21;655:17 instead (4) 653:21;665:3; 681:18;686:9 integrating (1) 605:21 intended (3) 642:14;679:23; 682:18 intent (1) 615:13 intentional (1) 621:9 interaction (1) 687:16 interest (1) 629:9 interested (2) 605:16;670:9 internal (1) 621:22 interpretation (3) 651:23;668:6;688:11 interpreted (1) 666:15 into (23) 605:16;607:3,5; 609:3,7;612:2;623:9; 635:5;641:7;643:13; 645:15,20;649:1,19,22; 650:11;660:16,19; 661:2;662:24;667:22; 668:7;683:7 invertebrates (1) 654:22 investigate (2) 639:16,18 investigated (1) 644:6 Investments (3) 603:10;671:22; 691:15	involved (2) 625:4,9 involvement (1) 625:7 involving (1) 625:10 Irrigation (4) 601:19;657:23; 658:4;691:4 isotope (1) 622:13 isotopic (1) 622:14 issued (1) 688:21	KMW-1 (2) 617:7;645:3 knew (3) 626:7;659:17;669:22 knowing (1) 671:2 known (2) 625:21;678:7 KW-1 (1) 641:3	669:18;673:1,2;679:1 led (1) 688:16 left (1) 623:2 less (9) 608:20;610:5,7,8,10; 623:2;654:6;663:18; 665:1 level (8) 617:3;637:1;639:3; 645:1;652:5;674:14; 679:5;684:22 levels (37) 608:8;611:6;612:7, 10,15;617:12;623:21; 624:5;626:9;629:16; 630:18,21;640:22; 644:5,15;651:11,12,14, 17,21;652:4,10;654:3, 5;663:1;665:24; 676:10,20;678:1; 679:2,8;681:14; 683:17;684:9,19; 685:3,4 lighter (1) 623:4 likely (4) 607:5;647:5;653:1; 654:2 limit (1) 686:8 limitations (1) 669:3 limited (1) 641:5 limits (1) 619:6 Lincoln (3) 636:9,14;689:9 Lincoln/Vidler (2) 687:15;688:22 line (7) 607:16,17;623:1; 627:6;643:22;649:8; 668:10 lines (2) 633:9;638:1 link (1) 675:12 lip (4) 649:12,13,13;650:1 listed (2) 615:15;675:11 lithologies (1) 651:15 lithology (2) 637:5;638:16 little (9) 620:14;629:5;662:6, 10;664:22;665:16; 685:7;687:14,18 local (2)	615:8;690:12 located (5) 634:4,5,8,9;675:6 location (9) 610:22;620:12; 628:2;632:10;640:21; 641:4;649:20,24;650:3 locations (3) 633:2,18;650:22 log (1) 614:15 logical (1) 650:6 long (9) 608:14;625:4; 641:22;652:7;678:19; 680:18;682:7,7;687:11 longer (3) 608:10;670:4;680:21 long-term (3) 629:7;678:18;679:19 look (24) 608:11;614:14; 615:15;619:23;621:13; 634:1;644:14;646:10, 14;650:7,14,18,19; 655:21;656:9;667:13; 671:2;679:6,24;682:1; 683:11;684:11,11; 685:6 looked (7) 614:19;622:11; 629:1;636:5;650:16; 662:19;667:8 Looking (18) 606:5;609:5,22; 610:1;613:22;616:9; 620:15;622:18,22; 646:16,24;665:19; 666:9;668:8;671:3; 676:17,18;679:13 looks (13) 617:2,8,11,14; 623:24;624:4,6; 640:24;641:5;646:15; 647:20;672:24;673:2 Los (1) 600:23 loss (1) 670:24 lot (8) 604:24;616:5;626:3; 661:9;662:14;669:4; 670:2;682:9 love (1) 686:5 low (15) 615:23;616:4; 618:22;619:4,4,14; 620:10;621:18;637:4, 17;638:15;647:24; 661:7,10;668:3 Lower (24)
	J	L		
	John (2) 600:11;665:6 journal (1) 689:23 JR (1) 603:21 July (1) 673:14 jumping (1) 692:4 Jurassic (1) 647:11 Justina (2) 601:2;660:4	labor (1) 674:23 laboratory (1) 662:3 lag (1) 678:2 Lake (11) 643:19;660:7,12,14, 19;661:5,6,7;667:22; 668:1,10 lands (1) 656:20 large (5) 605:4;631:13; 646:23;668:12;672:24 largest (1) 690:7 Las (14) 601:13;617:23; 618:1,9,11,14,18; 624:18;625:2;646:3,8; 672:18;681:4;690:20 last (5) 635:21;667:14; 682:12,16,18 late (1) 641:24 later (1) 641:6 lateral (2) 614:7,9 latter (1) 617:2 Laura (2) 601:12;646:7 Law (2) 601:13;670:10 lawyer (1) 646:14 layer (2) 648:9,14 leakage (2) 656:8;660:16 Leake (2) 641:17;689:14 learned (2) 669:17;670:2 least (9) 607:14;615:24; 652:6;653:15;668:6;		
	K			
	Kane (30) 611:18;617:6; 636:18,20;637:1,6,10, 19;638:22;639:8,15,17, 19;640:1;642:6,10,22, 22;643:1,8,12,18; 644:2,4,8;645:8,14,19; 687:21;688:22 Karen (2) 636:13;689:8 Karst (7) 655:6;656:24;657:5; 672:7,16,17;673:8 Karst's (2) 673:5,16 Kathy (2) 599:24;693:8 keep (2) 610:23;671:20 Kent (1) 600:20 kind (9) 608:2;611:1;643:15; 666:19;673:18;679:24; 680:1,24;685:10 King (4) 602:11;658:2,3; 691:5			

618:1;623:2;624:11; 625:5;634:13;635:1,5; 640:19;641:15;648:3; 651:17;655:20;659:1, 14;664:11;672:15; 674:8,23;675:14; 677:4;679:6;681:17; 685:20;686:23 lowers (1) 674:14 Ltd (1) 600:16 Luke (2) 601:17;614:24 Lyna (1) 615:7	10;662:10;665:15; 666:4;680:24 maybe (4) 603:17;655:24; 667:1;692:1 Mayer's (1) 685:14 Mead (4) 660:7,12,14,19 Meadows (1) 659:13 mean (10) 616:3;620:16;652:4; 654:12;655:16;664:14; 668:2;669:17;670:19; 682:5 measure (9) 604:14,20;605:7,10, 12;606:2;619:15,17; 620:6 measured (3) 604:22;609:24;610:5 measurement (1) 605:6 measurements (4) 605:19;656:16,17; 667:17 measuring (3) 605:20;656:7,17 mechanism (3) 663:4,7;674:11 memory (1) 621:18 mentioned (5) 610:20;620:21; 655:2;662:7;665:19 mentions (1) 655:7 Mesa (2) 641:21;678:7 messed (1) 689:16 Meteor (1) 623:1 method (1) 605:10 MICHELINE (2) 599:4;600:2 Michelle (2) 600:8;661:18 might (5) 612:21;617:13; 619:14;638:12;688:10 Miller (2) 601:17;614:24 mind (1) 611:4 mine (1) 688:10 mineralogic (1) 623:6 mineralogical (1) 622:19	minerals (1) 648:19 minor (1) 635:11 minute (1) 616:18 minutes (6) 603:15;604:8;651:4; 653:13;671:19;691:13 mischaracterized (1) 613:9 misheard (1) 665:12 misinterpretation (1) 634:20 misinterpreted (1) 666:4 mismatch (1) 610:20 missed (1) 663:20 misstate (1) 618:21 mistake (1) 627:23 mistaken (1) 676:5 mixes (1) 649:3 Moapa (9) 601:7;608:19,20,24; 615:2,7;675:21;687:5, 10 model (83) 606:4,6;608:4,8,18, 21;609:10,13,19,23; 610:12,15,22;611:2,9, 11,15,16,22;612:2,3; 618:12,13;619:9,11; 620:1;626:18,22; 627:5;632:19,23; 634:13,18;639:8,8,9, 17;641:20;643:14; 644:12;645:7,22; 652:15,17,23;653:10; 657:2;660:21;662:10, 11,17,24;663:4; 664:10;667:18,21; 668:13,24;669:3,5,10, 14,15,21;670:6,10,13, 14,17,18,23;674:1; 677:10,11,14;678:12; 681:1,12,14,20;682:1; 686:5,10 modeler (1) 686:4 modelers (3) 669:18,18;686:5 modeling (8) 618:7;628:22; 641:18;662:18,19; 664:5;667:22;686:4 models (7)	628:24;629:3; 632:21;633:5;645:15, 20;670:11 modified (1) 642:20 moment (1) 653:16 moments (1) 657:2 monitor (4) 629:20;631:1;684:2, 19 monitoring (9) 645:2;650:7,12; 654:7;656:2;665:24; 680:7,12;683:21 monitors (1) 684:19 month (1) 680:18 months (2) 640:13;680:17 more (17) 623:2;629:16; 646:18;647:20,22; 650:18;651:21;657:17; 663:16;664:24;672:4; 677:8;681:15;685:7; 686:13;689:22;690:21 Morison (1) 687:9 morning (2) 636:18;692:7 Morrison (4) 601:10;602:21; 687:8;689:1 most (5) 607:1;615:17; 650:13;652:24;665:13 Mountain (5) 623:23;644:19; 666:20;667:15,20 Mountains (3) 606:15,24;646:23 move (4) 604:9;606:3;640:18; 648:1 movement (4) 609:6;614:9;616:5; 661:10 Moving (4) 617:6;668:13;678:9; 679:14 much (17) 604:8;608:11;610:4, 12;617:17;618:18; 627:4;629:16;634:7; 648:1;650:18;651:2; 652:14;657:14;682:1; 687:4;692:6 MUDDY (48) 599:12;601:19; 606:13;607:3,4,8,13,	17;608:19;611:17; 614:10;622:2;625:15, 19,19;630:10;633:15, 18;634:2,10,14,23; 635:17,19,22;636:3,4; 639:14,14,19;643:4; 644:9;653:8;654:13; 656:2;657:23;658:4; 660:18;661:3;665:10, 20;666:3,14,16;674:8; 679:18;681:24;691:4 MX (1) 640:13 MX-4 (2) 614:2;666:11 MX-5 (10) 614:1,13,16;617:15; 630:14,19,20;639:4; 640:7;643:24
M				N
machine (1) 693:11 MacKenzie (1) 601:5 magnitude (1) 685:12 maintained (1) 642:17 major (2) 685:8,9 makes (1) 627:3 making (4) 660:9,12;670:7,21 management (4) 662:21;669:1; 670:12,20 many (2) 654:11,12 map (1) 607:16 mapped (1) 647:7 mapping (3) 628:5;647:17;650:18 maps (2) 643:10;645:23 March (1) 640:8 marked (1) 637:3 mass (1) 670:9 match (5) 610:2,24;663:1,6; 685:14 matches (1) 670:16 MATTER (1) 599:7 may (13) 615:12;623:6; 624:12,12;628:6; 633:12;653:15;656:9,				name (2) 625:1;660:3 name's (1) 668:20 Narrows (1) 611:19 National (3) 603:22;637:10; 672:17 NATURAL (1) 599:2 nature (1) 686:19 NCA (1) 601:8 near (4) 608:19;633:15; 668:1;678:7 necessarily (5) 607:16;613:16; 616:2;638:4;679:3 necessary (2) 628:8;650:17 need (4) 612:3;656:11; 680:20;689:18 needs (2) 669:15;685:15 NEVADA (14) 599:1;600:17;601:6; 603:1;624:18;625:2; 659:22;660:4;676:10; 681:3;691:7,22;693:4, 14 new (8) 625:10;628:11; 677:22;678:7;682:13, 14,19;686:9 Next (8) 614:23;624:18; 636:8;646:2;650:24;

657:19;659:17;666:19 nine (1) 640:12 Nobody's (1) 692:4 normal (2) 614:4,7 normally (1) 685:10 norms (1) 657:1 North (5) 601:13;640:19; 646:3,8;690:20 northeastern (1) 644:21 northern (2) 607:1;638:10 noted (1) 658:8 notes (2) 658:13;693:11 notice (1) 618:9 November (1) 640:7 number (11) 615:14;626:11; 629:24;641:5;653:20; 658:19;659:4;663:17; 667:23;682:11;683:21 numbers (4) 633:1;655:13;664:7; 676:18 NV (1) 601:2	657:15;663:5;678:8 occurred (2) 630:19;665:14 occurring (8) 641:2,6;664:15; 666:12,17;681:15,16; 685:21 occurs (7) 619:24;628:20; 632:9;634:10;641:1, 12;680:5 O'Connor (1) 600:18 off (4) 610:13;619:14; 668:14;678:6 offered (2) 623:15,16 offhand (1) 650:5 OFFICER (25) 599:4;600:7;603:5; 614:23;624:17;636:8; 646:2;650:24;651:4; 657:19,22;659:22; 661:15;671:8,14; 675:20;681:3;687:5; 689:3;690:19,22; 691:6,18,22;692:1 omauda (1) 635:1 Once (1) 680:19 one (31) 607:8,22;608:9,12; 610:21;612:19;614:12; 619:10;620:3;622:9; 624:4;630:23;632:20; 634:21,21;635:21; 642:18;644:16;645:5; 646:17,19,20;647:9; 648:16;649:10;655:7; 663:8;665:19;676:4; 678:16;679:1 one-tenth (1) 620:22 ongoing (1) 630:17 only (6) 611:16;629:1; 634:23;644:7;648:17; 651:14 onto (2) 622:13;663:24 open (5) 661:16;671:11,17; 691:10,12 opinion (25) 614:1;616:15;617:9; 618:17;622:10;623:9, 14;624:9;631:13,17; 632:5;635:20;636:6; 644:3,9;647:15;648:8;	650:13;663:15;667:15, 20;677:24;679:5,20; 685:23 opinions (3) 608:24;677:2;688:21 opportunity (2) 603:7;654:11 opposed (3) 626:18;673:18; 681:15 ORDER (16) 599:18;610:18; 615:10,12;616:14; 623:18;626:1;631:11; 637:3,11,20;638:23; 639:13;643:18;650:16; 669:17 original (1) 693:11 others (2) 610:2;628:12 otherwise (2) 671:3;680:16 ought (1) 654:6 out (12) 606:2;615:12;618:9; 629:23;656:11;659:8; 661:12;662:21;663:17; 668:5;669:2;674:12 outcome (1) 663:19 outflow (5) 604:14,17,18,19,21 output (2) 609:2;663:21 over (7) 605:12;617:19; 646:22;655:15;657:2; 669:5;676:20 overcome (1) 685:16 own (1) 683:19 oxygen-18 (1) 623:3	panel (4) 633:14;683:20; 684:7;685:6 paper (4) 641:17;684:12; 689:15,23 paragraph (1) 637:9 parameters (1) 628:15 Park (6) 603:23;623:14; 637:10;672:17,19; 690:4 part (13) 609:7;617:2,4; 623:17,19;637:6,11; 663:20;664:13;669:13; 672:24;678:12;683:8 participants (4) 603:14;671:12,18; 691:13 participating (1) 603:12 particular (6) 638:14;662:17; 672:10,19,21;673:13 particularly (1) 632:20 parties (1) 603:11 parts (3) 673:1,2;680:9 passing (1) 649:21 past (3) 617:15;655:15; 660:15 path (4) 632:6,14;646:15,18 paths (2) 607:8,14 pathway (5) 647:21;648:2,23,23; 667:5 Patrick (2) 601:16;651:9 Paul (1) 625:1 Pederson (2) 610:4;636:13 penetrated (1) 614:13 people (1) 621:22 per (8) 606:12,14,15,17; 652:10;653:10,14; 679:20 percent (2) 685:8,9 perception (1) 662:7	perfect (1) 627:3 performance (1) 670:15 performed (2) 605:18;607:23 perhaps (4) 656:18;658:20,24; 664:1 period (12) 605:12;617:20; 622:20;630:19;641:12; 652:16;653:6;655:21; 656:6;665:13;676:21, 21 permanent (2) 646:21;686:8 permeability (9) 612:21;614:6;619:5; 637:5,17;661:6,8; 667:24;668:3 permeability's (1) 647:24 permeable (1) 616:5 permitting (1) 679:19 pest (2) 628:16;662:8 Peterson (8) 602:8,22;636:12; 646:1;687:15;689:6,8; 690:17 petitioned (1) 655:8 phase (1) 641:16 phonetic (1) 635:1 piece (2) 657:4;684:12 pipeline (1) 643:21 place (5) 647:17;650:7;656:2; 659:3;693:12 places (2) 650:12,13 plans (1) 690:13 play (3) 622:14;629:10,11 please (1) 632:4 plot (1) 661:22 plotted (1) 627:10 PM (2) 603:1;692:10 Pockets (1) 649:16 Point (30)
O				
OOO- (1) 603:3 obeying (1) 670:8 obeys (1) 670:24 observation (2) 619:22,23 observations (2) 629:15;670:16 observe (2) 651:11;655:14 observed (8) 608:20;611:8;639:3; 651:16,24;654:19; 659:5;663:1 observer (1) 654:20 observing (1) 626:5 obtained (1) 682:19 occur (6) 630:9;641:1;652:21;				
		P		
		Pacific (2) 657:20;691:2 page (8) 630:4;633:10;642:5; 645:7,23;647:16; 648:11;676:18 Pages (1) 693:12 Pahrnagat (1) 643:20 Paiute (2) 615:2,7 Paiutes (1) 601:7		

620:15,17;621:12; 623:11;625:15,18; 632:8,11,16;640:2; 643:22;649:11;653:8; 654:15,24;655:3,12; 656:5;657:4,6;661:7; 662:13;664:9;666:17, 21;669:2,20;677:17; 679:21;691:9	604:11;614:12; 655:11;669:14;677:1; 689:16 presented (4) 609:1,13;644:1; 681:13 pressure (2) 652:14;659:10 presumed (1) 620:10 pretty (1) 661:10 preventing (1) 649:14 previous (2) 626:4;678:1 previously (2) 603:23;626:4 primarily (1) 683:9 primary (1) 622:21 prior (2) 617:3;679:19 probability (3) 637:4,17;638:16 probably (9) 621:7;635:6;645:4; 655:23;656:1;667:6; 668:8,10;672:13 problem (1) 647:23 proceed (1) 603:19 proceeding (2) 618:8;638:21 PROCEEDINGS (5) 599:16;637:11,20; 643:19;693:9 process (4) 608:10;611:7;663:6; 677:18 produced (1) 676:13 product (1) 628:16 projection (1) 633:14 Proper (1) 632:20 properties (1) 627:16 proportionately (1) 665:1 proposal (1) 626:12 propose (1) 679:16 proposing (2) 617:24;618:3 provide (12) 609:18;610:24; 612:24;613:23;614:20;	627:20;636:6;642:15; 653:19;670:10;677:8; 689:22 provided (4) 626:8;638:20; 642:11;669:1 provides (1) 616:8 proximity (1) 666:14 prudent (1) 654:7 PUBLIC (3) 599:17;629:9;659:19 publication (1) 689:24 published (1) 658:7 pull (3) 612:18;674:12,16 pulls (1) 674:16 pump (7) 619:23;631:10; 661:5;680:7;681:16; 686:14,14 pumpage (4) 663:16;664:23; 665:17;666:7 pumped (2) 629:8;641:22 pumping (96) 608:11;609:6; 610:18;617:14,15,19; 624:12;625:14,17,24; 626:5,8;629:14;630:9, 13,14,16,19,20;631:11; 634:13,17,17;639:4,9, 15,17,20,22,23;640:1, 13;641:12;642:2,6,10, 15,16,19,23;643:3,8, 12,24;644:3,7,11; 651:10,13,20;652:5,9, 13;653:14;654:1,3; 658:17,23;659:1,3,5, 11,14;661:3;663:21; 664:3,8,11,12;665:13, 15;666:8,12,15,17; 672:14;674:7,12,17,22; 679:7;680:4,4,5,11,22; 681:13,14,17,23; 682:22;683:2,4; 686:21;688:17,23 pumping's (2) 634:5,9 purveyors (1) 690:12 put (8) 629:23;645:12; 656:4;661:4,11;669:4; 678:17;683:12 puts (1) 670:23	putting (3) 611:4;662:23;663:4 Q quality (1) 616:11 quantification (1) 643:15 quantified (1) 643:9 quantitative (1) 632:24 quantity (3) 629:7;631:14;637:18 question's (1) 665:21 quick (2) 678:8;680:11 quickly (2) 604:9;678:23 quite (1) 670:11 quo (1) 652:5 quote (1) 677:19 quoted (1) 672:6 R raise (1) 666:16 ran (2) 652:9;653:10 range (6) 614:8;628:12;631:4; 673:22,23;674:3 rapid (1) 655:22 rate (9) 605:3;608:6;642:9; 662:20;664:11,12; 682:21;686:23,23 rates (10) 606:20;609:3; 629:16;642:17;655:19; 656:10;662:15,15; 664:3,16 reach (1) 652:10 reached (1) 652:21 reaches (1) 649:6 reaching (1) 653:6 read (4) 616:18;636:19,22,23 reading (4) 616:13;617:12; 637:8;679:22	reality (1) 652:16 realize (1) 620:22 really (9) 604:21;605:14; 609:5;616:20;617:17; 628:17;634:7;663:5; 669:2 reason (10) 620:23;621:7; 626:21;641:8;678:5; 685:19,22;686:18; 688:2;690:9 reasons (1) 653:20 rebuttal (3) 630:1;676:7;683:13 recalibrated (1) 612:3 recalibration (2) 609:15;629:3 recall (22) 606:8;608:14;610:3, 6;618:10;623:19; 631:22;637:12,20; 638:5;640:9;642:7; 645:9;660:9,20; 666:21;672:5,10; 674:9;687:16;688:19; 689:8 received (1) 659:7 recent (5) 609:19;611:22; 637:24;654:4;663:16 recently (1) 655:8 Recess (1) 671:13 recharge (33) 608:6;610:15;611:4, 5,7;622:16,23,23; 628:11,14,15,17,18; 629:2;660:16;662:7, 10,12,15,15,20,24; 663:3;673:21,22,23; 674:4;678:12,15,20,23; 685:13,16 recharging (1) 606:24 Reclamation (1) 690:6 recollection (7) 608:1,8;609:23; 611:20;644:20;687:19, 23 recommend (4) 613:14,16,18;680:3 recommendation (4) 613:15;618:5; 650:17;669:9 recommendations (1)
--	---	--	---	--

668:23 reconstruction (1) 656:7 reconvene (1) 671:10 record (6) 603:6;661:18; 663:11;665:7,9;671:15 recorded (1) 664:2 records (1) 665:19 recovery (8) 617:22;640:23; 641:6,8,14,16,24; 689:12 RECROSS (5) 602:17;672:1; 675:23;681:6;687:7 RECROSS-EXAMINATION (1) 689:5 reduces (1) 674:18 reduction (2) 656:19;657:10 reenters (1) 649:5 refer (2) 609:14;615:11 reference (3) 645:1;689:21;690:1 referenced (2) 638:17;689:14 references (1) 606:17 referred (1) 659:7 referring (5) 621:1;642:11; 648:10;658:17;672:11 refine (1) 667:1 reflect (1) 630:13 reflected (1) 693:10 regard (6) 611:10,15;638:22; 655:16;673:21;689:11 regarding (5) 629:18;632:6; 636:18;637:16;688:21 regardless (3) 634:4,16;664:15 region (2) 666:8;669:8 regional (3) 607:4;668:24;675:11 regular (1) 609:7 Reich (4) 626:12;627:9,24; 628:12	related (1) 684:22 relationship (2) 665:17;683:3 relatively (1) 635:11 release (1) 659:18 released (1) 658:8 relied (1) 627:14 rely (3) 627:7;628:1;643:16 relying (2) 627:1,5 remember (12) 629:24;631:24; 632:1;637:7,8;645:11; 672:8,12;687:19; 689:12,16,20 remind (1) 651:2 repeat (1) 645:17 repeatedly (1) 690:6 report (46) 606:5,11,22;607:21; 608:2,16,18;609:14; 618:6;620:21,24; 623:17;630:1;633:11, 22;634:2;642:4,5,7,19, 20,21,24;643:7;645:6; 648:6,7,10,15;653:19; 655:2,5,7;656:19,23; 657:10;658:9,14; 659:6,18;661:24; 664:2;672:13,21; 673:15;683:13 Reported (2) 599:24;693:9 reports (1) 658:23 Report's (1) 658:8 represent (5) 625:1;638:1;646:7; 658:4;660:4 representation (2) 670:15;677:15 representing (2) 636:14;689:9 reproduce (1) 676:24 Republic (1) 657:20 requested (1) 688:21 required (2) 680:21,22 requires (1) 622:20	resistivity (3) 627:14;628:1,3 RESOURCES (3) 599:2,3;661:17 respect (4) 609:3;610:3;662:16; 669:19 respond (2) 678:3;679:12 responded (1) 672:9 responding (1) 678:1 response (16) 614:12;616:14,17, 21;639:3;641:13; 652:14;658:7,24; 660:18;665:16;674:6; 678:8,17;680:12,22 responses (11) 641:9,24;643:23; 659:5,11,13;664:14; 665:9,23;678:9;680:19 rest (1) 686:1 restate (1) 673:11 result (6) 617:21;625:24; 626:1;647:20;667:22; 680:1 results (11) 605:5;618:7;632:19; 639:24;642:21,24; 643:4;652:12;662:18, 20;664:8 review (2) 607:21;608:18 reviewed (4) 608:1;625:22; 642:14;684:15 reviewers (1) 670:2 revist (1) 674:2 RICHARD (1) 603:21 Rick (2) 645:23;647:16 right (30) 608:17;614:9;616:9; 617:5,13;620:20; 623:2;624:3;632:2; 633:14;636:7,23; 637:9,14;640:11; 643:7;656:14;671:15, 16,21;675:12;685:5; 686:3;687:4;688:5; 689:1;691:11,12; 692:4,6 right-hand (1) 683:22 rights (2)	629:9;679:14 rise (1) 676:10 rising (2) 679:8;685:4 RIVER (73) 599:8,12;605:16,18, 19;606:13;607:3,4,9, 13,17;608:19;609:3,4; 611:17;614:10;618:1; 622:2;625:5,15,19,19; 630:10;633:16,18; 634:3,10,13,14,18,23; 635:14,16,18,19;636:4; 639:15,19;642:7,10,23; 644:9;651:17;653:8; 654:13;656:2;659:1, 15;660:7,18,19;661:3; 665:10,20;666:4,14,16; 672:15;674:8,8,12,15, 15,16,18,20,24;675:14; 677:4;679:6,18; 681:24;683:4 Robison (2) 600:19,20 rock (2) 616:4;649:16 rocks (10) 607:2;646:22;647:4, 11,11;648:18;649:5, 19;668:1,9 Rogers (17) 620:14,17;621:12; 623:10;625:15,18; 632:7,10,15;640:2; 649:6;653:7;654:15; 655:12,18;661:6; 666:21 role (4) 622:14;629:10,11; 654:10 rough (1) 693:10 Roughly (1) 617:1 round (1) 603:17 RPR (1) 599:24 Rule (1) 688:16 Ruling (7) 636:20,20,24; 638:17,24;687:16,19 run (1) 619:21 running (2) 633:22;639:22 runs (1) 614:10	Sacramento (1) 601:18 safe (1) 686:23 salt (1) 661:8 Same (12) 605:1;634:9;636:3; 637:9;641:20;647:18; 657:22;676:24;677:1; 685:23,24;693:10 satisfied (1) 680:23 saturated (1) 649:20 saw (3) 641:19;666:11; 685:20 saying (4) 607:19;610:10; 634:20;672:12 scale (2) 676:23;677:3 scenario (1) 642:18 scenarios (3) 642:16,20;664:11 schedule (3) 603:14;680:4,5 Schreck (1) 600:22 Schroeder (7) 601:12,13;602:9; 646:6,7;650:23;690:21 scientist (1) 619:13 search (1) 690:1 seasonal (10) 617:4;630:17;665:9, 16,23;666:6,11,12,17; 680:5 seasonality (1) 666:2 second (5) 603:17;639:23; 679:21;684:6;685:6 Section (10) 600:7,10;637:8; 647:14,22;672:24; 673:1,2,3,14 sections (4) 647:9;673:4,13,15 sediment (1) 649:4 sedimentary (3) 648:9,14,18 sediments (5) 648:18;661:8; 667:24;668:7,9 seeing (2) 664:14;684:8 seeded (1)
S				

666:3 senior (1) 629:8 sense (3) 627:2,3;685:18 sensitive (1) 656:21 sensitivity (2) 657:8;662:19 separate (2) 662:23;680:6 SEPTEMBER (3) 599:21;603:1;693:15 SeriesSEE (2) 678:13,16 Service (9) 603:23;614:24; 623:15;631:20;637:10; 672:18,19;675:21; 690:4 Services (1) 688:6 set (5) 605:18;611:5;630:4; 667:21;670:5 sets (1) 664:5 setting (2) 673:1,18 seven (3) 615:14;642:19; 671:19 several (6) 603:11;606:2; 655:15;658:6;680:17, 18 Sharp (1) 600:19 shear (6) 614:9;618:14,18,19; 619:6,7 Sheep (5) 628:12;631:4; 673:21,23;674:3 sheet (13) 646:22;647:4,10,14, 16,19;648:5;649:2,17, 22,23;650:4,21 shifting (1) 666:20 short (2) 633:22;679:22 shorter (1) 608:12 shorthand (1) 693:11 show (5) 616:10;631:10; 640:11,22;658:23 showed (9) 609:2;628:23; 641:19;643:10;653:5, 9;654:4;666:2;688:13	showing (4) 622:24;640:6;654:1; 678:8 shown (5) 633:17;634:1;638:1; 661:22;684:6 shows (10) 608:18;638:21; 641:13;647:22;653:16; 656:5;662:8;680:11; 685:6,7 side (3) 614:14;631:6;683:22 signal (4) 613:23;630:13; 631:10;680:6 signature (1) 630:18 significant (7) 628:17,19;629:10, 11;632:13;641:19; 648:4 similar (7) 609:6;622:7;668:8, 11;677:3;683:5;685:13 simple (1) 646:14 simplification (1) 678:21 simply (1) 667:18 simulate (6) 611:5;618:11;639:8, 21;665:5;667:18 simulated (15) 608:19,23;610:10; 611:16;618:12;621:3; 633:15,17;639:17; 643:3;652:15,17; 681:12,14;682:2 simulating (1) 611:7 simulation (9) 610:12;639:22,23; 652:12;653:9;657:3; 663:18,19;664:10 simulations (13) 609:9,19;618:8; 634:1,7,18;640:1; 652:9;653:5;663:5; 664:2;669:5;677:17 single (1) 684:12 Site (3) 658:9,14;659:12 situated (1) 671:19 situation (3) 622:7;623:3;682:19 slide (39) 612:17,20,24;613:2, 9;615:14,18;616:12; 617:6,23;621:11;	622:13,24;623:9,22,22, 22;624:2,3;632:3,19; 633:14;637:23;640:4; 644:14,16;646:11; 655:11;656:4;661:22; 675:5;676:3,3,18; 679:13;682:11,17; 689:11,18 slides (4) 612:18;615:11; 620:15;633:10 slideshow (1) 669:2 slow (1) 633:13 slower (2) 641:14;678:9 small (5) 605:8,8;616:19; 635:5;636:22 smallest (2) 604:12,13 snails (1) 655:8 SNWA (5) 600:16;683:12,13; 684:13;690:12 SNWA's (1) 629:24 softballs (1) 687:12 soil (1) 685:15 sometimes (2) 684:20;686:12 somewhere (3) 618:6;621:18;653:22 sooner (1) 652:21 sorry (16) 605:9;612:6;613:20; 624:3;627:23;630:3, 23;635:6;643:1;662:2; 664:22;665:6;672:23; 673:10;688:8;689:8 sort (3) 635:9;644:18;678:2 sounded (1) 672:7 sounds (4) 620:20;640:9; 645:12;656:23 source (8) 621:11;622:6,23; 632:11;635:2;646:13; 648:12,22 sourced (1) 636:3 sources (1) 636:4 south (4) 607:2,11,18;659:6 southeast (1)	607:5 southern (7) 609:7;624:18;625:2; 637:6;676:10;681:3; 691:22 southwest (2) 645:1;659:6 special (1) 672:14 Species (3) 655:9;656:22;657:12 specific (3) 666:7;675:14,17 specifically (3) 633:9;634:2;645:11 speculate (3) 624:10,13;653:4 spring (80) 605:2,3,4,5,9,12,15; 606:23;607:1,8,12,18; 611:17;612:1;613:7, 17;623:23;625:11,14, 15;626:6;629:21; 631:6;635:22;636:3; 637:1,2,6,7,11,19; 638:10,22;640:19; 643:12,13;644:2,3,4,5, 8,17,18,20,22;645:8,9, 14,15,19,19;651:24; 652:4;653:6,16;654:1, 17,20,24;655:3,15; 656:2,5,20;657:1,3,4,6, 11;661:7;671:22; 673:23;678:22;680:9, 10;683:21;684:2,5,20; 691:15 SPRINGS (57) 599:12;603:10; 606:13;607:4,9,13; 610:5;611:17,18; 612:23;613:12;614:10; 617:6;620:15;621:13; 622:2;623:11;625:18, 19;626:9,9;630:10; 634:10;636:18,21; 639:15,19;643:4; 644:9;646:14;648:13, 22;649:6;653:8; 654:11,13,15,16,21; 655:12,15,18;656:3,18; 659:1;660:18;666:4, 14,16,22;667:17; 668:4;678:19;679:18; 687:21,22;688:22 Spring's (2) 639:8,20 springsnails (1) 655:3 SS (1) 693:5 stable (3) 624:1,5,5 staff (2)	661:16;691:10 Stan (1) 641:17 standard (3) 619:20;661:24;662:3 stands (1) 669:15 start (7) 603:7,9;617:21; 640:12,22;646:18; 671:21 started (4) 640:7;664:10,14; 678:6 starting (2) 615:14;623:22 starts (2) 640:13;641:1 STATE (31) 599:1;600:4;608:3; 625:21;629:6;636:19, 24;637:14;638:17,18, 24;650:14;652:3; 657:13;661:17;664:4; 668:24;676:15,19,20, 22;677:3,6,9,13,19; 686:7,16;687:20; 691:10;693:4 stated (9) 604:11;612:7;652:8; 653:13,24;658:22; 660:5,10;690:6 statement (6) 636:2;645:10;660:9; 669:13;679:20;681:21 statements (3) 644:15;645:5;673:18 states (4) 606:11,12,22;675:21 stating (1) 660:20 station (3) 605:22;675:6,8 stationed (1) 672:18 stations (4) 605:18,19;675:6,8 status (1) 652:5 steady (9) 676:15,19,20,22; 677:3,6,9,13,19 steady-state (1) 607:22 step (1) 629:3 steps (2) 608:10,12 Steve (1) 658:3 still (1) 681:19 stop (1)
---	---	--	---	---

682:24 stopwatch (1) 605:10 storage (1) 620:2 stored (1) 641:15 stream (8) 605:6,8,24;681:19, 24;682:2;683:9;684:21 stress (1) 620:5 stretches (1) 609:4 strike (2) 605:6;682:9 strong (4) 688:1,10,13,14 stronger (1) 627:5 structural (2) 610:16;614:2 structure (6) 610:20,23;611:1; 637:5,17;638:16 structures (1) 627:9 study (3) 605:17;606:18;608:4 stuff (1) 611:2 subflow (2) 675:3,4 subject (1) 677:22 subsurface (1) 614:8 sufficient (9) 611:3;616:6;631:16; 682:22;685:12;686:7, 16,22,24 suggest (4) 623:6;648:7;650:14; 654:5 suggested (4) 621:22;665:8,23; 680:18 suggesting (2) 607:7,11 suggestions (2) 612:20,24 suggests (1) 621:20 Sullivan (5) 600:5;602:16; 668:19,21;671:7 summation (1) 632:8 support (3) 622:5;627:4;674:1 supported (1) 637:4 sure (7)	604:16;614:11; 616:20;620:24;634:19; 657:16;665:2 surface (4) 604:19;647:5; 660:11;668:11 surprise (1) 690:15 surrounding (1) 619:24 sustain (1) 682:22 sustainable (1) 653:20 switch (1) 654:9 sworn (1) 603:24 synoptic (1) 605:17 SYSTEM (31) 599:8;604:15;609:8; 613:20;618:2;625:6; 634:14;635:6;651:18; 652:9;654:16;655:24; 659:2,15;660:16; 661:12;667:1;669:11; 670:16;672:15;674:8, 15;675:15;676:15; 677:4;678:11,19; 679:6,11;683:7;685:21 systems (1) 654:21 T table (7) 604:6;606:6,11; 629:23;642:11,14; 661:23 Taggart (8) 600:16,16;602:7,20; 624:22;625:1;674:7; 681:7 TAGGERT (2) 636:7;691:24 talk (10) 604:17;620:14; 649:12;650:11;660:14; 662:8;665:16;666:24; 679:14;686:15 talked (6) 629:19;658:16; 660:13;662:11;678:13; 683:16 talking (14) 604:18,18;618:7; 621:2,11,17;622:17; 623:21;635:8;663:3,8; 666:20;680:10,16 Talks (2) 648:16;663:2 Tanner (1)	615:7 Tech (2) 662:11;669:14 technique (1) 605:7 techniques (1) 605:4 telling (1) 648:14 tells (3) 670:5;671:1,4 temperature (8) 613:5;621:14;622:4, 14,16,21,23;666:21 temperatures (4) 621:16;622:17,20; 667:8 tempo (1) 608:13 ten (2) 616:12;627:10 Terhune (2) 599:24;693:8 term (5) 628:7;670:4;680:21; 682:7,7 terminate (1) 680:14 terms (7) 609:22;633:1; 641:22;650:7;667:14; 670:2;680:17 test (23) 616:22,24;619:21; 625:24;626:8;630:14, 17;631:10,11;633:5; 640:7;644:7;652:13; 659:4;669:17;679:24, 24;680:4,14,18; 681:16;684:4;686:14 tested (2) 628:16;686:15 testified (6) 603:24;612:9;619:3; 620:9;638:11;658:6 testimony (16) 626:13;627:8; 628:10;629:19;631:9, 18;632:22;636:17; 640:16,17;669:4; 682:15;683:16;684:5, 16;685:2 testing (9) 613:5,6,17,22; 628:22,23;639:5; 650:8;680:21 Tetra (2) 662:11;669:14 Thanks (3) 614:22;617:18; 688:15 therefore (3) 648:1;677:22;682:16	thermal (1) 621:23 thinking (1) 638:19 thought (4) 613:8;638:11;643:2; 660:10 thoughts (1) 666:5 thousand (2) 639:11;688:17 three (11) 629:18,22;630:23; 634:6;642:15;655:3; 661:23;664:11;677:12; 680:24;684:9 three-dimensional (1) 607:15 throughout (3) 608:8;653:5;670:8 throw (1) 663:17 Thrust (18) 632:7;646:21,22; 647:2,4,10,14,16,19; 648:5;649:2,13,17,17, 22,23;650:4,21 thrusted (1) 667:3 Tim (2) 600:18;685:13 times (2) 606:2;672:9 title (1) 658:11 titled (2) 617:23;658:9 today (8) 603:13,16;609:1,9, 13;640:17;644:1; 678:13 today's (1) 692:5 told (1) 687:24 tomorrow (1) 692:7 tongue (1) 618:5 took (2) 656:2;659:3 tool (4) 670:4;671:2,4,5 tools (1) 686:13 top (3) 647:4;673:9;683:20 total (2) 620:18;663:16 totals (1) 606:16 toured (1) 654:13	toward (3) 607:8,9;674:12 towards (4) 607:12;614:10; 649:2;666:3 tracer (9) 613:5,16;621:13,14; 658:9,14;659:4,12; 666:24 track (1) 671:20 tracks (1) 654:9 TRANSCRIPT (2) 599:16;625:22 transient (9) 607:22,24;608:9; 611:5;662:12,24; 677:11,16,20 transmission (1) 640:20 transmissivity (8) 604:23;605:1; 619:16,18;620:2,7; 640:18,20 transmit (1) 652:14 transmitting (1) 648:4 trend (8) 641:7;651:16,24; 655:14;684:8;685:1,1, 20 trendline (2) 683:23;684:1 trends (4) 633:5;679:6;683:17; 685:3 Tribe (2) 675:22;691:19 tricky (1) 656:18 trouble (2) 616:13;617:12 true (3) 627:13;628:9;693:10 try (4) 604:8,9;615:9; 650:20 trying (12) 616:1;619:17; 622:22;646:17;652:20; 662:13,16;670:19; 676:14;677:14;687:3; 690:3 tubes (1) 607:15 Tule (3) 642:6,10,22 turn (5) 612:17;632:3;633:9; 658:7;675:5 two (17)
---	--	--	---	--

607:7,14,19,22,23; 623:24;624:4;638:1; 639:4,24;643:24; 654:17;658:19;659:4; 671:9;678:16;682:12	upon (15) 604:22;609:21; 626:20;627:14;628:1; 637:15,24;645:23; 662:9;664:4,11; 667:24;669:16;670:20; 686:23	value (1) 605:21	Wash (9) 606:16;607:6; 611:18;622:5,8; 623:12;649:1;667:7; 684:7	649:22;658:24;684:20
two-year (1) 617:20	upper (6) 623:2;649:2,17,17, 22,23	values (4) 605:1;628:18; 663:17,21	WATER (96) 599:3;601:4,5,10; 605:20;608:8;610:21; 611:6;612:7,10,14; 615:24;616:5;617:3, 11;618:18;621:12,20; 623:1,5,21;624:5,18, 19;625:2,3,14;626:9; 629:10,16;630:20; 631:14;632:11,14,15; 636:9,14,15;637:1,18; 639:3;640:22;641:15; 644:5,15;645:1; 646:13,16;647:13; 648:1,4,16;649:4; 651:12,14;652:4; 660:11,17;661:1,5,12, 17;663:1;665:23; 667:2,5,7;668:5,12; 674:12,14,16;676:9,20; 679:2,5,8,14,19;681:4, 4;683:17;684:9,19,22; 685:3,4,14;686:8; 687:5,10;689:3,9,10; 690:12;691:23	Wet (1) 675:11
type (7) 605:6;613:2,10,11; 616:10;648:19;684:8	use (15) 604:14;605:3,23; 616:9;620:12;628:3,5, 6;661:23;664:23; 669:14;677:16;679:19; 686:8,17	variability (1) 678:2	whereas (1) 605:2	wetter (1) 679:11
types (1) 670:10	used (8) 628:4;633:4;642:17; 663:20;665:3;666:24; 684:21;688:14	variable (1) 662:9	whenever (1) 651:22	what's (6) 670:4,5;673:13; 677:11;681:15;687:11
typically (3) 606:1;621:19;662:14	useful (7) 613:23;627:15,15, 18;667:10;670:12; 671:6	variation (1) 666:6	WHITE (13) 599:8;611:18;618:1; 625:5;634:13;651:17; 659:1,14;672:15; 674:8;675:14;677:4; 679:6	whole (1) 614:5
U	Uses (3) 632:21;669:3;686:8	varied (2) 609:24;629:4	Whose (1) 673:10	Wildlife (6) 601:17;614:24; 631:19;654:21;675:21; 688:6
Uh-hum (2) 649:18;682:3	USGS (10) 605:17;606:18; 641:18;658:8,15,23; 659:8;676:6,13;689:24	vary (1) 634:6	Wider (1) 622:5	without (7) 629:8;630:10; 635:18;656:13;661:3; 663:4;670:3
ultimately (2) 634:14,17	using (5) 609:15;613:1; 621:22;663:16;665:3	vectored (1) 666:3	WISER (15) 599:8;612:21;614:2, 3,19;628:15;638:22; 651:17;652:8;659:1; 662:10;666:7;667:16; 668:9;678:15	witness (1) 603:22
unasked (1) 608:3	V	vicinity (1) 680:7	WATER (10) 618:9;619:21;620:3, 4;643:20;646:15; 649:3;660:12;678:11; 679:23	wondering (3) 655:14;661:22; 689:21
uncertain (1) 668:2	valid (1) 629:16	Vidler (6) 601:5;611:23;636:8, 14;689:3,9	weather (1) 675:6	word (2) 616:9;688:14
uncertainty (5) 604:13,24;662:14, 17;670:18	validated (2) 626:2,3	view (3) 629:22;632:9;683:19	website (3) 664:4;675:9,10	words (3) 668:4;687:24;688:3
unclear (1) 662:6	VALLEY (81) 599:10,11;601:19; 606:23;607:1,8,12; 611:17;612:1,23; 613:7,12,17;617:7,24; 618:1,9,11,14,19; 624:19;625:2,11,14; 626:6;629:21;631:7; 636:18;637:1,2,6,7,11, 20;638:10,22;640:19; 642:7,10,23;643:13,20; 644:2,3,4,5,8,17,21; 645:2,8,9,15,15,19,19; 649:1;654:16;657:23; 658:4;666:13,18; 667:6,12;673:24; 676:15,22;677:12; 680:9,10;681:4; 683:21;684:2,6,6; 687:5,10,21,22;688:22; 691:4	viewed (1) 671:5	WEDNESDAY (1) 599:21	work (15) 611:22;613:10,15, 18;628:8;637:24; 645:23;659:10;669:16, 24;673:4,10,20;674:3; 678:10
under (2) 636:18;637:3	validity (1) 629:16	viewing (1) 685:24	weight (1) 669:4	working (1) 672:19
underestimated (5) 610:17;612:8,10,10, 15	validity (1) 629:16	Virgin (3) 642:6,10,22	weir (1) 605:22	write (1) 672:22
underflow (1) 606:24	VALID (1) 629:16	visit (1) 654:11	well-connected (2) 680:9,13	writings (1) 672:10
underlying (1) 647:10	VALLEY (81) 599:10,11;601:19; 606:23;607:1,8,12; 611:17;612:1,23; 613:7,12,17;617:7,24; 618:1,9,11,14,19; 624:19;625:2,11,14; 626:6;629:21;631:7; 636:18;637:1,2,6,7,11, 20;638:10,22;640:19; 642:7,10,23;643:13,20; 644:2,3,4,5,8,17,21; 645:2,8,9,15,15,19,19; 649:1;654:16;657:23; 658:4;666:13,18; 667:6,12;673:24; 676:15,22;677:12; 680:9,10;681:4; 683:21;684:2,6,6; 687:5,10,21,22;688:22; 691:4	VOLUME (3) 599:19;605:13; 668:12	wells (33) 610:1;614:2,18; 619:21,22,23,24; 623:24;624:4;626:6,6; 629:19,20,22;630:9,18; 634:4,5,6,8;639:4; 640:21;642:2;643:12, 24;644:8;665:24; 666:2;674:13;679:15; 680:12;684:2;688:13	working (1) 672:19
uneasy (1) 669:19	VALLEY (81) 599:10,11;601:19; 606:23;607:1,8,12; 611:17;612:1,23; 613:7,12,17;617:7,24; 618:1,9,11,14,19; 624:19;625:2,11,14; 626:6;629:21;631:7; 636:18;637:1,2,6,7,11, 20;638:10,22;640:19; 642:7,10,23;643:13,20; 644:2,3,4,5,8,17,21; 645:2,8,9,15,15,19,19; 649:1;654:16;657:23; 658:4;666:13,18; 667:6,12;673:24; 676:15,22;677:12; 680:9,10;681:4; 683:21;684:2,6,6; 687:5,10,21,22;688:22; 691:4	volumes (1) 681:17	west (5) 607:18;631:6;	writings (1) 672:10
unfortunately (1) 676:17	Valleys (2) 607:10;642:16	W		
unit (2) 615:19,19		WADDELL (11) 603:21;604:3;615:9; 624:23;636:13;658:3; 660:3;668:20;672:3; 687:9;689:7		
United (1) 675:20		wait (1) 686:13		
up (30) 605:18;608:20; 612:19;636:8;643:20; 646:22;648:2;649:20; 650:16,22;651:12,12; 656:4;661:16;664:9, 12;667:21;669:21; 671:11,17;672:23; 677:22;678:6;681:11; 687:18;688:16;689:16; 691:10,13;692:4		waiting (1) 686:9		
update (1) 609:10		warm (3) 621:16,17;684:20		
updated (5) 609:13;611:12; 663:21;664:3,5		warmer (3) 666:22;667:6,11		

<p>written (1) 673:13</p> <p>wrong (1) 628:3</p> <p>wrote (8) 619:3;655:6;656:24; 657:5;672:7,24;673:2; 679:22</p>	<p>14 (2) 664:12;665:3</p> <p>14,000 (1) 681:18</p> <p>14,000-acre-feet (1) 681:12</p> <p>14,500 (1) 653:22</p> <p>14,500-acre-feet (2) 652:10;653:10</p>	<p>617:8,12;641:3,6; 663:3</p> <p>2015 (3) 640:23;653:15; 675:12</p> <p>2017 (2) 653:15;685:7</p> <p>2019 (5) 599:21;603:1; 673:14;685:8;693:15</p> <p>209 (1) 693:8</p> <p>20th (1) 690:7</p> <p>210 (1) 599:9</p> <p>215 (1) 599:10</p> <p>217 (1) 599:11</p> <p>218 (1) 599:12</p> <p>219 (1) 599:13</p> <p>22 (1) 645:7</p> <p>23 (3) 617:6;640:4;689:11</p> <p>24 (1) 637:23</p> <p>25 (2) 599:21;603:1</p> <p>2-5 (1) 630:4</p> <p>2500-acre-feet (1) 660:6</p> <p>26th (1) 693:15</p> <p>27 (1) 644:14</p> <p>28 (1) 617:23</p>	<p>621:11</p> <p>3-4 (1) 606:6</p> <p>36 (2) 622:13;623:9</p> <p>37 (2) 622:24;661:22</p> <p>3rd (1) 673:14</p>	<p>660 (1) 602:12</p> <p>661 (1) 602:13</p> <p>663 (1) 602:14</p> <p>664 (1) 602:15</p> <p>668 (1) 602:16</p> <p>672 (1) 602:18</p> <p>675 (1) 602:19</p> <p>681 (1) 602:20</p> <p>687 (1) 602:21</p> <p>689 (1) 602:22</p>
<p>Y</p>	<p>15 (4) 608:20;623:22; 624:3;642:5</p> <p>150 (1) 685:9</p> <p>16 (3) 603:15;604:8;651:4</p> <p>1880-foot (1) 644:24</p> <p>19 (1) 612:17</p> <p>1910 (1) 665:20</p>	<p>209 (1) 693:8</p> <p>20th (1) 690:7</p> <p>210 (1) 599:9</p> <p>215 (1) 599:10</p> <p>217 (1) 599:11</p> <p>218 (1) 599:12</p> <p>219 (1) 599:13</p> <p>22 (1) 645:7</p> <p>23 (3) 617:6;640:4;689:11</p> <p>24 (1) 637:23</p> <p>25 (2) 599:21;603:1</p> <p>2-5 (1) 630:4</p> <p>2500-acre-feet (1) 660:6</p> <p>26th (1) 693:15</p> <p>27 (1) 644:14</p> <p>28 (1) 617:23</p>	<p>4</p> <p>4 (4) 629:18;630:9,13,22</p> <p>40 (3) 646:11,16,24</p> <p>4000-acre-feet (1) 606:12</p> <p>41 (2) 646:11,14</p> <p>45 (1) 632:3</p> <p>48 (1) 623:22</p>	<p>7</p>
<p>year (10) 606:12,14,15,17; 652:10;653:11,14; 656:3;664:3;690:7</p> <p>years (6) 606:2;621:2;652:8, 24;655:16;656:3</p> <p>yellow (1) 640:11</p> <p>yesterday (3) 631:19;635:22; 640:16</p> <p>yield (2) 653:20;686:23</p> <p>younger (3) 648:5,18;649:4</p> <p>Yucca (1) 658:18</p>	<p>2</p> <p>2 (2) 630:21;645:6</p> <p>2.0 (1) 621:4</p> <p>2.15 (2) 620:18;621:5</p> <p>2.25 (2) 620:21;621:4</p> <p>2000 (2) 611:11;683:13</p> <p>2000-acre-feet (1) 606:14</p> <p>2001 (1) 625:8</p> <p>2004 (1) 611:6</p> <p>2005 (2) 611:6;663:4</p> <p>2007 (1) 636:20</p> <p>2008 (4) 606:17,20,21;655:22</p> <p>2009 (1) 655:19</p> <p>2010 (2) 617:3;640:7</p> <p>2011 (2) 609:11,16</p> <p>2012 (13) 606:5,22;607:21; 609:20;611:11,12,13, 15;642:18;664:5; 669:15;674:1,4</p> <p>2013 (5) 616:19;617:16; 623:15,17;640:8</p> <p>2014 (5)</p>	<p>3</p> <p>3 (5) 629:18;630:9,13,21, 22</p> <p>3.2 (2) 673:3,14</p> <p>3:00 (1) 671:10</p> <p>3:35 (1) 692:10</p> <p>32 (2) 620:15;655:11</p> <p>3200-foot (1) 644:17</p> <p>33 (3) 620:15;655:11;656:4</p> <p>3-3 (1) 683:14</p> <p>34 (1)</p>	<p>5</p> <p>5 (2) 664:12;665:3</p> <p>500 (2) 621:2;652:8</p> <p>52 (1) 620:18</p> <p>54 (2) 675:5;676:3</p> <p>56 (1) 682:11</p> <p>5712 (6) 636:20;638:17,24; 687:16,19;688:16</p> <p>599-693 (1) 693:12</p>	<p>8</p> <p>81 (1) 684:13</p>
<p>Z</p>	<p>1</p>	<p>3</p>	<p>6</p>	<p>9</p>
<p>zone (7) 614:9,19;618:14,18, 19;619:6,7</p>	<p>2000 (2) 611:11;683:13</p> <p>2000-acre-feet (1) 606:14</p> <p>2001 (1) 625:8</p> <p>2004 (1) 611:6</p> <p>2005 (2) 611:6;663:4</p> <p>2007 (1) 636:20</p> <p>2008 (4) 606:17,20,21;655:22</p> <p>2009 (1) 655:19</p> <p>2010 (2) 617:3;640:7</p> <p>2011 (2) 609:11,16</p> <p>2012 (13) 606:5,22;607:21; 609:20;611:11,12,13, 15;642:18;664:5; 669:15;674:1,4</p> <p>2013 (5) 616:19;617:16; 623:15,17;640:8</p> <p>2014 (5)</p>	<p>23 (3) 617:6;640:4;689:11</p> <p>24 (1) 637:23</p> <p>25 (2) 599:21;603:1</p> <p>2-5 (1) 630:4</p> <p>2500-acre-feet (1) 660:6</p> <p>26th (1) 693:15</p> <p>27 (1) 644:14</p> <p>28 (1) 617:23</p>	<p>5 (2) 664:12;665:3</p> <p>500 (2) 621:2;652:8</p> <p>52 (1) 620:18</p> <p>54 (2) 675:5;676:3</p> <p>56 (1) 682:11</p> <p>5712 (6) 636:20;638:17,24; 687:16,19;688:16</p> <p>599-693 (1) 693:12</p>	<p>70 (1) 685:8</p> <p>73 (2) 633:10,14</p> <p>74 (1) 679:13</p>
<p>1</p>	<p>1 (1) 683:21</p> <p>1.0 (2) 673:1,14</p> <p>1.1 (2) 673:1,14</p> <p>1.2 (2) 673:2,14</p> <p>1.63 (1) 620:17</p> <p>1:00 (1) 603:1</p> <p>10,000 (3) 664:24;665:3;681:19</p> <p>1169 (16) 610:18;616:14; 623:18;626:1;630:14; 631:11;637:3,11,20; 638:23;639:4;643:19; 652:13;669:17;686:14, 15</p> <p>12,000-acre-feet (1) 606:17</p> <p>1303 (1) 599:18</p>	<p>3 (5) 629:18;630:9,13,21, 22</p> <p>3.2 (2) 673:3,14</p> <p>3:00 (1) 671:10</p> <p>3:35 (1) 692:10</p> <p>32 (2) 620:15;655:11</p> <p>3200-foot (1) 644:17</p> <p>33 (3) 620:15;655:11;656:4</p> <p>3-3 (1) 683:14</p> <p>34 (1)</p>	<p>6000-acre-feet (1) 606:15</p> <p>604 (1) 602:5</p> <p>615 (1) 602:6</p> <p>624 (1) 602:7</p> <p>636 (1) 602:8</p> <p>645 (1) 602:9</p> <p>65 (1) 632:19</p> <p>651 (1) 602:10</p> <p>658 (1) 602:11</p>	<p>9 (2) 630:4;683:13</p> <p>90s (1) 621:18</p> <p>9318 (1) 654:3</p> <p>9318-acre-feet (1) 653:14</p>

In The Matter Of:

*DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES*

*Vol. IV
September 26, 2019*

*Capitol Reporters
123 W. Nye Lane, Ste 107

Carson City, Nevada 89706*

Original File 9-26-19A.M.VolumeIVfinalSE_1.txt
Min-U-Script® with Word Index

SE ROA 53252

JA_17649

Page 694

1 STATE OF NEVADA
 2 DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
 3 DIVISION OF WATER RESOURCES
 4 BEFORE MICHELINE N. FAIRBANK, HEARING OFFICER
 5
 6
 7 IN THE MATTER OF THE ADMINISTRATION
 AND MANAGEMENT OF THE LOWER
 8 WHITE RIVER FLOW SYSTEM WITHIN
 COYOTE SPRING VALLEY HYDROGRAPHIC
 9 BASIN (210), A PORTION OF BLACK
 MOUNTAINS AREA HYDROGRAPHIC
 10 BASIN (215), GARNET VALLEY
 HYDROGRAPHIC BASIN (216), HIDDEN
 11 VALLEY HYDROGRAPHIC BASIN (217),
 CALIFORNIA WASH HYDROGRAPHIC BASIN
 12 (218), AND MUDDY RIVER SPRINGS AREA
 (AKA UPPER MOAPA VALLEY HYDROGRAPHIC
 13 BASIN (219)).
 _____ /
 14
 15 TRANSCRIPT OF PROCEEDINGS
 16 PUBLIC HEARING
 17 HEARING ON ORDER 1303
 18 VOLUME IV, A.M. SESSION
 19 (Pages 694-830)
 20 THURSDAY, SEPTEMBER 26, 2019
 21
 22
 23
 24 Reported by: Michel Loomis, RPR

Page 696

1 APPEARANCES:
 2 For Lincoln County
 Water District
 3 -and-
 Vidler Water Company: Allison MacKenzie
 4 By: Karen Peterson, Esq.
 Carson City, Nevada
 5
 For Moapa Band of Paiutes: Beth Baldwin, Esq.
 6
 7 For NCA: Alex Flangas, Esq.
 Reno, Nevada
 8
 9 For Moapa Valley
 Water District: Greg Morrison, Esq.
 10
 11 For Bedroc: Schroeder Law
 By: Laura Schroeder, Esq.
 12
 For City of North Las Vegas: Schroeder Law
 13 By: Laura Schroeder, Esq.
 14 For National Park Service: Karen Glasgow
 15 For Center for Biologic
 Diversity: Patrick Donnelly
 16
 17
 18
 19
 20
 21
 22
 23
 24

Page 695

1 APPEARANCES:
 2 Micheline N. Fairbank,
 Hearing Officer
 3
 Tim Wilson,
 4 Acting State Engineer
 5 Adam Sullivan,
 Deputy State Engineer
 6
 Melissa Flatley,
 7 Chief of the Hearing Officer Section
 8 Michelle Barnes,
 Supervising Professional Engineer
 9
 Levi Kryder,
 10 Chief of the Hydrology Section
 11 Jon Benedict,
 Hydrologist
 12
 Christi Cooper,
 13 Geologist
 14 Bridget Bliss,
 Basin Engineer
 15
 16 For SNWA: Taggart & Taggart, Ltd.
 By: Paul G. Taggart, Esq.
 Carson City, Nevada
 -and-
 18 Tim O'Connor, Esq.
 19 For CSI: Robison, Belaustegui, Sharp
 & Low
 20 By: Kent R. Robison, Esq.
 Reno, Nevada
 21
 22 For CSI: Brownstein Hyatt Farber Schreck
 By: Brad Herrema, Esq.
 23 Los Angeles, California
 24 For NV Energy: Justina Caviglia, Esq.

Page 697

1 INDEX
 2 DR. CADY JOHNSON: DIRECT CROSS REDIRECT EXAMINATION
 3 By Ms. Baldwin: 701
 4 By Mr. Herrema: 755
 5 By Mr. Miller: 763
 6 By Mr. Taggart: 771
 7 By Ms. Peterson: 786
 8 By Mr. Donnelly: 7797
 9 By Ms. Cooper: 811
 10 By Mr. Benedict: 813
 11 By Mr. Kryder: 818
 12 By Hearing Officer Fairbank: 819
 13
 14 EXHIBITS: ADMITTED
 15 MBOP 2 703
 16 MBOP 3 703
 17
 18
 19
 20
 21
 22
 23
 24

Page 698

1 CARSON CITY, NV, THURSDAY, SEPTEMBER 26, 2019, A.M. SESSION
2 -o0o-
3
4 HEARING OFFICER FAIRBANK: Good morning. This is
5 a continuation of the hearing in the matter of a Lower White
6 River Flow System Order 1303 proceedings. And so today, we're
7 going to go ahead and hear from the Moapa Band of Paiute
8 Indians. And we might have additional -- more time for
9 cross-examination today based upon conversations I've had with
10 the Tribal representative.
11 So once we get through the initial presentation
12 by the Tribe, then we'll go ahead and make a determination of
13 how much time to assign, and then we'll go from there.
14 And so I'll go ahead and let you guys start in,
15 Ms. Baldwin.
16 MS. BALDWIN: Thank you, Mr. King, Ms. Fairbank,
17 Ms. Flatley, the Division of Water Resources staff. My name
18 is Beth Baldwin. I'm an attorney for the Moapa Band of
19 Paiutes. With me is Debbie Leonard, our local counsel.
20 Before we put Dr. Johnson on to testify today, we
21 have two things that we want to put into the record.
22 The first is a general objection to the State
23 Engineer's authority to engage in the proceedings based on the
24 absence of an express legislative direction. The only

Page 699

1 statutory provision cited authorizing Order 1303 is Nevada
2 Revised Statute 533.024, which is a legislative declaration of
3 policy to conjunctively manage the waters of the State.
4 It does not expressly authorize the State
5 Engineer to manage distinct basins is one, and secondly, even
6 if that does provide statutory authority, this proceeding is
7 an ad hoc rule making in the absence of any regulations
8 regarding conjunctive management in multiple hydrographic
9 basins that until now, were managed as the State, therefore,
10 it's arbitrary and capricious. We just want to make this
11 objection known on the record. Thank you.
12 Secondly, the Tribe chose not to put on any
13 witnesses as to policy matters because we understood those to
14 be outside of the scope of this proceeding. We only have a
15 technical expert. But we understand that other parties may be
16 putting on witnesses describing the extent of their water
17 rights or hypothetical interference with their water rights.
18 So for that, we'd like to just point out three
19 things for the record:
20 The Tribe possesses federally reserved rights to
21 surface and groundwater appurtenant to the original 1,000-acre
22 reservation with an 1873 priority date and groundwater rights
23 to the 70,000-acre expansion with a 1980 priority date.
24 Those rights are an asset held in trust by the

Page 700

1 United States for the benefit of the Tribe, and the United
2 States has a money mandating responsibility to manage those
3 rights for the Tribe's benefit.
4 Those rights are unadjudicated and unquantified
5 as of yet, but the Tribe has the right to invoke those rights
6 and ask that they be adjudicated in Nevada State Court.
7 The Tribe leases 3,700-acre-feet annually of
8 Muddy River surface water from the Muddy Valley Irrigation
9 Company, and those rights are contractually senior to all
10 other Muddy Valley Irrigation Company rights per the 2006
11 lease, which is Nevada State Engineer's Exhibit Number 242.
12 And one housekeeping matter. I brought about 30
13 copies, paper copies of the PowerPoint presentation. That's
14 probably enough for every party, but maybe not every person.
15 So if someone didn't get one, if you could share with your
16 neighbors, that would be appreciated.
17 And now I'll stop talking and let Dr. Cady
18 Johnson, the Tribe's hydrogeologist begin.
19 HEARING OFFICER FAIRBANK: And before you start
20 speaking, Mr. Johnson, let's go ahead and have you sworn in.
21 DR. CADY JOHNSON,
22 called as a witness in this matter,
23 having been first duly sworn,
24 testified as follows:

Page 701

1 DIRECT EXAMINATION
2 BY MS. BALDWIN:
3 Q. Dr. Johnson, can you spell you name -- say your
4 name and spell it for the record, please?
5 A. Cady Johnson, C-A-D-Y --
6 Q. And turn your microphone on?
7 A. Thank you. C-A-D-Y, Johnson, J-O-H-N-S-O-N.
8 Q. And are you currently employed as a
9 hydrogeologist?
10 A. I'm an associate with Mifflin and Associates,
11 practicing as a hydrogeologist, self employed.
12 Q. How long have you been working in this field?
13 A. 47 years.
14 Q. How long have you been focusing on the
15 hydrogeology of southern Nevada?
16 A. 47 years.
17 Q. We've already presented Dr. Johnson's CV as MBOP
18 Exhibit 1. So I believe it's already in the record. What
19 were you asked to do for this proceeding?
20 A. Quite specifically, offer our analysis of the
21 most appropriate boundaries, administrative boundaries for
22 the -- what's presently designated the Lower White River Flow
23 System. Try to estimate the flux through that system.
24 Address issues related to transfers of water rights from

Page 702

1 alluvial locations in the MRSA, in the Muddy River Springs
2 area, to presumably someplace more remote and in the carbonate
3 rock, completed in carbonate rock. And then there was an
4 offer to raise any other issues that we felt were legitimate
5 and related to this topic.
6 Q. And you formed opinions as to all these matters?
7 A. Of varying certainty, yes.
8 Q. Did you author any reports containing those
9 opinions?
10 A. Many.
11 Q. Specifically, the two reports that were submitted
12 to the State Engineer's office?
13 A. Yes. There was an Order 1303, I think we filed
14 it with the original report and then there was also -- after
15 we reviewed the other participants submittals, there was a
16 rebuttal report.
17 Q. And those reports are your own work?
18 A. They are in consultation with Martin Mifflin.
19 Q. And they accurately reflects the opinions you're
20 going to offer today?
21 A. They do. They do.
22 Q. And you intend to allow yourself be
23 cross-examined by the other parties present?
24 A. Actually I'd like to keep the direct as brief as

Page 703

1 possible and do most of our information exchange during cross.
2 I prefer to take questions that matter to the other
3 participants than try to anticipate those.
4 MS. BALDWIN: Okay. Thank you. We would like to
5 offer MBOP Exhibit Numbers 2 and 3, which are Dr. Johnson's
6 report into the record.
7 HEARING OFFICER FAIRBANK: Those shall be
8 admitted.
9 MS. BALDWIN: Thank you.
10 (Exhibit 2 admitted into evidence.)
11 (Exhibit 3 admitted into evidence.)
12 BY MS. BALDWIN:
13 Q. Dr. Johnson, if you want to just go ahead and
14 start giving your presentation and I'll interrupt you with
15 questions as they arise.
16 A. Thank you. I'll start with just touching on our
17 model we developed. This was -- and we'll lead from this to
18 why we did this.
19 We built a finite element model in two weeks with
20 a demonstration version, I mean, fully capable demonstration
21 version of the de-flow code. And what we were able to
22 accomplish in two weeks is part of the record, I don't have
23 the number there, but the actual binary model is available for
24 anyone who's licensed for de-flow.

Page 704

1 And as you'll see or may have seen if you read
2 the reports, there's a lot we could -- a lot more we could do
3 with the model.
4 But just briefly, at this point, I'd just like to
5 say that we -- what enabled this, what enabled this is a
6 conversation I had with Andrew Burns --
7 HEARING OFFICER FAIRBANK: Mr. Mifflin, if I can
8 just remind you to speak in the microphone --
9 DR. JOHNSON: -- oh, I'm very-- I'm very sorry --
10 HEARING OFFICER FAIRBANK: -- so everyone else --
11 DR. JOHNSON: -- I was looking at Colby because
12 she was present at the conversation.
13 I've always thought, in thinking about the Las
14 Vegas Valley, that all that water can't be coming from the
15 Spring Mountains. There's just -- on one end, not enough high
16 terrain up there. And underlying the carbonates in the high
17 terrain is Aztec sandstone, which you can see from Las Vegas,
18 the beautiful red cliffs up there in Red Rock.
19 And that Aztec sandstone is a heck of a difficult
20 environment to get a groundwater supply out of. And
21 Dr. Mifflin worked on it a lot, I've worked on it some, trying
22 to get a water supply in a Valley of Fire, and it's not a very
23 satisfying place to get somebody a potable water supply.
24 But anyway, I don't want to get distracted. All

Page 705

1 I want to show here is the way this model, you can present
2 model results in a number of ways. Most of -- or I would say
3 all of what we've seen in the past three days has been
4 potentiometric surfaces or contours, potentiometric maps.
5 You can also present the groundwater flow field
6 as stream lines and -- in a steady state in a steady field.
7 It -- let's just leave it at that.
8 So we built a steady state model based on Andrew
9 Burns' comment to me that they're pumping between 70 and
10 80,000-acre-feet per year in Las Vegas Valley, reinjecting
11 about 15, and so that gives me a nominal 60,000-acre-feet to
12 start with.
13 Q. And, Dr. Johnson, when you say "they" and refer
14 to Mr. Burns, can you explain who that -- who you're talking
15 about?
16 A. Well, I had a certain conversation -- I made -- I
17 made a -- in our first 1303 meeting, I made a comment and
18 Colby objected regarding Las Vegas Valley and its relevance to
19 this topic.
20 And I was asking for a -- I felt they should do a
21 full-blown analysis, water balance analysis within Las Vegas
22 Valley to see how closely the system has reached a new steady
23 state, you know, how would you characterize that.
24 How much water is really being produced and what

Page 706

1 does that mean in relation to the 25,000-acre-feet that
2 Malberg estimated back in the '60's as the sustainable yield.
3 So something's not making sense. You got a lot
4 more water coming out of Las Vegas than the estimated
5 perennial yield by Malberg and where is all that water coming
6 from?
7 You know, it's been how many years since the
8 pipeline, '46 or '7, and the temporary permits were revoked.
9 And we've had nearly half a century for those water levels in
10 Las Vegas Valley to reach new equilibrium, and that's clearly
11 the goal is to stop the drawdown in Las Vegas Valley.
12 So whether it's really happening or not, I don't
13 think anybody could argue that in Las Vegas, the runaway
14 decline's been arrested. But without an analysis, all I have
15 is a number from the expert, a rough number, and I don't
16 know -- I don't know if it includes what the big hotels are
17 pumping, what Nellis Airforce Base, what the Airforce is
18 pumping, and any miscellaneous small, but senior rights.
19 So I don't know the total from Las Vegas Valley.
20 But based on what Dr. Burns told me, I went ahead and started
21 the model with a sync -- with a 60,000-acre foot feeder
22 strength in Las Vegas Valley and through the calibration
23 process, which was both the water levels and temperatures.
24 Now, this is the -- how a model differs. It's a

Page 707

1 model of anisotropic system, and surprisingly, we've been here
2 for three days, and the word "anisotropy" has not been
3 mentioned. It was mentioned that the Theis equation needs an
4 anisotropic aquifer on these anisotropic ya da, ya da, ya da,
5 perfectly confined, but nobody's mentioned the anisotropy.
6 We've mentioned faults and the anisotropy they create at a
7 larger scale, but the word wasn't mentioned. I'm just amazed.
8 So we're taking a regional approach. This shot
9 is just about the southern third of our model, which we -- I
10 mean let me get off the slide so I don't run out of time.
11 Okay. Let me go back and do this better because I'm going
12 to -- first slides are for history.
13 Basically we present our model results that's
14 calibrated in terms of temperatures at Tule Springs and an
15 assumed one degree Celsius temperature of the recharge. Okay.
16 So -- and we're solving for the temperature at the springs,
17 all right, at Tule Springs. So -- and the way we're doing
18 this is we're taking heat from the Eureka low.
19 Now, that's another thing, I was shocked I
20 haven't heard in the last three days, especially yesterday
21 with all the Nevada test site experience that was referenced.
22 Has the -- has somebody else solved the problem of the Eureka
23 low? The Eureka low is a heat flow deficit in the central
24 great basin and it's always been assumed to be due to flowing

Page 708

1 groundwater. But our question is, where does that water go?
2 There was some preliminary attempts by John Sass.
3 We have one of those exhibits, preliminary interpretation of
4 the Eureka low. The Yucca Mountain people care, the Eureka
5 isolation people care because it's a tracer. It's a tracer
6 and they're really interested in groundwater travel time. In
7 fact, the early regulations restrict -- they put a numerical
8 limit on the groundwater travel time for a nuclear waste site.
9 But anyway, we see two flow fields indicated here
10 and the red one on the left includes Pahranaagat Valley, just
11 kind of -- or Pahranaagat Springs, Pahranaagat discharge area,
12 it's kind of nested in this much larger flow field through Las
13 Vegas Valley. And these flow lines over here ought to make
14 the lake (ph.) isolation people really unhappy if there's any
15 related to that.
16 There's a -- there's another flow field indicated
17 that feeds the MRSA, and I didn't include the slide. It's in
18 the report. But this -- these -- this area needs to be turned
19 off of the model. The model domain has line segment
20 boundaries just because of the way the meshing works, and like
21 I said, I only had two weeks. So this is what you get for two
22 weeks of work.
23 And whoever can afford free flow and load it in a
24 model, the first thing you want to do is cut off the flow of

Page 709

1 the mountains and some of this stuff over here. And I've got
2 an illustration with how we clean that up. And there were
3 other things to clean up. So here we have, apparently, a
4 hydrodynamic life. I mean, this is a -- it's a
5 two-dimensional system, it's one layer, constant
6 transmissivity, 10 to 1 anisotropy ratio. In other words,
7 transmissivity north/south is ten times as great as the
8 transmissivity east/west, not exactly, no.
9 Q. So --
10 A. Transmissivity in the primary, in the most
11 transmissive direction in any element is ten times the
12 transmissivity normal to that.
13 Q. Dr. Johnson, I'm sorry to interrupt you. But
14 when you're talking about the hydrodynamic divide, for the
15 record and for people who can't see your pointer, you're
16 referring to those blue dots?
17 A. Thank you.
18 Q. That run down the middle?
19 A. Yes. I should have spoken while I was pointing.
20 There's a series of blue dots dividing the red streamlines
21 from the yellow streamlines, and that is a hydrodynamic
22 divide.
23 And the red dot is where there were numerical
24 difficulties in the model, but one of the goals was just to

Page 710

1 see if we could get a numerical solution.
 2 I mean, I was amazed that the model solved with
 3 realistic -- how should I say realistic? Everything in this
 4 model was assumed. On cross, don't ask me what we assumed
 5 because we assumed everything.
 6 We assumed the transmissivity, we assumed the
 7 anisotropy angles, we assumed the thickness. We assumed the
 8 amount of heat going into the aquifer under the water, and I'm
 9 not sure if that was correct.
 10 I didn't have a way to figure out, do you apply
 11 the heat just to the water, to the aquifer or both? Where do
 12 you apply the heat? The Eureka low is ill defined and we've
 13 got a couple of slides later and in the report, you can see.
 14 But without knowing what -- how much heat is
 15 really being lost, see, you have to know how much is coming in
 16 from the bottom, which is probably the order of 80 to 90
 17 milliwatts per square meter, but we don't know. We don't
 18 know.
 19 So anyway, I'd like to get off this, but what
 20 you -- off this particular slide. But this is the defined
 21 element model and we'd love to keep working with it. It's a
 22 joy to work with. You can couple geochemical codes, you can
 23 couple FREAK, which means you'd be doing a nonlinear iterative
 24 solution for the geochemistry in every element. Now, there

Page 711

1 are about 49,000 elements here on this one.
 2 But it's doable. I mean, this model solves in
 3 five seconds. So it's not like a big complex model with a
 4 framework that you don't want to touch. We can fix this or
 5 add a layer below it or, you know. These days now, we can
 6 make a good mesh.
 7 Now, this is the first finite element I've ever
 8 built on my own, only because, you know, I've studied finite
 9 elements for 30 years, taken courses and things, but they
 10 never give you a good meshed area, so you can't apply it.
 11 Q. Dr. Johnson, did you make -- and I don't know the
 12 exact term, but did you make the code or the file that you
 13 used to generate your model available to the other
 14 stakeholders in this proceeding?
 15 A. Yes, it's binary. All you can see is the first
 16 line that identifies it as a feed flow file. Apparently the
 17 binary file has a first line of text when I tried to look at
 18 it. But it'll load right into a feed flow, and this is what
 19 you'll have.
 20 Q. And to your knowledge, do you know if anyone else
 21 has attempted to work with your model or build upon it?
 22 A. I really hoped Tim Durbin would be here because
 23 he would -- he would have.
 24 Okay. Yeah, so we calibrated temperatures to --

Page 712

1 and heads. We calibrated heads between Tule Springs and we'll
 2 have them on another slide. The Steptoe is next up off this
 3 map to the north.
 4 Just catch me on cross with this, I've got to get
 5 off this slide. We talked about a little history. We don't
 6 like cumulative rain averages or that kind of thing either.
 7 But Eakin did it, Maxey did it.
 8 And just for history, I just want to show, and
 9 I'm going to point at two features of this graphic that's from
 10 Eakin 1964 where he noted that at the weather station at or
 11 about up in White River Valley, he had some wet years in the
 12 '40's and then the Muddy River seemed to peak in around 1960.
 13 Well, Maxey comes along two years later, trying
 14 to get the water supply for Nevada Power and he got a couple
 15 more years of data. And he -- and the same data that Eakin
 16 used, and he, again, make this suggestion that it looks like
 17 maybe you've got a 15- to 20-year lag between your wet years
 18 and your response in the river.
 19 Well, that was -- just keep that in mind. As we
 20 look through this and for our whole professional careers,
 21 we've known about this. What is the lag? We're talking about
 22 a regional system and I think the argument today is whether
 23 it's centuries like the Water Authority has asserted in their
 24 DDC work and accepted by you in your rulings, or is it decades

Page 713

1 like we'll try to convince you today with bringing in
 2 additional lines of evidence.
 3 So we'll get to that. But first, I'd like to
 4 show a slide of tree ring data. And this is from Salzer,
 5 from -- he's at the University of Arizona. These are proxy
 6 temperatures and there was a comment made and this is a really
 7 important point. There was a point made that why use proxy
 8 data if you can do the real thing? In other words, why use a
 9 river base flow when you can measure the rain?
 10 And the answer is the rain is proxy data. We're
 11 talking about recharge. So is the snow pack. So we -- and so
 12 that's one point. This is all proxy data. And the other
 13 point is if you want to extend the instrumental record, now
 14 we're open to the idea that these groundwater travel times
 15 could be centuries.
 16 How do you -- what's diastotic? But what we
 17 do -- and so if you want to extend the instrumental record,
 18 say, of temperatures, I don't know what it is, a couple
 19 hundred years at the most before we had good thermometers and
 20 record keeping, the tree rings were as good as a thermometer
 21 for what's going at the tree line.
 22 So we use and value and cherish proxy data like
 23 this. It's these -- and I'm going to point at the warming
 24 since the industrial revolution. You know, you talk about the

Page 714

1 anthropogenic or climate or driven climate signal, I'm
2 pointing at the up ramp from about 18 -- oh, just before 1850
3 up to the present. And the tree ring proxy temperatures from
4 the year about 850-AD, they wiggle a lot, but they trend down
5 until about 1850 and then they just take off.
6 And then you see, I'm pointing at the top chart
7 where this -- you've got the same record, just squished down
8 for comparison with the model record.
9 So the climate modelers build the climate
10 modelers and build on the climate modelers and trying to track
11 this. It's tree ring data, and the tree ring data are now a
12 sufficient resolution where they're getting pretty good,
13 pretty good.
14 So we have a -- we're getting to a point where we
15 have a theoretical and an empirical proxy database for
16 temperatures at the recharge areas. That -- by the way, that
17 Salzer paper was from Great Basin data all across the Great
18 Basin, from Bristlecone pines up the tree line.
19 Why did we build a finite element model when
20 we've never done that before? Well -- and there was a -- let
21 me clear one thing up. Our model explains this one. We have
22 another separate parallel model for the H-4 water logs. This
23 is a model for Big Muddy Spring, explaining its annual
24 discharge -- annual total discharge in terms of a prior

Page 715

1 interval of climate history as represented by water year total
2 flows of the Humboldt River.
3 So when we do that, and we don't know what that
4 span of time is. Is it two years worth of precip or climate
5 data from this year and last year or last year and the one
6 before? Fish and Wildlife, I think, uses a two-year -- and
7 get me -- if I misrepresent anything, please get me on cross,
8 because I'm not trying to.
9 It's -- I think, if I understand the Mayer
10 Congdon work, it's a couple of years of climate that they're
11 dealing with, immediately preceding the observation. And we
12 wanted to test that.
13 And what we had to do is figure out how to
14 automate the search because what we're talking about is once
15 we found a hundred year record at the Palisade Gage of the
16 Humboldt River, and each annual discharge tallied, how are we
17 going do a thousand multiple regressions, every two-year
18 interval going all the way back to the beginning of record,
19 you know, which would indicate, if that worked, maybe we do
20 have a hundred year lag and two years of climate to explain
21 the discharge.
22 So we had to do a thousand or so multiple
23 regressions and find out how to do that and look for the --
24 and hope there was one fault positive correlation coefficient.

Page 716

1 BY MS. BALDWIN:
2 Q. Dr. Johnson?
3 A. Yes.
4 Q. Just to orient us all to the slide, what you're
5 talking about is Big Muddy Spring discharge; is that correct?
6 A. Yeah, let me -- before -- let me just speak to
7 the slide before I speak generally.
8 So the slide, representing the climate response
9 model, has observed data in the blue dots connected by a solid
10 dark blue line, and these are in acre feet. So there's 53, I
11 think. Yeah, 51, 53, 5500, 700-acre-feet.
12 So Big Muddy Spring varies quite a bit and we
13 were avoiding it for the longest time because the swimming
14 pool and the Boy Scouts, when you get in and look at that
15 record, they used to drain the pool every weekend.
16 So you get this huge surge going down there one
17 day and then there wouldn't be anything the next day when you
18 fill up the pool. And so your day to day looks pretty bad,
19 but your annual data, it all adds up.
20 So we looked at annual discharge from the Big
21 Muddy Spring as measured by the USGS. It's their gage 1549 --
22 5900 -- I mean, I -- scratch that. Strike that. I'm not
23 going to give you a gage number off memory.
24 So then the other parts, others items on this

Page 717

1 chart -- well, the model predictions. These are forecast.
2 See, this model, the one that works, the only solution out of
3 a thousand-plus trials of different pieces of time at
4 different locations in time, the only solution was all
5 positive correlation coefficients, suggesting that -- you
6 know, more flow, more water in the system.
7 And I also agree with the comment about the
8 negative. You shouldn't have negative correlation
9 coefficients, and that's another issue and I've had no
10 argument with that.
11 We have -- there are two -- our spring flow model
12 and our gage floor model, we insisted there be no negative
13 correlation of coefficients. And there was one unique
14 solution. It was the interval of time from 12 -- inclusive 12
15 to 22 years before an observation, weighted roughly normally
16 across that distribution explains the river flow.
17 So here's -- we have got two models. We have --
18 the yellow dots are the actual, that -- those solutions, those
19 spring flow estimates, forecasts or estimates are based on the
20 actual model, the coefficients that came out of the model.
21 The other one, the green one, the smoother looking one --
22 let's see.
23 I don't think I put the -- no, I didn't put the
24 response function in there. But the way those regression

Page 718

1 coefficients vary across that interval of time, in the oldest,
 2 they're low, at the oldest measurement, then they're highest
 3 in the middle years, and then they're, again, low at the
 4 youngest, at the 12-year mark. And so I approximated the real
 5 solution with a normal -- with a bell curve shaped response
 6 function and got this.

7 And so now we've got a system where we can hind
 8 cast all the way back to -- as far as we want and we can
 9 forecast 16 years, because that's the way -- I mean, it's
 10 history that's driving the spring flow, not yesterday.

11 So first couple of years, and these are the two
 12 we presented at Devil's Hole, talking about the climate sweet
 13 spot. That's one of our -- we got a cool PowerPoint as one of
 14 our exhibits. These we presented in 2018 at Devil's Hole
 15 workshop.

16 This one was from last -- from water year 2018,
 17 just -- all that the same there. And this one here, I've
 18 estimated the last two weeks of water year 2019 at the average
 19 rate for the prior two years for -- the average September rate
 20 for the prior two years.

21 So this one will change a tiny bit, what we can
 22 finalize this in four days. But it's not -- it's hardly
 23 moving. We've got a whole year behind -- record behind it and
 24 two weeks to go. And I've guessed that two weeks. So my

Page 719

1 guess can't be off enough to move that, or else you'd be
 2 reading about Big Muddy Spring in the newspaper.

3 Okay. And so in hind cast, here's -- now, this
 4 is a really important point. When we hind cast this model,
 5 19 -- I'm pointing with my pointer to the hump on the left of
 6 the diagram, hind cast high flow in Big Muddy Spring in 1960.
 7 1960, that's when the river was high.

8 So the little we know, it seems like the Big
 9 Muddy Spring type or form of hydrograph is representing the
 10 system that dominates the Muddy River in terms of its
 11 discharge.

12 So the many hydrographs we have with the same
 13 form, I would -- we'll get to this, but a form that I would
 14 claim is dominated by climate and somewhat perturbed by
 15 bumping, they're all very similar and so similar that they've
 16 been called -- well, the reason we're here is that they're so
 17 similar, it looks like -- if you think the hydrograph is
 18 drawdown, it's the same everywhere.

19 But when you start subtracting hydrographs from
 20 one another and looking at differences, that's when you see
 21 the drawdown. This is one piece of the hydrograph. That's
 22 our professional opinion and a very strongly held one.

23 Q. Dr. Johnson?
 24 A. Yes.

Page 720

1 Q. Before we get off the slide, just to clarify some
 2 things. So when you -- so you looked at Muddy -- Big Muddy
 3 Spring discharge and you said that there's a lag of 12 to
 4 22 years, but I don't think you actually explained what you
 5 were comparing it to.

6 A. I'm not sure -- Beth, I'm not sure I understand.

7 Q. You were talking about the Humboldt River flow?
 8 A. Oh, that was -- there's another very important
 9 point, very important point. In the rebuttal reports, there
 10 was some misunderstanding. I'm not sure which one. I think
 11 it may have been Nevada Energy's -- clearly, there was a
 12 misunderstanding. We're not saying water comes from Humboldt
 13 River and goes to Big Muddy Spring.

14 We're saying that the Humboldt River with its
 15 huge catch of perennial flow and location in the zone two of
 16 climate is representative of the climate that we think is
 17 relevant to recharge.

18 So we think, as you'll see from our model input
 19 that I'll show next, we think the recharge occurs in high
 20 country from snow, no recharge to the regional system. Let me
 21 make sure we understand.

22 We're talking about a regional system that
 23 recharges, in our opinion, in high terrain, regionally high
 24 terrain in central and east central Nevada, and then finds its

Page 721

1 way through the regionally continuous pre-Mississippian shelf
 2 carbonate section to southern Nevada.

3 So the water, we're not claiming that the water
 4 is moving. We're claiming that the annual water going down
 5 the Humboldt River is a proxy for the wet versus dry climates,
 6 that because of that tree ring data, you'll see whether it's
 7 centuries or decades, those tree ring signals are driving the
 8 oxygen or the -- both the stabilizer to composition of the
 9 recharging precip.

10 And so we should be seeing those tree ring
 11 signals somehow transformed through whatever hydrodynamics
 12 occur to some other signal like the -- at the discharge area.

13 Now, regional springs are not constant. Muddy
 14 River flow is not constant, the natural flow. That's
 15 absolutely clear. Eakin knew that. So when we start
 16 averaging things, we get into trouble and we've got some
 17 examples where people have averaged things and they're in big
 18 trouble.

19 I don't have anything in direct here on the
 20 isotopics, but we have a lot of information and some slides,
 21 and that's one reason I'd like to leave plenty of time for
 22 cross. I'd hoped Jim Thomas would be here to talk about that.

23 Dr. Thomas is a former director of the DRI Water
 24 Center. He's a geochemist and was the author of the -- he's

Page 722

1 one of the -- it's an important report. We've got a
 2 geochemistry report in support of the Water Authority's
 3 Delamar Dry Lake and Cave work, very important report.
 4 But we've got problems with it and without him
 5 there or somebody that's equivalent for -- to discuss it with,
 6 we're not going to bring it up on direct. But we're happy to
 7 talk about it on cross.
 8 BY MS. BALDWIN:
 9 Q. And, Dr. Johnson, you've been going about
 10 30 minutes.
 11 A. Thank you.
 12 Q. If that's helpful to you.
 13 A. Oh, thank you, thank you. Let's look at some
 14 model input.
 15 On the left is the way we defined our flow to
 16 main and then this -- and then on the right, you can see with
 17 those straight boundaries, that's the way that they
 18 approximated it.
 19 And what you see, and I'm going to point first to
 20 the left diagram, it's the one that's blue. This shows how we
 21 constructed our recharge cutoff surface.
 22 Now, our -- our idea for the recharge is that it
 23 comes -- it's a regional problem, there's a regional solution
 24 or a regional component of the solution. The regional high

Page 723

1 terrain is in central and east central Nevada, Kane, the
 2 Monitor Range, the Grant Range, Egan, Schell Creek and Snake
 3 Range, that's the high country. And I'm pointing.
 4 Q. So just for everyone, we're looking at slide
 5 number seven and you're pointing at the diagram on the left,
 6 which is mostly blue. And can you explain maybe what the
 7 different colors are showing?
 8 A. Yeah. Yes, yes, I'm getting there. The point --
 9 the first point I wanted to make, though, was the way we
 10 constructed our recharge cutoff surface. We -- we constructed
 11 a plainer surface. In other words, we're going to chop off
 12 the terrain model to leave us a bunch of islands where we
 13 think the recharge occurs.
 14 But the surface we used to chop off the terrain,
 15 to cut off -- you know, our recharge cutoff surface is higher.
 16 It has to be higher in the south. The pine trees are higher
 17 up on the trees in the south, the climate's warmer.
 18 So where is that? Well, fortunately, the Kaibab
 19 Plateau over in the Grand Canyon area is well enough
 20 constrained in terms of its area and the spring discharge,
 21 because you can see the spring discharge is coming out of the
 22 canyon wells to where you can take a pretty good -- and just
 23 because of the way the elevations are there, we thought 8500
 24 feet, about where the Ponderosa pines start, was probably a

Page 724

1 good recharge cutoff elevation in the south at latitude 36
 2 north.
 3 On the other hand, in the northern areas, we look
 4 at the hill slope in Ruby Valley up behind the fish hatchery,
 5 and the whole thing -- you know, there's no runoff from that
 6 thing. So it's -- you know, the carbonate section there on
 7 the Ruby Mountain, the east side of the southern Ruby
 8 Mountains. So we think maybe 7,000 feet is an appropriate
 9 recharge cutoff.
 10 So in other words, up north, you only get
 11 recharge above 7,000 feet to the regional system. To the
 12 south, you have to be up above 8500 feet to get recharge. And
 13 so look what that does to the Spring Mountains.
 14 What I've done here with this tint, this isn't
 15 all that effective, but you can see the white areas are where
 16 that recharge cutoff surface. As I'm pointing, I'm pointing
 17 now to the Spring Mountain, just a little white speck with a
 18 little gold in it at the -- near the southern part of the blue
 19 flow domain and there's a Sheep Range.
 20 Almost all of that high terrain is carbonate
 21 rock. Sheep Range is a pretty good recharge area. Spring
 22 Mountains, look at that. All that high country and just a
 23 little carbonates up there above 8500 feet, just reinforces
 24 what I've been claiming about Las Vegas Valley. You just

Page 725

1 can't get all that water off the Spring Mountains.
 2 And the sheep range, maybe, but we know the sheep
 3 range is -- is -- the water is flowing this way because
 4 there's -- and I'm pointing to the area of the Divide well,
 5 BLM wells, up toward the northern -- east side of the
 6 northern -- or sorry, west side of the northern Sheep Range.
 7 There's a three well complex up there where you
 8 can see it flows to the north and -- but there's also plenty
 9 of opportunity to -- for a flow off the sheep range to get to
 10 the Muddy River Springs area or to Las Vegas Valley. So we
 11 think the sheep range is an important recharge area.
 12 And all I've done here with these circles, too,
 13 those are just sort of scaled representations of how much
 14 discharge is occurring from these different sinks that I have
 15 in the model.
 16 And just for your -- because of our concept of
 17 this system in the model, you don't have Pahrump and you don't
 18 have Indian Springs. Our concept is that Spring Mountain --
 19 I'm pointing at the Spring Mountains with the pointer, I'm
 20 pointing at Indian Springs, which is north of the Spring
 21 Mountains.
 22 I'm pointing at Pahrump, which is southwest of
 23 the Spring Mountains, and also Tecopa, which farther to the
 24 southwest than the Spring Mountains. The USGS work says that

Page 726

1 lower Amargosa -- or that the Amargosa River also gets a lot
2 of its water from the Spring Mountains. So how do you all
3 that and supply Las Vegas with 60,000-acre-feet or more?
4 You've got to have water coming in from the north. That's our
5 strongly held professional opinion.
6 Now, how does that happen because the water
7 levels are iffy. A lot of questions. Now, the other item on
8 this that I'm pointing to with a little gold -- still on the
9 blue left-hand diagram.
10 The gold areas are those elements that are mapped
11 as either Ortivision, Silurian or Devonian carbonate rocks.
12 So those are the regionally continuous shelf rocks. And so
13 what we did is we just got -- the Bureau of Mines has a
14 beautiful GIS data set of all the county geology reports.
15 And so I just went through that table and clicked
16 off everything that had a -- one of those rock types in it and
17 then went through and selected the elements that -- and with
18 the map as a guide, the geologic map, just selected all those
19 elements with those rocks in it.
20 So what we're left with is a right ring where the
21 recharge -- we take all the recharge from -- based on the
22 discharge. Remember Dr. Waddell's comment from Dr.
23 Bredehoeft? It's the discharge. It is the discharge. It's
24 the discharge, we believe it.

Page 727

1 We use the discharge, add it all up, it's a
2 couple thousand acre-feet annually and distribute that over
3 all these elements equally.
4 All these yellow or gold elements get what? See,
5 they like -- these are all -- well, fee flow, they're from
6 Germany, so they like, you know, some funny units. These are
7 recharge in meters per day. Okay. Fine, .00, that's -- it's
8 about 15 centimeters a year, okay? So all these gold spots.
9 Also, here, you can see on this right-hand
10 diagram, the location of the Steptoe annex well. And Tule
11 Springs well, we calibrate -- see, we first did this as a one
12 dimensional problem. And I showed it to -- I showed it to
13 Christi and she laughed in my face so we made a --
14 (Reporter interrupted proceedings.)
15 MR. JOHNSON: Oh, I was -- I just said that I
16 showed a one-dimensional version of this model to Christi and
17 she chuckled. So anyway that's the way we handle -- we take
18 all the discharge measured and the portion after the right
19 geology to tie enough up in the mountains.
20 We also build an anisotropy and I would have like
21 to go farther with this and I would like to try an anisotropy
22 ratio greater than ten.
23 But in my reading, you get in numerical
24 difficulties, more numerical difficulties if you have such a

Page 728

1 strongly anisotropic system. And I think at that point, you
2 want to start thinking about two bundles or streams.
3 And there was a comment that -- how capture zones
4 are misleading, they're for surface water. You can get into
5 all kinds of trouble and so forth. And I accept that, but
6 again, the word "anisotropy" was not mentioned and that worry
7 becomes less and less relevant as the anisotropy ratio gets
8 higher and higher.
9 So what we have here, the way you enter
10 anisotropy angles or directions into free flow is as
11 counterclockwise rotations from the east direction.
12 So let's just -- now I'm going to point at the
13 left-hand slide here and just show you, I mean, here in the
14 greens, say, between -- not even the 90-degree area. Okay.
15 90 degrees, all these greens, those were -- the green areas
16 represent a principal access of anisotropy that's rotated
17 90 degrees from east. So in other words, it's north/south.
18 So the green areas are most transmissive in the
19 north/south direction. Then you have areas like the
20 Pahrnatag Sheer Zone, which I'm pointing to here, and it's
21 got more of a purple hue to it, lower numbers, and those
22 numbers are like in the 30's.
23 So picture 30 -- a 30-degree rotation from east,
24 so the -- I'm pointing now, I'm moving the pointer over the

Page 729

1 Pahrnatag Sheer Zone in the model grid, moving it from
2 southwest to northeast, showing the principal direction of
3 anisotropy in the Pahrnatag Sheer Zone.
4 And that's what this -- pretty much the same
5 thing all the geologists were saying over the last three days,
6 was how these faults affect the -- you know, you can have an
7 enhanced permeability parallel to the strike of the fault or
8 your reduced relatively low permeability perpendicular cross
9 fault.
10 And then you have other areas like down here in
11 the -- where you start getting down into the Gerlach fault
12 domain, where the north Las Vegas sheer zone, like here, I
13 think, where the -- or, no, the resin oranges are places where
14 you have northwest striking structure, I believe, yeah,
15 because there you're up in the 150 degrees from east.
16 So now you're at a northwest orientation with the
17 principle axis. So every element of those, almost 50,000 of
18 them, gets its own preferred -- it's own anisotropy angles.
19 And on the right, we got the Eureka well and
20 that's another -- it was mentioned, this is a heat flow
21 deficit in the central Great Basin. It was well known for
22 years, almost universally attributed to groundwater flow
23 removing the heat.
24 Nobody's ever said where that heat is going. So

Page 730

1 that's what we tried to do is say the heat is going to the
 2 Warm Springs. Again, that would be a terrible thing for DOE
 3 to come up with from what I saw the waste at Yucca Mountain.
 4 You know, to have -- if this -- now, our solution didn't work
 5 over on that side for unknown reasons, probably because the --
 6 I'm pointing at our representation of the Eureka well now,
 7 probably because we should have had more heat loss on the west
 8 side of our representation of the Eureka well.
 9 But anyway with these values of -- and they're
 10 like joules per square meter per day. I like milliwatts per
 11 square meter, but whatever, because a joule -- watts joule per
 12 second, okay. So they like joules, we use watts. But what
 13 you see here is that's how, you know, our -- we had two weeks,
 14 we had one shot at it.
 15 This is what we came up with to see if we could
 16 get a model, first off --
 17 (Reporter interrupted proceedings.)
 18 THE WITNESS: Sorry. Thank you.
 19 Okay. One of our -- well, our first and foremost
 20 goal in modeling was to just see if we could get it to solve
 21 and not just be mathematically unstable, not diverge, not
 22 reach a solution. And so that was the goal. And we knew from
 23 our one-dimensional approach, what worked.
 24 We knew how fast the water had to move and how

Page 731

1 much to move to assume the amounts of heat loss to the
 2 springs, and warm them by the -- warm the water from one
 3 degree C to, we assumed -- I think we assumed 30. We might
 4 have assumed 35, but I don't remember. And this is awkward,
 5 too, see, because I can't get back into the model code because
 6 we're not licensed.
 7 So I can't go back and go back into the model and
 8 answer any questions you might have or improve it, because
 9 it's -- you know, I need 10,000 bucks and another couple
 10 thousand a year to get back on the model.
 11 I've run out my demo. But anybody else can get
 12 two weeks on this thing, go for it. You know, and the mesh
 13 and hard work is done, I think.
 14 Now, this one, I hope you like this. This is an
 15 animation of the last 35 million years of western North
 16 American tectonics, what plate tectonics have done to the
 17 continent. And you're probably wanting me to play this, and
 18 I'll be happy to play it again.
 19 But before I start it moving, this is what --
 20 it's the Colorado Plateau. Las Vegas or former Las Vegas is
 21 going to be somewhere over in here because you got the -- you
 22 know, the root country, the transition zone, you've got
 23 Flagstaff, and you know, all that -- the Muddy Rim is down
 24 here. And then up here is Wasatch Front and the whole, you

Page 732

1 know, driving 515 to Salt Lake.
 2 So, no, that's the Colorado Plateau. You're
 3 breaking away a little bit over by the front range in
 4 Colorado. But that in fact blocked the Colorado Plateau and
 5 I've been pointing at that. Also, now pointing at the Baja
 6 Peninsula that hasn't formed yet. And so this is the
 7 landscape 30 million years ago with some of the plate tectonic
 8 boundaries shown.
 9 I think there's a triple junction about to go
 10 under the edge of the continent. I'm pointing almost at the
 11 middle of the slide, kind of near where probably you'd want
 12 San Diego to go. But I'll play this and I'll probably play it
 13 a couple times.
 14 And remember, seduction stops and strikes the
 15 faults, starts about between 10 and about 14 million years
 16 ago. So watch the Baja, California start to break away, watch
 17 the Great Basin start to extend, now the Calderas come out.
 18 It was about 11, Kingsbury Wash Caldera and takes us up to the
 19 present.
 20 Again, yeah, there it goes. See seducting,
 21 seducting, seducting, and then the transform fault goes under
 22 the edge and starts ripping away Baja, California. Another
 23 thing to watch, look at these accommodation zones. Watch in
 24 here, how things extend a lot and not much.

Page 733

1 So I think if you're looking for an impediment --
 2 this another thing we need to talk about. If you're looking
 3 for an impediment to north/south flow, and again, last three
 4 days, I didn't hear anybody tell me why the Muddy Springs are
 5 there. Nobody showed us a structure.
 6 We saw a lot of north/south faults, we've seen
 7 maps from the Water Authority, showing no obstacles to flow
 8 from either California -- or Coyote Spring Valley to
 9 California Wash or the MRSA to California Wash. So my thought
 10 is then why the springs.
 11 See, we couldn't get our model to work. This is
 12 not our first model. We did publish a little element models,
 13 one of our exhibits. And where was I going with that? I lost
 14 my train of thought. I'm sorry. Let me just move to the next
 15 slide.
 16 This is just zoomed in a little bit to the -- to
 17 our solution, the streamline solution for the Muddy River
 18 Springs capture zone, and this is the area that needs to be
 19 cut out of the model. So we see -- because you've got the
 20 Mormon Mountains, you've got basin rock exposed in there, and
 21 you've got the Clover Mountains, intrusive rocks.
 22 And so I would put my -- I -- you know, it's just
 23 a matter of time. You know, we can be running the thing, we
 24 see things we don't like about it, and we fix what we can and

Page 734

1 then we're out of time. Demo's over.
 2 And so the last thing I did -- was able to do in
 3 the demo with the help, you know, of tech support was get
 4 these time to travel capture zones mapped in there.
 5 And so our model with a 300-meter squared per day
 6 regional transmissivity, one kilometer thickness, tiny proxy,
 7 which I don't remember, but it's in the report, I think .00015
 8 as a an inter -- regionally interconnected proxy. So that's
 9 what we -- that's what we get. I mean, that's our solution.
 10 And the water's coming from the high mountains.
 11 I mean, I don't know what else to -- how else to argue the
 12 regional -- our case for this being a regional problem. Now,
 13 here's our -- where we get 40,000-acre-feet and this is not
 14 tongue in cheek. This is serious and I think it's relevant.
 15 An anisotropic system, and these are just roughly
 16 indicating how we think the flow works following the preferred
 17 orientation of the transmissivity field, we go from the
 18 elevation at the bedrock well across from the mouth of Kane
 19 Springs Valley to the Gil Breece Ranch spring mountain in
 20 northwestern Las Vegas Valley.
 21 Here we go from MX-6 down to the Wilshire well,
 22 north Las Vegas, one of the longest production well records.
 23 And just by accident or happenstance, you get exactly the
 24 same -- and I'm pointing to the lines along which we estimated

Page 735

1 the hydraulic rating in -- from Coyote Spring -- or from the
 2 LWRFS to Las Vegas Valley.
 3 So between bedrock and to Gil Breece's place, we
 4 get -- I can't read it, .00021, I think, for hydraulic
 5 gradient. And in between MX-6 and the Wilshire well, we get
 6 the same thing. It's different in the third significant --
 7 (Reporter interrupted proceedings.)
 8 THE WITNESS: Oh, the hydraulic gradients from
 9 those two lines are identical in -- they only differ in the
 10 third decimal place.
 11 Now, going by colors here, the reds are what we
 12 think are the boundaries. We're actually doing the first two
 13 questions in this one slide. The red lines are what we think
 14 are the flow domain boundaries. The gas peak thrusts are not
 15 bothered by that, really, but we query whether water actually
 16 goes under there. But you got to get the water into Las Vegas
 17 Valley.
 18 This is just not acceptable, getting that --
 19 getting any quantity of water -- and we tried this. This is
 20 what our -- our published element model had outflow on this
 21 boundary because hydraulic gradient is like this, it's from
 22 west/northwest, east/southeast. But we don't think -- but in
 23 anisotropic system -- and nobody called this out yesterday.
 24 I don't understand why this -- how this could

Page 736

1 happen with all this fault discussion. In anisotropic system,
 2 the water does not move perpendicular to the full extension
 3 lines. Those are at an angle. And they were strongly
 4 isotropic, the more they differ. Until you get to a pipe and
 5 it flows straight down the preferred orientation because
 6 there's no permeability, lateral permeability to that
 7 preferred orientation.
 8 So I'm doubting this a little bit on the west
 9 side if -- maybe we shouldn't move this boundary in only
 10 because our well -- like I say, our well, Mifflin and
 11 Associates -- no, it was DRI at the time, did a groundwater
 12 exploration project for Nevada Power in 1986, and one of the
 13 wells we drilled was -- the one I worked on was a 4,000-foot
 14 well under what is now the tailings or flash.
 15 But we had tertiary rocks all the way to 4,000
 16 feet. We -- the first 400 was Muddy Creek. All the way down
 17 to 12,000 was a gooey white, greenish sticky ash. It was ash,
 18 ashy, very ashy, very thick.
 19 And 3960 -- and this is from memory, I remember
 20 it well, dense red sandstone, fine red sandstone and quit,
 21 because after 40 more feet because we decided 4,000 feet was
 22 deep as we'd go looking for carbonate aquifer.
 23 So there may be a fault. There -- with as much
 24 geophysics that's been done, I would not be surprised at all

Page 737

1 if there's a fault out here that's keeping the good water away
 2 from the tribal plaza. They can't get good water there. So
 3 here along the north Muddy Mountains, there's probably -- we
 4 should probably move this boundary in.
 5 What haven't I talked about? This is the -- this
 6 is the hydraulic barrier that we presented it at the GSA in
 7 Seattle in 2003, because in building our model, we couldn't
 8 get the water to come out without obstructing the flow.
 9 Then I called Brian Wernicke. He's the author of
 10 a couple of our exhibits. He's a professor at Cal Tech and
 11 he's -- he and his mentor, Clark Birchfield and Greg Davis,
 12 they've been leading the charge in reinventing the geologic
 13 framework, if you will. And I'll show a slide. It's the next
 14 slide.
 15 Now we may have trouble. We'll talk about
 16 geologic frame works in just a little bit. The other thing I
 17 haven't mentioned here, I've got a couple of colors, the
 18 model -- see, the captures on the model showed us -- included
 19 this part that I've colored brown. The part that I said
 20 should be cut out of the model. So I just -- for this slide,
 21 I just colored it.
 22 So this is roughly elevations in Lower Meadow
 23 Valley Wash that are too low to the springs. I just went up
 24 there, I think about the elevation of the -- elevation of the

Page 738

1 springs or along the contour line. That's just hand -- that's
 2 just our -- that's just our -- but this is -- this is -- the
 3 model solved in here where it shouldn't have.
 4 Wells, these are so close together, they look
 5 like one. Kane Springs well, Vidler well, Lincoln County
 6 wells right there. CSVM-4 is right there in Coyote Spring
 7 Valley or maybe it's this one. I think it's this one.
 8 Anything else? Pahrnatag sheer zone, you can see it from the
 9 terrain. You know, it's a bunch of washed up faults and the
 10 way -- there's another thing.
 11 We know they're actually faults because the
 12 Caldera Rim's offset, you can see it and you can measure
 13 offset. Now, whoever says there's a fault in Pahrnatag Wash
 14 and the Water Authority is putting arrows on it, I don't see
 15 the offset. I mean, show me the offset. I mean, I'll believe
 16 it. It's schematically consistent with the right lateral
 17 fault. But if you don't -- if you can't show me offset, don't
 18 show me the fault.
 19 But back to what Dr. Wernicke said, I was asking
 20 him about the structure because the existing structural maps
 21 and interpretation don't help us explain why those springs are
 22 there. Something is obstructing that flow. And he said,
 23 well, maybe you found the lateral ramp.
 24 Well, that's a really good point because if you

Page 739

1 look at that Glendale thrust, some places, it sits on
 2 Mississippian rocks, and some places, it sits on -- I mean,
 3 the -- you know, the -- I'll just refer you to the exhibit.
 4 The fact that the rocks under the Glendale thrust
 5 differ imply that that thrust had to cut through the section
 6 at some point that's not -- somewhere that's not exposed.
 7 And if that lateral ramp -- it could be, it could
 8 be, but there's so much we don't know about the subsurface out
 9 there. It's obvious because we don't know why the springs are
 10 there. And, you know, maybe on cross, I'll leave you as much
 11 time as you can, maybe somebody will tell me why those springs
 12 are there.
 13 Q. And, Dr. Johnson, you've been going for about an
 14 hour. I know you want to --
 15 A. Yeah, I going to zoom right through these now.
 16 Q. Okay.
 17 A. Okay. Here, you have the geology we've been
 18 hearing about. This is the traditional framework, whether
 19 it's Page, Dixon, Rowley, it's the USGS framework or the USGS
 20 derivative framework.
 21 These are two sections from -- oh, it's noted
 22 there, north and south of the section that Swanson and
 23 Wernicke published. And they recognized in the central Meadow
 24 Valley Mountains, and I don't think anybody said the phrase

Page 740

1 Meadow Valley Mountains yesterday either.
 2 Did I do something wrong? Did you --
 3 Q. I didn't say anything.
 4 A. Nobody interrupted? Okay.
 5 Q. No, proceed.
 6 A. Okay. They believe they've got the ramp's
 7 incline identified in the central Meadow Valley Mountains,
 8 which allows them to correlate -- or how should I say,
 9 characterize the extension, because there are a number of
 10 features in these thrust faults that you can see in the Spring
 11 Mountains, you can see in the Sheep Range, and now you can see
 12 in the Meadow Valley Mountains.
 13 So some of these -- and this is the key to
 14 Swanson and Wernicke's long history of waking us up to the
 15 extensional regime is using what they know about the thrust
 16 faults and the style of thrusting. You know, the leading
 17 thrust, the Keystone thrust is the dead column one. In other
 18 words, the thrust moves along parallel to the stategraphy for
 19 a long ways.
 20 Other thrusts, part of their back, the older ones
 21 cut up section there and they don't follow the stategraphy as
 22 much. So each of these thrust faults has its own unique
 23 characteristics that, once understood, can be found in these
 24 fragmented extended rocks.

Page 741

1 And also kinematic model like that allows you to
 2 extrapolate much deeper. Now, I'm pointing to the Swanson
 3 Wernicke section on the slide. They extrapolate much deeper
 4 in the subsurface than we can with the surface mapping.
 5 What are the -- oh, and this slide, slight
 6 modification from the report. And I hope you don't make me
 7 turn it off. We just added the Delamar, Dry Lake and the Cave
 8 basins because there's a little sample calculation I would
 9 like you to -- there's an area there where we can do another
 10 Darcy-flux calculation that I'd like to show you next.
 11 But this is Allen Chamberlain's dissertation map
 12 of the 21 Devonian sequences that make up the Sunny Side
 13 Basin, and this is a Devonian shelf, continental shelf. There
 14 was a -- well, a lot of stories there. Anyway, the point is
 15 the Sunny Side basin is thick in the middle, thins off to
 16 nothing around the edges, and we're sitting on the flanks of
 17 it.
 18 So one idea, and a very reasonable one, the
 19 reason we have the springs, maybe it's purely stratographic.
 20 I mean, even though we find the water there in Mississippian
 21 rocks, don't forget, those aren't the regionally continuous.
 22 The regionally continuous rocks are the
 23 Ortivision, Silurian, Devonian carbonate rocks for sure and I
 24 didn't include Cambrian because there's not a lot of exposure

Page 742

1 and, for example, with the Grand Canyon, the water comes out
2 of the top of the Cambrian Limestone. So it seems to be more
3 of an aquatar.
4 Even though we have Cambrian rocks just surging
5 over in the groundwater over in the Amargosa, we didn't use
6 them. This shows why we picked our flow domain for the model
7 the way we did. There's a structural thinning, you know,
8 Eureka quartz side's is absent. You know, all the Paleozoic
9 is in -- across it.
10 So we took that as a boundary and plus there's
11 a -- on the surface, there's a drainage divide to the Humboldt
12 River up here. So we took this as a rational northern
13 boundary for our flow model and we did have to let some water
14 out.
15 But that -- and then the western boundary, the
16 Roberts Mountain thrust is part of the whole orogeny that
17 thrusts deep water. So let's just -- let's say impermeable
18 rocks up over the shallow water are permeable carbonate rocks.
19 You don't have carbonate aquifer over here, so that's the
20 boundary.
21 Anyway, let me just -- okay. This is a good one.
22 I think everybody yesterday was kind of on the same page,
23 thinking this was --
24 Q. Okay. Can you talk into the microphone?

Page 743

1 A. I am so sorry. Yeah -- and I actually -- I'm
2 sorry, I'm not talking more directly to the panel, but it's so
3 much easier to see the slide on the wall than on my little
4 computer screen here.
5 So I'm pointing at a feature of this CSVN-4
6 hydrograph, beginning in 2014, and only lasting about a year,
7 maybe a little more, maybe two years.
8 That's been -- I think whoever -- all the
9 speakers that addressed this feature, I think, were on board
10 with it being a pumping response and I don't think so. If
11 it's pumping response, it starts up here.
12 The hydrograph doesn't look anything like the
13 other ones, except KMW-1. There's no -- I don't think this is
14 it with monthly measurements. But there's no mid-test
15 recovery from that 2012, 5-month shutdown.
16 It's diagnostic in the southern -- what we'll
17 call the southern flow field as far as apex. You know, the
18 BMDL well shows it clearly. I'd say that mid-test recovery is
19 what is diagnostic and it's absent here.
20 So if these things are moving in lockstep or
21 anything close to it, this one seems like it waited two years.
22 And as a -- one other philosophical point, as a practicing
23 hydrogeologist, you know, if I go ten miles up gradient from a
24 well I'm interested in to try and find a reference well or an

Page 744

1 unperturbed site, even in terrain like this, I'm going to feel
2 pretty safe because I know that in the case of MX-5, the well
3 right beside it only draws down to two feet. You know, pump
4 it for years and it only draw downs two feet.
5 And so -- and you go, you know, a couple of miles
6 away and because we don't believe the full hydrograph is drawn
7 down, draws down a fraction of a foot. So ten miles away, I'm
8 comfortable with draw down's in there. I can't see it.
9 So we -- well, I -- Marty and I are -- I don't
10 think Marty -- Dr. Mifflin is convinced, but I'm emphatic that
11 I believe this is not pumping response. And if I add the
12 whole Order 1169 evaluation to do over, this would be the
13 signal I would use for my reference well.
14 I'd go in and clean that up interplate with -- or
15 approximate it with empirical mode composition and use that as
16 a reference.
17 Q. So, Dr. Johnson, for the record, because it's
18 hard to know what you're -- exactly what you're doing, I'm
19 just going to recap.
20 We're looking at slide 14 and you're comparing
21 the hydrographs for KMW-1 and CSVN-4, and you've been pointing
22 at -- there's an apparent dip beginning around early 2014;
23 that's correct?
24 A. Correct.

Page 745

1 Q. And when you -- and at the top of your figure,
2 you say "reference trend negative .2 feet per year". Can you
3 explain what you mean by a reference trend?
4 A. Oh, yes. Thank you. That's a linear regression.
5 In other words, the slope of each of those records. So the
6 blue line is the slope of the blue measurement trend and the
7 red line is the slope of the red, CSVN-4 measurement trend.
8 Thanks. Thanks for that.
9 Q. You're welcome.
10 A. Okay. Now, you might want to object to this.
11 It's an example calculation of inflow to northern Cave Valley.
12 Q. Just -- this is inserted for demonstrative
13 purposes only; correct? You're showing a sample Darcy
14 calculation?
15 A. I don't know. You tell me.
16 Q. We're trying to clarify that this actual slide is
17 not in the report, but Dr. Johnson is trying to show an
18 example of how you would take different numbers from different
19 wells and do a Darcy calculation.
20 A. I just made it up. Thank you.
21 The Steptoe MX well, which we pointed out
22 earlier, and the Water Authority's 180 -- 180W5011 monitoring
23 wells, the northern most monitoring well in the Cave Valley.
24 What we've done is just look at the difference in

Page 746

1 elevation of the water levels in those wells. And they vary,
 2 so this is what they're -- you know, an approximate --
 3 approximation of the water level, both are trending.
 4 But just separation, distance and difference in
 5 elevation gives you the hydrologic gradient. And because of
 6 our model, we had a number we could guess with and that's
 7 300 meters squared per day, much less than any of our aquifer
 8 tests have given us.
 9 So we used our regional transmissivity, the
 10 observed water levels, and by the way, this area is, in its
 11 entire width, underlaid by Paleozoic carbonate rocks. So if
 12 you look at the geologic map, I mean, it's covered. These
 13 wells are -- there's cover, but the expected section is
 14 entirely Paleozoic carbonate rocks in both of those wells.
 15 So -- and I haven't looked at the well rocks, and
 16 maybe I'm wrong. But what we do have is a hydraulic gradient
 17 that assumed or derived, I would say, calibrated regionally
 18 transmissivity, and we take -- for the width of the aquifer,
 19 what did I say, 14 miles.
 20 So for 14-mile width of aquifer with those
 21 properties, we can get 25,000-acre-feet of water into Cave
 22 Valley from the north.
 23 Now, remember the assessment for that area said
 24 all the water supply is derived from within the mountain

Page 747

1 blocks surrounding the three basins. And I'm not doing this
 2 to pick on the Water Authority. We're trying to make the case
 3 that all this water, the regional water comes from farther
 4 north.
 5 Now, this one, there's an addition here, and I
 6 hope this is going to be helpful to Nevada Energy because this
 7 is not -- this is VH-4 water levels from the last three years.
 8 And this record, I don't know, you might want to
 9 go spank the contractor, but this is actually based on four
 10 discontinuous record segments, three breaks in the record, not
 11 very long ones, but the data was confused.
 12 And we called numerous consultants who actually
 13 does the work to ask about these offsets that I've prepared
 14 here and they didn't know about it, they weren't sure.
 15 You know, I talked to a senior person and the
 16 field tech wasn't there, and I don't know if they were
 17 inspired enough to go fix the problem. But I know Nevada
 18 Energy has, in their rebuttal, the fragmented record. But
 19 that's the record that's in your files. So there's -- there
 20 is a problem, but there's also something beautiful here.
 21 Once you reconnect the dots, you've lost the
 22 data, but you've got the trend. And so when we take an even
 23 three years, just so we don't do something screwy at the end,
 24 we've got exactly three years there of data that we do a

Page 748

1 linear regression through, and take that -- project that line
 2 back. We want to find our datum again. And this is -- here's
 3 something that is pretty amazing.
 4 These are adjusted data, they're -- our green
 5 data there are adjusted for Arrow Canyon Well pumping
 6 according to our model that's one of our appendices in our
 7 direct report -- or in our original report.
 8 So we fit that projected trend to pretest data.
 9 And I didn't include it, but that is exactly the trend that
 10 Rick Felling presented at the Nevada Water Resources
 11 Association meeting in 2014, in early February, only his was
 12 offset. His was -- it was almost exactly that slope, but his
 13 fit the blue. See, his data weren't adjusted for Arrow Canyon
 14 Well pumping.
 15 But I think, you know, Congress can recover that
 16 data, but -- that datum, but they need to -- they need to fix
 17 that because it's really misleading. We saw that, tried to
 18 resolve it with converse, and when we weren't able to, you
 19 won't -- this is our favorite hydrograph and we didn't include
 20 it in our report because of that.
 21 Okay. Inclusions and recommendations. We've
 22 authored 40,000-acre-feet based on Darcy's law with two
 23 estimates of hydraulic gradient in close agreement, a
 24 transmissivity intermediate between what's been measured in

Page 749

1 our aquifer tests and yours. And that leaves 19,000-acre-feet
 2 from somewhere else, Spring Mountains maybe, though I think
 3 that's way too much for the Spring Mountains, to make up the
 4 59,000 that we assume is coming from Las Vegas Valley.
 5 And the two flow fields are -- those that explain
 6 the Big Muddy Spring are those that nourish, I guess, Big
 7 Muddy Spring and another that seems to be represented in most
 8 hydrographs, I'd say those of the EH-4 form. And because that
 9 latter one, the response function was funny and Dr. Mayer
 10 pointed out it was funny.
 11 Well, it's funny because it's got two humps on it
 12 and I think we may have also something local, most likely
 13 Sheep Range because that's the only available recharge area
 14 that fits our criteria, sending in those immediate pulses and
 15 maybe that needs to be treated separately.
 16 And so using the Virgin River as a proxy to
 17 explain the needs for water levels, we got a funny response
 18 function and I'm not comfortable with it either.
 19 And when we combine the two to try and make the
 20 Muddy River, we get negative. And that was just an experiment
 21 and probably shouldn't have been in the report. And we don't
 22 accept negative correlations coefficients. It didn't work.
 23 You know, it fits the data, but it doesn't make physical
 24 sense, and that's incredibly important.

Page 750

1 We've got a lot of things that seem to fit the
2 observations, but don't make physical sense like this. It was
3 assumed, and I don't think anybody can offer me one shred of
4 evidence that this was not just an assumption, pumping goes
5 up, water goes down, cause and effect. And that's why we're
6 here.
7 That's why we're here today is because of that
8 assumption. Oh, there's -- oh, yeah, see these -- this is the
9 response function for the EH-4 explanatory. It's these
10 jagged -- it's this jagged curve. See, instead of having a --
11 what you hope for or normally distributed or somewhat normally
12 distributed, you know, high in the middle, low on the end, you
13 got two humps.
14 And so I say, well, maybe that really is an
15 environmental distribution and this is coming from the Sheep
16 Range and this is coming from -- now we're -- this one now, it
17 looks like it makes more sense coming from the north, though
18 we can't -- I don't know how to separate these. You know,
19 maybe somebody else can. It's important. If we could find
20 the well -- if we could find the hydrograph that we could
21 attribute to the Sheep Range purely, we could do that.
22 Okay. Everybody seems to ignore the antecedent
23 trend that was -- you know, that's been our thing is, you
24 know, most aquifer tests, you know, you're going to get your

Page 751

1 This response in the first half-hour in a place like this if
2 there is any Theis response. And so what point am I trying to
3 make here? There's not much of an issue with the reference
4 water level, starting water level changing during that six
5 hours.
6 If it -- they'll be a little bit from the --
7 from, you know, barometric and tide effects or semidiurnal,
8 so you will have something. But those are small, those are
9 small. If you're going out now a week, you might have some
10 weather, you know, a big barometric dip.
11 And so you might have things coming in,
12 interfering with the test. And now if you're going a year or
13 two years, there is absolutely no way that you can predict --
14 or there was no way that you can predict what that hydrograph
15 would look like in the absence of pumping. We heard
16 yesterday, one interpretation that would likely be rising if
17 there was no pumping.
18 You know, all those rising hydrographs, I'd say,
19 well, if it's not rebuilding and the hole's full of drilling
20 mud and slowly, slowly, slowly, the water freshening, and
21 therefore, rising because of the equivalent fresh water head
22 is rising, well, you know, it's delayed climate. You know,
23 you can't have bad well construction in all the Nevada test
24 site wells.

Page 752

1 And we know, even though this is not really the
2 issue, I don't think there is an issue about drought. It's a
3 red herring. It's a red herring. It's the pattern -- it's a
4 pattern in past climate over a number of years that explains
5 these hydrographs in a regional system, because it takes time
6 for the signals to get through the system.
7 That's all there is to it. And the farther away,
8 in general, the longer the signal. So we think Big Muddy is
9 sourced from farther away than the Refuge Spring.
10 We think recovery is complete to that declining
11 trend. I'll let you ask the geochemistry questions. There's
12 some very intriguing anomalies or -- how should I say it?
13 Anyway, interesting geochemistry if anyone wants to talk about
14 it.
15 Oh, I did put that in. Okay. Yeah, cold water.
16 Dr. Waddell, cold water, I wanted to ask how cold. We've
17 got -- if anybody wants to go into that, we'll show that the
18 water assumed to be recharged, modern recharge for the DDC
19 study is way, way, way too cold. It's a collaboration -- the
20 collaboration temperature based on the oxygen isotopes is way,
21 way, way too cold.
22 And finally, this is the last slide. We think
23 this is the way to think about this hydrologic system. We
24 don't have the mountains on the right end. We have a chart

Page 753

1 here based on a work of Joe Toad in Alberta, early in the
2 60's, conceptualizing regional flow. And then that was
3 implemented as numerical modeling came on in 1967, one of the
4 first applications, looking at the effects of layered
5 heterogeneity on groundwater flow.
6 And in this example, you have a number of basins
7 with a low hydraulic conductivity, and a beneath them a layer,
8 continuous layer with a hydraulic conductivity a hundred times
9 greater.
10 And so you can see these basins are -- and the
11 little -- I've got some -- I've colored in some little green
12 splotches in the basins to represent phreatophytes. And I've
13 colored in blue in the regional aquifer just to point at them
14 with the pointer, just to clarify the diagram a little bit.
15 But we think this is how it's working. The water
16 is coming in in the high mountains, following the lower -- the
17 Paleozoic shelf domain rocks to the south and discharging
18 these warm springs, picking up heat from the Eureka low on the
19 way. Now, this is the system we're here to protect.
20 Now, as far as the basins, we'd suggest that any
21 kind of phreatophyte capture up here, if you truly don't value
22 those phreatophytes and what lives in them, take it. But it's
23 not going to affect the regional aquifer hardly at all, you
24 know, at this contrast.

Page 754

1 So that's really where I'd like to leave it
2 before I just, you know, blabber on and go ahead with as much
3 cross as you want to throw at us.
4 Q. We'd like to save about 30 minutes for redirect,
5 if necessary, but Mr. Johnson's making himself available for
6 cross. So that's all I have.
7 HEARING OFFICER FAIRBANK: Okay. Thank you.
8 Okay. So thank you. So we'll go ahead and start
9 the cross-examination. And based upon kind of the additional
10 time that you guys are allocating for the use of
11 cross-examination, we'll go ahead and assign 17 minutes to a
12 participant for cross-examination.
13 And as we've done for the past several days, if
14 there's additional time remaining, then we may open that back
15 up to participants to ask additional questions if they don't
16 get through all their first questions in the first go-round.
17 So we'll go ahead and start with Coyote Springs Investments.
18 MR. JOHNSON: May I have a question?
19 HEARING OFFICER FAIRBANK: Yes, Mr. Mifflin?
20 MR. JOHNSON: May I -- no, Johnson.
21 HEARING OFFICER FAIRBANK: Johnson. Sorry.
22 Excuse me.
23 MR. JOHNSON: That's okay. Would it be okay if
24 the attorney sits here to do any computer things that need

Page 755

1 doing, so I can just talk?
2 HEARING OFFICER FAIRBANK: I think you -- I mean,
3 you know your PowerPoint presentation probably more
4 extensively.
5 THE WITNESS: Okay.
6 HEARING OFFICER FAIRBANK: And so I think we'll
7 just go ahead and let you go to those pages and we'll let the
8 attorneys --
9 THE WITNESS: Right. I was just concerned about
10 being distracted by the technology when I'm trying to answer a
11 question.
12 HEARING OFFICER FAIRBANK: If it -- if we -- if
13 there's a problem, we can go ahead and address it.
14 THE WITNESS: Okay. Okay.
15 HEARING OFFICER FAIRBANK: Thank you.
16 CROSS-EXAMINATION
17 BY MR. HERREMA:
18 Q. Good morning. Brad Herrema and Emilia Cargill
19 for CSI.
20 A. Good morning, Brad and Emilia.
21 Q. Good morning, Dr. Johnson. I'd like to start
22 with a question that relates to something you said when you
23 were looking at slide four, although I'm not sure that -- I'll
24 to find slide four. Let's see.

Page 756

1 A. You went past. That's three. That's one --
2 there's 1, 2, 3, 4 -- Maxey?
3 Q. Yes.
4 A. Okay.
5 Q. When you were discussing this slide, you stated
6 that you do not like cumulative departure from mean curves.
7 Are you familiar with the limitations of CDM curves?
8 A. Not in a formal sense, I'd say no.
9 Q. Okay. Do you know whether there's a limitation
10 associated with a set of data's period of record, meaning is
11 there a minimum number of years required to accurately use a
12 CDM curve?
13 A. No, I think the -- I would only use it with
14 really sparse data if I -- you know, when I'm looking for a
15 trend and I've got data that's too sparse to, you know, look
16 at -- well, I really don't want to go there, because we're
17 sort of venturing into statistics and I want to completely
18 fail at answering any statistics questions and refer those to
19 the -- you know, to the experts and we can do that.
20 Q. Okay.
21 A. But I'm not going do well answering that line of
22 questioning.
23 Q. Okay. Then what methodology would you recommend
24 for describing periodic wet and dry cycles over century-long

Page 757

1 periods based on rainfall data?
2 A. Well, I would not base it on rainfall data.
3 Q. Okay. What methodology would you recommend for
4 describing periodic wet and dry cycles?
5 A. Well, I think I -- I think I understand your
6 question. Try again, if I don't. I think you're saying what
7 type of proxy records are most appropriate in my opinion to
8 characterize climate annual -- let's say annually -- annual
9 climate.
10 Q. If you don't think CDM curves are a good way to
11 describe these trends or cycles, what do you think is the best
12 way to do that?
13 A. Well, I think you don't get more than one trend.
14 I mean, it -- I don't -- I won't do well -- I'm just admitting
15 here, I won't do well with this line of questioning.
16 Q. Okay. I can move on.
17 A. Yeah.
18 Q. In Appendix 4 of your initial report on page 66,
19 you stated that drawdown in EH-4 resulting from Arrow Canyon
20 well pumping has been established by comparing hydrographs of
21 EH-4 to reference well MX-4. Does that sound familiar?
22 A. MX-4 was the reference well, right.
23 Q. Could you describe the relationship you found
24 between EH-4 and MX-4 during 1993, 1994 testing of those Arrow

Page 758

1 Canyon wells?
2 A. Well, the figure -- we have a figure with a
3 direct comparison, one on top of the other. So without
4 looking at it and it's not in my packet -- oh, thanks, Beth.
5 MS. BALDWIN: You're welcome.
6 MR. JOHNSON: Okay. I've got the figure. What
7 would you like to know?
8 BY MS. BALDWIN:
9 Q. You're on Page 66 of your initial report?
10 A. I am, I've got it.
11 Q. Okay. Great. Could you describe the
12 relationship you found between EH-4 and MX-4 during the '93,
13 '94 testing?
14 A. Oh, actually that's not the figure. We do figure
15 of another figure. Well, the adjustment is given in Figure 4
16 on page 69. I think the point -- I think the point of this --
17 yeah, I can't answer that precisely. That interval is what's
18 considered on page 69, I think. Adjustment of EH-4 for the
19 121-day testing of Arrow Canyon well. So that's what we ended
20 up with.
21 The comparison here is just meant to show you how
22 similar they are. You know, they have the same form and those
23 differences are what we consider to be drawdown, because we
24 consider MX-4 to not be affected by Arrow Canyon Well pumping

Page 759

1 and we considered EH-4 to be affected by Arrow Canyon Well
2 pumping. You know, MX-4 is eight miles up gradient, EH-4 is
3 what, a mile down gradient.
4 So we're pretty comfortable, as hydrogeologists,
5 that MX-4 is an appropriate reference well with which to
6 compare EH-4, if you're looking for differences attributable
7 to somebody pumping remote from MX-5.
8 Q. You stated that Order 1169 pumping created about
9 a one-foot drawdown at EH-4 and a reduction in flows of .6 CFS
10 at Warm Springs West?
11 A. I believe so.
12 Q. Okay. And then you compared that to the '93
13 Arrow Canyon Well tests that produced the .8 feet of drawdown
14 at EH-4 and about .5 CFS reduction of flow at Warm Springs
15 West?
16 A. Okay. It sounds reasonable. I can't remember
17 the place and time I wrote that.
18 Q. So do you recall whether you accounted for recent
19 hydrologic conditions when you compared the two pump tests?
20 A. Interesting question. Recent hydrological
21 conditions. Well, we didn't -- put it this way, when you say
22 compare the tests, I analyzed the 1169 test. Every
23 combination of pumping and observation using MX-5, MX-4 and
24 RW-2. I think I got five estimates of transmissivity and

Page 760

1 storativity. I don't know if anybody else analyzed that
2 record. Crazy, but no, I analyzed that one.
3 The Arrow Canyon Well, I didn't analyze in terms
4 of aquifer properties. All I did was come up with a procedure
5 for establishing the drawdown in response to Arrow Canyon Well
6 pumping and it could be analyzed.
7 But, again, you got such funny geometry that it
8 won't be a Theis well, but I'm going off. The point is I
9 didn't analyze Arrow Canyon well pumping for aquifers, I did
10 the other.
11 Q. Okay. Do you recall what the pumping rate
12 during -- was during the Arrow Canyon Well pump test?
13 A. I don't recall. It was -- no, I don't recall.
14 Q. Okay. Do you recall whether you took different
15 pumping rates into account when you were preparing the impacts
16 caused by the 1169 pumping test in the Arrow Canyon well
17 pumping test by comparing those impacts at Warm Springs West
18 Gage?
19 A. I'm not sure I understand the question. I'm
20 really not trying to be difficult, I just -- I'm not sure I
21 understand.
22 Q. Well, this is complicated stuff.
23 A. It's complicated.
24 Q. When you were comparing the impacts at Warm

Page 761

1 Springs West Gage from the Arrow Canyon Well pumping to the
2 1169 pumping test, when you were comparing those impacts, did
3 you take into account the different pumping rates during those
4 tests?
5 A. I'm still -- maybe I'm just slow today. I'm just
6 not understanding the question. I'm sorry.
7 Can we -- do it again. We got time, do it again.
8 I want to answer you, I just -- I'm not sure I can.
9 Q. Okay. The two different pumping tests, 1169
10 pumping test, Arrow Canyon well?
11 A. See, you're referring to things that I wrote that
12 I can't clearly remember writing what I was thinking at the
13 time. So that's why I'm having a problem.
14 Q. Okay. I'll move on.
15 I believe you indicated that pumping at Arrow
16 Canyon wells does not affect Big Muddy Spring and Warm Springs
17 West measured flows equally; is that accurate?
18 A. Yes.
19 Q. Okay. What evidence did you use to make that
20 conclusion?
21 A. Maybe I shouldn't have answered so emphatically.
22 The -- just ask me again so I can be clear.
23 Q. In your conclusion, in making your conclusion
24 that pumping Arrow Canyon wells does not affect Big Muddy

Page 762

1 Spring and Warm Springs West measured flows equally, what
2 evidence did you use to make that conclusion?
3 A. Oh, okay. Well, the way I'm thinking about it,
4 I'm not sure if I -- you know, historically, if I'm accurately
5 thinking about it. We accept and value the correlation that
6 Dr. Mayer's made between EH-4 and the Pederson Spring flows,
7 and so we accept that fully.
8 And so, with no hesitation, if we see an impact
9 on the EH-4 hydrograph, we know what that means in terms of
10 flow at the high elevation springs.
11 And so through this Order 1169 test, you know, we
12 see within the southern flow field, widely propagating pumping
13 signals, but not of the magnitude that everybody has been
14 thinking.
15 So Big Muddy, I'd say there's only, you know,
16 negative -- what's the right word? There's no evidence that
17 Big Muddy Spring of Arrow Canyon Well impact, but on the other
18 hand, I haven't figured out how to analyze it.
19 There's no reference spring or well. We don't
20 have another hydrograph that looks like that. I just -- I
21 don't know how to -- I can't say that Big Muddy Springs is not
22 affected. I can't say that. But I can say that the higher
23 elevation springs are.
24 Q. Okay. Could there be a contribution to the Muddy

Page 763

1 River Springs from flow paths other than from Coyote Spring
2 Valley?
3 A. Oh, absolutely, through the Meadow Valley
4 Mountains, yes.
5 Q. Okay.
6 MR. HERREMA: I have no further questions at this
7 time.
8 HEARING OFFICER FAIRBANK: Thank you. Next will
9 be the United States Fish and Wildlife Service.
10 CROSS-EXAMINATION
11 BY MR. MILLER:
12 Q. Good morning, Luke Miller for the Fish and
13 Wildlife Service.
14 A. Morning.
15 Q. Dr. Johnson, just a few questions here. Are you
16 aware of the Fish and Wildlife Service, I guess, proffered
17 reason for the discharge at the Muddy Springs at the location
18 that they exist?
19 A. Are we speaking of the trigger levels? Do I
20 understand the rationale for the trigger levels?
21 Q. Well, just -- I believe it's just the reason for
22 why there was discharge at the Muddy River Springs at their
23 location?
24 A. Oh, that was one of my earlier points, is we

Page 764

1 don't know. We think we need to -- we need to impede the flow
2 to get the water to come out and I know that from my own
3 modeling.
4 But the feature that actually causes the water to
5 come out is -- it's not in anybody's map. And, you know,
6 the -- you know, the Cal Tech geologists suggested, you know,
7 maybe it's the lateral ramp. Well, we just don't know.
8 We put an obstacle to flow. We reduced the
9 permeability until the water came out. You know, all I can
10 say, we don't know. We don't know what it is. But if there's
11 not an obstacle to flow, it's going to keep going.
12 You know, there's some permeability reduction,
13 whether it's a -- whether it's a barrier like we represented
14 it, whether it's a thinning of the section, whether it's a
15 lateral ramp fault that's maybe just not exposed, we don't
16 know. We don't know. But you got to impede the southward
17 flow to get the water to come out.
18 Q. All right. In reference to some of the
19 statements in the report, you mentioned that there has been a
20 20-year drought or so that began in 1999. Can you clarify the
21 data that you relied on to determine when that drought started
22 and how it's lasted 20 years?
23 A. Thank you for that question. On the one hand, I
24 think arguing about drought is a red herring. What we think

Page 765

1 is a more important or valid or legitimate concept is the idea
2 that some interval of past climate is responsible for the
3 discharge in any given year at, let's say, Big Muddy Spring.
4 And so how do you find that interval of climate?
5 Now, that interval of climate won't be all
6 drought and it won't be all wet. Maybe if it's a short one,
7 but in general, no. And like you saw in our -- I guess that's
8 five -- no, six, yeah, in our slide six, there's a lot of
9 action in the discharge and what is that? You know, the --
10 everybody seems to think it's pumping. I just think that's
11 madness.
12 Q. Well, you know, in reference to the slide six,
13 here, can you kind of explain then where the drought response
14 is in here for the Big Muddy Springs?
15 A. Well, let me -- can I first answer you? I got
16 you sidetracked a little. I can answer your first question,
17 the way this started. If anybody has access, and I've got the
18 image here to the December 14th, 2010, issue of the
19 proceedings of the National Academy of Sciences, the issue is
20 on the drought in the southwest. It's full of articles.
21 There's fear of mega-drought.
22 I've got another article from 2019. Now, they're
23 talking about mega-droughts and if we don't change our
24 behavior, we might have a drought like we haven't had since

Page 766

1 1600 or before 1600.
2 So drought's an important concept to uncover, by
3 the way, of that issue, which shows Lake Mead with the water
4 levels way down, you know, obviously the Colorado catchments
5 have seen hard times water wise.
6 So, you know, the drought, we can argue about the
7 drought. But in aggregate, you know, a series of less than
8 normal water years are going to decrease the resource at the
9 outlet, whether it's the lake or the spring or whatever.
10 So I think -- I really do think this is the right
11 way to think about the problem and we presented it as an
12 analysis opportunity. And knowing we're not statisticians,
13 but we think -- and we think -- and as far as any expertise,
14 all I know is I'm licensed to use Excel and I know how to run
15 some regression in it. And what was hard to figure out was
16 how to look at a thousand cases without wasting the next year
17 doing it.
18 And we got that in our report, too. It's a
19 little R routine that you still have to, you know, look
20 through output for each interval length, but we got it done.
21 And we found one, this is out of a thousand or more candidate
22 solutions. The only one came up positive correlation
23 coefficients. But the reason I hope somebody else would get
24 engaged with this is because you might do better or worse with

Page 767

1 a different base flow selection.
2 See, our explanatory variable set are these
3 annual base flows and those are obtained by chopping off the
4 storm searches in the hydrograph, and there's no one best way
5 to do that. And maybe for this, we care most about the snow
6 and we only chop off little piece. You know, there's rain and
7 melting snow in that hydrograph. So somebody that's expert in
8 that could run with this and I think it's the keys to the
9 kingdom. And instead we get beat up about it.
10 Q. Well, I -- you know, I'll admit to having some
11 layman approach to this and I'm just trying to determine
12 whether there is -- you know, the slides labeled climate
13 response for big Muddy Springs, and I'm trying to understand
14 the climate response, it seems to go, again, layman term here,
15 around 1990, seems to drop, then it goes pretty up to 2000 and
16 then it drops down roughly 2009?
17 A. Are you looking at -- are you looking at the
18 spring discharge? That's the heavy -- the dark blue line,
19 solid line? Those are the observations. Those are the
20 observations. That's what actually came down the -- came out
21 of the spring in each year, each water year, so --
22 Q. Is the spring discharge equivalent somehow to a
23 climate response that's coming through the system and --
24 A. Oh, I see. I see. Okay. Let me go back and try

Page 768

1 to explain the whole procedure.
2 Let's say, just in the simplest case, that the
3 amount of water coming out this year, let's say
4 5,000-acre-feet, let's say I can explain that as -- and let's
5 say I've got three measurements of river flow. Let's say
6 Humboldt River flow, which is what we actually use.
7 So I've got three years of data and I've got
8 three years of -- three years of spring flow data and I've got
9 three years of run-off data, just the totals. Okay.
10 So I'm going to say, can I come up with something
11 like one times this amount of river discharge, plus two times
12 this amount of river discharge, plus one times this amount of
13 river discharge equals spring flow numerically. Forget about
14 dimensions and units and stuff numerically.
15 And so, if so, if one times this one, plus two
16 times that one, plus three times that one equals 5,000,
17 perfect. But now if I have -- if I'm going to have a test
18 case where -- well, all I'm saying is that you take a chunk
19 of -- a sequence of annual river discharge measurements and
20 see if statistically you can explain those through some set of
21 variables with individual weights that the program tries to --
22 it does -- Tim is going to have to explain this if you really
23 need it.
24 But you're trying to explain a variable with some

Page 769

1 other variable. So you're trying to explain spring flow with
2 river flow, which we're claiming is -- those are parallel with
3 the climate. In other words, low river flow, you've got a dry
4 year.
5 Q. Well, I think I'm following you that far and
6 that's why I'm just trying to stay with this.
7 A. Okay.
8 Q. This slide represents even maybe a delayed pulse
9 or something, I think is the word -- some of the terminology
10 I've heard as precipitation or --
11 A. Oh, I see. I see what you're saying. I see
12 what -- okay. In the old days, there was an observation or a
13 suggestion that this -- the river flow, because that's all
14 that was gauged at the time, Muddy River, and the springs
15 weren't measured yet.
16 But the suggestion was made that the high flows
17 in the river seem to follow wet weather by about 15 or
18 20 years. And so -- and then Maxey got into that. So we came
19 on the scene with two of the greatest Nevada hydrogeologists
20 suggesting there's a 15- to 20-year lag in response. And
21 so -- but how do you do better, you know?
22 And so that's what we tried to do with this
23 exploratory multiple regression thing is just try and see if
24 we could find a way to -- you know, without wasting our -- the

Page 770

1 rest of our lives, get in there and test all these
2 possibilities and see if one worked really good. And there
3 was only one with all positive correlation coefficients. It
4 was mind boggling.
5 Q. So do you think this slide represents a general
6 trend of drought for the past 20 years?
7 A. Not drought. This -- no, because this record --
8 see, these are projections. The only record is the blue line.
9 So let's just talk about that. What we're saying, we're
10 agreeing with Eakin and Maxey that this wet in these -- this
11 high spring flow in about 2000, okay, followed by about
12 20 years something back here, where's 20 years? Okay.
13 20 years. 12 to 22, 12 to 22.
14 So from here, some interval of climate in this
15 range up north produced what you see in that year. So in
16 other words, the measurement from 2000 is explained by
17 function of base flow measurements, weighted base flow
18 measurements dating from 12 to 20 -- two years before that
19 observation. And the model just seems to hit that observation
20 right on almost.
21 I mean, it's not very good in some places. I
22 mean, you know, it's not good here and especially not good
23 here. But it comes back, it comes back in the last two years
24 we're on, we're on our projection. And we'll keep this going

Page 771

1 for ten years and see what happens.
2 You know, it looks like the Muddy River or the
3 spring is in for a not too bad the next ten years according to
4 our model.
5 Is that helpful at all?
6 Q. I think I'll -- I'll leave it there. I'm trying
7 not to be redundant as well.
8 A. Okay.
9 Q. So okay.
10 MR. MILLER: Okay. Yeah, no further questions.
11 MR. JOHNSON: I feel kind of bad about that. I
12 wasn't very effective.
13 HEARING OFFICER FAIRBANK: Okay. National Park
14 Service.
15 MS. GLASGOW: The National Park Service has no
16 questions at this time. Thank you.
17 HEARING OFFICER FAIRBANK: Okay. Seeing no
18 questions from National Park Service, we'll move to the
19 Southern Nevada Water Authority and Las Vegas Valley Water
20 District.
21 CROSS-EXAMINATION
22 BY MR. TAGGART:
23 Q. Good morning, Mr. Johnson.
24 A. Good morning, Mr. Taggart.

Page 772

1 Q. My name is Paul Taggart, I represent the Southern
2 Nevada Water Authority and Las Vegas Valley Water District.
3 Mr. Johnson, are you aware of how many other
4 expert reports have been submitted in this proceeding?
5 A. Well, I've looked at all of them and printed and
6 bound the thick ones, no.
7 Q. Okay. Would it surprise you if there was 11
8 separate expert reports submitted on the --
9 A. Not a bit.
10 Q. Okay. And your analysis is one of those 11
11 expert reports. Does that sound about right?
12 A. The one outlier, yeah.
13 Q. And I guess that's one of my questions is, do any
14 of the other expert reports agree with your conclusions?
15 A. Well, in part. That's why I was so hoping I'd
16 hear the word anisotropy because when you back off from these
17 individual fault studies to a regional picture, that's what
18 those local features give you.
19 So we're, in a small sense, comparing apples and
20 oranges in your question, because we base all of our thinking
21 at this point on regional study. And even though our Tribe
22 has local interests, the physics is regional. And everybody
23 else has -- seems to have taken a much more local approach.
24 So I think there's lots of points of agreement

Page 773

1 regarding any or all of the discussions in faulting. But
2 it's -- there's not a direct -- they're different. I mean, we
3 think differently about this.
4 Q. Okay. And you describe, I think, your report as
5 the outlier; is that a fair statement?
6 A. Just this moment, I did. It is.
7 Q. Okay. And who's Marty Mifflin?
8 A. Dr. Martin Mifflin wrote the book on delineation
9 of groundwater flow systems in Nevada in his doctoral
10 dissertation in 1968 and he's sitting behind me.
11 Q. Okay. And you've worked with Mr. Mifflin on a
12 lot of the questions and issues that your presented in your
13 testimony this morning; correct?
14 A. All of the key issues. I mean, he's reviewed
15 everything. We're in general agreement, not on every single
16 small item, but yes, he's reviewed all my submittals -- our
17 submittals, our submittals.
18 Q. Now, do you have the -- well, I'll ask you to
19 turn to the slide under presentation. Do you have that
20 available?
21 A. Well, I can click down to it.
22 Q. All right. Let's go to -- well, there's the
23 slide with the large blue dots on the line with the large blue
24 dots; do you recall that slide?

Page 774

1 A. Um-hum. It was a -- I think -- yep.
2 Q. And that's in your report; correct?
3 A. It's in the appendix on the scope and model.
4 That's a plot made by the scoping model or by the software
5 hosting the scoping model.
6 Q. Now, you're familiar with the MX-5 well and the
7 1169 pumping that occurred at that well; right?
8 A. Yes, sir.
9 Q. And do you agree that the MX-4 well and the
10 hydrograph for the MX-4 well reflects the pumping signal from
11 pumping at MX-5 during 1169 pumping test?
12 A. Well, it's dominated by that, and of course, you
13 didn't ask about the environmental, the barometric and title.
14 But I think there was some Coyote Spring Valley pumping. I
15 doubt if it would be -- we don't know, we can't resolve it.
16 But there would be minor influences, but I'd say that would be
17 dominated to our measurement limitations by MX-5 pumping.
18 Q. Okay. And you'd agree with me that the two wells
19 are essentially on the same pad. They're on the same property
20 within a couple hundred yards of each other; right?
21 A. I think they're in a broken zone of sorts and
22 we've seen different representations of that. But they're
23 definitely in a -- they share a high permeability domain.
24 Q. Okay. And you heard the testimony from

Page 775

1 Mr. Reich; correct?
2 A. Yes.
3 Q. Okay. And I don't want to mischaracterize his
4 testimony, but do you recall what his testimony was about his
5 conclusion regarding the effect of pumping at MX-5 during the
6 Order 1169 pumping test on EH-4?
7 A. No, I've just been focused on that horse block,
8 having some ideas about that.
9 Q. Okay.
10 A. Not EH-4.
11 Q. Would it -- do you know if you were the only
12 expert who believes that pumping at MX-4 during the 1169
13 pumping test does not influence EH-4 water levels, do you know
14 if you're the only expert that believes that?
15 A. It does.
16 Q. Oh, it does. Okay. Could you --
17 A. Oh, yeah, yeah, yeah.
18 Q. Okay.
19 A. Yeah, it's in -- oh, yeah, we've presented that
20 over and over in different places, yeah. The -- it's got -- I
21 want to guess roughly half of the drawdown of MX-4, maybe
22 more.
23 Q. Okay. So you agree that pumping in the Order
24 1169 pumping test demonstrated a hydrologic connection between

Page 776

1 EMX-4 area and the EMX-5 area and EH-4?
2 A. Oh, not just that, I think that pumping signal is
3 diagnostic all the way down to Apex. And the reason it's
4 diasostic is because of that unplanned -- I won't say
5 unplanned, maybe you planned it, that five-month shutdown,
6 that recovery during the early 2012, that was diagnostic.
7 Nobody could say that BMDL-2 signal is not MX-5 pumping.
8 But I will say the upper Kane Springs Wash does.
9 No, that's a -- that put out a diagnostic signal, that went
10 along these features 20 miles.
11 Q. Okay.
12 A. Maybe not 20, but all the way to Apex.
13 Q. And the next question I have is, do you -- you
14 have a page in your PowerPoint that I was a little confused
15 about, page 14?
16 A. Okay. Yeah, and I'm not counting. What do you
17 want to see? About there, am I close? I don't have -- oh,
18 yes.
19 Q. Yes, next slide, right there.
20 A. Yeah, yeah, yeah. Good, good.
21 Q. I thought I heard you say that, in your view,
22 this would be the only index that should be used in the area?
23 Was that --
24 A. No.

Page 777

1 Q. Am I accurate in --
2 A. If I knew what I know now and we were beginning
3 the Order 1169 analysis, trying to separate the pumping from
4 whatever else was interfering with it, and that we do that in
5 every pump test, I mean, to some extent.
6 This one is just difficult because it was so
7 alarming because the antecedent trend is so dynamic and not
8 predictable. And it's not very --
9 Q. Well, in your earlier diagram where there was the
10 dotted line, the blue dotted line?
11 A. Um-hum.
12 Q. On the right side of that dotted line or to the
13 east was shaded in yellow, right?
14 A. Yeah, I cut out some low elevation terrain that
15 the model solved, but shouldn't even be in the model.
16 Q. Okay. But that -- other than that part that you
17 cut out, which was to the far extreme east, I think, of the
18 original domain?
19 A. Um-hum.
20 Q. But the area that would remain in shaded yellow?
21 A. Yes.
22 Q. And you referred to that as Muddy Springs
23 capture?
24 A. Well, the -- yeah, the capture zone, it goes to

Page 778

1 Meadow Valley Wash, Meadow Valley Mountains and out into
2 Coyote Spring Valley.
3 Q. Okay. And so when we talked about MX-4, MX-5
4 earlier, you'd agree that's in that capture zone for the Muddy
5 River Springs area?
6 A. Yes.
7 Q. Right? Okay. And is this well that we're
8 looking at on this hydrograph, which is in Kane Springs, I
9 believe, is -- do you also believe this is in that capture
10 zone?
11 A. Yes, yes.
12 Q. Okay. And I guess when -- I mean, I don't
13 understand what you mean by this one being an index. Is it an
14 index for seeing what happens?
15 A. Oh --
16 Q. Well, sir, let me finish my question, please.
17 Because I understand what you mean by an index
18 well. But to what value does that well provide you that
19 index? Is it what occurs from pumping or what doesn't occur
20 from pumping? I mean, do you see --
21 A. Oh, the background, yeah, yeah. What we like --
22 I mean, ideally you'd like to know what that water level in
23 your -- at your test location would look like if you weren't
24 pumping because that's what you subtract from to get drawdown.

Page 779

1 And so if you don't know it, you don't know
2 drawdown if you don't know the antecedent trend. And these
3 long-term acre antecedent trends are horribly difficult. I
4 mean, I can almost not believe that we've actually got a
5 useful working relationship for it. It can be improved for
6 the -- now we're back to the climate model.
7 But, no, this is what I would take as what those
8 water levels would look like throughout the -- what we've been
9 calling southern flow field. Let me -- I would say
10 hydrographs of the EH-4 form might be subtracted from this
11 hydrograph to get a different kind of pumping signal than we
12 analyzed.
13 Q. Okay.
14 A. Yeah.
15 Q. And in your testimony, you indicated that you
16 only had two weeks to perform your modeling exercise?
17 A. Yeah, it's --
18 Q. And I have a question about that.
19 A. Yeah.
20 Q. You understand the order that the State Engineer
21 issued requiring -- or asking stakeholders to submit
22 information was on January 11th, 2019, and the due date for
23 expert reports was in July of 2019. So that's roughly six
24 months, I think?

Page 780

1 A. Um-hum.
2 Q. Why did you only have two weeks?
3 A. No money. It's a demo. It was a -- it's -- the
4 software developers will give you a free two weeks, hoping
5 you'll buy their software. And this is a really high-end
6 expensive software package, really capable world wide.
7 Q. I see.
8 A. You know, in the waste management community, it's
9 used everywhere.
10 Q. So the demo period ran out in the two-week
11 period?
12 A. Yeah, I need to give them -- they haven't given
13 me a price, but it's real -- it's too expensive for DRI, put
14 it that way.
15 Q. Okay. So that two weeks is the demo period that
16 you were able to use the model and --
17 A. I did as much as I could in two weeks.
18 Q. Okay.
19 A. Around my drinking.
20 HEARING OFFICER FAIRBANK: Mr. -- Dr. Johnson, if
21 you'll just go ahead and let Mr. Taggart finish his questions
22 before you start answering. Otherwise, it creates a very
23 difficult record for the court reporter to decipher.
24 MR. JOHNSON: I caught myself, and I apologize.

Page 781

1 BY MR. TAGGART:
2 Q. Would you agree with me that, generally, before
3 numerical model is developed, a conceptual model has be to
4 created; right?
5 A. Yes.
6 Q. And you developed a conceptual model of the
7 regional area that you believe contributes to the Muddy River
8 Springs, you developed a conceptual model before you developed
9 the numerical model, right?
10 A. Yes.
11 Q. You'll have to --
12 A. Yes.
13 Q. And would you agree with me that that conceptual
14 model that you developed is not the consensus of scientific
15 opinion regarding the hydrologic and geologic conditions in
16 the region you analyzed?
17 A. Well, it's a -- there's a couple of points worth
18 making. It's a scoping model and you're the only folks that
19 have seen it, you know, so there's not -- and I don't know if
20 even if you've seen it, if you've had a chance to really
21 digest what we're saying and think about it.
22 Q. Okay. And let me clarify my question because I'm
23 short on time. But you understand that many times when a
24 numerical model is developed, the conceptual model is

Page 782

1 documented and distributed for peer review by other scientists
2 in the community; right? That occurs; correct?
3 A. Well, I won't agree because I'd like to make a --
4 well, let me just not -- can I just not answer that question?
5 Q. Okay.
6 A. Because I don't have a good one.
7 Q. So you do not agree that the conceptual model of
8 a hydrologic region is not generally reviewed prior to the
9 development of a numerical model?
10 A. Now, can I speak? Yeah, here's my answer. You
11 have a conceptual model. The binary model is on the website.
12 It's very simple. We like simple models. If you read our ADM
13 paper from 2006, the entire model -- I mean, there's pictures,
14 but the entire model is in one table.
15 You have recharge, your permeabilities of free
16 flow domains, the thickness, it's all in one place. You
17 could -- half an hour, you could have G-flow, you could
18 recreate our model.
19 Same with this one, except you don't have to do
20 the mesh. You can just load it up and start filling in with
21 properties. So it's so simple that it is the conceptual model
22 and it's all our assumptions. So everything is assumed, so it
23 is our own conceptual model.
24 It's just not -- it hasn't been circulated and

Page 783

1 thought about enough for too many people -- well, nobody's
2 really argued with us because nobody really understands it
3 yet. I mean, it's easily understood, it's just, you know, are
4 these guys crazy or is there something that -- you know,
5 bringing in the heat and the anisotropy, does it help us.
6 Q. Well, and earlier when you were testifying, you
7 said something about getting beat up about all of this when we
8 presented it. What did you mean by that?
9 A. Tongue in cheek. This -- you know, this Las
10 Vegas Valley, you know, just think about, what if that's real?
11 Q. Okay. I don't want to ask you --
12 A. And -- well, who brought up that --
13 Q. Well, Mr. Johnson, you understand the State
14 Engineer has to make a decision about groundwater in the Lower
15 White River Flow System?
16 A. Right.
17 Q. And that decision needs to be made based upon,
18 you know, sound scientific judgment?
19 A. You bet.
20 Q. Right? But is there any other scientist who
21 believes that the amount of water is flowing into Las Vegas
22 Valley as much as you believe?
23 A. Yeah, he's sitting behind me.
24 Q. Okay. Other than you and Dr. Mifflin, is there

Page 784

1 any other person who have any other literature that you can
2 point to that postulates that amount of inflow to Las Vegas
3 Valley?
4 A. Well, I've told you, it's misestimated.
5 Everybody's stuck with the Spring Mountains ever since Maxey.
6 Q. Okay. So just to be clear, that's a new idea
7 that you've authored; correct?
8 A. See, I don't know that. I don't know that it's a
9 new idea.
10 Q. Well, then is -- you can't point to any other
11 literature with that opinion in it; correct, other than your
12 own?
13 A. Well, there's no -- yeah, I'll agree with that.
14 Q. Okay.
15 A. We're out in -- we're outliers.
16 Q. Do you know what the gradient is between Garnet
17 Valley and Las Vegas Valley?
18 A. Yeah, we showed you -- we've got the photo --
19 Q. Okay. Is it true that there is an upward
20 gradient before you can get into Las Vegas Valley from Garnet
21 Valley?
22 A. Not necessarily, because you don't know the
23 thickness or the composition of the water colony.
24 Q. Okay.

Page 785

1 A. So the freshwater head is unknown.
2 Q. All right. Well, there's a page in your
3 PowerPoint, it's page 11.
4 A. I didn't mean to get testy there, Paul. Sorry.
5 Q. That's okay. I understand. I think my time is
6 up.
7 HEARING OFFICER FAIRBANK: It is. Let's go ahead
8 and take a ten-minute break and we will go ahead and resume at
9 I'll say 10:50.
10 (Recess.)
11 HEARING OFFICER FAIRBANK: All right. We will go
12 ahead and go back on the record.
13 And so the next participant up is the Moapa
14 Valley Water District. And I saw Mr. Morrison here a moment
15 ago, but I do not see him here right now. I think maybe --
16 and we may end up -- if Mr. Morrison doesn't step in here in a
17 moment, we may just go ahead and go out of turn slightly, just
18 to go ahead and keep this proceeding moving forward.
19 Not seeing Mr. Morrison, so we'll go ahead and
20 get back to Mr. Morrison and open it up to Lincoln County and
21 Vidler.
22 MR. MORRISON: We've got no questions for
23 Mr. Johnson.
24 HEARING OFFICER FAIRBANK: Okay. Just for the

Page 786

1 record, we'll go ahead and just make a note that the Moapa
2 Valley Water District indicated they did not have any
3 questions. Thank you. Ms. Peterson.
4 MS. PETERSON: Thank you.
5 CROSS-EXAMINATION
6 BY MS. PETERSON:
7 Q. Dr. Johnson, Karen Peterson representing the
8 Lincoln County Water District and Vidler Water Company.
9 A. Good morning.
10 Q. And I heard you say, I thought a couple times
11 during your direct presentation, that you couldn't get your
12 model to work; is that correct?
13 A. No.
14 Q. Okay. Is your model calibrated?
15 A. No. Oh, correction, I might say there are
16 degrees of calibration, but remind everybody this was a
17 scoping model where we just pick a set of parameters and see
18 if it works, see if it works both in terms of getting
19 reasonable predictive heads and temperatures or -- and also
20 mathematically if it works. So it was a scoping model, we
21 just set out to see what we could do in two weeks.
22 Q. Right. And you don't recall testifying that you
23 couldn't get it to work? I thought I heard you say that a
24 couple of times.

Page 787

1 A. Well, it worked -- when you say "worked," we
2 think it gives reasonable results in the eastern part because
3 both the heads and the temperatures look reasonable and the
4 captures zones look reasonable.
5 But in the west, there's no warming in the
6 springs. So it doesn't work in the western areas and also
7 there's some elements along the edges that need to be removed
8 from the model domain. So I'd say it's partially calibrated
9 and incomplete.
10 Q. And would you agree that a model must be fully
11 calibrated in order for it to be reliable?
12 A. Well, models have all different purposes and
13 there are many kinds of models. I'd say, no, without being --
14 I'm not being argumentative, but the answer is no.
15 Q. You don't think models need to be calibrated?
16 A. No. I have a model for how fast this will hit
17 the floor. I'm holding a pen and threatening to drop it.
18 That comes from gravity. So calibrated, I'm not -- I mean,
19 I'm not calibrating anything and I don't know about -- but
20 see, that's a model.
21 A model is just a concept and it can be
22 implemented in a number of ways, mathematically, by experiment
23 or whatever. Model is just a way of thinking in our case a
24 process.

Page 788

1 Q. Is -- again, not to -- I think calibration's
2 really important. So is your model calibrated to observations
3 of groundwater elevations in the Lower White River Flow
4 System?
5 A. We attempted to match -- well, this is a
6 beginning. But we attempted to match heads and temperatures
7 at Tule Springs based on -- no, we calibrated to the head at
8 Tule Springs and the Steptoe MX-4 well, and let the model
9 calculate temperatures with the assumption that the water goes
10 in at one degree Celsius.
11 So we think we've got a foundation that we can
12 build on. It's mathematically stable and if -- with
13 reasonable parameters, it gives us reasonable outputs of heads
14 and temperatures.
15 Q. But it's not fully calibrated?
16 A. Not --
17 Q. Would you agree?
18 A. No, no, no, not even close. It's the beginnings.
19 It's just the beginnings of a working tool.
20 Q. The model, we're talking about your feed flow
21 model?
22 A. Yes.
23 Q. All right. And so would you agree that at this
24 point, just because it's the beginnings, that it's probably,

Page 789

1 at this point, not something the State Engineer can rely on;
2 would you agree with that?
3 A. Well, the -- without having a big discussion
4 about reliance, I mean, he's going to put some weight to it
5 and it's at his discretion. So I don't think it should be
6 discarded and I don't think that it's accurate in the sense
7 that, you know -- well, on the west side, it's completely
8 wrong. The water doesn't warm up. So, no, it's the
9 beginnings.
10 There -- it's a -- it illustrates a conceptual
11 model. That's its value is it shows the State Engineer how
12 we're thinking about the problem and we're thinking about it
13 differently.
14 Q. And is your model calibrated to observations of
15 spring discharge in the Lower White River Flow System?
16 A. The spring discharge is an input. We take -- we
17 total up the -- from one reference from a recent USGS -- it's
18 Carlisle and Brooks, I believe. We total up all the regional
19 springs or a -- we select the larger regional springs and take
20 that total discharge estimated, except for Las Vegas Valley
21 now. We take a new number for that.
22 But we distribute that quantity of water annually
23 over all those elements that were colored yellow and gold, so
24 over about 1400 square miles, which comes out to about

Page 790

1 15 centimeters a year of recharge into the carbonate rocks.
2 So that's the conceptual model.
3 That's a conceptual model and it's easily
4 recorded or documented in our submittal. So that's what a
5 submittal does. It's not a calculation tool, it's an
6 illustration of how we think about the problem.
7 Q. So would you agree it's not a -- it's not a
8 calibrated model, you said if it's an illustration?
9 A. Well, it's calibrated because we have a
10 calibration point. We have a temperature and a head at Tule
11 Springs that we're trying to match. And so we matched it as
12 closely as we could with the uniform transmissivity.
13 See, our -- part of the -- part of the reason we
14 did it this way is what does this system look like in the
15 absence of features? It's uniform -- uniformly anisotropic --
16 how should I say? There's no faults, there's no faults.
17 There's no heterogeneity, it's all the same transmissivity,
18 just the orientations are different.
19 So you take out all that stuff that the others
20 build into -- or typically we build into a framework and we
21 don't have that. So our model is really simple. It's not
22 a -- it's not a calculation tool.
23 It's an illustration of how we think about the
24 system with the potential for being calibrated, depending on

Page 791

1 what your purpose might be, because this is a -- it's
2 a powerful software that can do lots of different things that
3 we haven't tried to do.
4 We just tried to set out the geometry and answer
5 the question, why is this recommended flow domain so big,
6 because that's where the physical boundaries are. And what
7 are the -- what are the properties of this great big thing?
8 Well, transmissivity pretty much has to be what it takes to
9 get the water and the heat at the right place at the right
10 temperature.
11 And so it's a beginning. It's a beginning and
12 it's not calibrated in the sense that management tool would be
13 calibrated, not even close. But there was a period of time
14 devoted to calibration just as there was a period of time
15 prior to that developing the mesh, dealing with the anisotropy
16 angles, you know, a number of things before we could even
17 think about calibrating in the last couple of days before
18 sending the thing.
19 So it illustrates how we're thinking about it,
20 and if we ever get back into it or someone else does, they can
21 start making it work better.
22 Q. Do you -- is it a tool or calibrated in any
23 fashion that impacts could be -- impacts could be shown that
24 would be reliable?

Page 792

1 A. Well, I -- at this point, and depending where, I
2 think you could use it for first approximation of impacts.
3 You know, something you might -- might help you design an
4 aquifer test maybe, maybe in terms of how much area might I
5 need for this aquifer test, because if it's tight rock, you
6 need to be enclosed if it's like we have, you know, you'll get
7 responses possibly miles away.
8 So it could be useful for test design, for
9 identifying areas where we're less confident about the
10 relationships, but not in a quantitative sense to -- it's not
11 a management tool, but perhaps could be grown to be one.
12 Q. And so directing your attention to page 59 of
13 Appendix 3 in your Exhibit 2?
14 A. Um-hum.
15 Q. You make a statement there at the bottom of the
16 page with regard to pumping in Kane Springs Valley?
17 A. I'm sorry. I'm looking for the page.
18 Q. Yes.
19 A. Okay. Okay. 59?
20 Q. Yes, 59 on the bottom?
21 A. Okay.
22 Q. The very last paragraph?
23 A. Um-hum. Right. Those are the time of travel
24 capture zones that the program computes.

Page 793

1 Q. Correct. But do you agree that that should --
2 that's, I guess -- well, sorry.
3 Did you calculate the propagation of drawdown
4 from assumed pumping in Kane Springs Valley?
5 A. Well, the model is a steady state model, so no.
6 Q. All right. And how about in Delamar Valley?
7 A. Well, it's a steady state model, so it's all
8 constant in time.
9 Q. And then, Dr. Johnson, I'm going to direct you to
10 Lincoln County, Vidler, Exhibit 19, and I have a copy for you
11 here and I have a copy for your counsel.
12 MS. PETERSON: And may I approach?
13 HEARING OFFICER FAIRBANK: Yes.
14 BY MS. PETERSON:
15 Q. Are you familiar with that, Dr. Johnson?
16 A. I wrote it, at least part -- no, I'm sorry. I
17 wrote it with Marty Mifflin.
18 Q. Yes. And if I could direct your attention to
19 Table 1, which is on page -- well, it's page 31 on the bottom?
20 A. Yes.
21 Q. And could you read -- do you see the -- on the
22 left-hand side, there's a column that says "far field
23 controls," and under V-12, it says, "Kane Springs Wash Fault
24 fault". Do you see that?

Page 794

1 A. I see far field controls.
2 Q. Oh, I'm sorry. No flow barriers. I apologize.
3 A. Yeah, um-hum. I do. I see that.
4 Q. All right. And could you explain what this
5 means, the notes here under the stream flow barrier that you
6 have here for Kane Springs Wash fault?
7 A. Okay. I need to look at the figure to see B2.
8 Q. This was a model that you built; is that correct?
9 A. Yes, and the reason -- you know, it's been a long
10 time. But that was one of the features. We put a number of
11 features in there to impede flow to try and reproduce water
12 levels using known or suspected fault zones.
13 I mean, simplified, obviously, but with those F's
14 and B are barriers to flow. And I think they're fully
15 penetrating, I think they're like a wall, if I'm not mistaken.
16 Q. And this was a model that you built the AEM
17 model; is that correct?
18 A. That's correct.
19 Q. And this was a regional carbonate aquifer model
20 that you built -- well it was -- this abstract was published
21 in this groundwater publication in 2006; is that correct?
22 A. Well, the article was published in 2006, but it
23 took us about two years of peer review. So I'm not -- what
24 was your question? I'm sorry. It was published in 2006.

Page 795

1 Q. Right. And so the model was built sometime, a
2 little prior to 2006?
3 A. Yes.
4 Q. Would that be accurate?
5 A. Um-hum.
6 Q. And if I understand this correctly, what you're
7 indicating is to make the model work, you had to put in this
8 Kane Springs Wash fault no-flow barrier, right, to make the
9 water elevations match between the two wells that you have
10 there?
11 A. Well --
12 Q. VF-2 and CSV-3?
13 A. Well, two parts to the answer, if you don't mind.
14 You know, I don't remember the details just because it's been
15 as long as it has and I -- there are a lot of things I do in
16 this paper differently now.
17 But I think the takeaway was that, you know, from
18 this whole effort, was that without B -- let me just make sure
19 which B it is in the figure.
20 Q. It's Figure 3; is that right?
21 A. Yeah.
22 Q. Or are you looking at Figure 5?
23 A. Yeah. Well, okay, I would have taken these from
24 geologic mapping. And all we're doing here, this is pretty

Page 796

1 simple minded, we've got a -- we've got a steady state flow
2 field.
3 We're trying to assign -- we assume a thickness
4 and we assigned hydraulic conductivities to the different
5 domains and then we try to match water levels. And we fiddled
6 with it and we fiddled it. It's trial and error. I mean,
7 this one is truly trial and error.
8 And it runs quickly and so over thousands of
9 attempts over, you know, two months, we get the water levels
10 to match pretty well with the transmissivities that we've
11 measured.
12 You know, that's the beauty of this, is these K's
13 in there are with our assumption of -- I think we said
14 4,000-foot thickness. I can't remember. But with the --
15 these give the -- with our assumed thickness, these get our
16 representative of transmissivities that were measured.
17 So that's the one place we're proud of the model.
18 The place we're not proud of the model is the EH-4 and 5
19 simulations, Figure 5.
20 MS. PETERSON: I don't have any other questions.
21 Thank you.
22 HEARING OFFICER FAIRBANK: Next, City of North
23 Las Vegas.
24 MS. URE: We have no questions.

Page 797

1 HEARING OFFICER FAIRBANK: Okay. Seeing no
2 questions, the Center for Biological Diversity.
3 MR. DONNELLY: Thank you.
4 CROSS-EXAMINATION
5 BY MR. DONNELLY:
6 Q. Patrick Donnelly for the Center for Biological
7 Diversity. Thank you, Dr. Johnson, for your testimony.
8 A. Greetings.
9 Q. I've got a number of questions. I guess, first,
10 as a baseline question, how long do climate signals take to
11 show up in the Lower White River Flow System approximately?
12 A. Our position -- I'll have to answer in general,
13 because obviously there's not a single number.
14 Q. Sure.
15 A. I mean, in reality. But our position based on
16 our analyses is decades. And the previous, I will say,
17 conventional wisdom is centuries.
18 Q. You cited, at various times, a 20-year lag time.
19 And in a previous question with the Fish and Wildlife Service,
20 you cited that the two greatest hydrogeologists had determined
21 that time. Who are these two greatest hydrogeologists?
22 A. Did I say that? George Maxey and Tom Eakin, I
23 think.
24 Q. Okay. And so you're citing Maxey-Eakin for a

Page 798

1 20-year lag time on pond signals?
2 A. Well, Eakin found it by comparing the autobahn
3 precip gage record with the Muddy River discharge record. And
4 then when Maxey and his students came along, a couple of years
5 later as consultants for Nevada Power, they had a couple of
6 more years of record and basically made the same suggestion,
7 that it looks like you might have a 15- or 20-year lag between
8 wet years and high discharge.
9 Q. Were you here for yesterday's testimony from the
10 National Park Service?
11 A. Yes.
12 Q. And do you recall them siting data showing
13 climate signals taking less than one year to show up in the
14 carbonate groundwater levels in the Lower White River Flow
15 System?
16 A. Well, we think -- yes.
17 Q. And you did not find that data compelling?
18 A. In part.
19 Q. Which part?
20 A. Well, we have -- if -- well, we find two distinct
21 forms of the -- of discharge hydrographs. Okay? There's one
22 common that I'll call the EH-4 form that is the form that
23 receives these diagnostic pumping signals.
24 The ones with the 2012 recovery in the middle

Page 799

1 diagnostic. I'm sorry. Now, with that, going off on that, I
2 lost my train of thought.
3 Q. I'm actually going to have to move on. I have a
4 number of other questions.
5 A. All right. I just --
6 Q. Thank you, thank you. You cited climate data
7 from tree rings in your report?
8 A. (Nodded head.)
9 Q. Does tree ring data demonstrate anything about
10 recharge rates?
11 A. The width of the tree ring -- now, this is from
12 reading. This is not expertise. But the width of the tree
13 ring, in general, represents a wet year.
14 Q. Does that indicate anything about recharge rates?
15 A. Potential recharge rates, yes, but not recharge
16 rates.
17 Q. Okay. So the tree rings do not indicate recharge
18 rates?
19 A. No.
20 Q. You cited data from the Humboldt River at
21 Palisades. Do Humboldt River flows indicate anything about
22 recharge rates?
23 A. I believe they do as a proxy for available
24 moisture.

Page 800

1 Q. Might there be confounding factors which might
2 alter the climate signals as -- excuse me.
3 Might there be confounding factors, which might
4 confound climate signals as they pertain to recharge rates?
5 A. Well, where I have been confounded with this
6 particular problem was the increasing flows in Maggie Creek
7 that affect the flows at Palisade, which we're using as an
8 explanatory variable set. The municipal water used in Elko, I
9 don't know if they take river water.
10 Somebody upstream is taking some river water. So
11 I'd say, in my mind, the biggest confounding factor is that we
12 don't know if the diversions have affected our -- the total at
13 Palisade.
14 Q. Are you aware of mine dewatering in the Humboldt
15 River basin?
16 A. That was my point -- yes, yes.
17 Q. Are you aware that it has cumulatively removed
18 millions of acre-feet of water from the groundwater there?
19 A. Well, that's another confounding factor -- yeah,
20 yes.
21 Q. Might this make it such that Humboldt River flows
22 at the Palisades do not accurately depict a climate regime?
23 A. Yes, if that -- if that cone of depression is
24 interacting or affecting or depleting the river, absolutely.

Page 801

1 Q. In your report, you also cite data from the
2 Virgin River; correct?
3 A. Yes.
4 Q. Are you aware as to where the head waters of the
5 Virgin River are?
6 A. In Zion Park, I believe.
7 Q. Is Zion Park part of the Colorado Plateau?
8 A. I don't know.
9 Q. Okay. Are you aware as to whether the climate in
10 Zion Park and the other head waters of the Virgin River is the
11 same climate as the Great Basin in North Mojave Desert?
12 A. Well, the climate -- if you're looking for a
13 hundred year representation of the climate, there's nothing
14 else out there.
15 Q. You seem to indicate that significant recharge
16 occurs only above 8,000 feet in eastern Nevada; is that
17 correct? I was not totally clear on that.
18 A. It's a northward plunging recharge cutoff
19 surface, that latitude 36 north is at 8500 feet based on
20 horology of the Kaibab Plateau.
21 And at latitude 40 north, it's at 7,000 feet,
22 just above the fish hatchery, entering the Ruby Mountains is
23 where it comes out.
24 Q. Does this imply that there's essentially no

Page 802

1 recharge within the Lower White River Flow System, for
2 instance, since there's no terrain above 8,000 feet?
3 A. We have some -- very minor areas, but I'd say,
4 yes, to the regional system that's sustaining these Warm
5 Springs, most of it comes from further north.
6 Q. If there is no recharge below 8,000 feet at
7 latitude 36, doesn't that imply that the vast majority of
8 Nevada's calculations for recharge in perennial yield are
9 wrong across the whole state?
10 A. Well, the basin -- see, the difference is there's
11 so much more water in the alluvial systems than in this
12 regional carbonate system, that for water balance in
13 individual basins, they can just ignore this.
14 Q. They can ignore recharge?
15 A. Well, the -- we're talking about
16 200,000-acre-feet of water here. And how much water is in
17 Spring Valley? I mean, this is a -- you know, we're -- as far
18 as the state-wide resources, this is not a big deal.
19 It's a big deal environmentally, but it's -- in
20 terms of the recharge, there's plenty of recharge through
21 infiltration into the alluvium basins through the stream beds.
22 And like we heard yesterday, much less -- any of
23 us that have dug holes in the desert know that there's not a
24 lot of -- even after it's raining, that the wetting front

Page 803

1 isn't very far into the soil.
2 So there's recharge to the alluvial basins
3 primarily through the streams and well documented, like
4 40-mile wash especially, good data there, Amargosa, good
5 data --
6 Q. Excuse me. Is there a connection between the
7 alluvial and carbonate aquifers?
8 A. Unknown, but probably because the isotopic
9 composition continues to become more and more -- in general,
10 more and more enriched as you go southward.
11 Q. Thank you.
12 A. So there's got to be some contribution.
13 Q. Thank you. Excuse me one moment. I have a
14 figure I need to pull up.
15 MR. DONNELLY: May I approach the witness with a
16 figure?
17 HEARING OFFICER FAIRBANK: Yes, you may.
18 MR. DONNELLY: I have to apologize, it's on my
19 laptop. I'm a new fangled kind of guy and didn't print
20 anything out for this thing. So -- but I have it blown up and
21 the brightness all the way up.
22 HEARING OFFICER FAIRBANK: And, Mr. Donnelly, if
23 you'll just make sure that you identify what it is that you're
24 showing the witness.

Page 804

1 MR. DONNELLY: Before I give it to him.
2 HEARING OFFICER FAIRBANK: Well, we --
3 THE WITNESS: We're looking at --
4 MR. DONNELLY: I've given him Figure 5 from the
5 Center for Biological Diversity's July 3rd report, a depiction
6 of annual precipitation from 1990 to 2018 in the southern --
7 extreme southern Nevada District of the Western Regional
8 Climate Center data.
9 HEARING OFFICER FAIRBANK: Thank you.
10 BY MR. DONNELLY:
11 Q. Do you observe a trend with that data?
12 A. No.
13 Q. So we see that precipitation is essentially --
14 I'm sorry?
15 A. No.
16 Q. So precipitation, on the whole, is essentially
17 flat?
18 A. There's an annual periodicity, but the trend
19 is -- there might be a trend, but it's not visually.
20 Q. So there's no reason to think there's a drought
21 in southern Nevada over the past 30 years?
22 A. Well, from the dying vegetation, something's
23 going on.
24 Q. No doubt, no doubt. But there's no reason to

Page 805

1 think there's a drought or decline in precipitation over those
2 30 years; correct?
3 A. Correct. From that record, correct.
4 Q. Thank you. You declared that the drought starts
5 in 1999; correct? The drought signal begins in 1999?
6 A. I don't think I did. But that would be about
7 when -- well, no, no, no, that's not -- I don't think I said
8 that and I don't know how you would define the beginning of
9 it, a drought.
10 Q. I'm going to have to come back to that at a later
11 time. You show on page 32 of your report, an increase of
12 approximately one CFS at Big Muddy Spring from 2010 to 2014,
13 after which it continued increasing by more than 12 percent;
14 is that correct?
15 A. 132, I've got Iverson and Warm Springs West. Are
16 we on the same figure?
17 Q. I'm sorry, I was going off of our rebuttal
18 report. So now I need to -- I'm going to come back to this
19 question as well in my next go-round. Thank you.
20 You estimate 40,000-acre-feet per year to the Las
21 Vegas Valley. That estimate is based on Darcy's law; is that
22 correct?
23 A. In part.
24 Q. And what was the transmissivity used for that

Page 806

1 calculation?
2 A. It was in -- it's in the report. It's
3 intermediate between what Mifflin International got at some
4 wells down in Black Mountains area and the MX-5 or the --
5 yeah, the Order 1169 transmissivity and it was higher than we
6 determined at ECP-1, I believe. But the number is in there.
7 Q. And for one of the references to determine that
8 transmissivity, you used your own unpublished report from 19
9 -- I'm sorry, your collaborator, Dr. Mifflin's unpublished
10 report from 1992 prepared for Nevada Cogen?
11 A. I did.
12 Q. Is that correct?
13 A. Yeah, he --
14 Q. Was this 1992 report peer reviewed?
15 A. I don't know.
16 Q. There are no fewer than 13 unpublished reports in
17 your July 3rd report; is that correct?
18 A. I'm not sure. They were mostly HRT reports, I
19 think.
20 Q. There are 13, at least 13 reports unpublished
21 from a variety of years dating back to 1945, I believe?
22 A. '45?
23 Q. -- or, I'm sorry, sometime previous to 19 --
24 A. Our reports?

Page 807

1 Q. I do not know. I would have to double check.
2 A. Our reports are almost -- have been considered or
3 submitted here, all have been shared with the HRT, I believe.
4 Q. You site this report for your estimates of
5 transmissivity -- excuse me. Your report indicates that the
6 anisotropy causes that high transmissivity are directly
7 parallel to the flow path to the Las Vegas Valley; is that
8 right?
9 A. In the Darcy's flux calculation?
10 Q. Yes.
11 A. Well, we have -- our two hydraulic gradient
12 estimates are along almost parallel lines and the flow is
13 generally southward. And so we just simply use the
14 transmissivity, the width, the gradient and Darcy's law.
15 Q. Was there geophysical evidence to back that up?
16 A. To back what up?
17 Q. The analysis you just stated that you conducted?
18 A. Well, I mean, there's always geophysics in the
19 literature. I mean, the big issue with that particular
20 calculation is the Las Vegas shear zone. We don't know what
21 it is and the Air Force owns it.
22 So, you know, that area is unknown, but the
23 gradients are such that if you follow the structural grain,
24 you can easily get water comfortably in the Las Vegas Valley.

Page 808

1 The uncertainty is not much.
2 Q. Did you rely on a water budget to determine the
3 40,000-acre-feet per year of inflow?
4 A. It was purely Darcy's law.
5 Q. Were you able to measure discharge or other
6 variables related to that within the Las Vegas Valley?
7 A. I used the estimate of 60,000-acre-feet, the net
8 withdraw rate of 60,000-acre-feet a year that I got from
9 Dr. Burns, as a starting point, and had to back that off a
10 little through calibration to 59,000.
11 Q. Is there any reason to think the Las Vegas Valley
12 is in steady state?
13 A. Yes.
14 Q. What evidence do you have that the Las Vegas
15 Valley is currently in steady state?
16 A. Because the Las Vegas Valley Water District has
17 been trying for 47 years to make it so.
18 Q. Okay. Well, I'll leave it at that.
19 But -- and you did not use a water budget;
20 correct?
21 A. What -- budget for what?
22 Q. For calculating the 40,000-acre-feet of inflow?
23 A. Well, yes, I -- oh, for that? No, no, no, just
24 Darcy's law.

Page 809

1 Q. So no water budget was used and no discharge was
2 measured?
3 A. Well, I'm not sure how Andrew measured it, but
4 they obviously know what their production is. So, yes,
5 discharge was measured.
6 Q. Is there evidence that the Las Vegas Valley is in
7 steady state, other than the heroic efforts of the Southern
8 Nevada Water Authority to make it that way?
9 A. The existence of the import water, the revocation
10 of all the temporary permits since it first showed up in 1972,
11 and the determination of the Water District to stabilize it.
12 Q. You reference many efforts made to bring it into
13 steady state. Do you have any evidence of it actually being
14 in steady state, of those efforts being successful?
15 A. No, no, I have a model that assumes it is in
16 steady state and the model can be tested.
17 Q. Okay. You allege that there is a vast flow field
18 originating in northeast Nevada and moving, down gradient to
19 the Las Vegas Valley; is that correct?
20 A. According to the fee flow results, yes.
21 Q. And this flow field includes the Ruby Mountains,
22 the Steptoe Valley, the upper White River and the Pahranaagat
23 Valley?
24 A. Well, not the Ruby Mountains, a portion of

Page 810

1 Steptoe. I'd have to look at -- I mean, we can look at the
2 map. But it extends up -- it includes part of the Schell
3 Creek range, does not include -- well, the southern most Snake
4 Range. It includes the Grant, the Eagan.
5 Q. Perhaps the most pertinent here, it does include
6 the Upper White River and Pahrnatag Valley?
7 A. Well, the model domain does, but the elevations
8 are low. So the recharge areas are not there.
9 Q. Sure. I guess the point is, you're saying there
10 is not flow from the Upper White River to the Lower White
11 River in Coyote Springs Valley?
12 A. I'm not saying that. I don't understand what
13 you're thinking I said.
14 Q. The map you depicted showed flow from Pahrnatag
15 Valley, heading westward toward Las Vegas Valley.
16 My question is, is there any flow from Pahrnatag
17 Valley in the carbonate to Coyote Springs Valley and beyond?
18 A. Oh, we would agree with pretty much everybody,
19 the other presenters that believe there's flow southward
20 across the Pahrnatag sheer zone from Pahrnatag Valley to
21 Coyote Spring Valley.
22 Q. So the waters part?
23 HEARING OFFICER FAIRBANK: And that will be your
24 last question.

Page 811

1 MR. DONNELLY: Thank you.
2 BY MR. DONNELLY:
3 Q. The waters part at the southern end of the
4 Pahrnatag Valley and half goes to -- some portion goes to Las
5 Vegas and some portion goes to Coyote Springs?
6 A. Every molecule has to go somewhere. It can't go
7 both.
8 MR. DONNELLY: Okay. Thank you.
9 HEARING OFFICER FAIRBANK: Next is Georgia
10 Pacific and Republic.
11 MS. HARRISON: We have no questions.
12 HEARING OFFICER FAIRBANK: Thank you. Seeing no
13 questions, and Nevada Cogeneration Associates? Okay. I
14 haven't seen Mr. Flangas today. Muddy Valley Irrigation
15 Company.
16 THE STATE ENGINEER: No questions.
17 HEARING OFFICER FAIRBANK: Seeing no questions,
18 and I have been informed that Nevada Energy does not have any
19 questions. So let's go ahead and open it up to the Division
20 of Water Resources and State Engineer for questions.
21 EXAMINATION
22 BY MS. COOPER:
23 Q. Christi Cooper, for the record. Hi, Mr. Johnson.
24 A. Hi, Ms. Cooper.

Page 812

1 Q. Page 11 in your presentation today. Thank you.
2 Based on your flow domain boundary lines on this
3 slide, do you think that the current geographic boundary
4 defined as the Lower White River Flow System is appropriate?
5 A. Not for the intended purpose as I understand it.
6 Not for the intended purpose as I understand it.
7 Q. What is -- elaborate on what you think is the
8 intended purpose.
9 A. Well, I think the -- there's enough evidence that
10 there's throughput. In other words, the water in the Warm
11 Springs, the water in Las Vegas has to come from somewhere.
12 Let's just get back to Las Vegas. And the Spring Mountains
13 don't cut it. I don't think anybody can torque max the
14 Maxey-Eakin method enough to get warm water out of the Spring
15 Mountain.
16 So it has to come from somewhere else. So that's
17 our thought process is if the water has to get to Las Vegas in
18 much greater quantities than the Spring Mountains can sustain,
19 and will it -- I think we know where it's coming from.
20 Q. Okay. I have just one more question and I'm
21 sorry if you did say this in the presentation and I missed it.
22 But what do you think is the source of the Big Muddy Springs?
23 A. Northern high terrain probably. And this is just
24 based on our capture zones, probably areas east of the area

Page 813

1 sustaining Pahrnatag and Las Vegas. So probably areas east
2 of the blue dots in our first blue graph cover slide.
3 MS. COOPER: Thank you.
4 THE WITNESS: Um-hum.
5 EXAMINATION
6 BY MR. BENEDICT:
7 Q. Jon Benedict for the record.
8 Dr. Johnson, to follow up on the question about
9 Big Muddy Springs, so a discharge hydrograph for that looks
10 also different from other springs that are in the Muddy River
11 area. Would you care to provide an opinion on why those are
12 different and then what the source area might be for those if
13 you think it's a different source?
14 A. Well, the -- it's a whole leap to go from
15 recognizing that you've got a different source area to
16 recognizing what it is.
17 But what I can say with high confidence is that
18 the conceptual model for the sensitive high elevation springs,
19 and the low elevation springs both being fed by the same
20 carbonate aquifer.
21 I don't see any way in the world you can make
22 those such vastly different hydrographs from the same aquifer,
23 you know, half mile apart.
24 So I think it's just inescapable that there are

Page 814

1 different sources. Now, they may -- like was suggested
 2 earlier, flow paths might have diverged. We've got some very
 3 similar isotropic compositions, but they haven't been
 4 monitored sufficiently. See, that's the thing. We have 1 or
 5 2 or 10 analyses, possibly not arid in time, these different
 6 springs. So we don't know.
 7 Big Muddy might be more different than we think
 8 it is chemically and isotopically than Warm Springs, because
 9 they can't be coming from the same place under the refuge, you
 10 know, or under the MRSA. So if they're not coming from the
 11 same place under the MRSA, where are they coming from?
 12 Well, we can track that EH-4 form hydrographs
 13 back up into Coyote Spring Valley and down to Apex. But we
 14 don't have anything that looks like Big Muddy Springs, except
 15 for the river itself. So it's a really interesting problem.
 16 We don't know where -- all I can say is it's coming from
 17 somewhere, right? That's a famous quote from Ed Weeks, it's
 18 coming from somewhere.
 19 So it's coming from the north and it's coming
 20 from High Mountains. And it's probably not coming from the
 21 Snake Range, just because of the geology. So any of the other
 22 ones.
 23 Q. Could we go to your slide number -- I think it's
 24 8? A couple of questions here. I just want to make sure I

Page 815

1 understand the image on the left with anisotropy. The color
 2 for the Pahrnagat sheer zone area is blue and you suggest
 3 that that anisotropy is has a principle direction that's about
 4 north 60 east; is that correct?
 5 A. That's about right -- I'm sorry, that would be
 6 about right. And I'm pointing with the pointer on the screen
 7 to the Pahrnagat sheer zone that's colored blue based on its
 8 anisotropy.
 9 Q. You've got a large area that's also blue, I'd say
 10 south of the Sheep Range and it kind of trends in a north 80
 11 west direction, but it has an anisotropy with a principle
 12 direction, which I think is probably similar color. So it'd
 13 be about north 60 east?
 14 A. Yeah, the faults, the structural grain bends
 15 around -- see, up the Las Vegas sheer zone.
 16 Q. So I'm just curious what that blue zone
 17 represents?
 18 A. You're seeing northeast trend -- you're seeing
 19 northeast trends. See, those are the structure bending around
 20 in California Wash and, you know, Dry Lake and Garnet Valley.
 21 The special grain bends in there, and so right in here is
 22 trending northeast.
 23 Q. Okay. So that fabric is -- principle direction
 24 is northeast to southwest; right?

Page 816

1 A. Yes, that's bedrock. This is the bedrock.
 2 Q. Okay. The next question goes to slide seven.
 3 You had stated that your recharge that was used
 4 was 15 centimeters a year. Is that applied across the --
 5 well, is that an average for the whole area?
 6 A. Well --
 7 Q. Or is that an average for the mountain range or
 8 what's that --
 9 A. Well, it's the total amount of -- quantity of
 10 assumed or measured discharge from the different regional
 11 springs, spread over the fixed area of high altitude carbons.
 12 So we'd have to fiddle with it. See, when we let some water
 13 out of the model to improve the calibration, then we'd have to
 14 do something with the recharge.
 15 We never messed with the discharge. It was all
 16 assigned. We never messed with the temperatures and we never
 17 messed with the Eureka well, you know, trying to vary things
 18 to make them better.
 19 But we -- to get it to work, you know, we needed
 20 to let some water -- and I'm pointing to the northwest corner.
 21 We'd have to let some water out up by Kobeh Valley to go into
 22 Diamond Valley.
 23 And there's some good -- there's MX wells up
 24 there. It'll give you a pretty good hydraulic gradient and a

Page 817

1 good basis for estimating the outflow of -- and we'd have to
 2 do other work on the model. But the way it worked is we'd
 3 have this fixed amount of water we'd want to apply on the --
 4 to these recharge areas, but then how well did it work?
 5 Well, we've got to let some water out over here,
 6 and so then we've got to increase the recharge a little bit to
 7 make up for the deficit. So that was sort of the workflow in
 8 the last two days when we got everything built.
 9 Q. Do you recall what the overall discharge volume
 10 for the model was that you used to --
 11 A. It was about -- it was a little over
 12 200,000-acre-feet a year. But they're all -- it's all in how
 13 Allen and Crooks, in their table -- it's in our references and
 14 I'm not sure which table, but it's in their table of spring
 15 flows. And we used their numbers exclusively except for Las
 16 Vegas Valley where we assumed 59 -- well, we assumed 60 and
 17 then backed it off to 59,000.
 18 Q. Okay. And so just to be clear, that recharge is
 19 really considered only the recharge that you would apply to
 20 the carbonate aquifers and not recharge that would go into the
 21 alluvial system; is that correct?
 22 A. Right. This is treated as isolated from the
 23 alluvial system.
 24 Q. Okay. So that portion of recharge that might

Page 818

1 otherwise go into the alluvium wasn't considered?
2 A. Well, recharge going into the alluvium is
3 irrelevant, unless it also recharges the -- I mean, it's not
4 irrelevant, it's irrelevant to our analysis.
5 Q. Okay.
6 A. So unless there's a gradient that gets it into
7 the carbonates, which we don't see or know about, we don't
8 care about it. So we're saying all the water that goes into
9 the carbonates goes into the mountains. Yeah, that works.
10 Q. Okay. Same for the discharge then?
11 A. And the discharge is all coming out at the
12 regional springs at a temperature -- we assumed the
13 temperature and I can't remember if it was 35 or 35C, but warm
14 and -- you know, just trying to see if this will work and --
15 yeah.
16 Q. Okay. I think that's all I have.
17 EXAMINATION
18 BY MR. KRYDER:
19 A. Levi Kryder, for the record.
20 Mr. Johnson, I've heard, I think, several
21 different things today. If you could go to slide -- your
22 slide 14, please?
23 A. Okay.
24 Q. Thank you. So I thought I heard you say earlier

Page 819

1 that the responses or the trends on this graph were due solely
2 to effected climate and not pumping? Did I understand that
3 correctly?
4 A. Yes, because I don't know of any pumping near
5 there in those -- in that time frame, yes.
6 MR. KRYDER: Thank you.
7 EXAMINATION
8 BY HEARING OFFICER FAIRBANK:
9 Q. Dr. Johnson, I have just a few questions.
10 A. Yeah.
11 Q. And I'm going to focus on page 35 of your July
12 2019 report submission where you basically summarize your
13 conclusions and relations to the questions that were, you
14 know, requested or proposed by the State Engineer in Order
15 1303.
16 And I guess I wanted to focus on -- first on your
17 fourth conclusion on that page where you state that pumping
18 from California Wash has little to no impact on the Muddy
19 River Springs area and much more groundwater is available in
20 California Wash than previously assumed.
21 And my question is, did you conclude how much
22 more water is available than previously assumed? Did you
23 quantify that?
24 A. Well, I don't know what previously assumed was,

Page 820

1 but our 40,000-acre foot estimate is quite a bit different
2 than everything else we've heard, you know.
3 Q. So just to clarify, so then are you saying that
4 there's 40,000-acre-feet additional water in California Wash?
5 A. In transit, and including also Hidden and Garnet
6 Valleys through the -- flowing through the Las Vegas sheer
7 zone to Las Vegas Valley is 40,000-acre-feet, according to our
8 Darcy flux calculation.
9 Q. But you didn't quantify that additional water
10 over those prior assumptions specific to California Wash.
11 You're only talking about that pass-through flow to the Las
12 Vegas Valley?
13 A. Well, I guess I must think about it differently,
14 because I'm not really making sense of the distinction.
15 I mean, we've got a -- there's really no alluvial
16 aquifer out there, except for near the springs. So we've got
17 a carbonate aquifer transmitting an unknown quantity of water
18 southward. I think we could probably all buy that. I mean,
19 there's anywhere from little to no water going through the Las
20 Vegas sheer zone or maybe as much as 40,000-acre-feet.
21 It depends on how you calculate or if you
22 calculate it. Now, the zero to -- some of the early ones that
23 we heard about this morning references two other calculations.
24 I didn't really see any data, any evidence.

Page 821

1 Q. But your conclusion was that there was
2 40,000-acre-feet going to the Las Vegas Valley wash --
3 A. Well --
4 Q. -- based upon the numbers to support what you see
5 is to be the deficit between the Spring Mountain recharge and
6 the water budget essentially in Las Vegas Valley?
7 A. Oh, I think I understand you better. The
8 uncertainty in that Darcy-flux calculation is almost entirely
9 in the transmissivity that we used. You know, the hydraulic
10 gradients pretty much indisputable. The transmissivities is
11 -- they vary over the magnitude. So they could be northern
12 magnitude, less, it could be more.
13 Q. So are you -- never mind. I'll move onto another
14 question.
15 With respect to Subpart 6 on page 35 of your
16 report where you make a statement that if a long-term drought
17 trend evident in climate records persists, no amount of
18 pumping curtailment will restore or maintain high elevation
19 spring flows.
20 Curtailment of pumping in sustainable locations
21 will serve no purpose, and thus, mitigation measures,
22 including curtailment will likely not prove effective in
23 protecting seeded right holders in the Muddy River and Moapa
24 Dace habitat from continued drought impacts.

Page 822

1 So my first question is, is -- and I haven't been
2 clear today on what you believe or what your opinion is as to
3 that timing delayed response for climate in the water flow.
4 It's -- I've heard a range from it can be as little as ten
5 years to centuries.
6 And so I'm trying to understand a little bit
7 better from our perspective in terms of trying to make
8 management decisions, what your opinion is as to what you
9 believe that climate delay may be?
10 A. Yeah. We're advocating centuries as shown in
11 that last figure of our direct report with the time of travel
12 capture zones. That's the best we can do now.
13 And it's consistent, we believe, with both the
14 isotopic data and the heat flow and the radiocarbon ages. If
15 you take the -- well, I don't want to get too technical on
16 you.
17 But we think it's decades. I only mentioned
18 centuries because others have claimed it's centuries. And, in
19 fact, in the waste isolation business, there's a school of
20 thought that we're looking at ice age water, just centuries
21 just sitting there.
22 Q. So I guess I'm still confused because you started
23 out your response saying you believed your opinion was it was
24 centuries, and then you said that you believe it's at least

Page 823

1 decades. And so I'm trying to get a better understanding.
2 A. You misunderstood me. I was giving credit to the
3 Southern Nevada Water Authority and their work to the north in
4 the estimating centuries to impact to senior water rights from
5 activities north of us.
6 So with that background, that's not my belief.
7 That's a professional opinion of somebody else that you've
8 accepted. So I just gave that for reference.
9 And in our analysis, because -- both because of
10 these climate solutions, and I think you may have a little
11 misunderstanding.
12 What we're saying with these two climate
13 solutions, the one for Big Muddy, we're saying is explained by
14 the wet years between 12 and 22 years prior to the
15 observation.
16 So in other words, this year, whatever we total
17 up in two weeks or a week from Big Muddy Spring for the last
18 year is explained by the weather between 12 and 22 years ago
19 as proxied by domino.
20 The other one in the EH-4 hydrographs, we're
21 saying that those were explained by weather from last year to
22 16 years ago. So it's got a 16-year memory, but it's right on
23 us. You know, the first year, we don't know. The first year,
24 we get a kick in the hydrographs.

Page 824

1 So that leads us to suspect that maybe that is
2 actually a composite hydrograph as something from the north
3 and something from the Sheep Range.
4 Q. And so I guess the final question is based upon
5 that opinion that was expressed in Subpart 6, and in this kind
6 of uncertainty or this delayed response to climate change or
7 that -- you know, these declines as you've expressed in your
8 testimony today and in response to Mr. Kryder's question, that
9 if these declines are -- the declines in water availability is
10 due to climate change, and that there's nothing that we can
11 do.
12 Is it your opinion that the State Engineer
13 shouldn't actively manage the system to try to create some
14 form of sustainability? I guess I'm just confused?
15 A. Well, I won't say a word about what you should
16 do, okay? But what I will say is that is a very big "if". I
17 should have capitalized that "if," the number six, if the
18 trend continues, because all those hydrographs were presented
19 in the EH-42 now that we have an update to it.
20 Everything is still declining after the test.
21 Now, we're not doomed. That's not going to go on forever.
22 Nothing goes on forever. But if it continues, the big "if,"
23 if it continues, at some point, we'd start hitting trigger
24 levels at the Warm Springs West Gage. We know it.

Page 825

1 And so that's what we're trying to call out for
2 you is a big "if," and try to bring in all this other evidence
3 to show you that it's not pumping to blame for all of this.
4 Pumping has an effect. The location matters, it really
5 matters.
6 Q. So to understand that, then, no matter what we do
7 with respect to pumping, if we don't -- if -- you know, if
8 pumping is able to escalate or deescalate, it will make no
9 difference in the end? Is that what you're saying to us?
10 A. No. Pumping, in general, will affect -- have
11 more effects closer to the pumping well than more distant.
12 But we all know already that in this heterogenous and
13 anisotropic terrain, you can get minimal effects close in or
14 almost identical effects, you know, drawdowns, you know, a
15 great distance as near. So I don't -- that's a big "if".
16 You know, we're not saying we're doomed and the
17 climate drought is going to keep going. Everybody needs to be
18 concerned about that, but there's not anything we can do about
19 it. But what we can do is just recognize that all of this
20 water level change is not -- you don't blame the pumping.
21 It's about as -- I don't think it's scientific, honestly. I
22 don't think it's scientific to continue to attribute all the
23 water level change in the EH-4 form hydrographs to pumping.
24 It's just -- you know, I feel like we've proved

Page 826

1 it, but -- and obviously it's -- there's a lot of doubt. But
 2 I think the pumping effect is minimum. And if something
 3 happens with the climate, you're going to have to deal with
 4 that as a new process. You've never had to deal with that
 5 before. But I would just manage the -- you know, I think if
 6 you manage the pumping smartly, you'll be fine.
 7 The climate will do what it will do. You might
 8 have to take some extraordinary measures someday, but that's
 9 to be figured out. It's a hypothetical. What we do know
 10 is -- I say "we," and this is me and Marty and the few we've
 11 convinced, is that once you start looking at this more
 12 realistically in terms of the flow field and the nonuniformity
 13 of -- spatial nonuniformity and temporal nonuniformity of
 14 impacts, you'll see it completely differently and I think much
 15 more favorably.
 16 Now, it won't be favorable to anybody that --
 17 like Dr. Waddell pointed out, what do you about the excessive
 18 production in Las Vegas Valley if it's excessive? Did you
 19 really issue water rights far in excess of the perennial
 20 yield? That's your problem. But if you didn't, that's
 21 somebody else's problem. But I can't talk about -- I'm not
 22 authorized or experienced to talk about, you know, the
 23 water -- the users.
 24 HEARING OFFICER FAIRBANK: Thank you. All right.

Page 827

1 So we're about ten minutes from noon. I just want to kind of
 2 get a sense of additional participants because we'll -- we do
 3 have time to open it up for additional questions if there are
 4 additional questions.
 5 So I'm just going to kind of run down the list,
 6 and then assuming there's additional questions, we'll resume
 7 after lunch. So Coyote Spring Investments, will you have
 8 additional questions?
 9 MR. HERREMA: No.
 10 HEARING OFFICER FAIRBANK: No. Okay. U.S. Fish
 11 and Wildlife Service, any additional questions?
 12 MR. MILLER: No.
 13 HEARING OFFICER FAIRBANK: And National Park
 14 Service?
 15 MS. GLASGOW: No.
 16 HEARING OFFICER FAIRBANK: No additional
 17 questions. Southern Nevada Water Authority, Las Vegas Valley
 18 Water District?
 19 MR. TAGGART: Well, I don't want to be the only
 20 reason we come back after lunch.
 21 HEARING OFFICER FAIRBANK: So if you're not the
 22 only person, then yes, you have additional questions?
 23 MR. TAGGART: If there's going to be redirect and
 24 we're going to come back, then we would have questions.

Page 828

1 HEARING OFFICER FAIRBANK: Okay. And then Muddy
 2 Valley Water District -- excuse me, Moapa Valley Water
 3 District?
 4 MR. MORRISON: We don't have any questions.
 5 HEARING OFFICER FAIRBANK: No additional
 6 questions. And Lincoln County, Vidler, will you have
 7 additional questions?
 8 MS. PETERSON: Not right now, but I don't know
 9 what Mr. Taggart's going to do, so --
 10 HEARING OFFICER FAIRBANK: And City of the North
 11 Las Vegas?
 12 MS. URE: No.
 13 HEARING OFFICER FAIRBANK: And Center for
 14 Biological Diversity?
 15 MR. DONNELLY: Yes, regardless of what Taggart
 16 does.
 17 HEARING OFFICER FAIRBANK: And Georgia Pacific?
 18 MS. HARRISON: No questions.
 19 HEARING OFFICER FAIRBANK: Okay. Seeing no
 20 questions there. And then Muddy Valley Irrigation Company,
 21 will you have any additional questions?
 22 MR. KING: No questions.
 23 THE STATE ENGINEER: No questions.
 24 HEARING OFFICER FAIRBANK: And then, Ms. Baldwin,

Page 829

1 will you have -- want to do some redirect?
 2 MS. BALDWIN: Not the full half-hour, but yes.
 3 HEARING OFFICER FAIRBANK: Okay. So let's plan
 4 on coming back after lunch and so we'll resume at noon -- or,
 5 excuse me, 1:00 p.m.
 6 (Lunch recess at 11:52 a.m.)
 7
 8
 9
 10
 11
 12
 13
 14
 15
 16
 17
 18
 19
 20
 21
 22
 23
 24

1 STATE OF NEVADA)

) ss.

2 CARSON CITY)

3

4 I, MICHEL LOOMIS, a Certified Court Reporter, do
5 hereby certify;

6 That on the 26th of September, 2019, in Carson
7 City, Nevada, I was present and took stenotype notes of the
8 hearing held before the Nevada Department of Conservation and
9 Natural Resources, Division of Water in the within entitled
10 matter, and thereafter transcribed the same into typewriting
11 as herein appears;

12 That the foregoing transcript, consisting of
13 pages 694 through 830 hereof, is a full, true and correct
14 transcription of my stenotype notes of said hearing to the
15 best of my ability.

16

17 Dated at Carson City, Nevada, this 27th day of
18 September, 2019.

19

20

21

MICHEL LOOMIS, RPR

22

NV CCR #228

23

24

#	718:1;734:18;742:9; 802:9;810:20;816:4	affect (6) 729:6;753:23; 761:16,24;800:7; 825:10	754:10	angles (4) 710:7;728:10; 729:18;791:16
#228 (1) 830:22	Acting (1) 695:4	affected (4) 758:24;759:1; 762:22;800:12	allow (1) 702:22	animation (1) 731:15
A	action (1) 765:9	affecting (1) 800:24	allows (2) 740:8;741:1	anisotropic (9) 707:1,4,4;728:1; 734:15;735:23;736:1; 790:15;825:13
ability (1) 830:15	actively (1) 824:13	afford (1) 708:23	alluvial (7) 702:1;802:11;803:2, 7;817:21,23;820:15	anisotropy (20) 707:2,5,6;709:6; 710:7;727:20,21; 728:6,7,10,16;729:3, 18;772:16;783:5; 791:15;815:1,3,8,11
able (6) 703:21;734:2; 748:18;780:16;808:5; 825:8	activities (1) 823:5	again (15) 712:16;718:3;728:6; 730:2;731:18;732:20; 733:3;748:2;757:6; 760:7;761:7,7,22; 767:14;788:1	alluvium (3) 802:21;818:1,2	anistropy (1) 807:6
above (6) 724:11,12,23; 801:16,22;802:2	actual (4) 703:23;717:18,20; 745:16	age (1) 822:20	Almost (11) 724:20;729:17,22; 732:10;748:12;770:20; 779:4;807:2,12;821:8; 825:14	annex (1) 727:10
absence (4) 698:24;699:7; 751:15;790:15	Actually (16) 702:24;720:4; 735:12,15;738:11; 743:1;747:9,12; 758:14;764:4;767:20; 768:6;779:4;799:3; 809:13;824:2	ages (1) 822:14	along (9) 712:13;734:24; 737:3;738:1;740:18; 776:10;787:7;798:4; 807:12	annual (12) 714:23,24;715:16; 716:19,20;721:4; 757:8,8;767:3;768:19; 804:6,18
absent (2) 742:8;743:19	ad (1) 699:7	aggregate (1) 766:7	alter (1) 800:2	annually (4) 700:7;727:2;757:8; 789:22
absolutely (4) 721:15;751:13; 763:3;800:24	Adam (1) 695:5	ago (5) 732:7,16;785:15; 823:18,22	although (1) 755:23	anomalies (1) 752:12
abstract (1) 794:20	add (3) 711:5;727:1;744:11	agree (18) 717:7;772:14;774:9, 18;775:23;778:4; 781:2,13;782:3,7; 784:13;787:10;788:17, 23;789:2;790:7;793:1; 810:18	altitude (1) 816:11	answered (1) 761:21
Academy (1) 765:19	added (1) 741:7	agreeing (1) 770:10	always (3) 704:13;707:24; 807:18	antecedent (4) 750:22;777:7;779:2, 3
accept (4) 728:5;749:22;762:5, 7	addition (1) 747:5	agreement (3) 748:23;772:24; 773:15	Amargosa (4) 726:1,1;742:5;803:4	anthropogenic (1) 714:1
acceptable (1) 735:18	additional (18) 698:8;713:2;754:9, 14,15;820:4,9;827:2,3, 4,6,8,11,16,22;828:5,7, 21	ahead (21) 698:7,12,14;700:20; 703:13;706:20;754:2, 8,11,17;755:7,13; 780:21;785:7,8,12,17, 18,19;786:1;811:19	amazed (2) 707:7;710:2	anticipate (1) 703:3
accepted (2) 712:24;823:8	Address (2) 701:24;755:13	Air (1) 807:21	amazing (1) 748:3	apart (1) 813:23
access (2) 728:16;765:17	addressed (1) 743:9	Airforce (2) 706:17,17	amount (10) 710:8;768:3,11,12, 12;783:21;784:2; 816:9;817:3;821:17	apex (4) 743:17;776:3,12; 814:13
accident (1) 734:23	adds (1) 716:19	AKA (1) 694:12.5	amounts (1) 731:1	apologize (3) 780:24;794:2;803:18
accommodation (1) 732:23	adjudicated (1) 700:6	alarming (1) 777:7	analysis (10) 701:20;705:21,21; 706:14;766:12;772:10; 777:3;807:17;818:4; 823:9	apparent (1) 744:22
accomplish (1) 703:22	adjusted (3) 748:4,5,13	Alberta (1) 753:1	analyses (2) 797:16;814:5	apparently (2) 709:3;711:16
according (4) 748:6;771:3;809:20; 820:7	adjustment (2) 758:15,18	Alex (1) 696:7	analyze (3) 760:3,9;762:18	APPEARANCES (2) 695:1;696:1
account (2) 760:15;761:3	ADM (1) 782:12	allege (1) 809:17	analyzed (6) 759:22;760:1,2,6; 779:12;781:16	appears (1) 830:11
accounted (1) 759:18	ADMINISTRATION (1) 694:7	Allen (2) 741:11;817:13	and- (2) 695:17.5;696:3	appendices (1) 748:6
accurate (4) 761:17;777:1;789:6; 795:4	administrative (1) 701:21	Allison (1) 696:3.5	Andrew (3) 704:6;705:8;809:3	Appendix (3) 757:18;774:3;792:13
accurately (4) 702:19;756:11; 762:4;800:22	admit (1) 767:10	allocating (1)	Angeles (1) 695:23	apples (1) 772:19
acre (2) 716:10;779:3	ADMITTED (4) 697:14;703:8,10,11		angle (1) 736:3	applications (1) 753:4
acre-feet (2) 727:2;800:18	admitting (1) 757:14			applied (1) 816:4
across (8) 714:17;717:16;	advocating (1) 822:10			
	AEM (1) 794:16			

apply (5) 710:10,12;711:10; 817:3,19	arid (1) 814:5	782:22;820:10	729:17	BASIN (18) 694:9,10,10.5,11, 11.5,13;695:14.5; 707:24;714:17,18; 729:21;732:17;733:20; 741:13,15;800:15; 801:11;802:10
appreciated (1) 700:16	arise (1) 703:15	attempted (3) 711:21;788:5,6	Aztec (2) 704:17,19	
approach (6) 707:8;730:23; 767:11;772:23;793:12; 803:15	Arizona (1) 713:5	attempts (2) 708:2;796:9	B	
appropriate (5) 701:21;724:8;757:7; 759:5;812:4	around (7) 712:12;741:16; 744:22;767:15;780:19; 815:15,19	attention (2) 792:12;793:18	B2 (1) 794:7	basins (11) 699:5,9;741:8;747:1; 753:6,10,12,20;802:13, 21;803:2
approximate (2) 744:15;746:2	arrested (1) 706:14	attorney (2) 698:18;754:24	back (32) 706:2;707:11; 715:18;718:8;731:5,7, 7,10;738:19;740:20; 748:2;754:14;767:24; 770:12,23,23;772:16; 779:6;785:12,20; 791:20;805:10,18; 806:21;807:15,16; 808:9;812:12;814:13; 827:20,24;829:4	basis (1) 817:1
approximated (2) 718:4;722:18	Arrow (18) 748:5,13;757:19,24; 758:19,24;759:1,13; 760:3,5,9,12,16;761:1, 10,15,24;762:17	attorneys (1) 755:8	backed (1) 817:17	beat (2) 767:9;783:7
approximately (2) 797:11;805:12	arrows (1) 738:14	attributable (1) 759:6	background (2) 778:21;823:6	beautiful (3) 704:18;726:14; 747:20
approximation (2) 746:3;792:2	article (2) 765:22;794:22	attribute (2) 750:21;825:22	bad (4) 716:18;751:23; 771:3,11	beauty (1) 796:12
appurtenant (1) 699:21	articles (1) 765:20	attributed (1) 729:22	Baja (3) 732:5,16,22	become (1) 803:9
aquatar (1) 742:3	ash (2) 736:17,17	author (3) 702:8;721:24;737:9	balance (2) 705:21;802:12	becomes (1) 728:7
aquifer (20) 707:4;710:8,11; 736:22;742:19;746:7, 18,20;749:1;750:24; 753:13,23;760:4; 792:4,5;794:19; 813:20,22;820:16,17	ashy (2) 736:18,18	authored (2) 748:22;784:7	Baldwin (15) 696:5.5;697:3; 698:15,16,18;701:2; 703:4,9,12;716:1; 722:8;758:5,8;828:24; 829:2	Bedroc (1) 696:11
aquifers (3) 760:9;803:7;817:20	asserted (1) 712:23	authority (11) 698:23;699:6; 712:23;733:7;738:14; 747:2;771:19;772:2; 809:8;823:3;827:17	Band (3) 696:5.5;698:7,18	bedrock (4) 734:18;735:3;816:1, 1
arbitrary (1) 699:10	assessment (1) 746:23	Authority's (2) 722:2;745:22	barne (1) 695:8	beds (1) 802:21
AREA (37) 694:9.5,12;702:2; 708:11,18;711:10; 721:12;723:19,20; 724:21;725:4,10,11; 728:14;733:18;741:9; 746:10,23;749:13; 776:1,1,22;777:20; 778:5;781:7;792:4; 806:4;807:22;812:24; 813:11,12,15;815:2,9; 816:5,11;819:19	asset (1) 699:24	authorize (1) 699:4	barometric (3) 751:7,10;774:13	begin (1) 700:18
areas (15) 714:16;724:3,15; 726:10;728:15,18,19; 729:10;787:6;792:9; 802:3;810:8;812:24; 813:1;817:4	assigned (2) 796:4;816:16	authorized (1) 826:22	barrier (4) 737:6;764:13;794:5; 795:8	beginning (8) 715:18;743:6; 744:22;777:2;788:6; 791:11,11;805:8
argue (3) 706:13;734:11;766:6	associate (1) 701:10	authorizing (1) 699:1	Barne (1) 695:8	beginnings (4) 788:18,19,24;789:9
argued (1) 783:2	associated (1) 756:10	autobahn (1) 798:2	based (22) 698:9,23;705:8; 706:20;717:19;726:21; 747:9;748:22;752:20; 753:1;754:9;757:1; 783:17;788:7;797:15; 801:19;805:21;812:2, 24;815:7;821:4;824:4	begins (1) 805:5
arguing (1) 764:24	Associates (3) 701:10;736:11; 811:13	automate (1) 715:14	Base (8) 706:17;713:9;757:2; 767:1,3;770:17,17; 772:20	behavior (1) 765:24
argument (2) 712:22;717:10	Association (1) 748:11	availability (1) 824:9	barriers (2) 794:2,14	behind (5) 718:23,23;724:4; 773:10;783:23
argumentative (1) 787:14	assume (3) 731:1;749:4;796:3	available (8) 703:23;711:13; 749:13;754:5;773:20; 799:23;819:19,22	baseline (1) 797:10	Belaustegui (1) 695:19
	assumed (25) 707:15,24;710:4,4,5, 6,6,7,7;731:3,3,4; 746:17;750:3;752:18; 782:22;793:4;796:15; 816:10;817:16,16; 818:12;819:20,22,24	average (4) 718:18,19;816:5,7	Basicly (3) 707:13;798:6;819:12	belief (1) 823:6
	assumes (1) 809:15	averaged (1) 721:17		believes (3) 775:12,14;783:21
	assuming (1) 827:6	averages (1) 712:6		bell (1) 718:5
	assumption (4) 750:4,8;788:9; 796:13	averaging (1) 721:16		below (2) 711:5;802:6
	assumptions (2)	avoiding (1) 716:13		bending (1) 815:19
		aware (6) 763:16;772:3; 800:14,17;801:4,9		bends (2) 815:14,21
		away (9) 732:3,16,22;737:1; 744:6,7;752:7,9;792:7		beneath (1)
		awkward (1) 731:4		
		axis (1)		

734:12;744:2;747:2; 768:2,18;787:23 cases (1) 766:16 cast (4) 718:8;719:3,4,6 catch (2) 712:4;720:15 catchments (1) 766:4 caught (1) 780:24 cause (1) 750:5 caused (1) 760:16 causes (2) 764:4;807:6 Cave (5) 722:3;741:7;745:11, 23;746:21 Caviglia (1) 695:24 CCR (1) 830:22 CDM (3) 756:7,12;757:10 Celsius (2) 707:15;788:10 Center (7) 696:15;721:24; 797:2,6;804:5,8; 828:13 centimeters (3) 727:8;790:1;816:4 central (8) 707:23;720:24,24; 723:1,1;729:21; 739:23;740:7 centuries (11) 712:23;713:15; 721:7;797:17;822:5, 10,18,18,20,24;823:4 century (1) 706:9 century-long (1) 756:24 certain (1) 705:16 certainty (1) 702:7 Certified (1) 830:4 certify (1) 830:5 CFS (3) 759:9,14;805:12 Chamberlain's (1) 741:11 chance (1) 781:20 change (6) 718:21;765:23;	824:6,10;825:20,23 changing (1) 751:4 characteristics (1) 740:23 characterize (3) 705:23;740:9;757:8 charge (1) 737:12 chart (3) 714:6;717:1;752:24 check (1) 807:1 cheek (2) 734:14;783:9 chemically (1) 814:8 cherish (1) 713:22 Chief (2) 695:7,10 chop (3) 723:11,14;767:6 chopping (1) 767:3 chose (1) 699:12 Christi (4) 695:12.5;727:13,16; 811:23 chuckled (1) 727:17 chunk (1) 768:18 circles (1) 725:12 circulated (1) 782:24 cite (1) 801:1 cited (5) 699:1;797:18,20; 799:6,20 citing (1) 797:24 City (9) 695:17;696:4.5,12.5; 698:1;796:22;828:10; 830:2,7,17 claim (1) 719:14 claimed (1) 822:18 claiming (4) 721:3,4;724:24; 769:2 clarify (6) 720:1;745:16; 753:14;764:20;781:22; 820:3 Clark (1) 737:11 clean (3)	709:2,3;744:14 clear (7) 714:21;721:15; 761:22;784:6;801:17; 817:18;822:2 clearly (4) 706:10;720:11; 743:18;761:12 click (1) 773:21 clicked (1) 726:15 cliffs (1) 704:18 climate (49) 714:1,1,9,9,10;715:1, 4,10,20;716:8;718:12; 719:14;720:16,16; 751:22;752:4;757:8,9; 765:2,4,5;767:12,14, 23;769:3;770:14; 779:6;797:10;798:13; 799:6;800:2,4,22; 801:9,11,12,13;804:8; 819:2;821:17;822:3,9; 823:10,12;824:6,10; 825:17;826:3,7 climates (1) 721:5 climate's (1) 723:17 close (7) 738:4;743:21; 748:23;776:17;788:18; 791:13;825:13 closely (2) 705:22;790:12 closer (1) 825:11 Clover (1) 733:21 code (3) 703:21;711:12;731:5 codes (1) 710:22 coefficient (1) 715:24 coefficients (8) 717:5,9,13,20;718:1; 749:22;766:23;770:3 Cogen (1) 806:10 Cogeneration (1) 811:13 Colby (2) 704:11;705:18 cold (5) 752:15,16,16,19,21 collaboration (2) 752:19,20 collaborator (1) 806:9 colony (1)	784:23 color (2) 815:1,12 Colorado (6) 731:20;732:2,4,4; 766:4;801:7 colored (6) 737:19,21;753:11, 13;789:23;815:7 colors (3) 723:7;735:11;737:17 column (2) 740:17;793:22 combination (1) 759:23 combine (1) 749:19 comfortable (3) 744:8;749:18;759:4 comfortably (1) 807:24 coming (26) 704:14;706:4,5; 710:15;723:21;726:4; 734:10;749:4;750:15, 16,17;751:11;753:16; 767:23;768:3;812:19; 814:9,10,11,16,18,19, 19,20;818:11;829:4 comment (6) 705:9,17;713:6; 717:7;726:22;728:3 common (1) 798:22 community (2) 780:8;782:2 Company (6) 696:3.5;700:9,10; 786:8;811:15;828:20 compare (2) 759:6,22 compared (2) 759:12,19 comparing (8) 720:5;744:20; 757:20;760:17,24; 761:2;772:19;798:2 comparison (3) 714:8;758:3,21 compelling (1) 798:17 complete (1) 752:10 completed (1) 702:3 completely (3) 756:17;789:7;826:14 complex (2) 711:3;725:7 complicated (2) 760:22,23 component (1) 722:24	composite (1) 824:2 composition (4) 721:8;744:15; 784:23;803:9 compositions (1) 814:3 computer (2) 743:4;754:24 computes (1) 792:24 concept (5) 725:16,18;765:1; 766:2;787:21 conceptual (13) 781:3,6,8,13,24; 782:7,11,21,23;789:10; 790:2,3;813:18 conceptualizing (1) 753:2 concerned (2) 755:9;825:18 conclude (1) 819:21 conclusion (7) 761:20,23,23;762:2; 775:5;819:17;821:1 conclusions (2) 772:14;819:13 conditions (3) 759:19,21;781:15 conducted (1) 807:17 conductivities (1) 796:4 conductivity (2) 753:7,8 cone (1) 800:23 confidence (1) 813:17 confident (1) 792:9 confined (1) 707:5 confound (1) 800:4 confounded (1) 800:5 confounding (4) 800:1,3,11,19 confused (4) 747:11;776:14; 822:22;824:14 Congdon (1) 715:10 Congress (1) 748:15 conjunctive (1) 699:8 conjunctively (1) 699:3 connected (1)
---	--	--	--	---

716:9 connection (2) 775:24;803:6 consensus (1) 781:14 CONSERVATION (2) 694:2;830:8 consider (2) 758:23,24 considered (5) 758:18;759:1;807:2; 817:19;818:1 consistent (2) 738:16;822:13 consisting (1) 830:12 constant (4) 709:5;721:13,14; 793:8 constrained (1) 723:20 constructed (3) 722:21;723:10,10 construction (1) 751:23 consultants (2) 747:12;798:5 consultation (1) 702:18 containing (1) 702:8 continent (2) 731:17;732:10 continental (1) 741:13 continuation (1) 698:5 continue (1) 825:22 continued (2) 805:13;821:24 continues (4) 803:9;824:18,22,23 continuous (5) 721:1;726:12; 741:21,22;753:8 contour (1) 738:1 contours (1) 705:4 contractor (1) 747:9 contractually (1) 700:9 contrast (1) 753:24 contributes (1) 781:7 contribution (2) 762:24;803:12 controls (2) 793:23;794:1 conventional (1)	797:17 conversation (3) 704:6,12;705:16 conversations (1) 698:9 converse (1) 748:18 convince (1) 713:1 convinced (2) 744:10;826:11 cool (1) 718:13 Cooper (6) 695:12.5;697:9; 811:22,23,24;813:3 copies (2) 700:13,13 copy (2) 793:10,11 corner (1) 816:20 correction (1) 786:15 correctly (2) 795:6;819:3 correlate (1) 740:8 correlation (7) 715:24;717:5,8,13; 762:5;766:22;770:3 correlations (1) 749:22 counsel (2) 698:19;793:11 counterclockwise (1) 728:11 counting (1) 776:16 country (4) 720:20;723:3; 724:22;731:22 County (7) 696:2;726:14;738:5; 785:20;786:8;793:10; 828:6 couple (21) 710:13,22,23; 712:14;713:18;715:10; 718:11;727:2;731:9; 732:13;737:10,17; 744:5;774:20;781:17; 786:10,24;791:17; 798:4,5;814:24 course (1) 774:12 courses (1) 711:9 Court (3) 700:6;780:23;830:4 cover (2) 746:13;813:2 covered (1)	746:12 COYOTE (14) 694:8.5;733:8;735:1; 738:6;754:17;763:1; 774:14;778:2;810:11, 17,21;811:5;814:13; 827:7 Crazy (2) 760:2;783:4 create (2) 707:6;824:13 created (2) 759:8;781:4 creates (1) 780:22 credit (1) 823:2 Creek (4) 723:2;736:16;800:6; 810:3 criteria (1) 749:14 Crooks (1) 817:13 CROSS (11) 697:2;703:1;710:4; 712:4;715:7;721:22; 722:7;729:8;739:10; 754:3,6 cross-examination (9) 698:9;754:9,11,12; 755:16;763:10;771:21; 786:5;797:4 cross-examined (1) 702:23 CSI (3) 695:19,22;755:19 CSV-3 (1) 795:12 CSVM-4 (4) 738:6;743:5;744:21; 745:7 cumulative (2) 712:6;756:6 cumulatively (1) 800:17 curious (1) 815:16 current (1) 812:3 currently (2) 701:8;808:15 curtailment (3) 821:18,20,22 curve (3) 718:5;750:10;756:12 curves (3) 756:6,7;757:10 cut (9) 708:24;723:15; 733:19;737:20;739:5; 740:21;777:14,17; 812:13	cutoff (7) 722:21;723:10,15; 724:1,9,16;801:18 CV (1) 701:17 cycles (3) 756:24;757:4,11 D da (3) 707:4,4,4 Dace (1) 821:24 Darcy (3) 745:13,19;820:8 Darcy-flux (2) 741:10;821:8 Darcy's (6) 748:22;805:21; 807:9,14;808:4,24 dark (2) 716:10;767:18 data (44) 712:15,15;713:4,8, 10,12,22;714:11,11,17; 715:5;716:9,19;721:6; 726:14;747:11,22,24; 748:4,5,8,13,16; 749:23;756:14,15; 757:1,2;764:21;768:7, 8,9;798:12,17;799:6,9, 20;801:1;803:4,5; 804:8,11;820:24; 822:14 database (1) 714:15 data's (1) 756:10 date (3) 699:22,23;779:22 Dated (1) 830:17 dating (2) 770:18;806:21 datum (2) 748:2,16 Davis (1) 737:11 day (9) 716:17,17,18,18; 727:7;730:10;734:5; 746:7;830:17 days (11) 705:3;707:2,20; 711:5;718:22;729:5; 733:4;754:13;769:12; 791:17;817:8 DDC (2) 712:24;752:18 dead (1) 740:17 deal (4)	802:18,19;826:3,4 dealing (2) 715:11;791:15 Debbie (1) 698:19 decades (5) 712:24;721:7; 797:16;822:17;823:1 December (1) 765:18 decided (1) 736:21 decimal (1) 735:10 decipher (1) 780:23 decision (2) 783:14,17 decisions (1) 822:8 declaration (1) 699:2 declared (1) 805:4 decline (1) 805:1 declines (3) 824:7,9,9 decline's (1) 706:14 declining (2) 752:10;824:20 decrease (1) 766:8 deep (2) 736:22;742:17 deeper (2) 741:2,3 deescalate (1) 825:8 deficit (4) 707:23;729:21; 817:7;821:5 define (1) 805:8 defined (4) 710:12,20;722:15; 812:4 definitely (1) 774:23 de-flow (2) 703:21,24 degree (3) 707:15;731:3;788:10 degrees (4) 728:15,17;729:15; 786:16 Delamar (3) 722:3;741:7;793:6 delay (1) 822:9 delayed (4) 751:22;769:8;822:3;
---	--	---	---	--

824:6 delineation (1) 773:8 demo (5) 731:11;734:3;780:3, 10,15 demonstrate (1) 799:9 demonstrated (1) 775:24 demonstration (2) 703:20,20 demonstrative (1) 745:12 Demo's (1) 734:1 dense (1) 736:20 DEPARTMENT (2) 694:2;830:8 departure (1) 756:6 depending (2) 790:24;792:1 depends (1) 820:21 depict (1) 800:22 depicted (1) 810:14 depiction (1) 804:5 depleting (1) 800:24 depression (1) 800:23 Deputy (1) 695:5.5 derivative (1) 739:20 derived (2) 746:17,24 describe (4) 757:11,23;758:11; 773:4 describing (3) 699:16;756:24;757:4 Desert (2) 801:11;802:23 design (2) 792:3,8 designated (1) 701:22 details (1) 795:14 determination (2) 698:12;809:11 determine (4) 764:21;767:11; 806:7;808:2 determined (2) 797:20;806:6 developed (7)	703:17;781:3,6,8,8, 14,24 developers (1) 780:4 developing (1) 791:15 development (1) 782:9 Devil's (2) 718:12,14 Devonian (4) 726:11;741:12,13,23 devoted (1) 791:14 dewatering (1) 800:14 diagnostic (7) 743:16,19;776:3,6,9; 798:23;799:1 diagram (7) 719:6;722:20;723:5; 726:9;727:10;753:14; 777:9 Diamond (1) 816:22 diasostic (2) 713:16;776:4 Diego (1) 732:12 differ (3) 735:9;736:4;739:5 difference (4) 745:24;746:4; 802:10;825:9 differences (3) 719:20;758:23;759:6 different (30) 717:3,4;723:7; 725:14;735:6;745:18, 18;760:14;761:3,9; 767:1;773:2;774:22; 775:20;779:11;787:12; 790:18;791:2;796:4; 813:10,12,13,15,22; 814:1,5,7;816:10; 818:21;820:1 differently (5) 773:3;789:13; 795:16;820:13;826:14 differs (1) 706:24 difficult (5) 704:19;760:20; 777:6;779:3;780:23 difficulties (3) 709:24;727:24,24 digest (1) 781:21 dimensional (1) 727:12 dimensions (1) 768:14 dip (2)	744:22;751:10 DIRECT (12) 697:2;701:1;702:24; 721:19;722:6;748:7; 758:3;773:2;786:11; 793:9,18;822:11 directing (1) 792:12 direction (9) 698:24;709:11; 728:11,19;729:2; 815:3,11,12,23 directions (1) 728:10 directly (2) 743:2;807:6 director (1) 721:23 discarded (1) 789:6 discharge (44) 708:11;714:24,24; 715:16,21;716:5,20; 719:11;720:3;721:12; 723:20,21;725:14; 726:22,23,23,24;727:1, 18;763:17,22;765:3,9; 767:18,22;768:11,12, 13,19;789:15,16,20; 798:3,8,21;808:5; 809:1,5;813:9;816:10, 15;817:9;818:10,11 discharging (1) 753:17 discontinuous (1) 747:10 discretion (1) 789:5 discuss (1) 722:5 discussing (1) 756:5 discussion (2) 736:1;789:3 discussions (1) 773:1 dissertation (2) 741:11;773:10 distance (2) 746:4;825:15 distant (1) 825:11 distinct (2) 699:5;798:20 distinction (1) 820:14 distracted (2) 704:24;755:10 distribute (2) 727:2;789:22 distributed (3) 750:11,12;782:1 distribution (2)	717:16;750:15 District (13) 696:2.5,9.5;771:20; 772:2;785:14;786:2,8; 804:7;808:16;809:11; 827:18;828:2,3 diverge (1) 730:21 diverged (1) 814:2 diversions (1) 800:12 Diversity (4) 696:15.5;797:2,7; 828:14 Diversity's (1) 804:5 divide (4) 709:14,22;725:4; 742:11 dividing (1) 709:20 DIVISION (4) 694:3;698:17; 811:19;830:9 Dixon (1) 739:19 doable (1) 711:2 doctoral (1) 773:9 documented (3) 782:1;790:4;803:3 DOE (1) 730:2 domain (12) 708:19;724:19; 729:12;735:14;742:6; 753:17;774:23;777:18; 787:8;791:5;810:7; 812:2 domains (2) 782:16;796:5 dominated (3) 719:14;774:12,17 dominates (1) 719:10 domino (1) 823:19 done (9) 714:20;724:14; 725:12;731:13,16; 736:24;745:24;754:13; 766:20 Donnelly (15) 696:15.5;697:8; 797:3,5,6;803:15,18, 22;804:1,4,10;811:1,2, 8;828:15 doomed (2) 824:21;825:16 dot (1) 709:23	dots (8) 709:16,20;716:9; 717:18;747:21;773:23, 24;813:2 dotted (3) 777:10,10,12 double (1) 807:1 doubt (4) 774:15;804:24,24; 826:1 doubting (1) 736:8 down (25) 709:18;714:4,7; 716:16;721:4;729:10, 11;731:23;734:21; 736:5,16;744:3,7,7; 750:5;759:3;766:4; 767:16,20;773:21; 776:3;806:4;809:18; 814:13;827:5 downs (1) 744:4 down's (1) 744:8 DR (43) 697:2;698:20; 700:17,21;701:3,17; 703:5,13;704:9,11,21; 705:13;706:20;709:13; 711:11;716:2;719:23; 721:23;722:9;726:22, 22;738:19;739:13; 744:10,17;745:17; 749:9;752:16;755:21; 762:6;763:15;773:8; 780:20;783:24;786:7; 793:9,15;797:7;806:9; 808:9;813:8;819:9; 826:17 drain (1) 716:15 drainage (1) 742:11 draw (2) 744:4,8 drawdown (12) 706:11;719:18,21; 757:19;758:23;759:9, 13;760:5;775:21; 778:24;779:2;793:3 drawdowns (1) 825:14 drawn (1) 744:6 draws (2) 744:3,7 DRI (3) 721:23;736:11; 780:13 drilled (1) 736:13
--	--	---	--	---

drilling (1) 751:19	720:24;723:1;724:7; 725:5;728:11,17,23; 729:15;777:13,17; 812:24;813:1;815:4,13	762:10,23;777:14; 813:18,19;821:18	747:17;783:1;812:9,14	744:12
drinking (1) 780:19	east/southeast (1) 735:22	elevations (5) 723:23;737:22; 788:3;795:9;810:7	enriched (1) 803:10	even (15) 699:5;728:14; 741:20;742:4;744:1; 747:22;752:1;769:8; 772:21;777:15;781:20; 788:18;791:13,16; 802:24
driven (1) 714:1	east/west (1) 709:8	Elko (1) 800:8	enter (1) 728:9	everybody (8) 742:22;750:22; 762:13;765:10;772:22; 786:16;810:18;825:17
driving (3) 718:10;721:7;732:1	eastern (2) 787:2;801:16	else (19) 704:10;707:22; 711:20;719:1;731:11; 734:11,11;738:8; 749:2;750:19;760:1; 766:23;772:23;777:4; 791:20;801:14;812:16; 820:2;823:7	entering (1) 801:22	Everybody's (1) 784:5
drop (2) 767:15;787:17	ECP-1 (1) 806:6	else's (1) 826:21	entire (3) 746:11;782:13,14	everyone (2) 704:10;723:4
drops (1) 767:16	Ed (1) 814:17	Emilia (2) 755:18,20	entirely (2) 746:14;821:8	everywhere (2) 719:18;780:9
drought (20) 752:2;764:20,21,24; 765:6,13,20,24;766:6, 7;770:6,7;804:20; 805:1,4,5,9;821:16,24; 825:17	edge (2) 732:10,22	emphatic (1) 744:10	entitled (1) 830:9	evidence (14) 703:10,11;713:2; 750:4;761:19;762:2, 16;807:15;808:14; 809:6,13;812:9; 820:24;825:2
drought's (1) 766:2	edges (2) 741:16;787:7	emphatically (1) 761:21	environment (1) 704:20	evient (1) 821:17
dry (7) 721:5;722:3;741:7; 756:24;757:4;769:3; 815:20	effect (4) 750:5;775:5;825:4; 826:2	empirical (2) 714:15;744:15	environmental (2) 750:15;774:13	exact (1) 711:12
due (4) 707:24;779:22; 819:1;824:10	effected (1) 819:2	employed (2) 701:8,11	equally (3) 727:3;761:17;762:1	exactly (6) 709:8;734:23; 744:18;747:24;748:9, 12
dug (1) 802:23	effective (3) 724:15;771:12; 821:22	EMX-4 (1) 776:1	equals (2) 768:13,16	EXAMINATION (6) 697:2;701:1;811:21; 813:5;818:17;819:7
duly (1) 700:23	effects (5) 751:7;753:4;825:11, 13,14	EMX-5 (1) 776:1	equation (1) 707:3	example (4) 742:1;745:11,18; 753:6
Durbin (1) 711:22	effort (1) 795:18	enabled (2) 704:5,5	equilibrium (1) 706:10	examples (1) 721:17
during (12) 703:1;751:4;757:24; 758:12;760:12,12; 761:3;774:11;775:5, 12;776:6;786:11	efforts (3) 809:7,12,14	enclosed (1) 792:6	equivalent (3) 722:5;751:21;767:22	Excel (1) 766:14
dying (1) 804:22	Egan (1) 723:2	end (7) 704:15;747:23; 750:12;752:24;785:16; 811:3;825:9	error (2) 796:6,7	except (6) 743:13;782:19; 789:20;814:14;817:15; 820:16
dynamic (1) 777:7	EH-4 (24) 749:8;750:9;757:19, 21,24;758:12,18;759:1, 2,6,9,14;762:6,9;775:6, 10,13;776:1;779:10; 796:18;798:22;814:12; 823:20;825:23	ended (1) 758:19	escalate (1) 825:8	excess (1) 826:19
E	EH-42 (1) 824:19	Energy (4) 695:24;747:6,18; 811:18	especially (3) 707:20;770:22;803:4	excessive (2) 826:17,18
Eagan (1) 810:4	eight (1) 759:2	Energy's (1) 720:11	Esq (11) 695:16.5,18,20,22.5, 24;696:4,5.5,7,9.5,11.5, 13	exchange (1) 703:1
Eakin (7) 712:7,10,15;721:15; 770:10;797:22;798:2	either (5) 712:6;726:11;733:8; 740:1;749:18	engage (1) 698:23	essentially (5) 774:19;801:24; 804:13,16;821:6	exclusively (1) 817:15
earlier (7) 745:22;763:24; 777:9;778:4;783:6; 814:2;818:24	elaborate (1) 812:7	engaged (1) 766:24	established (1) 757:20	Excuse (7) 754:22;800:2;803:6, 13;807:5;828:2;829:5
early (6) 708:7;744:22; 748:11;753:1;776:6; 820:22	element (9) 703:19;709:11; 710:21,24;711:7; 714:19;729:17;733:12; 735:20	Engineer (14) 695:4,5.5,8.5,14.5; 699:5;779:20;783:14; 789:1,11;811:16,20; 819:14;824:12;828:23	establishing (1) 760:5	exercise (1) 779:16
easier (1) 743:3	elements (9) 711:1,9;726:10,17, 19;727:3,4;787:7; 789:23	Engineer's (3) 698:23;700:11; 702:12	estimate (5) 701:23;805:20,21; 808:7;820:1	Exhibit (8) 700:11;701:18; 703:5,10,11;739:3; 792:13;793:10
easily (3) 783:3;790:3;807:24	elevation (12) 724:1;734:18; 737:24,24;746:1,5;	enhanced (1) 729:7	estimated (5) 706:2,4;718:18; 734:24;789:20	
east (14)		enough (9) 700:14;704:15; 719:1;723:19;727:19;	estimates (6) 717:19,19;748:23; 759:24;807:4,12	
			estimating (2) 817:1;823:4	
			Eureka (12) 707:18,22,23;708:4, 4;710:12;729:19; 730:6,8;742:8;753:18; 816:17	
			evaluation (1)	

<p>EXHIBITS (5) 697:14;708:3; 718:14;733:13;737:10</p> <p>exist (1) 763:18</p> <p>existence (1) 809:9</p> <p>existing (1) 738:20</p> <p>expansion (1) 699:23</p> <p>expected (1) 746:13</p> <p>expensive (2) 780:6,13</p> <p>experience (1) 707:21</p> <p>experienced (1) 826:22</p> <p>experiment (2) 749:20;787:22</p> <p>expert (10) 699:15;706:15; 767:7;772:4,8,11,14; 775:12,14;779:23</p> <p>expertise (2) 766:13;799:12</p> <p>experts (1) 756:19</p> <p>explain (15) 705:14;715:20; 723:6;738:21;745:3; 749:5,17;765:13; 768:1,4,20,22,24; 769:1;794:4</p> <p>explained (5) 720:4;770:16; 823:13,18,21</p> <p>explaining (1) 714:23</p> <p>explains (3) 714:21;717:16;752:4</p> <p>explanatory (3) 750:9;767:2;800:8</p> <p>exploration (1) 736:12</p> <p>exploratory (1) 769:23</p> <p>exposed (3) 733:20;739:6;764:15</p> <p>exposure (1) 741:24</p> <p>express (1) 698:24</p> <p>expressed (2) 824:5,7</p> <p>expressly (1) 699:4</p> <p>extend (4) 713:13,17;732:17,24</p> <p>extended (1) 740:24</p> <p>extends (1)</p>	<p>810:2</p> <p>extension (2) 736:2;740:9</p> <p>extensional (1) 740:15</p> <p>extensively (1) 755:4</p> <p>extent (2) 699:16;777:5</p> <p>extraordinary (1) 826:8</p> <p>extrapolate (2) 741:2,3</p> <p>extreme (2) 777:17;804:7</p> <p style="text-align: center;">F</p> <p>fabric (1) 815:23</p> <p>face (1) 727:13</p> <p>fact (4) 708:7;732:4;739:4; 822:19</p> <p>factor (2) 800:11,19</p> <p>factors (2) 800:1,3</p> <p>fail (1) 756:18</p> <p>fair (1) 773:5</p> <p>FAIRBANK (48) 694:4;695:2;697:12; 698:4,16;700:19; 703:7;704:7,10;754:7, 19,21;755:2,6,12,15; 763:8;771:13,17; 780:20;785:7,11,24; 793:13;796:22;797:1; 803:17,22;804:2,9; 810:23;811:9,12,17; 819:8;826:24;827:10, 13,16,21;828:1,5,10, 13,17,19,24;829:3</p> <p>familiar (4) 756:7;757:21;774:6; 793:15</p> <p>famous (1) 814:17</p> <p>fangled (1) 803:19</p> <p>far (11) 718:8;743:17; 753:20;766:13;769:5; 777:17;793:22;794:1; 802:17;803:1;826:19</p> <p>Farber (1) 695:22</p> <p>farther (5) 725:23;727:21; 747:3;752:7,9</p>	<p>fashion (1) 791:23</p> <p>fast (2) 730:24;787:16</p> <p>fault (18) 715:24;729:7,9,11; 732:21;736:1,23; 737:1;738:13,17,18; 764:15;772:17;793:23, 24;794:6,12;795:8</p> <p>faulting (1) 773:1</p> <p>faults (12) 707:6;729:6;732:15; 733:6;738:9,11; 740:10,16,22;790:16, 16;815:14</p> <p>favorable (1) 826:16</p> <p>favorably (1) 826:15</p> <p>favorite (1) 748:19</p> <p>fear (1) 765:21</p> <p>feature (3) 743:5,9;764:4</p> <p>features (7) 712:9;740:10; 772:18;776:10;790:15; 794:10,11</p> <p>February (1) 748:11</p> <p>fed (1) 813:19</p> <p>federally (1) 699:20</p> <p>fee (2) 727:5;809:20</p> <p>feed (3) 711:16,18;788:20</p> <p>feeder (1) 706:21</p> <p>feeds (1) 708:17</p> <p>feel (3) 744:1;771:11;825:24</p> <p>feet (18) 716:10;723:24; 724:8,11,12,23;736:16, 21,21;744:3,4;745:2; 759:13;801:16,19,21; 802:2,6</p> <p>Felling (1) 748:10</p> <p>felt (2) 702:4;705:20</p> <p>few (3) 763:15;819:9;826:10</p> <p>fewer (1) 806:16</p> <p>fiddle (1) 816:12</p>	<p>fiddled (2) 796:5,6</p> <p>field (16) 701:12;705:5,6; 708:12,16;734:17; 743:17;747:16;762:12; 779:9;793:22;794:1; 796:2;809:17,21; 826:12</p> <p>fields (2) 708:9;749:5</p> <p>figure (21) 710:10;715:13; 745:1;758:2,2,6,14,14, 15,15;766:15;794:7; 795:19,20,22;796:19; 803:14,16;804:4; 805:16;822:11</p> <p>figured (2) 762:18;826:9</p> <p>file (3) 711:12,16,17</p> <p>filed (1) 702:13</p> <p>files (1) 747:19</p> <p>fill (1) 716:18</p> <p>filling (1) 782:20</p> <p>final (1) 824:4</p> <p>finalize (1) 718:22</p> <p>finally (1) 752:22</p> <p>find (11) 715:23;741:20; 743:24;748:2;750:19, 20;755:24;765:4; 769:24;798:17,20</p> <p>finds (1) 720:24</p> <p>Fine (3) 727:7;736:20;826:6</p> <p>finish (2) 778:16;780:21</p> <p>finite (4) 703:19;711:7,8; 714:19</p> <p>Fire (1) 704:22</p> <p>first (32) 698:22;700:23; 705:17;707:12;708:24; 711:7,15,17;713:3; 718:11;722:19;723:9; 727:11;730:16,19; 733:12;735:12;736:16; 751:1;753:4;754:16, 16;765:15,16;792:2; 797:9;809:10;813:2; 819:16;822:1;823:23,</p>	<p>23</p> <p>Fish (8) 715:6;724:4;763:9, 12,16;797:19;801:22; 827:10</p> <p>fit (3) 748:8,13;750:1</p> <p>fits (2) 749:14,23</p> <p>five (3) 711:3;759:24;765:8</p> <p>five-month (1) 776:5</p> <p>fix (4) 711:4;733:24; 747:17;748:16</p> <p>fixed (2) 816:11;817:3</p> <p>Flagstaff (1) 731:23</p> <p>Flangas (2) 696:7;811:14</p> <p>flanks (1) 741:16</p> <p>flash (1) 736:14</p> <p>flat (1) 804:17</p> <p>Flatley (2) 695:6.5;698:17</p> <p>floor (2) 717:12;787:17</p> <p>FLOW (95) 694:8;698:6;701:22; 705:5;707:23;708:9, 12,13,16,23,24;711:16, 18;713:9;717:6,11,16, 19;718:10;719:6; 720:7,15;721:14,14; 722:15;724:19;725:9; 727:5;728:10;729:20, 22;733:3,7;734:16; 735:14;737:8;738:22; 742:6,13;743:17; 749:5;753:2,5;759:14; 762:10,12;763:1; 764:1,8,11,17;767:1; 768:5,6,8,13;769:1,2,3, 13;770:11,17,17; 773:9;779:9;782:16; 783:15;788:3,20; 789:15;791:5;794:2,5, 11,14;796:1;797:11; 798:14;802:1;807:7, 12;809:17,20,21; 810:10,14,16,19;812:2, 4;814:2;820:11;822:3, 14;826:12</p> <p>flowing (4) 707:24;725:3; 783:21;820:6</p> <p>flows (15) 715:2;725:8;736:5;</p>
---	---	--	---	---

759:9;761:17;762:1,6; 767:3;769:16;799:21; 800:6,7,21;817:15; 821:19 flux (3) 701:23;807:9;820:8 focus (2) 819:11,16 focused (1) 775:7 focusing (1) 701:14 folks (1) 781:18 follow (4) 740:21;769:17; 807:23;813:8 followed (1) 770:11 following (3) 734:16;753:16;769:5 follows (1) 700:24 foot (3) 706:21;744:7;820:1 Force (1) 807:21 forecast (2) 717:1;718:9 forecasts (1) 717:19 foregoing (1) 830:12 foremost (1) 730:19 forever (2) 824:21,22 forget (2) 741:21;768:13 form (11) 719:9,13,13;749:8; 758:22;779:10;798:22, 22;814:12;824:14; 825:23 formal (1) 756:8 formed (2) 702:6;732:6 former (2) 721:23;731:20 forms (1) 798:21 forth (1) 728:5 fortunately (1) 723:18 forward (1) 785:18 found (7) 715:15;738:23; 740:23;757:23;758:12; 766:21;798:2 foundation (1)	788:11 four (4) 718:22;747:9; 755:23,24 fourth (1) 819:17 fraction (1) 744:7 fragmented (2) 740:24;747:18 frame (2) 737:16;819:5 framework (6) 711:4;737:13; 739:18,19,20;790:20 FREAK (1) 710:23 free (4) 708:23;728:10; 780:4;782:15 fresh (1) 751:21 freshening (1) 751:20 freshwater (1) 785:1 Front (3) 731:24;732:3;802:24 F's (1) 794:13 full (6) 736:2;744:6;751:19; 765:20;829:2;830:13 full-blown (1) 705:21 fully (5) 703:20;762:7; 787:10;788:15;794:14 function (6) 717:24;718:6;749:9, 18;750:9;770:17 funny (6) 727:6;749:9,10,11, 17;760:7 further (3) 763:6;771:10;802:5	698:22;752:8;765:7; 770:5;773:15;797:12; 799:13;803:9;825:10 generally (4) 716:7;781:2;782:8; 807:13 generate (1) 711:13 geochemical (1) 710:22 geochemist (1) 721:24 geochemistry (4) 710:24;722:2; 752:11,13 geographic (1) 812:3 geologic (6) 726:18;737:12,16; 746:12;781:15;795:24 Geologist (1) 695:13 geologists (2) 729:5;764:6 geology (4) 726:14;727:19; 739:17;814:21 geometry (2) 760:7;791:4 geophysical (1) 807:15 geophysics (2) 736:24;807:18 George (1) 797:22 Georgia (2) 811:9;828:17 Gerlach (1) 729:11 Germany (1) 727:6 gets (4) 726:1;728:7;729:18; 818:6 G-flow (1) 782:17 Gil (2) 734:19;735:3 GIS (1) 726:14 given (5) 746:8;758:15;765:3; 780:12;804:4 gives (4) 705:11;746:5;787:2; 788:13 giving (2) 703:14;823:2 Glasgow (3) 696:14;771:15; 827:15 Glendale (2) 739:1,4	goal (3) 706:11;730:20,22 goals (1) 709:24 goes (16) 720:13;732:20,21; 735:16;750:4,5; 767:15;777:24;788:9; 811:4,4,5;816:2;818:8, 9;824:22 gold (6) 724:18;726:8,10; 727:4,8;789:23 Good (34) 698:4;711:6,10; 713:19,20;714:12,13; 723:22;724:1,21; 737:1,2;738:24; 742:21;755:18,20,21; 757:10;763:12;770:2, 21,22,22;771:23,24; 776:20,20;782:6; 786:9;803:4,4;816:23, 24;817:1 goody (1) 736:17 go-round (2) 754:16;805:19 gradient (15) 735:5,21;743:23; 746:5,16;748:23; 759:2,3;784:16,20; 807:11,14;809:18; 816:24;818:6 gradients (3) 735:8;807:23;821:10 grain (3) 807:23;815:14,21 Grand (2) 723:19;742:1 Grant (2) 723:2;810:4 graph (2) 813:2;819:1 graphic (1) 712:9 gravity (1) 787:18 great (10) 707:24;709:7; 714:17,17;729:21; 732:17;758:11;791:7; 801:11;825:15 greater (3) 727:22;753:9;812:18 greatest (3) 769:19;797:20,21 green (5) 717:21;728:15,18; 748:4;753:11 greenish (1) 736:17 greens (2)	728:14,15 Greetings (1) 797:8 Greg (2) 696:9.5;737:11 grid (1) 729:1 groundwater (19) 699:21,22;704:20; 705:5;708:1,6,8; 713:14;729:22;736:11; 742:5;753:5;773:9; 783:14;788:3;794:21; 798:14;800:18;819:19 grown (1) 792:11 GSA (1) 737:6 guess (16) 719:1;746:6;749:6; 763:16;765:7;772:13; 775:21;778:12;793:2; 797:9;810:9;819:16; 820:13;822:22;824:4, 14 guessed (1) 718:24 guide (1) 726:18 guy (1) 803:19 guys (3) 698:14;754:10;783:4
	G			H
	Gage (8) 715:15;716:21,23; 717:12;760:18;761:1; 798:3;824:24 GARNET (5) 694:10;784:16,20; 815:20;820:5 gas (1) 735:14 gauged (1) 769:14 gave (1) 823:8 general (9)			H-4 (1) 714:22 habitat (1) 821:24 half (5) 706:9;775:21; 782:17;811:4;813:23 half-hour (2) 751:1;829:2 hand (4) 724:3;738:1;762:18; 764:23 handle (1) 727:17 happen (2) 726:6;736:1 happening (1) 706:12 happens (3) 771:1;778:14;826:3 happenstance (1) 734:23 happy (2) 722:6;731:18 hard (4) 731:13;744:18; 766:5,15

hardly (2) 718:22;753:23	717:17;719:3; 734:13;748:2;782:10	825:21	719:9,17,21;743:6, 12;744:6;748:19; 750:20;751:14;762:9, 20;767:4,7;774:10; 778:8;779:11;813:9; 824:2	immediately (1) 715:11
HARRISON (2) 811:11;828:18	heroic (1) 809:7	hope (6) 715:24;731:14; 741:6;747:6;750:11; 766:23	HYDROGRAPHIC (7) 694:8.5,9.5,10.5,11, 11.5,12.5;699:8	impact (4) 762:8,17;819:18; 823:4
hatcher (1) 724:4	Herrema (6) 695:22.5;697:4; 755:17,18;763:6;827:9	hoped (2) 711:22;721:22	hydrographs (15) 719:12,19;744:21; 749:8;751:18;752:5; 757:20;779:10;798:21; 813:22;814:12;823:20, 24;824:18;825:23	impacts (9) 760:15,17,24;761:2; 791:23,23;792:2; 821:24;826:14
hatchery (1) 801:22	herring (3) 752:3,3;764:24	hoping (2) 772:15;780:4	hydrologist (1) 695:11.5	impede (3) 764:1,16;794:11
head (7) 751:21;785:1;788:7; 790:10;799:8;801:4,10	hesitation (1) 762:8	horology (1) 801:20	Hydrology (1) 695:10	impediment (2) 733:1,3
heading (1) 810:15	heterogeneity (2) 753:5;790:17	horribly (1) 779:3	hypothetical (2) 699:17;826:9	impermeable (1) 742:17
heads (6) 712:1,1;786:19; 787:3;788:6,13	heterogenous (1) 825:12	horse (1) 775:7	I	implemented (2) 753:3;787:22
hear (3) 698:7;733:4;772:16	Hi (2) 811:23,24	hosting (1) 774:5	ice (1) 822:20	imply (3) 739:5;801:24;802:7
heard (13) 707:20;751:15; 769:10;774:24;776:21; 786:10,23;802:22; 818:20,24;820:2,23; 822:4	HIDDEN (2) 694:10.5;820:5	hotels (1) 706:16	idea (6) 713:14;722:22; 741:18;765:1;784:6,9	import (1) 809:9
HEARING (54) 694:4,16.5,17.5; 695:2.5,7;697:12; 698:4,5;700:19;703:7; 704:7,10;739:18; 754:7,19,21;755:2.6, 12,15;763:8;771:13, 17;780:20;785:7,11, 24;793:13;796:22; 797:1;803:17,22; 804:2,9;810:23;811:9, 12,17;819:8;826:24; 827:10,13,16,21;828:1, 5,10,13,17,19,24; 829:3;830:8,14	high (26) 704:15,16;719:6,7; 720:19,23,23;722:24; 723:3;724:20,22; 734:10;750:12;753:16; 762:10;769:16;770:11; 774:23;798:8;807:6; 812:23;813:17,18; 814:20;816:11;821:18	hour (2) 739:14;782:17	ideally (1) 778:22	important (12) 713:7;719:4;720:8,9; 722:1,3;725:11; 749:24;750:19;765:1; 766:2;788:2
heat (16) 707:18,23;710:8,11, 12,14;729:20,23,24; 730:1,7;731:1;753:18; 783:5;791:9;822:14	high-end (1) 780:5	hours (1) 751:5	identical (2) 735:9;825:14	improve (2) 731:8;816:13
heavy (1) 767:18	higher (7) 723:15,16,16;728:8, 8;762:22;806:5	housekeeping (1) 700:12	identified (1) 740:7	improved (1) 779:5
heck (1) 704:19	highest (1) 718:2	HRT (2) 806:18;807:3	identifies (1) 711:16	incline (1) 740:7
held (4) 699:24;719:22; 726:5;830:8	hill (1) 724:4	hue (1) 728:21	ideas (1) 775:8	include (6) 708:17;741:24; 748:9,19;810:3,5
help (4) 734:3;738:21;783:5; 792:3	himself (1) 754:5	huge (2) 716:16;720:15	identifying (1) 792:9	included (1) 737:18
helpful (3) 722:12;747:6;771:5	hind (4) 718:7;719:3,4,6	Humboldt (12) 715:2,16;720:7,12, 14;721:5;742:11; 768:6;799:20,21; 800:14,21	iffy (1) 726:7	includes (5) 706:16;708:10; 809:21;810:2,4
hereby (1) 830:5	historically (1) 762:4	hump (1) 719:5	ignore (3) 750:22;802:13,14	including (2) 820:5;821:22
herein (1) 830:11	history (6) 707:12;712:5,8; 715:1;718:10;740:14	humps (2) 749:11;750:13	ill (1) 710:12	Inclusions (1) 748:21
hereof (1) 830:13	hit (2) 770:19;787:16	hundred (6) 713:19;715:15,20; 753:8;774:20;801:13	illustrates (2) 789:10;791:19	inclusive (1) 717:14
here's (5)	hitting (1) 824:23	Hyatt (1) 695:22	illustration (4) 709:2;790:6,8,23	incomplete (1) 787:9
	hoc (1) 699:7	hydraulic (13) 735:1,4,8,21;737:6; 746:16;748:23;753:7, 8;796:4;807:11; 816:24;821:9	image (2) 765:18;815:1	increase (2) 805:11;817:6
	holders (1) 821:23	hydrodynamic (3) 709:4,14,21	immediate (1) 749:14	increasing (2) 800:6;805:13
	holding (1) 787:17	hydrodynamics (1) 721:11		incredibly (1) 749:24
	Hole (2) 718:12,14	hydrogeologist (4) 700:18;701:9,11; 743:23		INDEX (6) 697:1;776:22; 778:13,14,17,19
	holes (1) 802:23	hydrogeologists (4) 759:4;769:19; 797:20,21		Indian (2) 725:18,20
	hole's (1) 751:19	hydrogeology (1) 701:15		Indians (1) 698:8
	honestly (1)	hydrograph (18)		indicate (5) 715:19;799:14,17,

21;801:15 indicated (5) 708:9,16;761:15; 779:15;786:2 indicates (1) 807:5 indicating (2) 734:16;795:7 indisputable (1) 821:10 individual (3) 768:21;772:17; 802:13 industrial (1) 713:24 inescapable (1) 813:24 infiltration (1) 802:21 inflow (4) 745:11;784:2;808:3, 22 influence (1) 775:13 influences (1) 774:16 information (3) 703:1;721:20;779:22 informed (1) 811:18 initial (3) 698:11;757:18;758:9 input (3) 720:18;722:14; 789:16 inserted (1) 745:12 insisted (1) 717:12 inspired (1) 747:17 instance (1) 802:2 instead (2) 750:10;767:9 instrumental (2) 713:13,17 intend (1) 702:22 intended (3) 812:5,6,8 inter (1) 734:8 interacting (1) 800:24 interconnected (1) 734:8 interested (2) 708:6;743:24 interesting (3) 752:13;759:20; 814:15 interests (1)	772:22 interference (1) 699:17 interfering (2) 751:12;777:4 intermediate (2) 748:24;806:3 International (1) 806:3 interplate (1) 744:14 interpretation (3) 708:3;738:21;751:16 interrupt (2) 703:14;709:13 interrupted (4) 727:14;730:17; 735:7;740:4 interval (10) 715:1,18;717:14; 718:1;758:17;765:2,4, 5;766:20;770:14 into (39) 698:21;703:6,10,11; 710:8;711:18;721:16; 728:4,10;729:11; 731:5,7;735:16; 742:24;746:21;752:17; 756:17;760:15;761:3; 769:18;778:1;783:21; 784:20;790:1,20,20; 791:20;802:21;803:1; 809:12;814:13;816:21; 817:20;818:1,2,6,8,9; 830:10 intriguing (1) 752:12 intrusive (1) 733:21 Investments (2) 754:17;827:7 invoke (1) 700:5 irrelevant (3) 818:3,4,4 Irrigation (4) 700:8,10;811:14; 828:20 islands (1) 723:12 isolated (1) 817:22 isolation (3) 708:5,14;822:19 isotopes (1) 752:20 isotopic (2) 803:8;822:14 isotopically (1) 814:8 isotopics (1) 721:20 isotropic (2)	736:4;814:3 issue (9) 717:9;751:3;752:2,2; 765:18,19;766:3; 807:19;826:19 issued (1) 779:21 issues (4) 701:24;702:4; 773:12,14 item (2) 726:7;773:16 items (1) 716:24 iterative (1) 710:23 IV (1) 694:18.5 Iverson (1) 805:15 J jagged (2) 750:10,10 January (1) 779:22 Jim (1) 721:22 Joe (1) 753:1 John (1) 708:2 JOHNSON (44) 697:2;698:20; 700:18,20,21;701:3,5, 7;703:13;704:9,11; 705:13;709:13;711:11; 716:2;719:23;722:9; 727:15;739:13;744:17; 745:17;754:18,20,20, 21,23;755:21;758:6; 763:15;771:11,23; 772:3;780:20,24; 783:13;785:23;786:7; 793:9,15;797:7; 811:23;813:8;818:20; 819:9 J-O-H-N-S-O-N (1) 701:7 Johnson's (3) 701:17;703:5;754:5 Jon (2) 695:11;813:7 joule (2) 730:11,11 joules (2) 730:10,12 joy (1) 710:22 judgment (1) 783:18 July (4)	779:23;804:5; 806:17;819:11 junction (1) 732:9 Justina (1) 695:24 K Kaibab (2) 723:18;801:20 Kane (10) 723:1;734:18;738:5; 776:8;778:8;792:16; 793:4,23;794:6;795:8 Karen (3) 696:4,14;786:7 keep (7) 702:24;710:21; 712:19;764:11;770:24; 785:18;825:17 keeping (2) 713:20;737:1 Kent (1) 695:20 key (2) 740:13;773:14 keys (1) 767:8 Keystone (1) 740:17 kick (1) 823:24 kilometer (1) 734:6 kind (15) 708:11,12;712:6; 732:11;742:22;753:21; 754:9;765:13;771:11; 779:11;803:19;815:10; 824:5;827:1,5 kinds (2) 728:5;787:13 kinematic (1) 741:1 King (2) 698:16;828:22 kingdom (1) 767:9 Kingsbury (1) 732:18 KMW-1 (2) 743:13;744:21 knew (4) 721:15;730:22,24; 777:2 knowing (2) 710:14;766:12 knowledge (1) 711:20 known (4) 699:11;712:21; 729:21;794:12	Kobeh (1) 816:21 Kryder (5) 695:9.5;697:11; 818:18,19;819:6 Kryder's (1) 824:8 K's (1) 796:12 L labeled (1) 767:12 lag (8) 712:17,21;715:20; 720:3;769:20;797:18; 798:1,7 lake (7) 708:14;722:3;732:1; 741:7;766:3,9;815:20 landscape (1) 732:7 laptop (1) 803:19 large (3) 773:23,23;815:9 larger (3) 707:7;708:12;789:19 Las (60) 696:12.5;704:13,17; 705:10,18,21;706:4,10, 11,13,19,22;708:12; 724:24;725:10;726:3; 729:12;731:20,20; 734:20,22;735:2,16; 749:4;771:19;772:2; 783:9,21;784:2,17,20; 789:20;796:23;805:20; 807:7,20,24;808:6,11, 14,16;809:6,19; 810:15;811:4;812:11, 12,17;813:1;815:15; 817:15;820:6,7,11,19; 821:2,6;826:18; 827:17;828:11 last (19) 707:20;715:5,5; 718:16,18;729:5; 731:15;733:3;734:2; 747:7;752:22;770:23; 791:17;792:22;810:24; 817:8;822:11;823:17, 21 lasted (1) 764:22 lasting (1) 743:6 later (4) 710:13;712:13; 798:5;805:10 lateral (6) 736:6;738:16,23;
---	--	---	---	---

<p>739:7;764:7,15 latitude (4) 724:1;801:19,21; 802:7 latter (1) 749:9 laughed (1) 727:13 Laura (2) 696:11.5,13 Law (7) 696:11,12.5;748:22; 805:21;807:14;808:4, 24 layer (4) 709:5;711:5;753:7,8 layered (1) 753:4 layman (2) 767:11,14 lead (1) 703:17 leading (2) 737:12;740:16 leads (1) 824:1 leap (1) 813:14 lease (1) 700:11 leases (1) 700:7 least (3) 793:16;806:20; 822:24 leave (7) 705:7;721:21; 723:12;739:10;754:1; 771:6;808:18 leaves (1) 749:1 left (7) 708:10;719:5; 722:15,20;723:5; 726:20;815:1 left-hand (3) 726:9;728:13;793:22 legislative (2) 698:24;699:2 legitimate (2) 702:4;765:1 length (1) 766:20 Leonard (1) 698:19 less (8) 728:7,7;746:7;766:7; 792:9;798:13;802:22; 821:12 level (6) 746:3;751:4,4; 778:22;825:20,23 levels (17)</p>	<p>706:9,23;726:7; 746:1,10;747:7; 749:17;763:19,20; 766:4;775:13;779:8; 794:12;796:5,9; 798:14;824:24 Levi (2) 695:9.5;818:19 licensed (3) 703:24;731:6;766:14 life (1) 709:4 likely (3) 749:12;751:16; 821:22 Limestone (1) 742:2 limit (1) 708:8 limitation (1) 756:9 limitations (2) 756:7;774:17 Lincoln (6) 696:2;738:5;785:20; 786:8;793:10;828:6 line (19) 708:19;711:16,17; 713:21;714:18;716:10; 738:1;745:6,7;748:1; 756:21;757:15;767:18, 19;770:8;773:23; 777:10,10,12 linear (2) 745:4;748:1 lines (9) 705:6;708:13;713:2; 734:24;735:9,13; 736:3;807:12;812:2 list (1) 827:5 literature (3) 784:1,11;807:19 little (31) 712:5;719:8;724:17, 18,23;726:8;732:3; 733:12,16;736:8; 737:16;741:8;743:3,7; 751:6;753:11,11,14; 765:16;766:19;767:6; 776:14;795:2;808:10; 817:6,11;819:18; 820:19;822:4,6;823:10 lives (2) 753:22;770:1 load (3) 708:23;711:18; 782:20 local (5) 698:19;749:12; 772:18,22,23 location (6) 720:15;727:10;</p>	<p>763:17,23;778:23; 825:4 locations (3) 702:1;717:4;821:20 lockstep (1) 743:20 logs (1) 714:22 long (8) 701:12,14;740:14, 19;747:11;794:9; 795:15;797:10 longer (1) 752:8 longest (2) 716:13;734:22 long-term (2) 779:3;821:16 look (26) 711:17;712:20; 715:23;716:14;722:13; 724:3,13,22;732:23; 738:4;739:1;743:12; 745:24;746:12;751:15; 756:15;766:16,19; 778:23;779:8;787:3,4; 790:14;794:7;810:1,1 looked (4) 716:20;720:2; 746:15;772:5 looking (22) 704:11;717:21; 719:20;723:4;733:1,2; 736:22;744:20;753:4; 755:23;756:14;758:4; 759:6;767:17,17; 778:8;792:17;795:22; 801:12;804:3;822:20; 826:11 looks (9) 712:16;716:18; 719:17;750:17;762:20; 771:2;798:7;813:9; 814:14 Loomis (3) 694:24;830:4,21.5 Los (1) 695:23 loss (2) 730:7;731:1 lost (4) 710:15;733:13; 747:21;799:2 lot (18) 704:2,2,21;706:3; 714:4;721:20;726:1,7; 732:24;733:6;741:14, 24;750:1;765:8; 773:12;795:15;802:24; 826:1 lots (2) 772:24;791:2 love (1)</p>	<p>710:21 Low (17) 695:19.5;707:18,23, 23;708:4;710:12; 718:2,3;729:8;737:23; 750:12;753:7,18; 769:3;777:14;810:8; 813:19 LOWER (15) 694:7.5;698:5; 701:22;726:1;728:21; 737:22;753:16;783:14; 788:3;789:15;797:11; 798:14;802:1;810:10; 812:4 Ltd (1) 695:16 Luke (1) 763:12 lunch (4) 827:7,20;829:4,6 LWRFS (1) 735:2</p>	<p>712:3;726:18,18; 741:11;746:12;764:5; 810:2,14 mapped (2) 726:10;734:4 mapping (2) 741:4;795:24 maps (3) 705:4;733:7;738:20 mark (1) 718:4 Martin (2) 702:18;773:8 Marty (5) 744:9,10;773:7; 793:17;826:10 match (6) 788:5,6;790:11; 795:9;796:5,10 matched (1) 790:11 mathematically (4) 730:21;786:20; 787:22;788:12 MATTER (8) 694:7;698:5;700:12, 22;703:2;733:23; 825:6;830:10 matters (4) 699:13;702:6;825:4, 5 max (1) 812:13 Maxey (8) 712:7,13;756:2; 769:18;770:10;784:5; 797:22;798:4 Maxey-Eakin (2) 797:24;812:14 may (17) 699:15;704:1; 720:11;736:23;737:15; 749:12;754:14,18,20; 785:16,17;793:12; 803:15,17;814:1; 822:9;823:10 maybe (34) 700:14;712:17; 715:19;723:6;724:8; 725:2;736:9;738:7,23; 739:10,11;741:19; 743:7,7;746:16;749:2, 15;750:14,19;761:5, 21;764:7,15;765:6; 767:5;769:8;775:21; 776:5,12;785:15; 792:4,4;820:20;824:1 Mayer (2) 715:9;749:9 Mayer's (1) 762:6 MBOP (4) 697:15,16;701:17;</p>
M				
			<p>MacKenzie (1) 696:3.5 madness (1) 765:11 Maggie (1) 800:6 magnitude (3) 762:13;821:11,12 main (1) 722:16 maintain (1) 821:18 majority (1) 802:7 makes (1) 750:17 making (7) 699:7;706:3;754:5; 761:23;781:18;791:21; 820:14 Malberg (2) 706:2,5 manage (6) 699:3,5;700:2; 824:13;826:5,6 managed (1) 699:9 MANAGEMENT (6) 694:7.5;699:8;780:8; 791:12;792:11;822:8 mandating (1) 700:2 Many (8) 702:10;706:7; 719:12;772:3;781:23; 783:1;787:13;809:12 map (8)</p>	

703:5 Mead (1) 766:3 Meadow (8) 737:22;739:23; 740:1,7,12;763:3; 778:1,1 mean (47) 703:20;706:1; 707:10;709:4;710:2; 711:2;716:22;718:9; 728:13;734:9,11; 738:15,15;739:2; 741:20;745:3;746:12; 755:2;756:6;757:14; 770:21,22;773:2,14; 777:5;778:12,13,17,20, 22;779:4;782:13; 783:3,8;785:4;787:18; 789:4;794:13;796:6; 797:15;802:17;807:18, 19;810:1;818:3; 820:15,18 meaning (1) 756:10 means (3) 710:23;762:9;794:5 meant (1) 758:21 measure (3) 713:9;738:12;808:5 measured (12) 716:21;727:18; 748:24;761:17;762:1; 769:15;796:11,16; 809:2,3,5;816:10 measurement (5) 718:2;745:6,7; 770:16;774:17 measurements (5) 743:14;768:5,19; 770:17,18 measures (2) 821:21;826:8 meeting (2) 705:17;748:11 mega-drought (1) 765:21 mega-droughts (1) 765:23 Melissa (1) 695:6.5 melting (1) 767:7 memory (3) 716:23;736:19; 823:22 mentioned (10) 707:3,3,5,6,7;728:6; 729:20;737:17;764:19; 822:17 mentor (1) 737:11	mesh (4) 711:6;731:12; 782:20;791:15 meshed (1) 711:10 meshing (1) 708:20 messed (3) 816:15,16,17 meter (3) 710:17;730:10,11 meters (2) 727:7;746:7 method (1) 812:14 methodology (2) 756:23;757:3 Michel (3) 694:24;830:4,21.5 MICHELINE (2) 694:4;695:2 Michelle (1) 695:8 microphone (3) 701:6;704:8;742:24 middle (6) 709:18;718:3; 732:11;741:15;750:12; 798:24 mid-test (2) 743:14,18 Mifflin (13) 701:10;702:18; 704:7,21;736:10; 744:10;754:19;773:7, 8,11;783:24;793:17; 806:3 Mifflin's (1) 806:9 might (27) 698:8;731:3,8; 745:10;747:8;751:9, 11;765:24;766:24; 779:10;786:15;791:1; 792:3,3,4;798:7;800:1, 1,3,3,21;804:19; 813:12;814:2,7; 817:24;826:7 mile (2) 759:3;813:23 miles (8) 743:23;744:5,7; 746:19;759:2;776:10; 789:24;792:7 Miller (5) 697:5;763:11,12; 771:10;827:12 million (3) 731:15;732:7,15 millions (1) 800:18 milliwatts (2) 710:17;730:10	mind (5) 712:19;770:4; 795:13;800:11;821:13 mindful (1) 796:1 mine (1) 800:14 Mines (1) 726:13 minimal (1) 825:13 minimum (2) 756:11;826:2 minor (2) 774:16;802:3 minutes (4) 722:10;754:4,11; 827:1 miscellaneous (1) 706:18 mischaracterize (1) 775:3 misestimated (1) 784:4 misleading (2) 728:4;748:17 misrepresent (1) 715:7 missed (1) 812:21 Mississippian (2) 739:2;741:20 mistaken (1) 794:15 misunderstanding (3) 720:10,12;823:11 misunderstood (1) 823:2 mitigation (1) 821:21 MOAPA (9) 694:12.5;696:5.5,9; 698:7,18;785:13; 786:1;821:23;828:2 mode (1) 744:15 model (127) 703:17,19,23;704:3; 705:1,2,8;706:21,24; 707:1,9,13;708:19,19, 24;709:24;710:2,4,21; 711:2,3,13,21;714:8, 19,21,22,23;716:9; 717:1,2,11,12,20,20; 719:4;720:18;722:14; 723:12;725:15,17; 727:16;729:1;730:16; 731:5,7,10;733:11,12, 19;734:5;735:20; 737:7,18,18,20;738:3; 741:1;742:6,13;746:6; 748:6;770:19;771:4; 774:3,4,5;777:15,15;	779:6;780:16;781:3,3, 6,8,9,14,18,24,24; 782:7,9,11,11,13,14,18, 21,23;786:12,14,17,20; 787:8,10,16,20,21,23; 788:2,8,20,21;789:11, 14;790:2,3,8,21;793:5, 5,7;794:8,16,17,19; 795:1,7;796:17,18; 809:15,16;810:7; 813:18;816:13;817:2, 10 modelers (3) 714:9,10,10 modeling (4) 730:20;753:3;764:3; 779:16 models (6) 717:17;733:12; 782:12;787:12,13,15 modern (1) 752:18 modification (1) 741:6 moisture (1) 799:24 Mojave (1) 801:11 molecule (1) 811:6 moment (4) 773:6;785:14,17; 803:13 money (2) 700:2;780:3 Monitor (1) 723:2 monitored (1) 814:4 monitoring (2) 745:22,23 monthly (1) 743:14 months (2) 779:24;796:9 more (39) 698:8;702:2;704:2; 706:4;712:15;717:6,6; 726:3;727:24;728:21; 730:7;736:4,21;742:2; 743:2,7;750:17;755:3; 757:13;765:1;766:21; 772:23;775:22;798:6; 802:11;803:9,9,10,10; 805:13;812:20;814:7; 819:19,22;821:12; 825:11,11;826:11,15 Mormon (1) 733:20 morning (11) 698:4;755:18,20,21; 763:12,14;771:23,24; 773:13;786:9;820:23	Morrison (7) 696:9.5;785:14,16, 19,20,22;828:4 most (15) 701:21;703:1;705:2; 709:10;713:19;728:18; 745:23;749:7,12; 750:24;757:7;767:5; 802:5;810:3,5 mostly (2) 723:6;806:18 Mountain (11) 708:4;724:7,17; 725:18;730:3;734:19; 742:16;746:24;812:15; 816:7;821:5 MOUNTAINS (37) 694:9.5;704:15; 709:1;724:8,13,22; 725:1,19,21,23,24; 726:2;727:19;733:20, 21;734:10;737:3; 739:24;740:1,7,11,12; 749:2,3;752:24; 753:16;763:4;778:1; 784:5;801:22;806:4; 809:21,24;812:12,18; 814:20;818:9 mouth (1) 734:18 move (12) 719:1;730:24;731:1; 733:14;736:2,9;737:4; 757:16;761:14;771:18; 799:3;821:13 moves (1) 740:18 moving (8) 718:23;721:4; 728:24;729:1;731:19; 743:20;785:18;809:18 MRSA (5) 702:1;708:17;733:9; 814:10,11 much (36) 698:13;705:24; 708:12;710:14,15; 725:13;729:4;731:1; 732:24;736:23;739:8, 10;740:22;741:2,3; 743:3;746:7;749:3; 751:3;754:2;772:23; 780:17;783:22;791:8; 792:4;802:11,16,22; 808:1;810:18;812:18; 819:19,21;820:20; 821:10;826:14 mud (1) 751:20 MUDDY (58) 694:12;700:8,8,10; 702:1;712:12;714:23; 716:5,12,21;719:2,6,9,
---	---	--	---	--

<p>10;720:2,2,13;721:13; 725:10;731:23;733:4, 17;736:16;737:3; 749:6,7,20;752:8; 761:16,24;762:15,17, 21,24;763:17,22;765:3, 14;767:13;769:14; 771:2;777:22;778:4; 781:7;798:3;805:12; 811:14;812:22;813:9, 10;814:7,14;819:18; 821:23;823:13,17; 828:1,20 multiple (4) 699:8;715:17,22; 769:23 municipal (1) 800:8 must (2) 787:10;820:13 MX (2) 745:21;816:23 MX-4 (14) 757:21,22,24; 758:12,24;759:2,5,23; 774:9,10;775:12,21; 778:3;788:8 MX-5 (10) 744:2;759:7,23; 774:6,11,17;775:5; 776:7;778:3;806:4 MX-6 (2) 734:21;735:5 myself (1) 780:24</p>	<p>803:14;805:18 needed (1) 816:19 needs (7) 707:3;708:18; 733:18;749:15,17; 783:17;825:17 negative (7) 717:8,8,12;745:2; 749:20,22;762:16 neighbors (1) 700:16 Nellis (1) 706:17 nested (1) 708:12 net (1) 808:7 NEVADA (39) 694:1;695:17,20,5; 696:4,5,7,5;699:1; 700:6,11;701:15; 707:21;712:14;720:11, 24;721:2;723:1; 736:12;747:6,17; 748:10;751:23;769:19; 771:19;772:2;773:9; 798:5;801:16;804:7, 21;806:10;809:8,18; 811:13,18;823:3; 827:17;830:1,7,8,17 Nevada's (1) 802:8 new (7) 705:22;706:10; 784:6,9;789:21; 803:19;826:4 newspaper (1) 719:2 next (16) 712:2;716:17; 720:19;733:14;737:13; 741:10;763:8;766:16; 771:3;776:13,19; 785:13;796:22;805:19; 811:9;816:2 Nobody (5) 733:5;735:23;740:4; 776:7;783:2 nobody's (3) 707:5;729:24;783:1 Nodded (1) 799:8 no-flow (1) 795:8 nominal (1) 705:11 nonlinear (1) 710:23 nonuniformity (3) 826:12,13,13 noon (2) 827:1;829:4</p>	<p>normal (3) 709:12;718:5;766:8 normally (3) 717:15;750:11,11 North (29) 696:12,5;712:3; 724:2,10;725:8,20; 726:4;729:12;731:15; 734:22;737:3;739:22; 746:22;747:4;750:17; 770:15;796:22;801:11, 19,21;802:5;814:19; 815:4,10,13;823:3,5; 824:2;828:10 north/south (5) 709:7;728:17,19; 733:3,6 northeast (6) 729:2;809:18; 815:18,19,22,24 northern (9) 724:3;725:5,6,6; 742:12;745:11,23; 812:23;821:11 northward (1) 801:18 northwest (3) 729:14,16;816:20 northwestern (1) 734:20 note (1) 786:1 noted (2) 712:10;739:21 notes (3) 794:5;830:7,14 nourish (1) 749:6 nuclear (1) 708:8 Number (22) 700:11;703:23; 705:2;706:15,15; 716:23;723:5;740:9; 746:6;752:4;753:6; 756:11;787:22;789:21; 791:16;794:10;797:9, 13;799:4;806:6; 814:23;824:17 Numbers (6) 703:5;728:21,22; 745:18;817:15;821:4 numerical (10) 708:7;709:23;710:1; 727:23,24;753:3; 781:3,9,24;782:9 numerically (2) 768:13,14 numerous (1) 747:12 NV (3) 695:24;698:1;830:22</p>	<p style="text-align: center;">O</p> <p>o0o- (1) 698:2 object (1) 745:10 objected (1) 705:18 objection (2) 698:22;699:11 observation (7) 715:11;717:15; 759:23;769:12;770:19, 19;823:15 observations (5) 750:2;767:19,20; 788:2;789:14 observe (1) 804:11 observed (2) 716:9;746:10 obstacle (2) 764:8,11 obstacles (1) 733:7 obstructing (2) 737:8;738:22 obtained (1) 767:3 obvious (1) 739:9 obviously (5) 766:4;794:13; 797:13;809:4;826:1 occur (2) 721:12;778:19 occurred (1) 774:7 occurring (1) 725:14 occurs (5) 720:19;723:13; 778:19;782:2;801:16 O'Connor (1) 695:18 off (28) 707:10;708:19,24; 710:19,20;712:2,5; 714:5;716:23;719:1; 720:1;723:11,14,15; 725:1,9;726:16; 730:16;741:7,15; 760:8;767:3,6;772:16; 799:1;805:17;808:9; 817:17 offer (5) 701:20;702:4,20; 703:5;750:3 office (1) 702:12 OFFICER (48) 694:4;695:2,5,7;</p>	<p>697:12;698:4;700:19; 703:7;704:7,10;754:7, 19,21;755:2,6,12,15; 763:8;771:13,17; 780:20;785:7,11,24; 793:13;796:22;797:1; 803:17,22;804:2,9; 810:23;811:9,12,17; 819:8;826:24;827:10, 13,16,21;828:1,5,10, 13,17,19,24;829:3 offset (6) 738:12,13,15,15,17; 748:12 offsets (1) 747:13 old (1) 769:12 older (1) 740:20 oldest (2) 718:1,2 once (5) 698:11;715:14; 740:23;747:21;826:11 one (102) 699:5;700:12,15; 704:15;707:15;708:3, 10;709:5,24;711:1; 713:12;714:21,21; 715:5,24;716:16; 717:2,13,21,21,21; 718:13,13,16,17,21; 719:20,21,22;720:10; 721:21;722:1,20; 726:16;727:11;730:14, 19;731:2,14;733:13; 734:6,22;735:13; 736:12,13;738:5,7,7; 740:17;741:18,18; 742:21;743:21,22; 747:5;748:6;749:9; 750:3,16;751:16; 753:3;756:1;757:13; 758:3;760:2;763:24; 764:23;765:6;766:21, 22;767:4;768:11,12,15, 15,16,16;770:2,3; 772:10,12,13;777:6; 778:13;782:6,14,16,19; 788:10;789:17;792:11; 794:10;796:7,17; 798:13,21;803:13; 805:12;806:7;812:20; 823:13,20 one-dimensional (2) 727:16;730:23 one-foot (1) 759:9 ones (7) 740:20;743:13; 747:11;772:6;798:24; 814:22;820:22</p>
--	---	---	---	--

<p>only (33) 698:24;699:14; 708:21;711:8;717:2,4; 724:10;735:9;736:9; 743:6;744:3,4;745:13; 748:11;749:13;756:13; 762:15;766:22;767:6; 770:3,8;775:11,14; 776:22;779:16;780:2; 781:18;801:16;817:19; 820:11;822:17;827:19, 22</p> <p>onto (1) 821:13</p> <p>open (5) 713:14;754:14; 785:20;811:19;827:3</p> <p>opinion (13) 719:22;720:23; 726:5;757:7;781:15; 784:11;813:11;822:2, 8,23;823:7;824:5,12</p> <p>opinions (3) 702:6,9,19</p> <p>opportunity (2) 725:9;766:12</p> <p>oranges (2) 729:13;772:20</p> <p>ORDER (15) 694:17.5;698:6; 699:1;702:13;710:16; 744:12;759:8;762:11; 775:6,23;777:3; 779:20;787:11;806:5; 819:14</p> <p>orient (1) 716:4</p> <p>orientation (4) 729:16;734:17; 736:5,7</p> <p>orientations (1) 790:18</p> <p>original (4) 699:21;702:14; 748:7;777:18</p> <p>originating (1) 809:18</p> <p>orogeny (1) 742:16</p> <p>Ortvision (2) 726:11;741:23</p> <p>others (3) 716:24;790:19; 822:18</p> <p>Otherwise (2) 780:22;818:1</p> <p>ought (1) 708:13</p> <p>out (57) 699:18;704:20; 706:4;707:10;710:10; 715:13,23;717:2,20; 723:21;731:11;732:17;</p>	<p>733:19;734:1;735:23; 737:1,8,20;739:8; 742:1,14;745:21; 749:10;751:9;762:18; 764:2,5,9,17;766:15, 21;767:20;768:3; 776:9;777:14,17; 778:1;780:10;784:15; 785:17;786:21;789:24; 790:19;791:4;801:14, 23;803:20;812:14; 816:13,21;817:5; 818:11;820:16;822:23; 825:1;826:9,17</p> <p>outflow (2) 735:20;817:1</p> <p>outlet (1) 766:9</p> <p>outlier (2) 772:12;773:5</p> <p>outliers (1) 784:15</p> <p>output (1) 766:20</p> <p>outputs (1) 788:13</p> <p>outside (1) 699:14</p> <p>over (30) 708:13;709:1; 723:19;727:2;728:24; 729:5;730:5;731:21; 732:3;734:1;742:5,5, 18,19;744:12;752:4; 756:24;775:20,20; 789:23,24;796:8,9; 804:21;805:1;816:11; 817:5,11;820:10; 821:11</p> <p>overall (1) 817:9</p> <p>own (9) 702:17;711:8; 729:18,18;740:22; 764:2;782:23;784:12; 806:8</p> <p>owns (1) 807:21</p> <p>oxygen (2) 721:8;752:20</p>	<p>Page (20) 739:19;742:22; 757:18;758:9,16,18; 776:14,15;785:2,3; 792:12,16,17;793:19, 19;805:11;812:1; 819:11,17;821:15</p> <p>Pages (3) 694:19;755:7;830:13</p> <p>Pahrnagat (18) 708:10,11,11; 728:20;729:1,3;738:8, 13;809:22;810:6,14,16, 20,20;811:4;813:1; 815:2,7</p> <p>Pahrump (2) 725:17,22</p> <p>Paiute (1) 698:7</p> <p>Paiutes (2) 696:5.5;698:19</p> <p>Paleozoic (4) 742:8;746:11,14; 753:17</p> <p>Palisade (3) 715:15;800:7,13</p> <p>Palisades (2) 799:21;800:22</p> <p>panel (1) 743:2</p> <p>paper (4) 700:13;714:17; 782:13;795:16</p> <p>paragraph (1) 792:22</p> <p>parallel (6) 714:22;729:7; 740:18;769:2;807:7,12</p> <p>parameters (2) 786:17;788:13</p> <p>Park (9) 696:14;771:13,15, 18;798:10;801:6,7,10; 827:13</p> <p>part (19) 703:22;724:18; 737:19,19;740:20; 742:16;772:15;777:16; 787:2;790:13,13; 793:16;798:18,19; 801:7;805:23;810:2, 22;811:3</p> <p>partially (1) 787:8</p> <p>participant (2) 754:12;785:13</p> <p>participants (4) 702:15;703:3; 754:15;827:2</p> <p>particular (3) 710:20;800:6;807:19</p> <p>parties (2) 699:15;702:23</p>	<p>parts (2) 716:24;795:13</p> <p>party (1) 700:14</p> <p>pass-through (1) 820:11</p> <p>past (7) 705:3;752:4;754:13; 756:1;765:2;770:6; 804:21</p> <p>path (1) 807:7</p> <p>paths (2) 763:1;814:2</p> <p>Patrick (2) 696:15.5;797:6</p> <p>pattern (2) 752:3,4</p> <p>Paul (3) 695:16.5;772:1; 785:4</p> <p>peak (2) 712:12;735:14</p> <p>Pederson (1) 762:6</p> <p>peer (3) 782:1;794:23;806:14</p> <p>pen (1) 787:17</p> <p>penetrating (1) 794:15</p> <p>Peninsula (1) 732:6</p> <p>people (6) 708:4,5,14;709:15; 721:17;783:1</p> <p>per (13) 700:10;705:10; 710:17;727:7;730:10, 10,10,11;734:5;745:2; 746:7;805:20;808:3</p> <p>percent (1) 805:13</p> <p>perennial (4) 706:5;720:15;802:8; 826:19</p> <p>perfect (1) 768:17</p> <p>perfectly (1) 707:5</p> <p>perform (1) 779:16</p> <p>perhaps (2) 792:11;810:5</p> <p>period (6) 756:10;780:10,11, 15;791:13,14</p> <p>periodic (2) 756:24;757:4</p> <p>periodicity (1) 804:18</p> <p>periods (1) 757:1</p>	<p>permeabilities (1) 782:15</p> <p>permeability (7) 729:7,8;736:6,6; 764:9,12;774:23</p> <p>permeable (1) 742:18</p> <p>permits (2) 706:8;809:10</p> <p>perpendicular (2) 729:8;736:2</p> <p>persists (1) 821:17</p> <p>person (4) 700:14;747:15; 784:1;827:22</p> <p>perspective (1) 822:7</p> <p>pertain (1) 800:4</p> <p>pertinent (1) 810:5</p> <p>perturbed (1) 719:14</p> <p>Peterson (10) 696:4;697:7;786:3,4, 6,7;793:12,14;796:20; 828:8</p> <p>ph (1) 708:14</p> <p>philosophical (1) 743:22</p> <p>photo (1) 784:18</p> <p>phrase (1) 739:24</p> <p>phreatophyte (1) 753:21</p> <p>phreatophytes (2) 753:12,22</p> <p>physical (3) 749:23;750:2;791:6</p> <p>physics (1) 772:22</p> <p>pick (2) 747:2;786:17</p> <p>picked (1) 742:6</p> <p>picking (1) 753:18</p> <p>picture (2) 728:23;772:17</p> <p>pictures (1) 782:13</p> <p>piece (2) 719:21;767:6</p> <p>pieces (1) 717:3</p> <p>pine (1) 723:16</p> <p>pinos (2) 714:18;723:24</p> <p>pipe (1)</p>
	P			
	<p>Pacific (2) 811:10;828:17</p> <p>pack (1) 713:11</p> <p>package (1) 780:6</p> <p>packet (1) 758:4</p> <p>pad (1) 774:19</p>			

<p>736:4 pipeline (1) 706:8 place (11) 704:23;735:3,10; 751:1;759:17;782:16; 791:9;796:17,18; 814:9,11 places (5) 729:13;739:1,2; 770:21;775:20 plainer (1) 723:11 plan (1) 829:3 planned (1) 776:5 plate (2) 731:16;732:7 Plateau (6) 723:19;731:20; 732:2,4;801:7,20 play (4) 731:17,18;732:12,12 plaza (1) 737:2 please (4) 701:4;715:7;778:16; 818:22 plenty (3) 721:21;725:8;802:20 plot (1) 774:4 plunging (1) 801:18 plus (5) 742:10;768:11,12, 15,16 pm (1) 829:5 point (37) 699:18;704:4;712:9; 713:7,7,12,13,23; 714:14;719:4;720:9,9; 722:19;723:8,9;728:1, 12;738:24;739:6; 741:14;743:22;751:2; 753:13;758:16,16; 760:8;772:21;784:2, 10;788:24;789:1; 790:10;792:1;800:16; 808:9;810:9;824:23 pointed (3) 745:21;749:10; 826:17 pointer (6) 709:15;719:5; 725:19;728:24;753:14; 815:6 pointing (25) 709:19;714:2,6; 719:5;723:3,5;724:16, 16;725:4,19,20,22;</p>	<p>726:8;728:20,24; 730:6;732:5,5,10; 734:24;741:2;743:5; 744:21;815:6;816:20 points (3) 763:24;772:24; 781:17 policy (2) 699:3,13 pond (1) 798:1 Ponderosa (1) 723:24 pool (3) 716:14,15,18 PORTION (6) 694:9;727:18; 809:24;811:4,5;817:24 position (2) 797:12,15 positive (4) 715:24;717:5; 766:22;770:3 possesses (1) 699:20 possibilities (1) 770:2 possible (1) 703:1 possibly (2) 792:7;814:5 postulates (1) 784:2 potable (1) 704:23 potential (2) 790:24;799:15 potentiometric (2) 705:4,4 Power (3) 712:14;736:12;798:5 powerful (1) 791:2 PowerPoint (5) 700:13;718:13; 755:3;776:14;785:3 practicing (2) 701:11;743:22 preceding (1) 715:11 precip (3) 715:4;721:9;798:3 precipitation (5) 769:10;804:6,13,16; 805:1 precisely (1) 758:17 predict (2) 751:13,14 predictable (1) 777:8 predictions (1) 717:1</p>	<p>predictive (1) 786:19 prefer (1) 703:2 preferred (4) 729:18;734:16; 736:5,7 preliminary (2) 708:2,3 pre-Mississippian (1) 721:1 prepared (2) 747:13;806:10 preparing (1) 760:15 present (8) 702:23;704:12; 705:1,5;707:13;714:3; 732:19;830:7 presentation (8) 698:11;700:13; 703:14;755:3;773:19; 786:11;812:1,21 presented (10) 701:17;718:12,14; 737:6;748:10;766:11; 773:12;775:19;783:8; 824:18 presenters (1) 810:19 presently (1) 701:22 presumably (1) 702:2 pretest (1) 748:8 pretty (16) 714:12,13;716:18; 723:22;724:21;729:4; 744:2;748:3;759:4; 767:15;791:8;795:24; 796:10;810:18;816:24; 821:10 previous (3) 797:16,19;806:23 previously (3) 819:20,22,24 price (1) 780:13 primarily (1) 803:3 primary (1) 709:10 principal (2) 728:16;729:2 principle (4) 729:17;815:3,11,23 print (1) 803:19 printed (1) 772:5 prior (8) 714:24;718:19,20;</p>	<p>782:8;791:15;795:2; 820:10;823:14 priority (2) 699:22,23 probably (20) 700:14;710:16; 723:24;730:5,7; 731:17;732:11,12; 737:3,4;749:21;755:3; 788:24;803:8;812:23, 24;813:1;814:20; 815:12;820:18 problem (15) 707:22;722:23; 727:12;734:12;747:17, 20;755:13;761:13; 766:11;789:12;790:6; 800:6;814:15;826:20, 21 problems (1) 722:4 procedure (2) 760:4;768:1 proceed (1) 740:5 proceeding (6) 699:6,14;701:19; 711:14;772:4;785:18 PROCEEDINGS (7) 694:15.5;698:6,23; 727:14;730:17;735:7; 765:19 process (4) 706:23;787:24; 812:17;826:4 produced (3) 705:24;759:13; 770:15 production (3) 734:22;809:4;826:18 Professional (5) 695:8.5;712:20; 719:22;726:5;823:7 professor (1) 737:10 proffered (1) 763:16 program (2) 768:21;792:24 project (2) 736:12;748:1 projected (1) 748:8 projection (1) 770:24 projections (1) 770:8 propagating (1) 762:12 propagation (1) 793:3 properties (4) 746:21;760:4;</p>	<p>782:21;791:7 property (1) 774:19 proposed (1) 819:14 protect (1) 753:19 protecting (1) 821:23 proud (2) 796:17,18 prove (1) 821:22 proved (1) 825:24 provide (3) 699:6;778:18;813:11 provision (1) 699:1 proxied (1) 823:19 proxy (13) 713:5,7,10,12,22; 714:3,15;721:5;734:6, 8;749:16;757:7;799:23 PUBLIC (1) 694:16.5 publication (1) 794:21 publish (1) 733:12 published (5) 735:20;739:23; 794:20,22,24 pull (1) 803:14 pulse (1) 769:8 pulses (1) 749:14 pump (4) 744:3;759:19; 760:12;777:5 pumping (69) 705:9;706:17,18; 743:10,11;744:11; 748:5,14;750:4; 751:15,17;757:20; 758:24;759:2,7,8,23; 760:6,9,11,15,16,17; 761:1,2,3,9,10,15,24; 762:12;765:10;774:7, 10,11,11,14,17;775:5, 6,12,13,23,24;776:2,7; 777:3;778:19,20,24; 779:11;792:16;793:4; 798:23;819:2,4,17; 821:18,20;825:3,4,7,8, 10,11,20,23;826:2,6 purely (3) 741:19;750:21;808:4 purple (1) 728:21</p>
--	--	---	--	---

purpose (5) 791:1;812:5,6,8; 821:21	740:11;749:13;750:16, 21;770:15;810:3,4; 814:21;815:10;816:7; 822:4;824:3	rebuttal (4) 702:16;720:9; 747:18;805:17	821:17	794:19;802:4,12; 804:7;816:10;818:12
purposes (2) 745:13;787:12	rate (4) 718:19,19;760:11; 808:8	recall (10) 759:18;760:11,13, 13,14;773:24;775:4; 786:22;798:12;817:9	recover (1) 748:15	regionally (7) 720:23;721:1; 726:12;734:8;741:21, 22;746:17
put (15) 698:20,21;699:12; 708:7;717:23,23; 733:22;752:15;759:21; 764:8;776:9;780:13; 789:4;794:10;795:7	rates (9) 760:15;761:3; 799:10,14,15,16,18,22; 800:4	recap (1) 744:19	recovery (5) 743:15,18;752:10; 776:6;798:24	regression (5) 717:24;745:4;748:1; 766:15;769:23
putting (2) 699:16;738:14	rating (1) 735:1	receives (1) 798:23	recreate (1) 782:18	regressions (2) 715:17,23
Q	ratio (3) 709:6;727:22;728:7	recent (3) 759:18,20;789:17	red (13) 704:18,18;708:10; 709:20,23;735:13; 736:20,20;745:7,7; 752:3,3;764:24	regulations (2) 699:7;708:7
quantify (2) 819:23;820:9	rational (1) 742:12	Recess (2) 785:10;829:6	REDIRECT (4) 697:2;754:4;827:23; 829:1	Reich (1) 775:1
quantitative (1) 792:10	rational (1) 742:12	recharge (52) 707:15;713:11; 714:16;720:17,19,20; 722:21,22;723:10,13, 15;724:1,9,11,12,16, 21;725:11;726:21,21; 727:7;749:13;752:18; 782:15;790:1;799:10, 14,15,15,17,22;800:4; 801:15,18;802:1,6,8, 14,20,20;803:2;810:8; 816:3,14;817:4,6,18, 19,20,24;818:2;821:5	reds (1) 735:11	reinforces (1) 724:23
quantities (1) 812:18	rationale (1) 763:20	recharged (1) 752:18	reduced (2) 729:8;764:8	reinjecting (1) 705:10
quantity (4) 735:19;789:22; 816:9;820:17	reach (2) 706:10;730:22	recharges (2) 720:23;818:3	reduction (3) 759:9,14;764:12	reinventing (1) 737:12
quartz (1) 742:8	reached (1) 705:22	recharging (1) 721:9	redundant (1) 771:7	related (4) 701:24;702:5; 708:15;808:6
query (1) 735:15	read (4) 704:1;735:4;782:12; 793:21	recognize (1) 825:19	refer (3) 705:13;739:3;756:18	relates (1) 755:22
quickly (1) 796:8	reading (3) 719:2;727:23;799:12	recognized (1) 739:23	reference (15) 743:24;744:13,16; 745:2,3;751:3;757:21, 22;759:5;762:19; 764:18;765:12;789:17; 809:12;823:8	relation (1) 706:1
quit (1) 736:20	real (4) 713:8;718:4;780:13; 783:10	reconnect (1) 747:21	referenced (1) 707:21	relations (1) 819:13
Quite (3) 701:20;716:12;820:1	realistic (2) 710:3,3	recognizing (2) 813:15,16	references (3) 806:7;817:13;820:23	relationship (3) 757:23;758:12;779:5
quote (1) 814:17	realistically (1) 826:12	recommend (2) 756:23;757:3	referred (1) 777:22	relationships (1) 792:10
R	reality (1) 797:15	recommendations (1) 748:21	referring (2) 709:16;761:11	relatively (1) 729:8
radiocarbon (1) 822:14	really (34) 705:24;706:12; 708:6,14;710:15; 711:22;713:6;719:4; 735:15;738:24;748:17; 750:14;752:1;754:1; 756:14,16;760:20; 766:10;768:22;770:2; 780:5,6;781:20;783:2, 2;788:2;790:21; 814:15;817:19;820:14, 15,24;825:4;826:19	recommended (1) 791:5	refuge (2) 752:9;814:9	relevance (1) 705:18
rain (4) 712:6;713:9,10; 767:6	reason (13) 719:16;721:21; 741:19;763:17,21; 766:23;776:3;790:13; 794:9;804:20,24; 808:11;827:20	reconnect (1) 747:21	regard (1) 792:16	relationships (1) 792:10
rainfall (2) 757:1,2	reasonable (8) 741:18;759:16; 786:19;787:2,3,4; 788:13,13	record (37) 698:21;699:11,19; 701:4,18;703:6,22; 709:15;713:13,17,20; 714:7,8;715:15,18; 716:15;718:23;744:17; 747:8,10,10,18,19; 756:10;760:2;770:7,8; 780:23;785:12;786:1; 798:3,3,6;805:3; 811:23;813:7;818:19	regarding (5) 699:8;705:18;773:1; 775:5;781:15	reliant (1) 789:4
raining (1) 802:24	reasons (1) 730:5	recorded (1) 790:4	regardless (1) 828:15	relied (1) 764:21
raise (1) 702:4	rebuilding (1) 751:19	records (4) 734:22;745:5;757:7;	regime (2) 740:15;800:22	rely (2) 789:1;808:2
ramp (5) 714:2;738:23;739:7; 764:7,15			regional (31) 707:8;712:22; 720:20,22;721:13; 722:23,23,24,24; 724:11;734:6,12,12; 746:9;747:3;752:5; 753:2,13,23;772:17,21, 22;781:7;789:18,19;	remain (1) 777:20
ramp's (1) 740:6			region (2) 781:16;782:8	remaining (1) 754:14
ran (1) 780:10			regional (31) 707:8;712:22; 720:20,22;721:13; 722:23,23,24,24; 724:11;734:6,12,12; 746:9;747:3;752:5; 753:2,13,23;772:17,21, 22;781:7;789:18,19;	Remember (11) 726:22;731:4; 732:14;734:7;736:19; 746:23;759:16;761:12; 795:14;796:14;818:13
Ranch (1) 734:19				remind (2) 704:8;786:16
Range (23) 723:2,2,3;724:19,21; 725:2,3,6,9,11;732:3;				remote (2) 702:2;759:7
				removed (2) 787:7;800:17

removing (1) 729:23	766:8	795:1,8,20;799:5;	rotations (1) 728:11	satisfying (1) 704:23
Reno (2) 695:20.5;696:7.5	RESOURCES (7) 694:2,3;698:17;	807:8;814:17;815:5,6,	rough (1) 706:15	save (1) 754:4
report (36) 702:14,16;703:6;	748:10;802:18;811:20;	823:22;826:24;828:8	roughly (6) 717:15;734:15;	saw (5) 730:3;733:6;748:17;
708:18;710:13;722:1,	830:9	right-hand (1) 727:9	737:22;767:16;775:21;	765:7;785:14
2,3;734:7;741:6;	respect (2) 821:15;825:7	rights (14) 699:17,17,20,22,24;	779:23	saying (18) 720:12,14;729:5;
745:17;748:7,7,20;	response (22) 712:18;716:8;	700:3,4,5,9,10;701:24;	routine (1) 766:19	757:6;768:18;769:11;
749:21;757:18;758:9;	717:24;718:5;743:10,	706:18;823:4;826:19	Rowley (1) 739:19	770:9;781:21;810:9,
764:19;766:18;773:4;	11;744:11;749:9,17;	Rim (1) 731:23	RPR (2) 694:24;830:21.5	12;818:8;820:3;
774:2;799:7;801:1;	750:9;751:1,2;760:5;	Rim's (1) 738:12	Ruby (6) 724:4,7,7;801:22;	822:23;823:12,13,21;
804:5;805:11,18;	765:13;767:13,14,23;	ring (11) 713:4;714:3,11,11;	809:21,24	825:9,16
806:2,8,10,14,17;	769:20;822:3,23;	721:6,7,10;726:20;	rule (1) 699:7	scale (1) 707:7
807:4,5;819:12;	824:6,8	722:18;723:10;724:10;	rulings (1) 712:24	scaled (1) 725:13
821:16;822:11	responses (2) 792:7;819:1	725:10;726:10;727:10;	run (6) 707:10;709:18;	scene (1) 769:19
Reported (1) 694:24	responsibility (1) 700:2	728:10;729:10;730:10;	731:11;766:14;767:8;	Schell (2) 723:2;810:2
Reporter (5) 727:14;730:17;	responsible (1) 765:2	731:10;732:10;733:10;	827:5	schematically (1) 738:16
735:7;780:23;830:4	rest (1) 770:1	734:10;735:10;736:10;	runaway (1) 706:13	school (1) 822:19
reports (16) 702:8,11,17;704:2;	restrict (1) 708:7	737:10;738:10;739:10;	running (1) 733:23	Schreck (1) 695:22
720:9;726:14;772:4,8,	resulting (1) 757:19	740:10;741:10;742:10;	runoff (1) 724:5	Schroeder (4) 696:11,11.5,12.5,13
11,14;779:23;806:16,	results (4) 705:2;707:13;787:2;	743:10;744:10;745:10;	run-off (1) 768:9	Sciences (1) 765:19
18,20,24;807:2	809:20	746:10;747:10;748:10;	runs (1) 796:8	scientific (4) 781:14;783:18;
represent (3) 728:16;753:12;772:1	resume (3) 785:8;827:6;829:4	749:10;750:10;751:10;	RW-2 (1) 759:24	825:21,22
representation (3) 730:6,8;801:13	review (2) 782:1;794:23	752:10;753:10;754:10;		scientist (1) 783:20
representations (2) 725:13;774:22	reviewed (5) 702:15;773:14,16;	755:10;756:10;757:10;	S	scientists (1) 782:1
representative (3) 698:10;720:16;	782:8;806:14	758:10;759:10;760:10;	safe (1) 744:2	scope (2) 699:14;774:3
796:16	Revised (1) 699:2	761:10;762:10;763:10;	Salt (1) 732:1	scoping (5) 774:4,5;781:18;
represented (3) 715:1;749:7;764:13	revocation (1) 809:9	764:10;765:10;766:10;	Salzer (2) 713:4;714:17	786:17,20
representing (3) 716:8;719:9;786:7	revoked (1) 706:8	767:10;768:10;769:10;	same (23) 712:15;714:7;	Scouts (1) 716:14
represents (4) 769:8;770:5;799:13;	revolution (1) 713:24	770:10;771:10;772:10;	718:17;719:12,18;	scratch (1) 716:22
815:17	Rick (1) 748:10	773:10;774:10;775:10;	729:4;734:24;735:6;	screen (2) 743:4;815:6
reproduce (1) 794:11	right (57) 700:5;707:17;	776:10;777:10;778:10;	742:22;758:22;774:19,	screwy (1) 747:23
Republic (1) 811:10	711:18;722:16;726:20;	779:10;780:10;781:10;	798:19;790:17;	search (1) 715:14
requested (1) 819:14	727:18;729:19;738:6,	782:10;783:10;784:10;	813:19,22;814:9,11;	searches (1) 767:4
required (1) 756:11	6,16;739:15;744:3;	785:10;786:10;787:10;	818:10;830:10	Seattle (1) 737:7
requiring (1) 779:21	752:24;755:9;757:22;	788:10;789:10;790:10;	sample (2) 741:8;745:13	second (1) 730:12
reservation (1) 699:22	762:16;764:18;766:10;	791:10;792:10;793:10;	San (1) 732:12	secondly (2) 699:5,12
reserved (1) 699:20	770:20;772:11;773:22;	794:10;795:10;796:10;	sandstone (4) 704:17,19;736:20,20	seconds (1)
resin (1) 729:13	774:7,20;776:19;	797:10;798:10;799:10;	Sass (1) 708:2	
resolution (1) 714:12	777:12,13;778:7;	800:10;801:10;802:10;		
resolve (2) 748:18;774:15	781:4,9;782:2;783:16,	803:10;804:10;805:10;		
resource (1)	20;785:2,11,15;	806:10;807:10;808:10;		
	786:22;788:23;791:9,	809:10;810:10;811:10;		
	9;792:23;793:6;794:4;	812:10;813:10;814:10;		
		815:10;816:10;817:10;		
		818:10;819:10;820:10;		
		821:10;822:10;823:10;		
		824:10;825:10;826:10;		
		827:10;828:10;829:10;		
		830:10;831:10;832:10;		
		833:10;834:10;835:10;		
		836:10;837:10;838:10;		
		839:10;840:10;841:10;		
		842:10;843:10;844:10;		
		845:10;846:10;847:10;		
		848:10;849:10;850:10;		
		851:10;852:10;853:10;		
		854:10;855:10;856:10;		
		857:10;858:10;859:10;		
		860:10;861:10;862:10;		
		863:10;864:10;865:10;		
		866:10;867:10;868:10;		
		869:10;870:10;871:10;		
		872:10;873:10;874:10;		
		875:10;876:10;877:10;		
		878:10;879:10;880:10;		
		881:10;882:10;883:10;		
		884:10;885:10;886:10;		
		887:10;888:10;889:10;		
		890:10;891:10;892:10;		
		893:10;894:10;895:10;		
		896:10;897:10;898:10;		
		899:10;900:10;901:10;		
		902:10;903:10;904:10;		
		905:10;906:10;907:10;		
		908:10;909:10;910:10;		
		911:10;912:10;913:10;		
		914:10;915:10;916:10;		
		917:10;918:10;919:10;		
		920:10;921:10;922:10;		
		923:10;924:10;925:10;		
		926:10;927:10;928:10;		
		929:10;930:10;931:10;		
		932:10;933:10;934:10;		
		935:10;936:10;937:10;		
		938:10;939:10;940:10;		
		941:10;942:10;943:10;		
		944:10;945:10;946:10;		
		947:10;948:10;949:10;		
		950:10;951:10;952:10;		
		953:10;954:10;955:10;		
		956:10;957:10;958:10;		
		959:10;960:10;961:10;		
		962:10;963:10;964:10;		
		965:10;966:10;967:10;		
		968:10;969:10;970:10;		
		971:10;972:10;973:10;		
		974:10;975:10;976:10;		
		977:10;978:10;979:10;		
		980:10;981:10;982:10;		
		983:10;984:10;985:10;		
		986:10;987:10;988:10;		
		989:10;990:10;991:10;		
		992:10;993:10;994:10;		
		995:10;996:10;997:10;		
		998:10;999:10;1000:10;		

711:3 Section (10) 695:7,10;721:2; 724:6;739:5,22; 740:21;741:3;746:13; 764:14 sections (1) 739:21 seducting (3) 732:20,21,21 seduction (1) 732:14 seeded (1) 821:23 seeing (10) 721:10;771:17; 778:14;785:19;797:1; 811:12,17;815:18,18; 828:19 seem (3) 750:1;769:17;801:15 seemed (1) 712:12 seems (10) 719:8;742:2;743:21; 749:7;750:22;765:10; 767:14,15;770:19; 772:23 segment (1) 708:19 segments (1) 747:10 select (1) 789:19 selected (2) 726:17,18 selection (1) 767:1 self (1) 701:11 semidiurnal (1) 751:7 sending (2) 749:14;791:18 senior (4) 700:9;706:18; 747:15;823:4 sense (11) 706:3;749:24;750:2, 17;756:8;772:19; 789:6;791:12;792:10; 820:14;827:2 sensitive (1) 813:18 separate (4) 714:22;750:18; 772:8;777:3 separately (1) 749:15 separation (1) 746:4 SEPTEMBER (5) 694:20;698:1;	718:19;830:6,18 sequence (1) 768:19 sequences (1) 741:12 series (2) 709:20;766:7 serious (1) 734:14 serve (1) 821:21 Service (11) 696:14;763:9,13,16; 771:14,15,18;797:19; 798:10;827:11,14 SESSION (2) 694:18.5;698:1 set (8) 726:14;756:10; 767:2;768:20;786:17, 21;791:4;800:8 seven (2) 723:5;816:2 several (2) 754:13;818:20 shaded (2) 777:13,20 shall (1) 703:7 shallow (1) 742:18 shaped (1) 718:5 share (2) 700:15;774:23 shared (1) 807:3 Sharp (1) 695:19 Sheep (13) 724:19,21;725:2,2,6, 9,11;740:11;749:13; 750:15,21;815:10; 824:3 Sheer (12) 728:20;729:1,3,12; 738:8;807:20;810:20; 815:2,7,15;820:6,20 shelf (5) 721:1;726:12; 741:13,13;753:17 shocked (1) 707:19 short (2) 765:6;781:23 shot (2) 707:8;730:14 show (17) 705:1;712:8;713:4; 720:19;728:13;737:13; 738:15,17,18;741:10; 745:17;752:17;758:21; 797:11;798:13;805:11;	825:3 showed (8) 727:12,12,16;733:5; 737:18;784:18;809:10; 810:14 showing (6) 723:7;729:2;733:7; 745:13;798:12;803:24 shown (3) 732:8;791:23;822:10 shows (5) 722:20;742:6; 743:18;766:3;789:11 shred (1) 750:3 shutdown (2) 743:15;776:5 side (11) 724:7;725:5,6;730:5, 8;736:9;741:12,15; 777:12;789:7;793:22 side's (1) 742:8 sidetracked (1) 765:16 signal (10) 714:1;721:12; 744:13;752:8;774:10; 776:2,7,9;779:11; 805:5 signals (10) 721:7,11;752:6; 762:13;797:10;798:1, 13,23;800:2,4 significant (2) 735:6;801:15 Silurian (2) 726:11;741:23 similar (6) 719:15,15,17; 758:22;814:3;815:12 simple (5) 782:12,12,21; 790:21;796:1 simplest (1) 768:2 simplified (1) 794:13 simply (1) 807:13 simulations (1) 796:19 single (2) 773:15;797:13 sinks (1) 725:14 site (5) 707:21;708:8;744:1; 751:24;807:4 siting (1) 798:12 sits (3) 739:1,2;754:24	sitting (4) 741:16;773:10; 783:23;822:21 six (6) 751:4;765:8,8,12; 779:23;824:17 slide (41) 707:10;708:17; 710:20;712:2,5;713:4; 716:4,7,8;720:1;723:4; 728:13;732:11;733:15; 735:13;737:13,14,20; 741:3,5;743:3;744:20; 745:16;752:22;755:23, 24;756:5;765:8,12; 769:8;770:5;773:19, 23,24;776:19;812:3; 813:2;814:23;816:2; 818:21,22 slides (4) 707:12;710:13; 721:20;767:12 slight (1) 741:5 slightly (1) 785:17 slope (5) 724:4;745:5,6,7; 748:12 slow (1) 761:5 slowly (3) 751:20,20,20 small (5) 706:18;751:8,9; 772:19;773:16 smartly (1) 826:6 smoother (1) 717:21 Snake (3) 723:2;810:3;814:21 snow (4) 713:11;720:20; 767:5,7 SNWA (1) 695:16 software (5) 774:4;780:4,5,6; 791:2 soil (1) 803:1 solely (1) 819:1 solid (2) 716:9;767:19 solution (13) 710:1,24;717:2,4,14; 718:5;722:23,24; 730:4,22;733:17,17; 734:9 solutions (4) 717:18;766:22;	823:10,13 solve (1) 730:20 solved (4) 707:22;710:2;738:3; 777:15 solves (1) 711:2 solving (1) 707:16 somebody (11) 704:23;707:22; 722:5;739:11;750:19; 759:7;766:23;767:7; 800:10;823:7;826:21 some day (1) 826:8 somehow (2) 721:11;767:22 someone (2) 700:15;791:20 someplace (1) 702:2 something's (2) 706:3;804:22 sometime (2) 795:1;806:23 somewhat (2) 719:14;750:11 somewhere (8) 731:21;739:6;749:2; 811:6;812:11,16; 814:17,18 sorry (22) 704:9;709:13;725:6; 730:18;733:14;743:1, 2;754:21;761:6;785:4; 792:17;793:2,16; 794:2,24;799:1; 804:14;805:17;806:9, 23;812:21;815:5 sort (3) 725:13;756:17;817:7 sorts (1) 774:21 sound (3) 757:21;772:11; 783:18 sounds (1) 759:16 source (4) 812:22;813:12,13,15 sourced (1) 752:9 sources (1) 814:1 south (7) 723:16,17;724:1,12; 739:22;753:17;815:10 southern (19) 701:15;707:9;721:2; 724:7,18;743:16,17; 762:12;771:19;772:1;
--	--	--	---	--

779:9;804:6,7,21; 809:7;810:3;811:3; 823:3;827:17 southward (5) 764:16;803:10; 807:13;810:19;820:18 southwest (5) 725:22,24;729:2; 765:20;815:24 span (1) 715:4 spank (1) 747:9 sparse (2) 756:14,15 spatial (1) 826:13 speak (4) 704:8;716:6,7; 782:10 speakers (1) 743:9 speaking (2) 700:20;763:19 special (1) 815:21 specific (1) 820:10 specifically (2) 701:20;702:11 speck (1) 724:17 spell (2) 701:3,4 splotches (1) 753:12 spoken (1) 709:19 spot (1) 718:13 spots (1) 727:8 spread (1) 816:11 SPRING (69) 694:8,5;704:15; 714:23;716:5,12,21; 717:11,19;718:10; 719:2,6,9;720:3,13; 723:20,21;724:13,17, 21;725:1,18,19,20,23, 24;726:2;733:8; 734:19;735:1;738:6; 740:10;749:2,3,6,7; 752:9;761:16;762:1,6, 17,19;763:1;765:3; 766:9;767:18,21,22; 768:8,13;769:1; 770:11;771:3;774:14; 778:2;784:5;789:15, 16;802:17;805:12; 810:21;812:12,14,18; 814:13;817:14;821:5,	19;823:17;827:7 SPRINGS (77) 694:12;702:1; 707:14,16,17;708:11; 712:1;721:13;725:10, 18,20;727:11;730:2; 731:2;733:4,10,18; 734:19;737:23;738:1, 5,21;739:9,11;741:19; 753:18;754:17;759:10, 14;760:17;761:1,16; 762:1,10,21,23;763:1, 17,22;765:14;767:13; 769:14;776:8;777:22; 778:5,8;781:8;787:6; 788:7,8;789:19,19; 790:11;792:16;793:4, 23;794:6;795:8;802:5; 805:15;810:11,17; 811:5;812:11,22; 813:9,10,18,19;814:6, 8,14;816:11;818:12; 819:19;820:16;824:24 square (4) 710:17;730:10,11; 789:24 squared (2) 734:5;746:7 squished (1) 714:7 ss (1) 830:1.5 stabilize (1) 809:11 stabilizer (1) 721:8 stable (1) 788:12 staff (1) 698:17 stakeholders (2) 711:14;779:21 start (21) 698:14;700:19; 703:14,16;705:12; 719:19;721:15;723:24; 728:2;729:11;731:19; 732:16,17;754:8,17; 755:21;780:22;782:20; 791:21;824:23;826:11 started (4) 706:20;764:21; 765:17;822:22 starting (2) 751:4;808:9 starts (4) 732:15,22;743:11; 805:4 STATE (34) 694:1;695:4,5,5; 698:22;699:3,4,9; 700:6,11;702:12; 705:6,8,23;779:20;	783:13;789:1,11; 793:5,7;796:1;802:9; 808:12,15;809:7,13,14, 16;811:16,20;819:14, 17;824:12;828:23; 830:1 stated (5) 756:5;757:19;759:8; 807:17;816:3 stategraphy (2) 740:18,21 statement (3) 773:5;792:15;821:16 statements (1) 764:19 States (3) 700:1,2;763:9 state-wide (1) 802:18 station (1) 712:10 statistically (1) 768:20 statisticians (1) 766:12 statistics (2) 756:17,18 Statute (1) 699:2 statutory (2) 699:1,6 stay (1) 769:6 steady (13) 705:6,6,8,22;793:5, 7;796:1;808:12,15; 809:7,13,14,16 stenotype (2) 830:7,14 step (1) 785:16 Steptoe (6) 712:2;727:10; 745:21;788:8;809:22; 810:1 sticky (1) 736:17 still (5) 726:8;761:5;766:19; 822:22;824:20 stop (2) 700:17;706:11 stops (1) 732:14 storativity (1) 760:1 stories (1) 741:14 storm (1) 767:4 straight (2) 722:17;736:5 stratographic (1)	741:19 stream (3) 705:6;794:5;802:21 streamline (1) 733:17 streamlines (2) 709:20,21 streams (2) 728:2;803:3 strength (1) 706:22 Strike (2) 716:22;729:7 strikes (1) 732:14 striking (1) 729:14 strongly (4) 719:22;726:5;728:1; 736:3 structural (4) 738:20;742:7; 807:23;815:14 structure (4) 729:14;733:5; 738:20;815:19 stuck (1) 784:5 students (1) 798:4 studied (1) 711:8 studies (1) 772:17 study (2) 752:19;772:21 stuff (4) 709:1;760:22; 768:14;790:19 style (1) 740:16 submission (1) 819:12 submit (1) 779:21 submittal (2) 790:4,5 submittals (4) 702:15;773:16,17,17 submitted (4) 702:11;772:4,8; 807:3 Subpart (2) 821:15;824:5 subsurface (2) 739:8;741:4 subtract (1) 778:24 subtracted (1) 779:10 subtracting (1) 719:19 successful (1)	809:14 sufficient (1) 714:12 sufficiently (1) 814:4 suggest (2) 753:20;815:2 suggested (2) 764:6;814:1 suggesting (2) 717:5;769:20 suggestion (4) 712:16;769:13,16; 798:6 Sullivan (1) 695:5 summarize (1) 819:12 Sunny (2) 741:12,15 Supervising (1) 695:8.5 supply (6) 704:20,22,23; 712:14;726:3;746:24 support (3) 722:2;734:3;821:4 sure (20) 710:9;720:6,6,10,21; 741:23;747:14;755:23; 760:19,20;761:8; 762:4;795:18;797:14; 803:23;806:18;809:3; 810:9;814:24;817:14 surface (12) 699:21;700:8; 722:21;723:10,11,14, 15;724:16;728:4; 741:4;742:11;801:19 surfaces (1) 705:4 surge (1) 716:16 surging (1) 742:4 surprise (1) 772:7 surprised (1) 736:24 surprisingly (1) 707:1 surrounding (1) 747:1 suspect (1) 824:1 suspected (1) 794:12 sustain (1) 812:18 sustainability (1) 824:14 sustainable (2) 706:2;821:20
--	---	--	--	---

sustaining (2) 802:4;813:1	747:16;764:6	698:20	796:8	742:10,12;760:14; 794:23;830:7
Swanson (3) 739:22;740:14;741:2	technical (2) 699:15;822:15	testifying (2) 783:6;786:22	threatening (1) 787:17	tool (6) 788:19;790:5,22; 791:12,22;792:11
sweet (1) 718:12	technology (1) 755:10	testimony (8) 773:13;774:24; 775:4,4;779:15;797:7; 798:9;824:8	three (19) 699:18;705:3;707:2, 20;725:7;729:5;733:3; 747:1,7,10,23,24; 756:1;768:5,7,8,8,9,16	top (4) 714:6;742:2;745:1; 758:3
swimming (1) 716:13	Tecopa (1) 725:23	testing (3) 757:24;758:13,19	throughout (1) 779:8	topic (2) 702:5;705:19
sworn (2) 700:20,23	tectonic (1) 732:7	tests (8) 746:8;749:1;750:24; 759:13,19,22;761:4,9	throughput (1) 812:10	torque (1) 812:13
sync (1) 706:21	tectonics (2) 731:16,16	testy (1) 785:4	throw (1) 754:3	total (9) 706:19;714:24; 715:1;789:17,18,20; 800:12;816:9;823:16
SYSTEM (38) 694:8;698:6;701:23, 23;705:22;707:1; 709:5;712:22;717:6; 718:7;719:10;720:20, 22;724:11;725:17; 728:1;734:15;735:23; 736:1;752:5,6,23; 753:19;767:23;783:15; 788:4;789:15;790:14, 24;797:11;798:15; 802:1,4,12;812:4; 817:21,23;824:13	temperature (7) 707:15,16;752:20; 790:10;791:10;818:12, 13	Thanks (3) 745:8,8;758:4	thrust (10) 739:1,4,5;740:10,15, 17,17,18,22;742:16	totally (1) 801:17
systems (2) 773:9;802:11	temperatures (13) 706:23;707:14; 711:24;713:6,18; 714:3,16;786:19; 787:3;788:6,9,14; 816:16	Theis (4) 707:3;751:1,2;760:8	thrusting (1) 740:16	totals (1) 768:9
T	temporal (1) 826:13	theoretical (1) 714:15	thrusts (3) 735:14;740:20; 742:17	touch (1) 711:4
	temporary (2) 706:8;809:10	thereafter (1) 830:10	THURSDAY (2) 694:20;698:1	touching (1) 703:16
	ten (9) 709:7,11;727:22; 743:23;744:7;771:1,3; 822:4;827:1	therefore (2) 699:9;751:21	thus (1) 821:21	toward (2) 725:5;810:15
	ten-minute (1) 785:8	thermometer (1) 713:20	tie (1) 727:19	tracer (2) 708:5,5
	term (2) 711:12;767:14	thermometers (1) 713:19	tight (1) 792:5	track (2) 714:10;814:12
table (6) 726:15;782:14; 793:19;817:13,14,14	terminology (1) 769:9	thick (3) 736:18;741:15;772:6	Tim (4) 695:3,5,18;711:22; 768:22	traditional (1) 739:18
Taggart (12) 695:16,16,16,5; 697:6;771:22,24; 772:1;780:21;781:1; 827:19,23;828:15	terms (11) 707:14;714:24; 719:10;723:20;760:3; 762:9;786:18;792:4; 802:20;822:7;826:12	thickness (7) 710:7;734:6;782:16; 784:23;796:3,14,15	times (16) 709:7,11;713:14; 732:13;753:8;766:5; 768:11,11,12,15,16,16; 781:23;786:10,24; 797:18	train (2) 733:14;799:2
Taggart's (1) 828:9	terrain (14) 704:16,17;720:23, 24;723:1,12,14; 724:20;738:9;744:1; 777:14;802:2;812:23; 825:13	thinking (13) 704:13;728:2; 742:23;761:12;762:3, 5,14;772:20;787:23; 789:12,12;791:19; 810:13	timing (1) 822:3	transcribed (1) 830:10
tailings (1) 736:14	terrible (1) 730:2	thinning (2) 742:7;764:14	tint (1) 724:14	TRANSCRIPT (2) 694:15.5;830:12
takeaway (1) 795:17	tertiary (1) 736:15	thins (1) 741:15	tiny (2) 718:21;734:6	transcription (1) 830:14
talk (11) 713:24;721:22; 722:7;733:2;737:15; 742:24;752:13;755:1; 770:9;826:21,22	test (23) 707:21;715:12; 751:12,23;759:22; 760:12,16,17;761:2,10; 762:11;768:17;770:1; 774:11;775:6,13,24; 777:5;778:23;792:4,5, 8;824:20	third (3) 707:9;735:6,10	title (2) 751:7;774:13	transfers (1) 701:24
talked (4) 712:5;737:5;747:15; 778:3	tested (1) 809:16	Thomas (2) 721:22,23	Toad (1) 753:1	transform (1) 732:21
talking (15) 700:17;705:14; 709:14;712:21;713:11; 715:14;716:5;718:12; 720:7,22;743:2; 765:23;788:20;802:15; 820:11	testified (1) 700:24	though (7) 723:9;741:20;742:4; 749:2;750:17;752:1; 772:21	today (13) 698:6,9,20;702:20; 712:22;713:1;750:7; 761:5;811:14;812:1; 818:21;822:2;824:8	transformed (1) 721:11
tallied (1) 715:16	testify (1)	thought (12) 704:13;723:23; 733:9,14;776:21; 783:1;786:10,23; 799:2;812:17;818:24; 822:20	toad (1) 753:1	transit (1) 820:5
tech (4) 734:3;737:10;		thousand (6) 715:17,22;727:2; 731:10;766:16,21	tom (1) 797:22	transition (1) 731:22
		thousand-plus (1) 717:3	tongue (2) 734:14;783:9	transmissive (2) 709:11;728:18
		thousands (1)	took (5)	transmissivities (3) 796:10,16;821:10
				transmissivity (22) 709:6,7,8,10,12; 710:6;734:6,17;746:9, 18;748:24;759:24; 790:12,17;791:8; 805:24;806:5,8;807:5, 6,14;821:9
				transmitting (1) 820:17

travel (6) 708:6,8;713:14; 734:4;792:23;822:11	755:10;760:20;767:11, 13;768:24;769:1,6; 771:6;777:3;790:11; 796:3;808:17;816:17; 818:14;822:6,7;823:1; 825:1	773:19;793:23;794:5; 814:9,10,11 underlaid (1) 746:11 underlying (1) 704:16 understands (1) 783:2 understood (3) 699:13;740:23;783:3 uniform (1) 790:15 unhappy (1) 708:14 uniform (1) 790:12 uniformly (1) 790:15 unique (2) 717:13;740:22 United (3) 700:1,1;763:9 units (2) 727:6;768:14 universally (1) 729:22 University (1) 713:5 unknown (5) 730:5;785:1;803:8; 807:22;820:17 unless (2) 818:3,6 unperturbed (1) 744:1 unplanned (2) 776:4,5 unpublished (4) 806:8,9,16,20 unquantified (1) 700:4 unstable (1) 730:21 up (79) 704:16,18;709:2,3; 712:2,11;714:2,3,18, 21;716:18,19;722:6; 723:17;724:4,10,12,23; 725:5,7;727:1,19; 729:15;730:3,15; 731:24;732:18;737:23; 738:9;740:14,21; 741:12;742:12,18; 743:11,23;744:14; 745:20;749:3;750:5; 753:18,21;754:15; 758:20;759:2;760:4; 766:22;767:9,15; 768:10;770:15;782:20; 783:7,12;785:6,13,16, 20;789:8,17,18; 797:11;798:13;803:14, 20,21;807:15,16;	809:10;810:2;811:19; 813:8;814:13;815:15; 816:21,23;817:7; 823:17;827:3 update (1) 824:19 upon (6) 698:9;711:21;754:9; 783:17;821:4;824:4 UPPER (5) 694:12.5;776:8; 809:22;810:6,10 upstream (1) 800:10 upward (1) 784:19 URE (2) 796:24;828:12 use (19) 713:7,8,22;727:1; 730:12;742:5;744:13, 15;754:10;756:11,13; 761:19;762:2;766:14; 768:6;780:16;792:2; 807:13;808:19 used (16) 711:13;712:16; 716:15;723:14;746:9; 776:22;780:9;800:8; 805:24;806:8;808:7; 809:1;816:3;817:10, 15;821:9 useful (2) 779:5;792:8 users (1) 826:23 uses (1) 715:6 USGS (5) 716:21;725:24; 739:19,19;789:17 using (5) 740:15;749:16; 759:23;794:12;800:7	772:2;774:14;778:1,1, 2;783:10,22;784:3,17, 17,20,21;785:14; 786:2;789:20;792:16; 793:4,6;802:17; 805:21;807:7,24; 808:6,11,15,16;809:6, 19,22,23;810:6,11,15, 15,17,17,20,21;811:4, 14;814:13;815:20; 816:21,22;817:16; 820:7,12;821:2,6; 826:18;827:17;828:2, 2,20 Valleys (1) 820:6 value (5) 713:22;753:21; 762:5;778:18;789:11 values (1) 730:9 variable (4) 767:2;768:24;769:1; 800:8 variables (2) 768:21;808:6 varies (1) 716:12 variety (1) 806:21 various (1) 797:18 vary (4) 718:1;746:1;816:17; 821:11 varying (1) 702:7 vast (2) 802:7;809:17 vastly (1) 813:22 Vegas (60) 696:12.5;704:14,17; 705:10,18,21;706:4,10, 11,13,19,22;708:13; 724:24;725:10;726:3; 729:12;731:20,20; 734:20,22;735:2,16; 749:4;771:19;772:2; 783:10,21;784:2,17,20; 789:20;796:23;805:21; 807:7,20,24;808:6,11, 14,16;809:6,19; 810:15;811:5;812:11, 12,17;813:1;815:15; 817:16;820:6,7,12,20; 821:2,6;826:18; 827:17;828:11 vegetation (1) 804:22 venturing (1) 756:17 version (3)
tree (15) 713:4,20,21;714:3, 11,11,18;721:6,7,10; 799:7,9,11,12,17 trees (2) 723:16,17 trend (21) 714:4;745:2,3,6,7; 747:22;748:8,9; 750:23;752:11;756:15; 757:13;770:6;777:7; 779:2;804:11,18,19; 815:18;821:17;824:18 trending (2) 746:3;815:22 trends (5) 757:11;779:3; 815:10,19;819:1 trial (2) 796:6,7 trials (1) 717:3 Tribal (2) 698:10;737:2 Tribe (7) 698:12;699:12,20; 700:1,5,7;772:21 Tribe's (2) 700:3,18 tried (7) 711:17;730:1; 735:19;748:17;769:22; 791:3,4 tries (1) 768:21 trigger (3) 763:19,20;824:23 triple (1) 732:9 trouble (4) 721:16,18;728:5; 737:15 true (2) 784:19;830:13 truly (2) 753:21;796:7 trust (1) 699:24 Try (13) 701:23;703:3;713:1; 727:21;743:24;749:19; 757:6;767:24;769:23; 794:11;796:5;824:13; 825:2 trying (26) 704:21;712:13; 714:10;715:8;745:16, 17;747:2;751:2;	Tule (7) 707:14,17;712:1; 727:10;788:7,8;790:10 turn (4) 701:6;741:7;773:19; 785:17 turned (1) 708:18 two (62) 698:21;702:11; 703:19,22;708:9,21,21; 712:9,13;715:4,20; 717:11,17;718:11,18, 19,20,24,24;720:15; 728:2;730:13;731:12; 735:9,12;739:21; 743:7,21;744:3,4; 748:22;749:5,11,19; 750:13;751:13;759:19; 761:9;768:11,15; 769:19;770:18,23; 774:18;779:16;780:2, 4,15,17;786:21; 794:23;795:9,13; 796:9;797:20,21; 798:20;807:11;817:8; 820:23;823:12,17 two-dimensional (1) 709:5 two-week (1) 780:10 two-year (2) 715:6,17 type (2) 719:9;757:7 types (1) 726:16 typewriting (1) 830:10 typically (1) 790:20	U	U	U
	Um-hum (9) 774:1;777:11,19; 780:1;792:14,23; 794:3;795:5;813:4 unadjudicated (1) 700:4 uncertainty (3) 808:1;821:8;824:6 uncover (1) 766:2 under (12) 710:8;732:10,21; 735:16;736:14;739:4;		V	
			V-12 (1) 793:23 valid (1) 765:1 VALLEY (94) 694:8.5,10,11,12.5; 696:9;700:8,10; 704:14,22;705:10,18, 22;706:10,11,19,22; 708:10,13;712:11; 724:4,24;725:10; 733:8;734:19,20; 735:2,17;737:23; 738:7;739:24;740:1,7, 12;745:11,23;746:22; 749:4;763:2,3;771:19;	

703:20,21;727:16 versus (1) 721:5 very- (1) 704:9 VF-2 (1) 795:12 VH-4 (1) 747:7 Vidler (6) 696:3.5;738:5; 785:21;786:8;793:10; 828:6 view (1) 776:21 Virgin (4) 749:16;801:2,5,10 visually (1) 804:19 VOLUME (2) 694:18.5;817:9	watch (4) 732:16,16,23,23 WATER (154) 694:3;696:2.5,3,5, 9.5;698:17;699:16,17; 700:8;701:24;704:14, 22,23;705:21,24;706:4, 5,9,23;708:1;710:8,11; 712:14,23;714:22; 715:1;717:6;718:16, 18;720:12;721:3,3,4, 23;722:2;725:1,3; 726:2,4,6;728:4; 730:24;731:2;733:7; 735:15,16,19;736:2; 737:1,2,8;738:14; 741:20;742:1,13,17,18; 745:22;746:1,3,10,21, 24;747:2,3,3,7;748:10; 749:17;750:5;751:4,4, 20,21;752:15,16,18; 753:15;764:2,4,9,17; 766:3,5,8;767:21; 768:3;771:19,19; 772:2,2;775:13; 778:22;779:8;783:21; 784:23;785:14;786:2, 8,8;788:9;789:8,22; 791:9;794:11;795:9; 796:5,9;800:8,9,10,18; 802:11,12,16,16; 807:24;808:2,16,19; 809:1,8,9,11;811:20; 812:10,11,14,17; 816:12,20,21;817:3,5; 818:8;819:22;820:4,9, 17,19;821:6;822:3,20; 823:3,4;824:9;825:20, 23;826:19,23;827:17, 18;828:2,2;830:9	813:21;817:2 ways (3) 705:2;740:19;787:22 weather (5) 712:10;751:10; 769:17;823:18,21 website (1) 782:11 week (2) 751:9;823:17 weekend (1) 716:15 weeks (17) 703:19,22;708:21, 22;718:18,24,24; 730:13;731:12;779:16; 780:2,4,15,17;786:21; 814:17;823:17 weight (1) 789:4 weighted (2) 717:15;770:17 weights (1) 768:21 welcome (2) 745:9;758:5 wells (18) 723:22;725:5; 736:13;738:4,6; 745:19,23;746:1,13,14; 751:24;758:1;761:16, 24;774:18;795:9; 806:4;816:23 weren't (5) 747:14;748:13,18; 769:15;778:23 Wernicke (4) 737:9;738:19; 739:23;741:3 Wernicke's (1) 740:14 west (14) 725:6;730:7;736:8; 759:10,15;760:17; 761:1,17;762:1;787:5; 789:7;805:15;815:11; 824:24 west/northwest (1) 735:22 western (4) 731:15;742:15; 787:6;804:7 westward (1) 810:15 wet (11) 712:11,17;721:5; 756:24;757:4;765:6; 769:17;770:10;798:8; 799:13;823:14 wetting (1) 802:24 what's (7) 701:22;713:16,21;	748:24;758:17;762:16; 816:8 where's (1) 770:12 WHITE (18) 694:8;698:5;701:22; 712:11;724:15,17; 736:17;783:15;788:3; 789:15;797:11;798:14; 802:1;809:22;810:6, 10,10;812:4 whole (12) 712:20;718:23; 724:5;731:24;742:16; 744:12;768:1;795:18; 802:9;804:16;813:14; 816:5 who's (2) 703:24;773:7 wide (1) 780:6 widely (1) 762:12 width (6) 746:11,18,20; 799:11,12;807:14 wiggle (1) 714:4 Wildlife (6) 715:6;763:9,13,16; 797:19;827:11 Wilshire (2) 734:21;735:5 Wilson (1) 695:3.5 wisdom (1) 797:17 wise (1) 766:5 withdraw (1) 808:8 WITHIN (8) 694:8;705:21; 746:24;762:12;774:20; 802:1;808:6;830:9 without (10) 706:14;710:14; 722:4;737:8;758:3; 766:16;769:24;787:13; 789:3;795:18 witness (10) 700:22;730:18; 735:8;755:5,9,14; 803:15,24;804:3;813:4 witnesses (2) 699:13,16 word (7) 707:2,7;728:6; 762:16;769:9;772:16; 824:15 words (11) 709:6;713:8;723:11; 724:10;728:17;740:18;	745:5;769:3;770:16; 812:10;823:16 work (24) 702:17;708:22; 710:22;711:21;712:24; 715:10;722:3;725:24; 730:4;731:13;733:11; 747:13;749:22;753:1; 786:12,23;787:6; 791:21;795:7;816:19; 817:2,4;818:14;823:3 worked (10) 704:21,21;715:19; 730:23;736:13;770:2; 773:11;787:1,1;817:2 workflow (1) 817:7 working (5) 701:12;710:21; 753:15;779:5;788:19 works (8) 708:20;717:2; 734:16;737:16;786:18, 18,20;818:9 workshop (1) 718:15 world (2) 780:6;813:21 worry (1) 728:6 worse (1) 766:24 worth (2) 715:4;781:17 writing (1) 761:12 wrong (4) 740:2;746:16;789:8; 802:9 wrote (5) 759:17;761:11; 773:8;793:16,17
W				
Waddell (2) 752:16;826:17 Waddell's (1) 726:22 waited (1) 743:21 waking (1) 740:14 wall (2) 743:3;794:15 wants (2) 752:13,17 Warm (18) 730:2;731:2,2; 753:18;759:10,14; 760:17,24;761:16; 762:1;789:8;802:4; 805:15;812:10,14; 814:8;818:13;824:24 warmer (1) 723:17 warming (2) 713:23;787:5 Wasatch (1) 731:24 WASH (18) 694:11.5;732:18; 733:9,9;737:23; 738:13;776:8;778:1; 793:23;794:6;795:8; 803:4;815:20;819:18, 20;820:4,10;821:2 washed (1) 738:9 waste (4) 708:8;730:3;780:8; 822:19 wasting (2) 766:16;769:24	waters (5) 699:3;801:4,10; 810:22;811:3 water's (1) 734:10 watts (2) 730:11,12 way (52) 705:1;707:17; 708:20;710:10;714:16; 715:18;717:24;718:8, 9;721:1;722:15,17; 723:9,23;725:3; 727:17;728:9;736:15, 16;738:10;742:7; 746:10;749:3;751:13, 14;752:19,19,19,20,21, 21,23;753:19;757:10, 12;759:21;762:3; 765:17;766:3,4,11; 767:4;769:24;776:3, 12;780:14;787:23; 790:14;803:21;809:8;	717:15;770:17 768:21 745:9;758:5 723:22;725:5; 736:13;738:4,6; 745:19,23;746:1,13,14; 751:24;758:1;761:16, 24;774:18;795:9; 806:4;816:23 747:14;748:13,18; 769:15;778:23 737:9;738:19; 739:23;741:3 740:14 725:6;730:7;736:8; 759:10,15;760:17; 761:1,17;762:1;787:5; 789:7;805:15;815:11; 824:24 735:22 731:15;742:15; 787:6;804:7 810:15 712:11,17;721:5; 756:24;757:4;765:6; 769:17;770:10;798:8; 799:13;823:14 802:24 701:22;713:16,21;	748:24;758:17;762:16; 816:8 where's (1) 770:12 WHITE (18) 694:8;698:5;701:22; 712:11;724:15,17; 736:17;783:15;788:3; 789:15;797:11;798:14; 802:1;809:22;810:6, 10,10;812:4 whole (12) 712:20;718:23; 724:5;731:24;742:16; 744:12;768:1;795:18; 802:9;804:16;813:14; 816:5 who's (2) 703:24;773:7 wide (1) 780:6 widely (1) 762:12 width (6) 746:11,18,20; 799:11,12;807:14 wiggle (1) 714:4 Wildlife (6) 715:6;763:9,13,16; 797:19;827:11 Wilshire (2) 734:21;735:5 Wilson (1) 695:3.5 wisdom (1) 797:17 wise (1) 766:5 withdraw (1) 808:8 WITHIN (8) 694:8;705:21; 746:24;762:12;774:20; 802:1;808:6;830:9 without (10) 706:14;710:14; 722:4;737:8;758:3; 766:16;769:24;787:13; 789:3;795:18 witness (10) 700:22;730:18; 735:8;755:5,9,14; 803:15,24;804:3;813:4 witnesses (2) 699:13,16 word (7) 707:2,7;728:6; 762:16;769:9;772:16; 824:15 words (11) 709:6;713:8;723:11; 724:10;728:17;740:18;	745:5;769:3;770:16; 812:10;823:16 work (24) 702:17;708:22; 710:22;711:21;712:24; 715:10;722:3;725:24; 730:4;731:13;733:11; 747:13;749:22;753:1; 786:12,23;787:6; 791:21;795:7;816:19; 817:2,4;818:14;823:3 worked (10) 704:21,21;715:19; 730:23;736:13;770:2; 773:11;787:1,1;817:2 workflow (1) 817:7 working (5) 701:12;710:21; 753:15;779:5;788:19 works (8) 708:20;717:2; 734:16;737:16;786:18, 18,20;818:9 workshop (1) 718:15 world (2) 780:6;813:21 worry (1) 728:6 worse (1) 766:24 worth (2) 715:4;781:17 writing (1) 761:12 wrong (4) 740:2;746:16;789:8; 802:9 wrote (5) 759:17;761:11; 773:8;793:16,17
Y				
ya (3) 707:4,4,4 yards (1) 774:20 year (37) 705:10;714:4;715:1, 5,5,5,15,20;718:16,18, 23;727:8;731:10; 743:6;745:2;751:12; 765:3;766:16;767:21, 21;768:3;769:4; 770:15;790:1;798:13; 799:13;801:13;805:20; 808:3,8;816:4;817:12; 823:16,18,21,23,23 years (60) 701:13,16;706:7; 711:9;712:11,13,15,17;				

713:19;715:4,10,20; 717:15;718:3,9,11,19, 20;720:4;729:22; 731:15;732:7,15; 743:7,21;744:4;747:7, 23,24;751:13;752:4; 756:11;764:22;766:8; 768:7,8,8,9;769:18; 770:6,12,12,13,18,23; 771:1,3;794:23;798:4, 6,8;804:21;805:2; 806:21;808:17;822:5; 823:14,14,18,22	1	1549 (1) 716:21	802:16;817:12	722:10;728:23;731:3; 732:7;754:4;804:21; 805:2
yellow (6) 709:21;717:18; 727:4;777:13,20; 789:23		16 (2) 718:9;823:22	2000 (3) 767:15;770:11,16	2003 (1) 737:7
yep (1) 774:1	1 (5) 701:18;709:6;756:2; 793:19;814:4	1600 (2) 766:1,1	2006 (6) 700:10;782:13; 794:21,22,24;795:2	300-meter (1) 734:5
yesterday (7) 707:20;718:10; 735:23;740:1;742:22; 751:16;802:22	1,000-acre (1) 699:21	16-year (1) 823:22	2009 (1) 767:16	30-degree (1) 728:23
yesterday's (1) 798:9	1:00 (1) 829:5	17 (1) 754:11	2010 (2) 765:18;805:12	30's (1) 728:22
yield (4) 706:2,5;802:8; 826:20	10 (3) 709:6;732:15;814:5	18 (1) 714:2	2012 (3) 743:15;776:6;798:24	31 (1) 793:19
youngest (1) 718:4	10,000 (1) 731:9	180 (1) 745:22	2014 (4) 743:6;744:22; 748:11;805:12	32 (1) 805:11
Yucca (2) 708:4;730:3	10:50 (1) 785:9	180W5011 (1) 745:22	2018 (3) 718:14,16;804:6	35 (5) 731:4,15;818:13; 819:11;821:15
Z	11 (5) 732:18;772:7,10; 785:3;812:1	1850 (2) 714:2,5	2019 (9) 694:20;698:1; 718:18;765:22;779:22, 23;819:12;830:6,18	35C (1) 818:13
zero (1) 820:22	11:52 (1) 829:6	1873 (1) 699:22	20-year (6) 712:17;764:20; 769:20;797:18;798:1,7	36 (3) 724:1;801:19;802:7
Zion (3) 801:6,7,10	1169 (14) 744:12;759:8,22; 760:16;761:2,9; 762:11;774:7,11; 775:6,12,24;777:3; 806:5	19 (4) 719:5;793:10;806:8, 23	21 (1) 741:12	3960 (1) 736:19
zone (20) 720:15;728:20; 729:1,3,12;731:22; 733:18;738:8;774:21; 777:24;778:4,10; 807:20;810:20;815:2, 7,15,16;820:7,20	12 (9) 717:14,14;720:3; 770:13,13,18;805:13; 823:14,18	19,000-acre-feet (1) 749:1	210 (1) 694:9	3rd (2) 804:5;806:17
zones (8) 728:3;732:23;734:4; 787:4;792:24;794:12; 812:24;822:12	12,000 (1) 736:17	1945 (1) 806:21	215 (1) 694:10	4 (3) 756:2;757:18;758:15
zoom (1) 739:15	121-day (1) 758:19	1960 (3) 712:12;719:6,7	216 (1) 694:10.5	4,000 (2) 736:15,21
zoomed (1) 733:16	12-year (1) 718:4	1964 (1) 712:10	217 (1) 694:10.5	4,000-foot (2) 736:13;796:14
0	13 (3) 806:16,20,20	1967 (1) 753:3	218 (1) 694:11	40 (2) 736:21;801:21
00 (1) 727:7	1303 (6) 694:17.5;698:6; 699:1;702:13;705:17; 819:15	1968 (1) 773:10	218 (1) 694:12	40,000-acre (1) 820:1
00015 (1) 734:7	132 (1) 805:15	1972 (1) 809:10	219 (1) 694:13	40,000-acre-feet (9) 734:13;748:22; 805:20;808:3,22; 820:4,7,20;821:2
00021 (1) 735:4	14 (5) 732:15;744:20; 746:19;776:15;818:22	1980 (1) 699:23	22 (6) 717:15;720:4; 770:13,13;823:14,18	400 (1) 736:16
	1400 (1) 789:24	1986 (1) 736:12	242 (1) 700:11	40-mile (1) 803:4
	14-mile (1) 746:20	1990 (2) 767:15;804:6	25,000-acre-feet (2) 706:1;746:21	40's (1) 712:12
	14th (1) 765:18	1992 (2) 806:10,14	26 (2) 694:20;698:1	45 (1) 806:22
	15 (5) 705:11;727:8; 769:17;790:1;816:4	1993 (1) 757:24	26th (1) 830:6	46 (1) 706:8
	15- (3) 712:17;769:20;798:7	1994 (1) 757:24	27th (1) 830:17	47 (3) 701:13,16;808:17
	150 (1) 729:15	1999 (3) 764:20;805:5,5	3 (6) 697:16;703:5,11; 756:2;792:13;795:20	49,000 (1) 711:1
		2	3,700-acre-feet (1) 700:7	5 (5) 759:14;795:22; 796:18,19;804:4
		2 (7) 697:15;703:5,10; 745:2;756:2;792:13; 814:5	30 (9) 700:12;711:9;	
		20 (9) 764:22;769:18; 770:6,12,12,13,18; 776:10,12		
		200,000-acre-feet (2)		

<p>5,000 (1) 768:16</p> <p>5,000-acre-feet (1) 768:4</p> <p>50,000 (1) 729:17</p> <p>51 (1) 716:11</p> <p>515 (1) 732:1</p> <p>53 (2) 716:10,11</p> <p>533.024 (1) 699:2</p> <p>5500 (1) 716:11</p> <p>59 (4) 792:12,19,20;817:16</p> <p>59,000 (3) 749:4;808:10;817:17</p> <p>5900 (1) 716:22</p> <p>5-month (1) 743:15</p> <hr/> <p style="text-align: center;">6</p> <hr/> <p>6 (3) 759:9;821:15;824:5</p> <p>60 (3) 815:4,13;817:16</p> <p>60,000-acre (1) 706:21</p> <p>60,000-acre-feet (4) 705:11;726:3;808:7,8</p> <p>60's (2) 706:2;753:2</p> <p>66 (2) 757:18;758:9</p> <p>69 (2) 758:16,18</p> <p>694 (1) 830:13</p> <p>694-830 (1) 694:19</p> <hr/> <p style="text-align: center;">7</p> <hr/> <p>7 (1) 706:8</p> <p>7,000 (3) 724:8,11;801:21</p> <p>70 (1) 705:9</p> <p>70,000-acre (1) 699:23</p> <p>700-acre-feet (1) 716:11</p> <p>701 (1) 697:3</p> <p>703 (2) 697:15,16</p>	<p>755 (1) 697:4</p> <p>763 (1) 697:5</p> <p>771 (1) 697:6</p> <p>7797 (1) 697:8</p> <p>786 (1) 697:7</p> <hr/> <p style="text-align: center;">8</p> <hr/> <p>8 (2) 759:13;814:24</p> <p>8,000 (3) 801:16;802:2,6</p> <p>80 (2) 710:16;815:10</p> <p>80,000-acre-feet (1) 705:10</p> <p>811 (1) 697:9</p> <p>813 (1) 697:10</p> <p>818 (1) 697:11</p> <p>819 (1) 697:12</p> <p>830 (1) 830:13</p> <p>8500 (4) 723:23;724:12,23;</p> <p>801:19</p> <p>850-AD (1) 714:4</p> <hr/> <p style="text-align: center;">9</p> <hr/> <p>90 (3) 710:16;728:15,17</p> <p>90-degree (1) 728:14</p> <p>93 (2) 758:12;759:12</p> <p>94 (1) 758:13</p>			
--	--	--	--	--

In The Matter Of:

*DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES*

*Vol. IV
September 26, 2019*

*Capitol Reporters
123 W. Nye Lane, Ste 107

Carson City, Nevada 89706*

Original File 092619pmfinalWater.txt
Min-U-Script® with Word Index

SE ROA 53313

JA_17710

Page 831

1 STATE OF NEVADA
 2 DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
 3 DIVISION OF WATER RESOURCES
 4 BEFORE MICHELINE FAIRBANK, HEARING OFFICER
 5 ---oOo---
 6 IN THE MATTER OF THE ADMINISTRATION
 AND MANAGEMENT OF THE LOWER
 7 WHITE RIVER FLOW SYSTEM WITHIN
 COYOTE SPRING VALLEY HYDROGRAPHIC
 8 BASIN (210), A PORTION OF BLACK
 MOUNTAIN'S AREA HYDROGRAPHIC
 9 BASIN (215), GARNET VALLEY
 HYDROGRAPHIC BASIN (216), HIDDEN
 10 VALLEY HYDROGRAPHIC BASIN (217),
 CALIFORNIA WASH HYDROGRAPHIC BASIN
 11 (218), AND MUDDY RIVER SPRINGS AREA
 (AKA UPPER MOAPA VALLEY HYDROGRAPHIC
 12 BASIN (219).
 _____ /
 13
 14 TRANSCRIPT OF PROCEEDINGS
 15 PUBLIC HEARING
 16 HEARING ON ORDER 1303
 17 VOLUME IV
 (P.M. SESSION, Pages 831 - 863)
 18
 THURSDAY, SEPTEMBER 26, 2019
 19
 20
 21 REPORTED BY: CAPITOL REPORTERS
 Certified Shorthand Reporters
 22 BY: CHRISTY Y. JOYCE, CCR
 Nevada CCR #625
 23 123 W. Nye Lane Suite 107
 Carson City, Nevada 89706
 24 (775)882-5322

Page 832

1 A P P E A R A N C E S
 2
 3 Micheline N. Fairbank,
 Hearing Officer
 4
 5 Tim Wilson,
 Acting State Engineer
 6 Adam Sullivan,
 Deputy State Engineer
 7
 8 Melissa Flatley,
 Chief of the Hearing Officer Section
 9 Michelle Barnes,
 Supervising Professional Engineer
 10
 11 Levi Kryder,
 Chief of the Hydrology Section
 12 Jon Benedict,
 Senior Hydrologist
 13
 14 Christi Cooper,
 Well Supervisor
 15 Bridget Bliss,
 Basin Engineer
 16
 17
 18
 19
 20
 21
 22
 23
 24

Page 833

1 A P P E A R A N C E S
 (Continued)
 2
 3 For SNWA: Taggart & Taggart, Ltd.
 By: Paul G. Taggart, Esq.
 4 Carson City, Nevada
 -and-
 5 Tim O'Connor, Esq.
 6 For CSI: Robison, Belaustegui, Sharp
 & Low
 7 By: Kent R. Robison, Esq.
 Reno, Nevada
 8
 9 For CSI: Brownstein Hyatt Farber Schreck
 By: Bradley J. Herrema, Esq.
 Los Angeles, California
 10
 11 For NV Energy: Justina Caviglia, Esq.
 Reno, Nevada
 12 For Lincoln County
 Water District
 13 -and-
 Vidler Water Company: Allison MacKenzie
 14 By: Karen Peterson, Esq.
 Carson City, Nevada
 15
 16 For NCA: Alex Flangas, Esq.
 Reno, Nevada
 17 For Moapa Band of Paiutes: Beth Baldwin, Esq.
 18 For Moapa Valley
 Water District: Greg Morrison, Esq.
 19
 20 For Bedroc: Laura Schroeder, Esq.
 21 For City of North Las Vegas: Laura Schroeder, Esq.
 22 For National Park Service: Karen Glasgow
 23 For Center for Biologic
 Diversity: Patrick Donnelly
 24

Page 834

1 I N D E X
 2 WITNESS PAGE
 3 CADY JOHNSON
 4 Recross-Examination by Mr. Taggart 835
 5 Recross-Examination by Ms. Peterson 842
 6 Recross-Examination by Mr. Donnelly 844
 7 Examination by Ms. Cooper 852
 8 Examination by Mr. Sullivan 853
 9 Examination by Mr. Benedict 857
 10 Further Examination by Ms. Cooper 859
 11 Examination by Ms. Barnes 859
 12
 13
 14
 15
 16
 17
 18
 19
 20
 21
 22
 23
 24

Page 835

1 CARSON CITY, THURSDAY, SEPTEMBER 26, 2019, P.M. SESSION
2 ---oOo---

3 HEARING OFFICER FAIRBANK: Okay. We'll go ahead
4 and go back on the record. And we're going to go ahead and
5 reopen things up for recross-examination. And we'll start
6 with Southern Nevada Water Authority. And we'll allow an
7 additional ten minutes at this point in time for the further
8 questions.

9 RECROSS-EXAMINATION
10 By Mr. Taggart:
11 Q. All right. Good afternoon, Dr. Johnson. Again,
12 Paul Taggart for the record. A couple of quick questions.
13 One is you were asked about -- by Ms. Peterson
14 about this groundwater study or paper that you did in the
15 groundwater magazine that's marked as Tribe's Exhibit Number
16 30. Do you remember those questions?
17 A. I remember the session. Not the specific
18 questions.
19 Q. Okay. Do you remember whether in that study you
20 considered the -- there to be a no-flow boundary between
21 Garnet Valley and Las Vegas Valley?
22 A. Well, from the F-1 -- Excuse me. I'm referring
23 to figure one in the reference publication. The F-1 is drawn
24 along the Las Vegas shear zone but it's a segment. It

Page 836

1 doesn't -- Yes, there's a segment of the Las Vegas shear zone
2 that's represented as an impermeable boundary.
3 Q. Okay. Do you believe that alluvial pumping in
4 the Muddy River area captures Muddy River flow, water that
5 would otherwise, I'm sorry, be in the Muddy River as flow?
6 A. Yes.
7 Q. And do you believe that happens essentially as
8 a -- on a one-to-one ratio?
9 A. Yes.
10 Q. Do you believe that carbonate pumping within the
11 capture zone that you've identified also impacts the Muddy
12 River and the Muddy River Springs?
13 A. Yes. With qualifications.
14 Q. Okay. Now, do you have a figure that shows where
15 your Muddy River -- your Muddy River capture zone is?
16 A. Figure -- Page two.
17 Q. It's the one with the --
18 A. Power point. First figure up in the --
19 Q. Yeah. I was hoping we could find one that's a
20 little bigger. But -- Oh, yeah, figure five from your
21 report, but also that one that's up on the screen. So my
22 specific questions have to do with what is in and what is not
23 in the MRSA capture zone, which I think is depicted in yellow
24 here with your qualification that part of the eastern part of

Page 837

1 that would be taken out if you were to do that again today.
2 Does that make sense?
3 A. Excuse me. I missed most of that as I was
4 looking for figure five in our initial report. And I've got
5 a hydrograph for that of BMDL 2.
6 Q. I'm looking at page 55.
7 A. In our initial report?
8 Q. Yes.
9 A. Okay. That's the same figure as on the screen.
10 Q. Okay. And I just want to ask you do you know
11 whether you would consider CSI Well Number 1, CSI Well Number
12 3, and CSI Well Number 4 to be within that yellow MRSA area,
13 which is the MRSA capture area in your figure?
14 A. Repeat the wells again, please.
15 Q. CSI-1, CSI-3, and CSI-4.
16 A. I think so -- I have another plot, I believe,
17 with those plotted, and I would say yes.
18 Q. Okay. So, therefore, in your opinion would
19 pumping from those wells, CSI-1, 3, and 4, impact the Muddy
20 River Springs?
21 A. No. With qualification.
22 Q. Okay. Well, they're within your capture; am I
23 right?
24 A. It's a scoping model.

Page 838

1 Q. Okay. Earlier you were testifying about how
2 Sheep Range recharge makes it to the Big Muddy Spring, do you
3 recall that?
4 A. No, I don't believe that's correct.
5 Q. Okay. Do you think that that Sheep Range
6 recharge makes it to the Muddy River Springs?
7 A. Yes. To those with the hydrograph of VH-4 form,
8 if that makes sense.
9 Q. Okay. Now, I think earlier I asked you about
10 impacts from pumping at MX-5 during the Order 1169 pumping
11 test. Do you believe that pumping at Arrow Canyon impacts
12 the MX-5 area?
13 A. No.
14 Q. Are you -- Are you aware of anyone else who
15 shares that opinion other than Dr. Mifflin?
16 A. Well, the opinion has been shared with everyone
17 in this room. And I haven't taken a poll. And I think
18 opinions are changing.
19 Q. Okay. Now, I'd like you, if you could, could you
20 look at Figure 5-5 that I put in that binder right in front
21 of you?
22 A. Thank you.
23 Q. So that is a -- that is in SNWA's initial report
24 and you've reviewed that; correct? You reviewed that report?

Page 839

1 A. Well, yes, weakly, w-e-a-k-l-y, reviewed. I've
2 looked at it.
3 Q. All right. Okay. I'm just using this to look at
4 the hydrographs. So, do you see the top hydrograph there,
5 which is CSVM-1, the top panel?
6 A. I do.
7 Q. And would you agree with me that this is a
8 monitor well that is very close to MX-5?
9 A. I think it is. That's one I'm not as certain of
10 the location on as some of the others. But I believe it is
11 close and northeast, if I'm not mistaken, of MX-5.
12 Q. Okay. And do you agree that that monitor well
13 shows the signal of pumping at MX-5 during the pump test?
14 A. I do, because of the diagnostic -- Let me see
15 here. 2012. The 2012 recovery. So yes.
16 Q. Okay. Now, and can you -- have you quantified
17 the amount of drawdown at that location in quantity?
18 A. I am not sure. I don't believe -- Well, I'm not
19 sure. I'm not sure. I looked at several wells using our
20 method of differences. And the nearest well was MX-4. And I
21 think the next one out was UMVM-1. So I think I have not
22 looked at any of the detail CSI-1 or -- Is that what it is?
23 CSVM-1.
24 Q. But is it kind of, in your words, is it okay to

Page 840

1 blame pumping for this drawdown in this particular
2 hydrograph?
3 A. Important point. Drawdown, yes. Water level
4 change, no.
5 Q. Okay. Now, if you look down at the California
6 Wash, there's one, two, three panels down, there's
7 Paultes-TH2 California Wash. Do you see that panel?
8 A. Got it.
9 Q. Okay. And would you agree with me there was also
10 a change in water level during the pumping test?
11 A. Yes.
12 Q. Okay. But in this well you do not believe that
13 pumping can be blamed for that change in water level;
14 correct?
15 A. Not for the entire change. There's a component
16 of environmental -- environmentally -- Excuse me --
17 environmentally-driven change also.
18 Q. Okay. But can pumping be blamed for any of this
19 change in this water level?
20 A. Absolutely, based on the diagnostic 2012 recovery
21 peak.
22 Q. Okay. And, let me specify, pumping at MX-5
23 during the 1169 pumping test.
24 A. Understood.

Page 841

1 Q. Yes. Could you go to slide 17 on your power
2 point there, please.
3 A. I'm trying. I'm trying. 17?
4 Q. Yes. No. Keep going. Two more. Now, before I
5 ask this question, I've got another slightly different one.
6 You talked about a opinion that you have regarding roughly
7 40,000 acre-feet of water going through the shear zone, Las
8 Vegas shear zone in to Las Vegas Valley from the Lower White
9 River Flow System; right?
10 A. Yes. Qualified.
11 Q. Okay. But would you agree with me that if that
12 was occurring that that amount of water is already being
13 appropriated in the Las Vegas Valley?
14 A. I don't know what the status of appropriations
15 is. All I have is verbal hearsay. I think better than
16 hearsay, but a verbal total quantity pumped and total
17 quantity reinjected estimates both.
18 Q. Okay. Did you check the State Engineer's pumping
19 inventories on their website and to validate the statement
20 that was made to you by Mr. Burns or did you just simply rely
21 upon that statement that he made?
22 A. I relied on his statement.
23 Q. Okay.
24 A. And it was modified slightly during the modeling,

Page 842

1 during the calibration. But initially precisely on his
2 estimate.
3 MR. TAGGART: Okay. Thank you very much.
4 HEARING OFFICER FAIRBANK: All right. So the
5 next participant who had expressed interest in asking
6 additional questions after the lunch break was the Center for
7 Biological Diversity. And you will have ten minutes.
8 MS. PETERSON: I think I would like some
9 questions.
10 HEARING OFFICER FAIRBANK: I'm sorry. What was
11 that, Ms. Peterson?
12 MS. PETERSON: I think I had a couple of
13 questions and I had reserved some time after I heard
14 Mr. Taggart's questions.
15 HEARING OFFICER FAIRBANK: I'm sorry. I didn't
16 mark you down. But I will go ahead and -- Mr. Donnelly, if
17 you'll wait, we'll just continue in the order as we've been
18 going. So, excuse me.
19 Ms. Peterson, we'll go ahead and call you up for
20 Lincoln County and for Vidler. Thank you.
21 MS. PETERSON: Thank you.
22 RE-CROSS-EXAMINATION
23 By Ms. Peterson:
24 Q. Hi, Dr. Johnson.

Page 843

1 A. Hello.
2 Q. Karen Peterson again for Lincoln County Water
3 District and Vidler Water Company. Were you here for
4 Dr. Waddell's testimony yesterday?
5 A. Yes.
6 Q. And did you hear him express an opinion that
7 drawdowns do not stay in capture zones?
8 A. I did.
9 Q. And do you agree with that?
10 A. No. Qualifying.
11 Q. No. Qualify. Okay. What's your qualification?
12 A. Depending on the anisotropy of the system, which
13 we're the first to discuss and I'm not sure if we're the
14 first to analyze. But depending on the degree or the extent
15 of how anisotropic the transmissivity is, in the extreme you
16 would have a pipe. And then he's wrong, okay.
17 So the argument or the explanation that
18 Dr. Waddell gave us is absolutely correct for an isotropic
19 system. And it begins to -- And if you can get him to
20 respond, maybe I've got this wrong. But I would suggest that
21 for an anisotropic system, which is what we analyze, that's
22 less correct than the context of the statement he made
23 yesterday.
24 MS. PETERSON: Thank you. I don't have any

Page 844

1 further questions.
2 HEARING OFFICER FAIRBANK: Thank you.
3 Mr. Donnelly.
4 RE-CROSS-EXAMINATION
5 By Mr. Donnelly:
6 Q. Thank you. Patrick Donnelly with the Center for
7 Biological Diversity. Hello again, Dr. Johnson.
8 A. Mr. Donnelly.
9 Q. I want to hit a couple of topics we talked about
10 before in a little more detail. First, I would like to get
11 back to this idea of the two flow fields. One we can call
12 the illegal Las Vegas Express. And the other I feel like we
13 didn't get a whole lot of detail about. You know, the map
14 you showed -- I believe it was slide two in your presentation
15 with the two flow fields -- shows a pretty small area for
16 recharging the Muddy River Springs.
17 And can you expound more on the exact boundaries
18 of this recharge area, particularly how far north and east it
19 goes?
20 A. And I, unfortunately, because the -- Well, we had
21 access to the software, we didn't make a plot of -- or I
22 didn't preserve a plot of stream lines for the whole state,
23 for the whole flow domain. So what these do north of the
24 illustration is widen out and get really squirrely as all

Page 845

1 the water from all of these little recharge patches tries to
2 get in to get organized in to the system. So it's much less
3 clear.
4 There is a boundary between the capture zones
5 farther north. But the look of those -- The stream lines are
6 a mess. Put it that way. For it to solve all of these
7 little bits of flow, it doesn't do anything for you visually.
8 Q. So the northern and eastern boundaries of these
9 flow paths are unclear?
10 A. Well, not so much the boundary. It widens out.
11 What the eastern captures zone widens out. So they're more
12 proportional to the north. But you do have more water in our
13 assumed conceptual model coming out of Las Vegas and
14 Pahranaagat in those springs than you do out of Muddy and
15 Panaca. So we would have a proportionately smaller capture
16 zone, all other things being equal.
17 Q. Do you have any geochemical or other types of
18 analysis to prove these flow paths?
19 A. Yes.
20 Q. Did you present those here and I'm just glossing
21 over that?
22 A. No. I didn't present any geochemistry, because I
23 was hoping to get it on cross, and so far nothing.
24 Q. So you have a geochemical analysis tracing water

Page 846

1 from north and east of Panaca to the Muddy River Springs
2 area, you're saying?
3 A. Well, can I show you just one example from a
4 slide?
5 Q. Sure.
6 A. I'm going to have to go backwards in my power
7 point. But I want to show you one -- a couple locations and
8 a couple of numbers. Okay. That was it. We've got the
9 slide. That's slide 11. It shows our Darcy flux
10 calculation. And, by the way, that 40,000, in our opinion,
11 is, even though we use transmissivities that were mid-range
12 of what's been measured, we're only comfortable with
13 asserting to you that that would be an upper limit, pending
14 any more data.
15 But in this figure --
16 (The court reporter interrupts)
17 THE WITNESS: I'm pointing to the Craig Ranch
18 Number 2 Well at the southern end of the page 11 diagram of
19 our power point. That well, if you refer to Thomas and
20 others professional paper, I believe it's 1409C, that's got a
21 stable isotope composition of, if I recall correctly, minus
22 107 and a half or 107 on the deuterium and about minus 14 on
23 the oxygen. That's exactly what Vidler has in KPW-1.
24 How did that isotopic composition that's lighter

Page 847

1 than anything that can be developed at this latitude, how did
2 it get from there to there?
3 Q. (By Mr. Donnelly) So that is on the western, the
4 Ely to Vegas Express flow path, but not on the Muddy River
5 Springs area flow path; correct?
6 A. The way we visualize the flow fields as, again,
7 drawn by a scoping model and we can see in detail the
8 problems. But, yes, the water that we claim as entering Las
9 Vegas Valley, I forget the quantity at the moment. But we've
10 got a gradient and everything has got a finite permeability.
11 So some water has got to be going in there.
12 Q. Can I move this on? But I appreciate this
13 depiction there. Thank you. You're aware of past
14 characterizations of the carbonate groundwater flow paths in
15 central Nevada showing Railroad Valley as a regional sink?
16 A. Can you be more specific about the literature?
17 Q. You got me. I do not have a reference for that,
18 so I'll move on. You declared in your report the drought
19 starts in 1999; is that correct?
20 A. I don't think I said that.
21 Q. On page 29 of your July 3rd report, you say,
22 since the start of the ongoing drought in 1999.
23 A. Okay. There's -- If you want to --
24 Q. I'm just asking if those words are in your report

Page 848

1 or not.
2 A. Well, I don't remember, so I would have to look.
3 Tell me again the page. Actually, let's don't waste time on
4 it. I believe you.
5 Q. Okay. So you said the start of ongoing drought
6 in 1999. Are you aware of when the significant increase in
7 Arrow Canyon pumping began?
8 A. It was about the same time. And that's the
9 assumption that we're challenging. That's the fundamental
10 problem here. That assumption that those two are cause and
11 effect rather than just correlative.
12 Q. I understand.
13 A. But it is our -- That's our fundamental problem.
14 It all starts there.
15 Q. Are you aware of anyone else, hydrologists, the
16 other 11 reports being presented here, who agree with that?
17 A. My co-author.
18 Q. Indeed. From the 11 other parties in this?
19 A. I'm not sure. I really honestly think opinions
20 are evolving here. And so ask for a show of hands.
21 Q. I don't think I'm permitted to do that, so I'm
22 not going to.
23 A. Well, no. I mean --
24 Q. I'm not an attorney, but I don't think --

Page 849

1 A. I'm not trying to be funny with you. I'm
2 serious. I don't know. I don't know. I hope we've
3 convinced somebody. I hope one hand would go up.
4 Q. Okay. Thank you. I have one remaining set of
5 questions and I'll move things along here. You show on page
6 32 of your report, you describe an increase of approximately
7 one CFS at Big Muddy Spring from 2010 to 2012 -- '14; is that
8 correct?
9 A. Page 32?
10 Q. Page 32.
11 A. Figure 27?
12 Q. You just verbally describe or in text you say
13 there's an increase.
14 A. Tell me where in the text.
15 Q. I'm sorry. I don't have it in front of me.
16 A. Okay. I can find it. Just read it to me.
17 Q. You say there's an increase of approximately one
18 CFS at -- I'm sorry. I'm flipping between files here -- Big
19 Muddy Spring. Center of the page. Second sentence of the
20 second paragraph.
21 A. However between 2010 and 2014?
22 Q. Yes. Discharge --
23 A. The Muddy Spring increased by one full CFS.
24 Okay. And I'm referencing a figure, 27.

Page 850

1 Q. Yes. So are you aware of a fire near Big Muddy
2 Springs in 2010?
3 A. Absolutely. I was there.
4 Q. Might the reduction in evapotranspiration due to
5 the fire cause increases in spring discharge?
6 A. There's been that speculation. I don't know that
7 there's any evidence.
8 Q. But that could be a cause for the increase in
9 spring discharge?
10 A. An influence. A component, a forcing agent, yes.
11 Q. Okay. Finally, one last thing. As we've
12 determined, you said your 40,000 acre-feet inflow to Las
13 Vegas Valley number is based on modeling; correct?
14 A. Very simple. It's all there, all of that
15 modeling.
16 Q. Yes, yes. And then in a question from the State
17 Engineer's office you said it could be in order of magnitude
18 more or less?
19 A. If you were to use the transmissivity of roughly
20 a hundred thousand meters squared a day from the MX-5, 1169
21 pump test, you would get a lot more water coming across that
22 boundary. But from our steady state, from REM, the published
23 one, we think the transmissivities in that domain in
24 California Wash are much less than at MX-4. And because --

Page 851

1 So we put a mid-range between our Calpine test, our ECB-1
 2 test, and the Mifflin International Test down in Black
 3 Mountains that got about a -- I'm going to screw up units
 4 because they use gallons per day per foot -- about a million.
 5 Q. So but in theory, as you've attested earlier, the
 6 amount flowing in to Las Vegas Valley could be between 4,000
 7 acre-feet per year and 400,000 acre-feet per year?
 8 A. Well, if you --
 9 Q. Is that correct?
 10 A. Yes. With qualification.
 11 Q. Would having 4,000 acre-feet of inflow a year
 12 throw off the budget that has been conceptualized here?
 13 A. Well, hasn't -- Excuse me to answer with a
 14 question. But I think everybody has hypothesized inflow from
 15 the Pahrnagat Valley. I mean -- I guess I don't understand
 16 what you are --
 17 Q. You developed a model for the Las Vegas Valley
 18 and the amount of water flowing in and this flow path --
 19 A. Now, this is this simple little model that's on
 20 the screen. Is that the one you're discussing?
 21 Q. Yes, yeah.
 22 A. Good. Okay.
 23 Q. So would a flow amount, in-basin flow amount of
 24 4,000 acre-feet substantially alter your results here?

Page 852

1 A. No.
 2 MR. DONNELLY: Okay. I guess we'll leave it at
 3 that.
 4 HEARING OFFICER FAIRBANK: Okay. Thank you. So
 5 and just to confirm, those were the only parties that I had
 6 listed for asking questions after the break. Are there any
 7 other parties, participants, that wanted to ask questions?
 8 Seeing none, then I'm going to go ahead and open
 9 it up to State Engineer staff for any questions.
 10 EXAMINATION
 11 By Ms. Cooper:
 12 Q. Hi. Christi Cooper for the record.
 13 A. Hi, Christi.
 14 Q. Can you go to slide 14, please. Thank you. I
 15 believe that you stated that the drop in the water levels
 16 that we see after 2014 in to 2015 maybe but you thought that
 17 was not due to the pumping response; is that correct?
 18 A. Correct.
 19 Q. Okay. So what do you think is the reason for the
 20 subsequent water level rise?
 21 A. The way I would approach this is exactly the way
 22 we approached the Big Muddy Spring to find that piece of
 23 climate record that explains the, in this case, the
 24 hydrographs. In other words, it's a parallel study to what

Page 853

1 we did at EH-4, but we would have to go back in to R and look
 2 at the thousand possibilities for -- Again, I use -- I would
 3 try both rivers. I would try both rivers and see which one I
 4 get a better fit with. But, you know, we have hundred year
 5 stream flow records that we can sample to try and explain
 6 these hydrographs. And if we get with one all positive
 7 correlation coefficients, maybe we got it. Maybe that's it.
 8 So that's what -- I don't like to talk about
 9 drought anymore. I think it's a red herring. I think most
 10 of these explanatory climate intervals are longer than the
 11 typical drought segment. So we're better off, I think,
 12 thinking in terms of a data-driven model based on the best
 13 climate long term, century type climate proxies that we can
 14 find.
 15 MS. COOPER: Thank you.
 16 EXAMINATION
 17 By Mr. Sullivan:
 18 Q. Adam Sullivan. I have one question on your slide
 19 11. You give an explanation for this in your testimony, and
 20 maybe I didn't quite understand it. But at the bottom end of
 21 the figure, there's -- you're showing flow arrows in blue
 22 that are going in the southwestern direction and then you
 23 show water surface elevations at Gilcrease and Wilshire
 24 Wells?

Page 854

1 A. The Gilcrease is a spring. Wilshire is a City of
 2 North Las Vegas well.
 3 Q. Can you just explain why it appears on this
 4 figure that water is flowing from low gradient to high
 5 gradient?
 6 A. It's a function of the anisotropy. It's not --
 7 If you follow the flow path, it's not.
 8 Q. Maybe I'm misunderstanding. I'm just looking at
 9 the number 539.5 and the number 714.8.
 10 A. Yeah. But that's not where the -- The water is
 11 flowing down those -- follows those arrows. See, that's the
 12 anisotropy. That's what's confusing people. See, if you
 13 believe that the -- Just imagine a bundle of tubes, a tube
 14 bundle, a bunch of little pipes instead of an aquifer,
 15 contained between those red lines, the California Wash and
 16 the Gas Peak Thrust, you've got a river. You've got a river
 17 and it -- a molecule stays about the same distance from the
 18 bank of that river all the way down.
 19 So that's the conceptual model that we suggested,
 20 I believe, somewhere that maybe a paradigm shift is needed.
 21 Maybe treat the system like the Muddy River was treated. You
 22 know, lock in the water rights, get a special master if you
 23 need it, treat it like a stream. Because there's no question
 24 there's a hydraulic gradient. There's no question there's

Page 855

1 flow. There's a lot of water to the south that's coming from
2 somewhere. And so it's an idea that it's new, it's not
3 basins anymore. And you've got to start somewhere, but at
4 least you know where you finish.
5 So that's what an anisotropy does. Just imagine
6 that you've got a bundle of little tubes in that aquifer that
7 it can't -- the water can't move sideways. We're not that
8 restrictive in our model. It's a ten-to-one ratio. But
9 imagine if that anisotropy ratio was a hundred-to-one or a
10 thousand-to-one like it might be down a fault fracture,
11 right. Super permeable transmissivity in the long axis of
12 the fracture next to nothing, you know, out in to the rock.
13 So that's the concept that -- one of the concepts we bring
14 that I'm sure everybody has that's got any hydro background,
15 but it's not been part of this analysis. And once you start
16 treating this as a strong anisotropic system favoring
17 north/south flow, everything looks a little different and
18 easier actually, management wise.
19 So it's a function of the anisotropy that's
20 giving it. The water is not flowing that high. It's flowing
21 north to south and restricted in how much it can get out and
22 flow east to west. That's the anisotropy.
23 Q. Is there some water level data that you can point
24 to that supports that characterization?

Page 856

1 A. Well, these are all -- Well, it's more the
2 pumping response. When you see a direction -- directional
3 dependence to the pumping response, you've got -- Well, one
4 explanation is that you've got an anisotropic system.
5 Heterogeneities will do that too. But if the water, for
6 example, the best example I can think of is the response of
7 CSVN-6 to MX-5. This response and actually its water levels
8 are identical to those in MX-4, identical. So that thing is
9 one transmissive fracture connecting the broken zone or
10 whatever it is at the pumping site with a well a couple of
11 miles to the north in Coyote Spring Valley. So that thing
12 responds instantly and exactly like the monitoring well close
13 right beside the pumping well.
14 On the other hand, CSI-3 production well there to
15 the west of the Horst they discussed the other day, they did
16 a, it was either 24 hours long aquifer test on that thing
17 while CSVN-6 was being monitored by transducer. No response.
18 No detectible response. And then you can quibble about
19 whether there was any response from CSI-1 or CSI-2, which
20 were on and off during that testing. They didn't silence the
21 other production wells while they tested a new one.
22 So there's a little bit of -- But there's good
23 evidence that there's directionality to the transmissive
24 properties, strong directionality. I mean, how can you have

Page 857

1 that and yet another response 20 miles away that looks --
2 that's half as strong, I mean, it's attenuated, but there's
3 no doubt based on that 2012 recovery signal that, yeah, that
4 pumping schedule is getting down to apex but it can't get
5 across half a kilometer of rock in the other direction.
6 So, once you realize how strongly anisotropic the
7 system is, everything changes. You might want to treat it
8 like a river. And I don't say that tongue in cheek. I mean,
9 we don't know how strong anisotropic is. So it's just an
10 idea that might make things easier.
11 Q. Okay. Thanks.
12 A. Yeah.
13 EXAMINATION
14 By Mr. Benedict:
15 Q. Jon Benedict for the record. I just want to
16 follow up on that. Do you see any problem with using MX-6 as
17 the monitoring well to measure that gradient going across the
18 capture zone that's shown in --
19 A. Well, it's a production well, so you have to go
20 look at the recovery intervals to estimate water level. And,
21 of course, it's trending too. So these are -- We've got --
22 Let's take that one, 553 and 539, there's 14 meters of
23 difference between those and there's not that much
24 uncertainty in taking the water level at roughly the same

Page 858

1 time. So, you know, if we're off by a meter so in
2 representative water level three to one, it won't change the
3 fact that there's a gradient north to south.
4 Q. But if you think they're in separate capture
5 zones then why would you suggest that that gradient is
6 important?
7 A. Oh, I see what you're saying. Well, again, the
8 capture zone is from a scoping model and you can see -- we
9 can already see that it's not accurate out in the Coyote
10 Spring Valley. We're capturing from areas where we know
11 there's -- The example I just gave you, the CSI-3 example.
12 No effects. But, you know, you go where you can get a good
13 water level.
14 Now, if I went to -- Actually, if we want to do
15 some math, we could. I know Wilshire -- Well, somebody
16 convert 539.5 to feet. And we're looking for something up
17 there about 1812 or 1815. So I think there will still be a
18 gradient. I think you can move south on that. I was looking
19 for long -- the longest distance I could get, you know, to do
20 those Darcy calculations.
21 So you either use just the other one. If you
22 don't like that one, let's go down and use maybe H-4. That's
23 a couple of feet lower, but it's also a little bit south. So
24 I bet it would come out pretty close.

Page 859

1 MR. BENEDICT: All right.
2 FURTHER EXAMINATION
3 By Ms. Cooper:
4 Q. Christi Cooper. Can you just maybe following up
5 on your statement about CSI Well Number 3. Do you think that
6 there was any pumping effects seen from the MX-5 pumping test
7 there?
8 A. It's a production well, so I don't know. It's
9 been busy and it was in service.
10 Q. What would you say as far as to the other CSI
11 wells, 1, 2 and 4?
12 A. Well, the production wells aren't -- You know,
13 when I think about the effects, I want to look at them in the
14 CSVM sense and not in the production wells. I mean, we
15 could. But that's exactly where you'll find the messiest
16 data and the most uncertainty about what's, you know,
17 recovered water levels. So I avoided those for -- as
18 designers.
19 MS. COOPER: Okay. Thank you.
20 EXAMINATION
21 By Ms. Barnes:
22 Q. Michelle Barnes for the record. I'm looking at
23 figure seven from appendix three. It's the isotope data. I
24 don't have a question specifically on the chart. I was just

Page 860

1 wondering if you would be willing to make that data
2 available.
3 A. I don't have any isotope data of my own. Let me
4 see what this is. I'm sorry. What --
5 Q. Appendix three, figure seven, page 57.
6 A. Which appendix, number wise, is this?
7 Q. Three.
8 A. Page three. Oh, I see. That must be here. It
9 must be here. Oh, okay, okay. We're getting there. I've
10 got it. I've got it. Which page? I'm sorry.
11 Q. Page 57, figure seven.
12 A. Oh, yeah, good, yes.
13 Q. I'm just wondering if you would be willing, I
14 guess, and able to make that data available?
15 A. It's TRI data. It's in your -- This is all out
16 of the baseline data report.
17 Q. Oh, okay.
18 A. It's Southern Nevada Water Authority's baseline
19 data report.
20 Q. Perfect. Thank you.
21 A. And I don't think we put that as one of our
22 exhibits, but it's in here. It's around.
23 Q. Okay. Thank you.
24 A. Yeah. It was just the number and just the

Page 861

1 analyses, so everything in that one reference.
2 Q. Okay. Thank you.
3 HEARING OFFICER FAIRBANK: All right. So we're
4 doing well on time today and so I wanted to just find out
5 whether or not Southern Nevada Water Authority has any
6 additional questions?
7 Seeing no additional questions, Lincoln County,
8 Vidler, do you have any further questions? Seeing none.
9 And, finally, Center for Biological Diversity?
10 Okay. Well, then we'll go ahead and open it up
11 to -- you wanted to reserve some time for redirect?
12 MS. BALDWIN: I think we're okay.
13 HEARING OFFICER FAIRBANK: So seeing that you're
14 going to not do anymore redirect, okay, we'll wrap things up
15 and we will go ahead and conclude the hearing for today.
16 Oh, yeah. Thank you for reminding me. So
17 yesterday Mr. Waddell -- Dr. Waddell, you had wanted to
18 get -- you had said you were going to get back with some
19 information regarding a report. Would you like to go ahead
20 and share that with us?
21 THE WITNESS: Should I move, pack up?
22 HEARING OFFICER FAIRBANK: Yes, Dr. Johnson,
23 you're done for the day. Thank you.
24 MR. WADDELL: Yes. Rick Waddell for the record.

Page 862

1 I was asked to provide the reference to that Stan Leake work
2 dealing with recovery time from pumping. And so I found
3 that. It's in a US Geological circular -- US Geological
4 Survey circular by Paul Barlow and Stan Leake. It was
5 published in 2012. Title is Stream Flow Depletion by Wells,
6 Understanding and Managing the Effects of Groundwater Pumping
7 on Stream Flow. That's US Geological Survey circular 1376.
8 And it's available on the web at the following URL: HTTPS,
9 colon, front slash, front slash, DOI, dot ORG, front slash,
10 10.3133, front slash, CIRC, 1376.
11 HEARING OFFICER FAIRBANK: Thank you very much,
12 Dr. Waddell.
13 All right. Well, I think we've concluded our
14 proceedings for today. So we will go ahead and commence
15 tomorrow promptly at 8:30 a.m. Thank you very much.
16 (Hearing concluded at 1:40 p.m.)
17
18
19
20
21
22
23
24

1 STATE OF NEVADA)

)ss.

2 COUNTY OF WASHOE)

3

4 I, CHRISTY Y. JOYCE, Official Certified Court
5 Reporter for the State of Nevada, Department of Conservation
6 and Natural Resources, Division of Water Resources, do hereby
7 certify:

8 That on Thursday, the 26th day of September,
9 2019, I was present at the Legislative Counsel Bureau, Carson
10 City, Nevada, for the purpose of reporting in verbatim
11 stenotype notes the within-entitled public hearing;

12 That the foregoing transcript, consisting of
13 pages 831 through 862, inclusive, includes a full, true and
14 correct transcription of my stenotype notes of said public
15 hearing.

16

17 Dated at Reno, Nevada, this 26th day of
18 September, 2019.

19

20

21

CHRISTY Y. JOYCE, CCR #625

22

23

24

#	851:6,18,23,23 analyses (1) 861:1	attorney (1) 848:24	bet (1) 858:24	841:20
#625 (2) 831:22.5;863:21.5	analysis (3) 845:18,24;855:15	Authority (2) 835:6;861:5	Beth (1) 833:17	busy (1) 859:9
A	analyze (2) 843:14,21	Authority's (1) 860:18	better (3) 841:15;853:4,11	C
able (1) 860:14	and- (2) 833:4.5,13	available (3) 860:2,14;862:8	Big (5) 838:2;849:7,18; 850:1;852:22	CADY (1) 834:3
Absolutely (3) 840:20;843:18;850:3	Angeles (1) 833:9.5	avoided (1) 859:17	bigger (1) 836:20	calculation (1) 846:10
access (1) 844:21	anisotropic (6) 843:15,21;855:16;	aware (5) 838:14;847:13; 848:6,15;850:1	binder (1) 838:20	calculations (1) 858:20
accurate (1) 858:9	anisotropy (7) 843:12;854:6,12; 855:5,9,19,22	away (1) 857:1	Biologic (1) 833:23	calibration (1) 842:1
acre-feet (6) 841:7;850:12;851:7, 7,11,24	anymore (3) 853:9;855:3;861:14	axis (1) 855:11	Biological (3) 842:7;844:7;861:9	CALIFORNIA (6) 831:10.5;833:9.5; 840:5,7;850:24;854:15
across (3) 850:21;857:5,17	apex (1) 857:4	B	bit (2) 856:22;858:23	call (2) 842:19;844:11
Acting (1) 832:5	appears (1) 854:3	back (4) 835:4;844:11;853:1; 861:18	bits (1) 845:7	Calpine (1) 851:1
Actually (4) 848:3;855:18;856:7; 858:14	appendix (3) 859:23;860:5,6	background (1) 855:14	BLACK (2) 831:8;851:2	can (26) 839:16;840:13,18; 843:19;844:11,17; 846:3;847:1,7,12,16; 849:16;852:14;853:5, 13;854:3;855:21,23; 856:6,18,24;858:8,9, 12,18;859:4
Adam (2) 832:6;853:18	appreciate (1) 847:12	backwards (1) 846:6	blame (1) 840:1	Canyon (2) 838:11;848:7
additional (4) 835:7;842:6;861:6,7	approach (1) 852:21	Baldwin (2) 833:17;861:12	blamed (2) 840:13,18	CAPITOL (1) 831:21
ADMINISTRATION (1) 831:6	approached (1) 852:22	Band (1) 833:17	Bliss (1) 832:15	capture (11) 836:11,15,23; 837:13,22;843:7; 845:4,15;857:18; 858:4,8
afternoon (1) 835:11	appropriated (1) 841:13	bank (1) 854:18	blue (1) 853:21	captures (2) 836:4;845:11
Again (9) 835:11;837:1,14; 843:2;844:7;847:6; 848:3;853:2;858:7	appropriations (1) 841:14	Barlow (1) 862:4	BMDL (1) 837:5	capturing (1) 858:10
agent (1) 850:10	approximately (2) 849:6,17	Barnes (4) 832:9;834:11; 859:21,22	both (3) 841:17;853:3,3	carbonate (2) 836:10;847:14
agree (6) 839:7,12;840:9; 841:11;843:9;848:16	aquifer (3) 854:14;855:6;856:16	based (4) 840:20;850:13; 853:12;857:3	bottom (1) 853:20	Carson (5) 831:23.5;833:4,14.5; 835:1;863:9
ahead (9) 835:3,4;842:16,19; 852:8;861:10,15,19; 862:14	AREA (10) 831:8.5,11;836:4; 837:12,13;838:12; 844:15,18;846:2;847:5	baseline (2) 860:16,18	boundaries (2) 844:17;845:8	case (1) 852:23
AKA (1) 831:11.5	areas (1) 858:10	BASIN (7) 831:8,9,9.5,10,10.5, 12;832:15.5	boundary (5) 835:20;836:2;845:4, 10;850:22	cause (3) 848:10;850:5,8
Alex (1) 833:15.5	argument (1) 843:17	basins (1) 855:3	Bradley (1) 833:9	Caviglia (1) 833:10.5
Allison (1) 833:13.5	around (1) 860:22	Bedroc (1) 833:20	break (2) 842:6;852:6	CCR (3) 831:22,22.5; 863:21.5
allow (1) 835:6	Arrow (2) 838:11;848:7	began (1) 848:7	Bridget (1) 832:15	Center (5) 833:23;842:6;844:6; 849:19;861:9
alluvial (1) 836:3	arrows (2) 853:21;854:11	begins (1) 843:19	bring (1) 855:13	central (1) 847:15
along (2) 835:24;849:5	asserting (1) 846:13	Belaustegui (1) 833:6	broken (1) 856:9	century (1) 853:13
alter (1) 851:24	assumed (1) 845:13	Benedict (5) 832:12;834:9; 857:14,15;859:1	Brownstein (1) 833:8.5	
amount (6) 839:17;841:12;	assumption (2) 848:9,10	beside (1) 856:13	budget (1) 851:12	
	attenuated (1) 857:2	best (2) 853:12;856:6	bunch (1) 854:14	
	attested (1) 851:5		bundle (3) 854:13,14;855:6	
			Bureau (1) 863:9	
			Burns (1)	

certain (1) 839:9	833:13.5;843:3	857:21	862:5	doubt (1) 857:3
Certified (2) 831:21.5;863:4	component (2) 840:15;850:10	court (2) 846:16;863:4	Deputy (1) 832:6.5	down (9) 840:5,6;842:16; 851:2;854:11,18; 855:10;857:4;858:22
certify (1) 863:7	composition (2) 846:21,24	COYOTE (3) 831:7.5;856:11; 858:9	describe (2) 849:6,12	Dr (9) 835:11;838:15; 842:24;843:4,18; 844:7;861:17,22; 862:12
CFS (3) 849:7,18,23	concept (1) 855:13	Craig (1) 846:17	designers (1) 859:18	drawdown (3) 839:17;840:1,3
challenging (1) 848:9	concepts (1) 855:13	cross (1) 845:23	detail (4) 839:22;844:10,13; 847:7	drawdowns (1) 843:7
change (7) 840:4,10,13,15,17, 19;858:2	conceptual (2) 845:13;854:19	CSI (7) 833:6,8.5;837:11,11, 12;859:5,10	detectible (1) 856:18	drawn (2) 835:23;847:7
changes (1) 857:7	conceptualized (1) 851:12	CSI-1 (4) 837:15,19;839:22; 856:19	determined (1) 850:12	drop (1) 852:15
changing (1) 838:18	conclude (1) 861:15	CSI-2 (1) 856:19	deuterium (1) 846:22	drought (5) 847:18,22;848:5; 853:9,11
characterization (1) 855:24	concluded (2) 862:13,16	CSI-3 (3) 837:15;856:14; 858:11	developed (2) 847:1;851:17	due (2) 850:4;852:17
characterizations (1) 847:14	confirm (1) 852:5	CSI-4 (1) 837:15	diagnostic (2) 839:14;840:20	during (7) 838:10;839:13; 840:10,23;841:24; 842:1;856:20
chart (1) 859:24	confusing (1) 854:12	CSVM (1) 859:14	diagram (1) 846:18	
check (1) 841:18	connecting (1) 856:9	CSVM-1 (2) 839:5,23	difference (1) 857:23	E
cheek (1) 857:8	CONSERVATION (2) 831:2;863:5	CSVM-6 (2) 856:7,17	differences (1) 839:20	
Chief (2) 832:8,11	consider (1) 837:11		different (2) 841:5;855:17	
Christi (4) 832:13.5;852:12,13; 859:4	considered (1) 835:20	D	direction (3) 853:22;856:2;857:5	
CHRISTY (3) 831:22;863:4,21.5	consisting (1) 863:12	Darcy (2) 846:9;858:20	directional (1) 856:2	Earlier (3) 838:1,9;851:5
CIRC (1) 862:10	contained (1) 854:15	data (10) 846:14;855:23; 859:16,23;860:1,3,14, 15,16,19	directionality (2) 856:23,24	easier (2) 855:18;857:10
circular (3) 862:3,4,7	context (1) 843:22	data-driven (1) 853:12	Discharge (3) 849:22;850:5,9	east (3) 844:18;846:1;855:22
City (7) 831:23.5;833:4,14.5, 21;835:1;854:1;863:10	continue (1) 842:17	Dated (1) 863:17	discuss (1) 843:13	eastern (3) 836:24;845:8,11
claim (1) 847:8	Continued (1) 833:1.5	day (6) 850:20;851:4; 856:15;861:23;863:8, 17	discussed (1) 856:15	ECB-1 (1) 851:1
clear (1) 845:3	convert (1) 858:16	dealing (1) 862:2	discussing (1) 851:20	effect (1) 848:11
climate (4) 852:23;853:10,13,13	convinced (1) 849:3	declared (1) 847:18	distance (2) 854:17;858:19	effects (4) 858:12;859:6,13; 862:6
close (4) 839:8,11;856:12; 858:24	Cooper (9) 832:13.5;834:7,10; 852:11,12;853:15; 859:3,4,19	degree (1) 843:14	District (3) 833:12.5,18.5;843:3	EH-4 (1) 853:1
co-author (1) 848:17	correctly (1) 846:21	DEPARTMENT (2) 831:2;863:5	Diversity (4) 833:23.5;842:7; 844:7;861:9	either (2) 856:16;858:21
coefficients (1) 853:7	correlation (1) 853:7	dependence (1) 856:3	DIVISION (2) 831:3;863:6	elevations (1) 853:23
colon (1) 862:9	correlative (1) 848:11	Depending (2) 843:12,14	DOI (1) 862:9	else (2) 838:14;848:15
comfortable (1) 846:12	Counsel (1) 863:9	depicted (1) 836:23	domain (2) 844:23;850:23	Ely (1) 847:4
coming (3) 845:13;850:21;855:1	County (5) 833:12;842:20; 843:2;861:7;863:2	depiction (1) 847:13	done (1) 861:23	end (2) 846:18;853:20
commence (1) 862:14	couple (7) 835:12;842:12; 844:9;846:7,8;856:10; 858:23	Depletion (1)	Donnelly (9) 833:23.5;834:6; 842:16;844:3,5,6,8; 847:3;852:2	Energy (1) 833:10.5
Company (2)	course (1)		dot (1) 862:9	Engineer (5) 832:5,6,5,9,5,15,5; 852:9

<p>Engineer's (2) 841:18;850:17</p> <p>entering (1) 847:8</p> <p>entire (1) 840:15</p> <p>environmental (1) 840:16</p> <p>environmentally (1) 840:16</p> <p>environmentally-driven (1) 840:17</p> <p>equal (1) 845:16</p> <p>Esq (11) 833:3,5,5,7,9,10,5, 14,15,5,17,18,5,20,21</p> <p>essentially (1) 836:7</p> <p>estimate (2) 842:2;857:20</p> <p>estimates (1) 841:17</p> <p>evapotranspiration (1) 850:4</p> <p>even (1) 846:11</p> <p>everybody (2) 851:14;855:14</p> <p>everyone (1) 838:16</p> <p>evidence (2) 850:7;856:23</p> <p>evolving (1) 848:20</p> <p>exact (1) 844:17</p> <p>exactly (4) 846:23;852:21; 856:12;859:15</p> <p>Examination (10) 834:7,8,9,10,11; 852:10;853:16;857:13; 859:2,20</p> <p>example (5) 846:3;856:6,6; 858:11,11</p> <p>Excuse (5) 835:22;837:3; 840:16;842:18;851:13</p> <p>Exhibit (1) 835:15</p> <p>exhibits (1) 860:22</p> <p>explain (2) 853:5;854:3</p> <p>explains (1) 852:23</p> <p>explanation (3) 843:17;853:19;856:4</p> <p>explanatory (1) 853:10</p> <p>expound (1)</p>	<p>844:17</p> <p>express (3) 843:6;844:12;847:4</p> <p>expressed (1) 842:5</p> <p>extent (1) 843:14</p> <p>extreme (1) 843:15</p> <hr/> <p style="text-align: center;">F</p> <hr/> <p>F-1 (2) 835:22,23</p> <p>fact (1) 858:3</p> <p>FAIRBANK (12) 831:4;832:3;835:3; 842:4,10,15;844:2; 852:4;861:3,13,22; 862:11</p> <p>far (3) 844:18;845:23; 859:10</p> <p>Farber (1) 833:8.5</p> <p>farther (1) 845:5</p> <p>fault (1) 855:10</p> <p>favoring (1) 855:16</p> <p>feel (1) 844:12</p> <p>feet (2) 858:16,23</p> <p>fields (3) 844:11,15;847:6</p> <p>figure (17) 835:23;836:14,16, 18,20;837:4,9,13; 838:20;846:15;849:11, 24;853:21;854:4; 859:23;860:5,11</p> <p>files (1) 849:18</p> <p>Finally (2) 850:11;861:9</p> <p>find (6) 836:19;849:16; 852:22;853:14;859:15; 861:4</p> <p>finish (1) 855:4</p> <p>finite (1) 847:10</p> <p>fire (2) 850:1,5</p> <p>First (4) 836:18;843:13,14; 844:10</p> <p>fit (1) 853:4</p>	<p>five (2) 836:20;837:4</p> <p>Flangas (1) 833:15.5</p> <p>Flatley (1) 832:7.5</p> <p>flipping (1) 849:18</p> <p>FLOW (25) 831:7;836:4,5;841:9; 844:11,15,23;845:7,9, 18;847:4,5,6,14; 851:18,23,23;853:5,21; 854:7;855:1,17,22; 862:5,7</p> <p>flowing (6) 851:6,18;854:4,11; 855:20,20</p> <p>flux (1) 846:9</p> <p>follow (2) 854:7;857:16</p> <p>following (2) 859:4;862:8</p> <p>follows (1) 854:11</p> <p>foot (1) 851:4</p> <p>forcing (1) 850:10</p> <p>foregoing (1) 863:12</p> <p>forget (1) 847:9</p> <p>form (1) 838:7</p> <p>found (1) 862:2</p> <p>fracture (3) 855:10,12;856:9</p> <p>front (6) 838:20;849:15; 862:9,9,10</p> <p>full (2) 849:23;863:13</p> <p>function (2) 854:6;855:19</p> <p>fundamental (2) 848:9,13</p> <p>funny (1) 849:1</p> <p>Further (5) 834:10;835:7;844:1; 859:2;861:8</p> <hr/> <p style="text-align: center;">G</p> <hr/> <p>gallons (1) 851:4</p> <p>GARNET (2) 831:9;835:21</p> <p>Gas (1) 854:16</p>	<p>gave (2) 843:18;858:11</p> <p>geochemical (2) 845:17,24</p> <p>geochemistry (1) 845:22</p> <p>Geological (3) 862:3,3,7</p> <p>Gilcrease (2) 853:23;854:1</p> <p>giving (1) 855:20</p> <p>Glasgow (1) 833:22</p> <p>glossing (1) 845:20</p> <p>goes (1) 844:19</p> <p>Good (5) 835:11;851:22; 856:22;858:12;860:12</p> <p>gradient (8) 847:10;854:4,5,24; 857:17;858:3,5,18</p> <p>Greg (1) 833:18.5</p> <p>groundwater (4) 835:14,15;847:14; 862:6</p> <p>guess (3) 851:15;852:2;860:14</p> <hr/> <p style="text-align: center;">H</p> <hr/> <p>H-4 (1) 858:22</p> <p>half (3) 846:22;857:2,5</p> <p>hand (2) 849:3;856:14</p> <p>hands (1) 848:20</p> <p>happens (1) 836:7</p> <p>hear (1) 843:6</p> <p>heard (1) 842:13</p> <p>HEARING (19) 831:4,15,16;832:3,5, 8;835:3;842:4,10,15; 844:2;852:4;861:3,13, 15,22;862:11,16; 863:11,15</p> <p>hearsay (2) 841:15,16</p> <p>Hello (2) 843:1;844:7</p> <p>hereby (1) 863:6</p> <p>Herrema (1) 833:9</p> <p>herring (1)</p>	<p>853:9</p> <p>Heterogeneities (1) 856:5</p> <p>Hi (3) 842:24;852:12,13</p> <p>HIDDEN (1) 831:9.5</p> <p>high (2) 854:4;855:20</p> <p>hit (1) 844:9</p> <p>honestly (1) 848:19</p> <p>hope (2) 849:2,3</p> <p>hoping (2) 836:19;845:23</p> <p>Horst (1) 856:15</p> <p>hours (1) 856:16</p> <p>HTTPS (1) 862:8</p> <p>hundred (2) 850:20;853:4</p> <p>hundred-to-one (1) 855:9</p> <p>Hyatt (1) 833:8.5</p> <p>hydraulic (1) 854:24</p> <p>hydro (1) 855:14</p> <p>hydrograph (4) 837:5;838:7;839:4; 840:2</p> <p>HYDROGRAPHIC (6) 831:7.5,8.5,9.5,10, 10.5,11.5</p> <p>hydrographs (3) 839:4;852:24;853:6</p> <p>Hydrologist (1) 832:12.5</p> <p>hydrologists (1) 848:15</p> <p>Hydrology (1) 832:11</p> <p>hypothesized (1) 851:14</p> <hr/> <p style="text-align: center;">I</p> <hr/> <p>idea (3) 844:11;855:2;857:10</p> <p>identical (2) 856:8,8</p> <p>identified (1) 836:11</p> <p>illegal (1) 844:12</p> <p>illustration (1) 844:24</p> <p>imagine (3)</p>
---	--	--	---	---

854:13;855:5,9 impact (1) 837:19 impacts (3) 836:11;838:10,11 impermeable (1) 836:2 Important (2) 840:3;858:6 in-basin (1) 851:23 includes (1) 863:13 inclusive (1) 863:13 increase (5) 848:6;849:6,13,17; 850:8 increased (1) 849:23 increases (1) 850:5 Indeed (1) 848:18 inflow (3) 850:12;851:11,14 influence (1) 850:10 information (1) 861:19 initial (3) 837:4,7;838:23 initially (1) 842:1 instantly (1) 856:12 instead (1) 854:14 interest (1) 842:5 International (1) 851:2 interrupts (1) 846:16 intervals (2) 853:10;857:20 inventories (1) 841:19 isotope (3) 846:21;859:23;860:3 isotopic (1) 846:24 isotropic (1) 843:18 IV (1) 831:17	832:12;857:15 JOYCE (3) 831:22;863:4,21.5 July (1) 847:21 Justina (1) 833:10.5	Lincoln (4) 833:12;842:20; 843:2;861:7 lines (3) 844:22;845:5;854:15 listed (1) 852:6 literature (1) 847:16 little (10) 836:20;844:10; 845:1,7;851:19; 854:14;855:6,17; 856:22;858:23 location (2) 839:10,17 locations (1) 846:7 lock (1) 854:22 long (4) 853:13;855:11; 856:16;858:19 longer (1) 853:10 longest (1) 858:19 look (8) 838:20;839:3;840:5; 845:5;848:2;853:1; 857:20;859:13 looked (3) 839:2,19,22 looking (6) 837:4,6;854:8; 858:16,18;859:22 looks (2) 855:17;857:1 Los (1) 833:9.5 lot (3) 844:13;850:21;855:1 Low (2) 833:6.5;854:4 LOWER (3) 831:6.5;841:8; 858:23 Ltd (1) 833:3 lunch (1) 842:6	831:6.5;855:18 Managing (1) 862:6 map (1) 844:13 mark (1) 842:16 marked (1) 835:15 master (1) 854:22 math (1) 858:15 MATTER (1) 831:6 maybe (10) 843:20;852:16; 853:7,7,20;854:8,20, 21;858:22;859:4 mean (6) 848:23;851:15; 856:24;857:2,8;859:14 measure (1) 857:17 measured (1) 846:12 Melissa (1) 832:7.5 mess (1) 845:6 messiest (1) 859:15 meter (1) 858:1 meters (2) 850:20;857:22 method (1) 839:20 MICHELINE (2) 831:4;832:3 Michelle (2) 832:9;859:22 mid-range (2) 846:11;851:1 Mifflin (2) 838:15;851:2 Might (4) 850:4;855:10;857:7, 10 miles (2) 856:11;857:1 million (1) 851:4 minus (2) 846:21,22 minutes (2) 835:7;842:7 missed (1) 837:3 mistaken (1) 839:11 misunderstanding (1) 854:8	MOAPA (3) 831:11.5;833:17,18 model (9) 837:24;845:13; 847:7;851:17,19; 853:12;854:19;855:8; 858:8 modeling (3) 841:24;850:13,15 modified (1) 841:24 molecule (1) 854:17 moment (1) 847:9 monitor (2) 839:8,12 monitored (1) 856:17 monitoring (2) 856:12;857:17 more (10) 841:4;844:10,17; 845:11,12;846:14; 847:16;850:18,21; 856:1 Morrison (1) 833:18.5 most (3) 837:3;853:9;859:16 MOUNTAINS (2) 831:8.5;851:3 move (6) 847:12,18;849:5; 855:7;858:18;861:21 MRSA (3) 836:23;837:12,13 much (8) 842:3;845:2,10; 850:24;855:21;857:23; 862:11,15 MUDDY (21) 831:11;836:4,4,5,11, 12,15,15;837:19;838:2, 6;844:16;845:14; 846:1;847:4;849:7,19, 23;850:1;852:22; 854:21 must (2) 860:8,9 MX-4 (3) 839:20;850:24;856:8 MX-5 (9) 838:10,12;839:8,11, 13;840:22;850:20; 856:7;859:6 MX-6 (1) 857:16
J	K	L	M	N
JOHNSON (5) 834:3;835:11; 842:24;844:7;861:22 Jon (2)	Karen (3) 833:14,22;843:2 Keep (1) 841:4 Kent (1) 833:7 kilometer (1) 857:5 kind (1) 839:24 KPW-1 (1) 846:23 Kryder (1) 832:10.5	Lane (1) 831:23 Las (14) 833:21;835:21,24; 836:1;841:7,8,13; 844:12;845:13;847:8; 850:12;851:6,17;854:2 last (1) 850:11 latitude (1) 847:1 Laura (2) 833:20,21 Leake (2) 862:1,4 least (1) 855:4 leave (1) 852:2 Legislative (1) 863:9 less (4) 843:22;845:2; 850:18,24 level (10) 840:3,10,13,19; 852:20;855:23;857:20, 24;858:2,13 levels (3) 852:15;856:7;859:17 Levi (1) 832:10.5 lighter (1) 846:24 limit (1) 846:13	MacKenzie (1) 833:13.5 magazine (1) 835:15 magnitude (1) 850:17 makes (3) 838:2,6,8 MANAGEMENT (2)	National (1) 833:22

NATURAL (2) 831:2;863:6	844:2;852:4;861:3,13, 22;862:11	Pages (2) 831:17.5;863:13	855:11	properties (1) 856:24
NCA (1) 833:15.5	Official (1) 863:4	Pahranaagat (2) 845:14;851:15	permitted (1) 848:21	proportional (1) 845:12
near (1) 850:1	once (2) 855:15;857:6	Paiutes (1) 833:17	Peterson (11) 833:14;834:5; 835:13;842:8,11,12,19, 21,23;843:2,24	proportionately (1) 845:15
nearest (1) 839:20	One (33) 835:13,23;836:17, 19,21;839:9,21;840:6; 841:5;844:11;846:3,7; 849:3,4,7,17,23; 850:11,23;851:20; 853:3,6,18;855:13; 856:3,9,21;857:22; 858:2,21,22;860:21; 861:1	Panaca (2) 845:15;846:1	piece (1) 852:22	prove (1) 845:18
need (1) 854:23	panel (2) 839:5;840:7	panel (2) 839:5;840:7	pipe (1) 843:16	provide (1) 862:1
needed (1) 854:20	panels (1) 840:6	panels (1) 840:6	pipes (1) 854:14	proxies (1) 853:13
NEVADA (16) 831:1,22.5,23.5; 833:4,7.5,11,14.5,16; 835:6;847:15;860:18; 861:5;863:1,5,10,17	paper (2) 835:14;846:20	paper (2) 835:14;846:20	please (3) 837:14;841:2;852:14	PUBLIC (3) 831:15;863:11,14
new (2) 855:2;856:21	paradigm (1) 854:20	paradigm (1) 854:20	plot (3) 837:16;844:21,22	publication (1) 835:23
next (3) 839:21;842:5;855:12	one-to-one (1) 836:8	paragraph (1) 849:20	plotted (1) 837:17	published (2) 850:22;862:5
no-flow (1) 835:20	ongoing (2) 847:22;848:5	parallel (1) 852:24	PM (3) 831:17.5;835:1; 862:16	pump (2) 839:13;850:21
none (2) 852:8;861:8	only (2) 846:12;852:5	Park (1) 833:22	point (7) 835:7;836:18;840:3; 841:2;846:7,19;855:23	pumped (1) 841:16
North (10) 833:21;844:18,23; 845:5,12;846:1;854:2; 855:21;856:11;858:3	oOo- (2) 831:5;835:2	part (3) 836:24,24;855:15	pointing (1) 846:17	pumping (25) 836:3,10;837:19; 838:10,10,11;839:13; 840:1,10,13,18,22,23; 841:18;848:7;852:17; 856:2,3,10,13;857:4; 859:6,6;862:2,6
north/south (1) 855:17	open (2) 852:8;861:10	participant (1) 842:5	poll (1) 838:17	purpose (1) 863:10
northeast (1) 839:11	opinion (6) 837:18;838:15,16; 841:6;843:6;846:10	participants (1) 852:7	PORTION (1) 831:8	put (4) 838:20;845:6;851:1; 860:21
northern (1) 845:8	opinions (2) 838:18;848:19	particular (1) 840:1	positive (1) 853:6	
notes (2) 863:11,14	ORDER (4) 831:16;838:10; 842:17;850:17	particularly (1) 844:18	possibilities (1) 853:2	Q
Number (11) 835:15;837:11,11, 12;846:18;850:13; 854:9,9;859:5;860:6, 24	ORG (1) 862:9	parties (3) 848:18;852:5,7	Power (4) 836:18;841:1;846:6, 19	qualification (4) 836:24;837:21; 843:11;851:10
numbers (1) 846:8	organized (1) 845:2	past (1) 847:13	precisely (1) 842:1	qualifications (1) 836:13
NV (1) 833:10.5	others (2) 839:10;846:20	patches (1) 845:1	present (3) 845:20,22;863:9	Qualified (1) 841:10
Nye (1) 831:23	otherwise (1) 836:5	path (4) 847:4,5;851:18; 854:7	presentation (1) 844:14	Qualify (1) 843:11
O	out (13) 837:1;839:21; 844:24;845:10,11,13, 14;855:12,21;858:9, 24;860:15;861:4	paths (3) 845:9,18;847:14	preserve (1) 844:22	Qualifying (1) 843:10
occurring (1) 841:12	over (1) 845:21	Patrick (2) 833:23.5;844:6	pretty (2) 844:15;858:24	quantified (1) 839:16
O'Connor (1) 833:5	own (1) 860:3	Pauites-TH2 (1) 840:7	problem (3) 848:10,13;857:16	quantity (4) 839:17;841:16,17; 847:9
off (4) 851:12;853:11; 856:20;858:1	oxygen (1) 846:23	Paul (3) 833:3.5;835:12; 862:4	problems (1) 847:8	quibble (1) 856:18
office (1) 850:17	P	peak (2) 840:21;854:16	PROCEEDINGS (2) 831:14;862:14	quick (1) 835:12
OFFICER (13) 831:4;832:3.5,8; 835:3;842:4,10,15;	PACK (14) 834:2;836:16;837:6; 846:18;847:21;848:3; 849:5,9,10,19;860:5,8, 10,11	pending (1) 846:13	production (6) 856:14,21;857:19; 859:8,12,14	quite (1) 853:20
	per (4) 851:4,4,7,7	people (1) 854:12	Professional (2) 832:9.5;846:20	R
	Perfect (1) 860:20	per (4) 851:4,4,7,7	promptly (1) 862:15	Railroad (1)
	permeability (1) 847:10	per (4) 851:4,4,7,7		
	permeable (1)	Perfect (1) 860:20		
		permeability (1) 847:10		
		permeable (1)		

847:15 Ranch (1) 846:17 Range (2) 838:2,5 rather (1) 848:11 ratio (3) 836:8;855:8,9 read (1) 849:16 realize (1) 857:6 really (2) 844:24;848:19 reason (1) 852:19 recall (2) 838:3;846:21 recharge (4) 838:2,6;844:18; 845:1 recharging (1) 844:16 record (7) 835:4,12;852:12,23; 857:15;859:22;861:24 records (1) 853:5 recovered (1) 859:17 recovery (5) 839:15;840:20; 857:3,20;862:2 Recross-Examination (7) 834:4,5,6;835:5,9; 842:22;844:4 red (2) 853:9;854:15 redirect (2) 861:11,14 reduction (1) 850:4 refer (1) 846:19 reference (4) 835:23;847:17; 861:1;862:1 referencing (1) 849:24 referring (1) 835:22 regarding (2) 841:6;861:19 regional (1) 847:15 reinjected (1) 841:17 relied (1) 841:22 rely (1) 841:20 REM (1)	850:22 remaining (1) 849:4 remember (4) 835:16,17,19;848:2 reminding (1) 861:16 Reno (4) 833:7,5,11,16; 863:17 reopen (1) 835:5 Repeat (1) 837:14 report (12) 836:21;837:4,7; 838:23,24;847:18,21, 24;849:6;860:16,19; 861:19 REPORTED (1) 831:21 reporter (2) 846:16;863:5 REPORTERS (2) 831:21,21.5 reporting (1) 863:10 reports (1) 848:16 representative (1) 858:2 represented (1) 836:2 reserve (1) 861:11 reserved (1) 842:13 RESOURCES (4) 831:2,3;863:6,6 respond (1) 843:20 responds (1) 856:12 response (9) 852:17;856:2,3,6,7, 17,18,19;857:1 restricted (1) 855:21 restrictive (1) 855:8 results (1) 851:24 reviewed (3) 838:24,24;839:1 Rick (1) 861:24 right (11) 835:11;837:23; 838:20;839:3;841:9; 842:4;855:11;856:13; 859:1;861:3;862:13 rights (1) 854:22	rise (1) 852:20 RIVER (20) 831:7,11;836:4,4,5, 12,12,15,15;837:20; 838:6;841:9;844:16; 846:1;847:4;854:16, 16,18,21;857:8 rivers (2) 853:3,3 Robison (2) 833:6,7 rock (2) 855:12;857:5 room (1) 838:17 roughly (3) 841:6;850:19;857:24	SESSION (3) 831:17.5;835:1,17 set (1) 849:4 seven (3) 859:23;860:5,11 several (1) 839:19 share (1) 861:20 shared (1) 838:16 shares (1) 838:15 Sharp (1) 833:6 shear (4) 835:24;836:1;841:7, 8 Sheep (2) 838:2,5 shift (1) 854:20 Shorthand (1) 831:21.5 show (5) 846:3,7;848:20; 849:5;853:23 showed (1) 844:14 showing (2) 847:15;853:21 shown (1) 857:18 shows (4) 836:14;839:13; 844:15;846:9 sideways (1) 855:7 signal (2) 839:13;857:3 significant (1) 848:6 silence (1) 856:20 simple (2) 850:14;851:19 simply (1) 841:20 sink (1) 847:15 site (1) 856:10 slash (4) 862:9,9,9,10 slide (7) 841:1;844:14;846:4, 9,9;852:14;853:18 slightly (2) 841:5,24 small (1) 844:15 smaller (1)	845:15 SNWA (1) 833:3 SNWA's (1) 838:23 software (1) 844:21 solve (1) 845:6 somebody (2) 849:3;858:15 somewhere (3) 854:20;855:2,3 sorry (7) 836:5;842:10,15; 849:15,18;860:4,10 south (5) 855:1,21;858:3,18, 23 Southern (4) 835:6;846:18; 860:18;861:5 southwestern (1) 853:22 special (1) 854:22 specific (3) 835:17;836:22; 847:16 specifically (1) 859:24 specify (1) 840:22 speculation (1) 850:6 SPRING (11) 831:7.5;838:2;849:7, 19,23;850:5,9;852:22; 854:1;856:11;858:10 SPRINGS (9) 831:11;836:12; 837:20;838:6;844:16; 845:14;846:1;847:5; 850:2 squared (1) 850:20 squirrely (1) 844:24 ss (1) 863:1.5 stable (1) 846:21 staff (1) 852:9 Stan (2) 862:1,4 start (5) 835:5;847:22;848:5; 855:3,15 starts (2) 847:19;848:14 STATE (10) 831:1;832:5,6,5;
		S		
		same (4) 837:9;848:8;854:17; 857:24 sample (1) 853:5 saying (2) 846:2;858:7 schedule (1) 857:4 Schreck (1) 833:8.5 Schroeder (2) 833:20,21 scoping (3) 837:24;847:7;858:8 screen (3) 836:21;837:9;851:20 screw (1) 851:3 Second (2) 849:19,20 Section (2) 832:8,11 Seeing (4) 852:8;861:7,8,13 segment (3) 835:24;836:1;853:11 Senior (1) 832:12.5 sense (3) 837:2;838:8;859:14 sentence (1) 849:19 separate (1) 858:4 SEPTEMBER (4) 831:18.5;835:1; 863:8,18 serious (1) 849:2 Service (2) 833:22;859:9		

841:18;844:22;850:16, 22;852:9;863:1,5 stated (1) 852:15 statement (5) 841:19,21,22; 843:22;859:5 status (1) 841:14 stay (1) 843:7 stays (1) 854:17 steady (1) 850:22 stereotype (2) 863:11,14 still (1) 858:17 stream (6) 844:22;845:5;853:5; 854:23;862:5,7 strong (4) 855:16;856:24; 857:2,9 strongly (1) 857:6 study (3) 835:14,19;852:24 subsequent (1) 852:20 substantially (1) 851:24 suggest (2) 843:20;858:5 suggested (1) 854:19 Suite (1) 831:23 Sullivan (4) 832:6;834:8;853:17, 18 Super (1) 855:11 Supervising (1) 832:9.5 Supervisor (1) 832:14 supports (1) 855:24 sure (7) 839:18,19,19; 843:13;846:5;848:19; 855:14 surface (1) 853:23 Survey (2) 862:4,7 SYSTEM (10) 831:7;841:9;843:12, 19,21;845:2;854:21; 855:16;856:4;857:7	T Taggart (7) 833:3,3,3,5;834:4; 835:10,12;842:3 Taggart's (1) 842:14 talk (1) 853:8 talked (2) 841:6;844:9 ten (2) 835:7;842:7 ten-to-one (1) 855:8 term (1) 853:13 terms (1) 853:12 test (10) 838:11;839:13; 840:10,23;850:21; 851:1,2,2;856:16; 859:6 tested (1) 856:21 testifying (1) 838:1 testimony (2) 843:4;853:19 testing (1) 856:20 Thanks (1) 857:11 theory (1) 851:5 therefore (1) 837:18 thinking (1) 853:12 Thomas (1) 846:19 though (1) 846:11 thought (1) 852:16 thousand (2) 850:20;853:2 thousand-to-one (1) 855:10 three (6) 840:6;858:2;859:23; 860:5,7,8 throw (1) 851:12 Thrust (1) 854:16 THURSDAY (3) 831:18.5;835:1; 863:8 Tim (2) 832:4.5;833:5	Title (1) 862:5 today (4) 837:1;861:4,15; 862:14 tomorrow (1) 862:15 tongue (1) 857:8 top (2) 839:4,5 topics (1) 844:9 total (2) 841:16,16 tracing (1) 845:24 TRANSCRIPT (2) 831:14;863:12 transcription (1) 863:14 transducer (1) 856:17 transmissive (2) 856:9,23 transmissivities (2) 846:11;850:23 transmissivity (3) 843:15;850:19; 855:11 treat (3) 854:21,23;857:7 treated (1) 854:21 treating (1) 855:16 trending (1) 857:21 TRI (1) 860:15 Tribe's (1) 835:15 tries (1) 845:1 true (1) 863:13 try (3) 853:3,3,5 trying (3) 841:3,3;849:1 tube (1) 854:13 tubes (2) 854:13;855:6 two (7) 836:16;840:6;841:4; 844:11,14,15;848:10 type (1) 853:13 types (1) 845:17 typical (1) 853:11	U UMVM-1 (1) 839:21 uncertainty (2) 857:24;859:16 unclear (1) 845:9 Understood (1) 840:24 unfortunately (1) 844:20 units (1) 851:3 up (13) 835:5;836:18,21; 842:19;849:3;851:3; 852:9;857:16;858:16; 859:4;861:10,14,21 upon (1) 841:21 UPPER (2) 831:11.5;846:13 URL (1) 862:8 use (6) 846:11;850:19; 851:4;853:2;858:21,22 using (3) 839:3,19;857:16	VOLUME (1) 831:17 W Waddell (6) 843:18;861:17,17, 24,24;862:12 Waddell's (1) 843:4 wait (1) 842:17 WASH (5) 831:10.5;840:6,7; 850:24;854:15 WASHOE (1) 863:2 waste (1) 848:3 WATER (41) 831:3;833:12.5,13.5, 18.5;835:6;836:4; 840:3,10,13,19;841:7, 12;843:2,3;845:1,12, 24;847:8,11;850:21; 851:18;852:15,20; 853:23;854:4,10,22; 855:1,7,20,23;856:5,7; 857:20,24;858:2,13; 859:17;860:18;861:5; 863:6 way (6) 845:6;846:10;847:6; 852:21,21;854:18 weakly (1) 839:1 w-e-a-k-l-y (1) 839:1 web (1) 862:8 website (1) 841:19 wells (9) 837:14,19;839:19; 853:24;856:21;859:11, 12,14;862:5 west (2) 855:22;856:15 western (1) 847:3 What's (4) 843:11;846:12; 854:12;859:16 WHITE (2) 831:7;841:8 whole (3) 844:13,22,23 widen (1) 844:24 widens (2) 845:10,11 willing (2) 860:1,13
			V validate (1) 841:19 VALLEY (17) 831:7.5,9,10,11.5; 833:18;835:21,21; 841:8,13;847:9,15; 850:13;851:6,15,17; 856:11;858:10 Vegas (15) 833:21;835:21,24; 836:1;841:8,8,13; 844:12;845:13;847:4, 9;850:13;851:6,17; 854:2 verbal (2) 841:15,16 verbally (1) 849:12 verbatim (1) 863:10 VH-4 (1) 838:7 Vidler (5) 833:13.5;842:20; 843:3;846:23;861:8 visualize (1) 847:6 visually (1) 845:7	

In The Matter Of:

*DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES*

*Vol. v
September 27, 2019*

*Capitol Reporters
123 W. Nye Lane, Ste 107

Carson City, Nevada 89706*

Original File 9-27-19a.m.VolumeVFINALSE_1.txt
Min-U-Script® with Word Index

SE ROA 53331

JA_17728

Page 864

1 STATE OF NEVADA
 2 DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
 3 DIVISION OF WATER RESOURCES
 4 BEFORE MICHELINE N. FAIRBANK, HEARING OFFICER
 5
 6
 7 IN THE MATTER OF THE ADMINISTRATION
 AND MANAGEMENT OF THE LOWER
 8 WHITE RIVER FLOW SYSTEM WITHIN
 COYOTE SPRING VALLEY HYDROGRAPHIC
 9 BASIN (210), A PORTION OF BLACK
 MOUNTAIN'S AREA HYDROGRAPHIC
 10 BASIN (215), GARNET VALLEY
 HYDROGRAPHIC BASIN (216), HIDDEN
 11 VALLEY HYDROGRAPHIC BASIN (217),
 CALIFORNIA WASH HYDROGRAPHIC BASIN
 12 (218), AND MUDDY RIVER SPRINGS AREA
 (AKA UPPER MOAPA VALLEY HYDROGRAPHIC
 13 BASIN (219)).
 _____ /
 14
 15 TRANSCRIPT OF PROCEEDINGS
 16 PUBLIC HEARING
 17 HEARING ON ORDER 1303
 18 VOLUME V, A.M. SESSION
 19 (Pages 864-986)
 20 FRIDAY, SEPTEMBER 27, 2019
 21
 22
 23
 24 Reported by: Michel Loomis, RPR

Page 866

1 APPEARANCES:
 2 For Lincoln County
 Water District
 3 -and-
 Vidler Water Company: Allison MacKenzie
 4 By: Karen Peterson, Esq.
 Carson City, Nevada
 5
 For Moapa Band of Paiutes: Beth Baldwin, Esq.
 6
 7 For NCA: Alex Flangas, Esq.
 Reno, Nevada
 8
 9 For Moapa Valley
 Water District: Greg Morrison, Esq.
 10
 11 For Bedroc: Schroeder Law
 By: Laura Schroeder, Esq.
 12
 For City of North Las Vegas: Schroeder Law
 13 By: Laura Schroeder, Esq.
 14 For National Park Service: Karen Glasgow
 15 For Center for Biologic
 Diversity: Patrick Donnelly
 16
 17
 18
 19
 20
 21
 22
 23
 24

Page 865

1 APPEARANCES:
 2 Micheline N. Fairbank,
 Hearing Officer
 3
 Tim Wilson,
 4 Acting State Engineer
 5 Adam Sullivan,
 Deputy State Engineer
 6
 Melissa Flatley,
 7 Chief of the Hearing Officer Section
 8 Michelle Barnes,
 Supervising Professional Engineer
 9
 Levi Kryder,
 10 Chief of the Hydrology Section
 11 Jon Benedict,
 Hydrologist
 12
 Christi Cooper,
 13 Geologist
 14 Bridget Bliss,
 Basin Engineer
 15
 16 For SNWA: Taggart & Taggart, Ltd.
 By: Paul G. Taggart, Esq.
 Carson City, Nevada
 -and-
 18 Tim O'Connor, Esq.
 19 For CSI: Robison, Belaustegui, Sharp
 & Low
 20 By: Kent R. Robison, Esq.
 Reno, Nevada
 21
 22 For CSI: Brownstein Hyatt Farber Schreck
 By: Brad Herrema, Esq.
 23 Los Angeles, California
 24 For NV Energy: Justina Caviglia, Esq.

Page 867

1 INDEX
 2 THE PANEL: DIRECT CROSS REDIRECT EXAMINATION
 3 By Mr. Taggart: 869
 4 By Mr. Herrema: 955
 5 By Ms. Baldwin: 965
 6 By Mr. Morrison: 973
 7 By Ms. Peterson: 974
 8
 9
 10
 11 EXHIBITS: ADMITTED
 12 SNWA 85, corrected Figure 6-2 916
 13
 14
 15
 16
 17
 18
 19
 20
 21
 22
 23
 24

Page 868

1 CARSON CITY, NEVADA, FRIDAY, SEPTEMBER 27, 2019, A.M. SESSION
2 -o0o-
3
4 HEARING OFFICER FAIRBANK: Good morning. So we
5 will go ahead and get started this morning. This is a
6 continuation of the hearing regarding the Lower White River
7 Flow System and Order 1303.
8 And this morning, we will be starting with
9 Southern Nevada Water Authority and Las Vegas Valley Water
10 District. And, Mr. Taggart, you may go ahead and proceed.
11 MR. TAGGART: Good morning. As was said, my name
12 is Paul Taggart. I represent the Southern Nevada Water
13 Authority and Las Vegas Valley Water District.
14 We've assembled a panel this morning to provide
15 you with the information -- hydrologic information related to
16 the 1303 order, and we will also have a panel to describe the
17 biological issues that we have -- that we plan to present,
18 that will be on Monday.
19 So with me here today is Ms. Colby Pellegrino,
20 Mr. Andrew Burns, and Ms. Warda Drici. And after we swear
21 them in, I'll have them introduce themselves to the panel.
22 HEARING OFFICER FAIRBANK: Okay. If we can go
23 ahead and swear in the witnesses. Thank you.
24 (Panel sworn.)

Page 869

1 DIRECT EXAMINATION
2 BY MR. TAGGART:
3 Q. Good morning. And could each of you, for the
4 record, state your name and spell it for the record, and also
5 what is your position at the Southern Nevada Water Authority.
6 MS. PELLEGRINO: I'm Colby Pellegrino,
7 P-E-L-L-E-G-R-I-N-O, Director of Water Resources for the
8 Southern Nevada Water Authority and Las Vegas Valley Water
9 District.
10 MR. BURNS: I'm Andrew Burns, A-N-D-R-E-W,
11 B-U-R-N-S, and I'm the Manager of the Water Resource Division
12 for SNWA and Las Vegas Valley Water District.
13 MS. DRICI: Good morning. I'm Warda Drici,
14 Warda, W-A-R-D, as in David, A. Drici, D, as in David,
15 R-I-C-I. I am a hydrologist with the Southern Nevada Water
16 Authority.
17 BY MR. TAGGART:
18 Q. Thank you. And my first questions will be for
19 you, Ms. Pellegrino.
20 Could you provide the State Engineer briefly with
21 an explanation of the role SNWA has in the Lower White River
22 Flow System, why SNWA and the Las Vegas Valley Water District
23 is a stakeholder in these proceedings?
24 ANSWERS BY MS. PELLEGRINO:

Page 870

1 A. Okay. So very briefly, the Southern Nevada Water
2 Authority is essentially a wholesale water provider with seven
3 member agencies, the largest of which is the Las Vegas Valley
4 Water District. We were originally created in 1991 to manage
5 the State's Colorado River allocation, but our
6 responsibilities now include regional water supply planning.
7 So we have a myriad of water rights in this area
8 and I'm going to go through those very briefly. The SNWA
9 controls about 20,000-acre-feet of decreed surface water on
10 the Muddy River, about half of that is through the Muddy
11 Valley Irrigation Company shares that we own and lease.
12 We also have 9,000-acre-feet of water from Coyote
13 Spring Valley that was originally owned by the Las Vegas
14 Valley Water District. 2200-acre-feet of water in Garnet and
15 Hidden Valley that are used to meet the needs of the power
16 plants and the future needs of the City of north Las Vegas.
17 As I mentioned, the district is the largest
18 member agency of SNWA. The two agencies share common staff,
19 and in addition to the district owning the groundwater rights
20 in the Las Vegas Valley, they are also the operator of the
21 Coyote Springs Water Resources General Improvement District,
22 which is responsible for the water -- which is responsible for
23 the water system that serves the Coyote Spring Development.
24 Q. Is SNWA also a party to the MOA and could you

Page 871

1 describe their role in that way?
2 A. Yes. So there's a series of agreements that were
3 implemented post Order 1169 to allow the pump test to
4 continue. One of those was a memorandum agreement with the
5 Moapa Band of Paiutes. It's actually a series of agreements.
6 The Muddy Valley Irrigation Company, the Moapa
7 Valley Water District, ourselves, the Fish and Wildlife
8 Service all related to the compliance and settling claims to
9 groundwater associated with these basins.
10 Q. And could you describe the role SNWA has played
11 in the activities that have led us to where we are here today?
12 A. Okay. I think I'm going to go back and talk a
13 little bit historically to do that.
14 One of the things that the Water Authority in
15 every -- and the Water District in every proceeding before the
16 State Engineer has said, is that our conceptual models cannot
17 be validated until we have not only significant pumping
18 stresses, but also recovery data.
19 So in 2001, we went before the State Engineer on
20 applications in this area, and I want to read two quotes that
21 were Mr. Ricci summarizing our testimony in that hearing.
22 And the first one says, "while testimony
23 presented indicated that belief that significant quantities of
24 water may be available for capture from storage, it is unknown

Page 872

1 what quantity that would be and if any underground water could
 2 be appropriated without unreasonable and irreversible
 3 impacts."
 4 He went on to summarize that our testimony and
 5 evidence, and I quote again, "indicates that their own expert
 6 witnesses are unable to make a suggestion to the State
 7 Engineer as to what part of the water budget could be captured
 8 without a great deal of uncertainty and that the question
 9 cannot be resolved without stressing the system."
 10 So after Order 1169, we prepared for the pump
 11 test and entered into the MOA and several other agreements,
 12 like I mentioned previously. A few years after that, we also
 13 had a series of agreements in relationship with NV Energy
 14 regarding the surface water on the Muddy River as well as
 15 water for Garnet Valley for use of the power plants.
 16 We later constructed the 348 pipeline to
 17 facilitate the Order 1169 pump test, and we were required to
 18 submit, within a relatively short period of time after that
 19 test was done, data to the State Engineer that would be used
 20 to determine whether the outstanding applications, how they
 21 would be dealt with.
 22 After that, it was a pretty significant period of
 23 time where through the recession, economic activity in this
 24 general area was low. But we began to see more aquifer

Page 873

1 recovery data in the response to the aquifer in general after
 2 the pump test had concluded. And then we began, within the
 3 last maybe 3 to 4 years, seeing more significant economic
 4 activity occurring.
 5 And we were really coming to a new realization
 6 that the aquifer was not recovering as well as that there were
 7 on going declines. So when the Coyote Spring development
 8 really began ramping up again, we began expressing to the
 9 developer --
 10 HEARING OFFICER FAIRBANK: Mr. Herrema.
 11 MR. HERREMA: Brad Herrema for CSI.
 12 Ms. Pellegrino has not been designated or qualified as an
 13 expert. I believe she's here as a fact witness and so
 14 opinions or conclusions about recovery of the aquifer, I don't
 15 think are appropriate.
 16 MR. TAGGART: We don't disagree. Any expert
 17 conclusion on that topic will be provided by Mr. Burns and
 18 Ms. Drici.
 19 HEARING OFFICER FAIRBANK: Okay. So the
 20 testimony will only be considered in this relationship as that
 21 as a fact witness, and certainly any expert opinions or
 22 interpretations of data will be relied upon by the testimony
 23 of those experts so designated.
 24 MR. HERREMA: Thank you.

Page 874

1 THE WITNESS: So as the development began to ramp
 2 back up in this area through our role as the operator of the
 3 general improvement district, we began expressing concern that
 4 the water that they were relying upon would not be there in
 5 perpetuity to support that development.
 6 I'm not going to get into the whole history here,
 7 but essentially after sending that message to Coyote Springs
 8 Valley several times without much response, we asked the State
 9 Engineer for their opinion on whether there was water there
 10 for that development, and ultimately that's what's led us to
 11 the process that we're here involved with today.
 12 BY MR. TAGGART:
 13 Q. Ms. Pellegrino, are -- was SNWA's reports for the
 14 hydrologic and biologic resources that were submitted to the
 15 State Engineer, were those prepared under your direction and
 16 supervision?
 17 A. Yes.
 18 Q. And I'm going to ask you to just summarize for
 19 the State Engineer what SNWA's recommendations are based on
 20 the four 1303 questions that were asked. And I just want to
 21 clarify for the record that you're summarizing what would be
 22 supported through the expert testimony of Mr. Burns and
 23 Ms. Drici?
 24 A. Yes.

Page 875

1 Q. Okay. Please -- what recommendation is SNWA
 2 making regarding the geographic boundary for the Lower White
 3 River Flow System?
 4 A. This question was the hardest question in a lot
 5 of ways for us to reach a conclusion on, because it's much
 6 easier for us to identify where there is high levels of
 7 connectivity and degree of connectivity.
 8 But the boundary really depends a lot upon how
 9 the basins are jointly managed together. And I'm going to
 10 give just a few hypotheticals that I think will shine some
 11 light on why this is a little bit perplexing for us.
 12 For example, if there are water rights that are
 13 really at a very far distance from the springs and the impacts
 14 to senior water rights and a new basin is added, and that
 15 water is allowed to move between all of the basins, there is
 16 the potential that that pumping could move closer to the
 17 springs and could impact senior water rights and the
 18 endangered Moapa Dace sooner.
 19 So in some ways, hydrologic connectivity may be
 20 there, but the management decision of allowing water to move
 21 across the basins could be a problem.
 22 Similarly, there's less connected areas, which
 23 Ms. Drici will talk about, such as the Black Mountains area
 24 where taking that water and moving it closer to the springs

Page 876

1 and into a more connected area would accelerate impacts.
2 So ultimately, regardless of the boundary, we
3 know that the State will have to continue managing the
4 adjacent basins to ensure that we're not negatively impacting
5 the Lower White River Flow System, because no matter where the
6 boundary is drawn, if the adjacent basins are allowed to
7 significantly pile up points of diversion along the boundary,
8 that's going to have a negative impact along with -- so
9 there's just some unintended consequences that were really
10 hard to contemplate here.
11 So we make the recommendation that the boundaries
12 should not change, but should be revisited in the next portion
13 of this where we'll talk about groundwater management
14 decisions. But we do have some extensive testimony on
15 hydrologic connectivity within this region.
16 Q. Now, the second question that the State Engineer
17 has asked under 1303 has to do with the hydrological responses
18 to the Order 1169 pumping test and what will SNWA's
19 recommendations be regarding that?
20 A. I'm going to be very brief here, again, because
21 Andrew and Warda are going to present a lot of testimony on
22 this. But essentially water levels are continuing to decline
23 in this area as a result of the ongoing pumping.
24 Q. And with respect to the question about moving

Page 877

1 alluvial pumping to carbonate wells or moving current
2 carbonate pumping to alluvial wells, which is the fourth
3 question the State Engineer had in his 1303 order, what is
4 SNWA's recommendation with respect to that?
5 A. Our recommendation is essentially that it doesn't
6 matter where you move it. You may change the timing of
7 impacts, but impacts will still occur to the Muddy River
8 Springs and senior decreed water rights.
9 Q. Okay. Now, lastly, what is SNWA's recommendation
10 regarding the long-term annual quantity of groundwater that
11 can be pumped in the Lower White River Flow System, including
12 the relationships between the location of pumping on discharge
13 from the Muddy River Springs and capturing Muddy River flow?
14 A. This hydrologic region is unique. I think
15 everyone in this room knows that. If the Muddy River were not
16 there, the changes that we see in groundwater levels would not
17 constitute an unreasonable lowering of the water table. And
18 if the springs were not there, there weren't endangered fish
19 in those springs. The capture of senior decreed water rights
20 could be dealt with in a way that the Moapa Dace prohibit in a
21 lot of ways. So we have kind of two answers on this.
22 There's no quantity of water that can be pumped
23 long term without conflicting with the decree by capturing
24 Muddy River water. If you set aside those conflicts with

Page 878

1 senior water rights and look at what the Moapa Dace need, we
2 formed the conclusion that based upon protecting a flow of
3 3.2 CFS at the Warm Springs West Gage, there's approximately 4
4 to 6,000-acre-feet of water that can be pumped long term.
5 However, that water cannot and should not be
6 pumped long term without dealing with the conflicts and the
7 capture of Muddy River water. I'm just going to go on to say
8 that conflicts, the State's very familiar with. There's
9 litigation, there's damages and that can be very costly.
10 But violating the SAS criminal penalties and as a
11 water manager, I take that very seriously, and I don't believe
12 there's any way that we can reasonably separate those two
13 issues when we consider how much water can be pumped in this
14 basin.
15 Q. And my last question for you, Ms. Pellegrino, is
16 what would you like the State Engineer to do at the conclusion
17 of the hearing with those recommendations?
18 A. We appreciate the State Engineer's process that
19 they've laid out, that this is the first phase in that
20 process. We would ask that the State accept written closing
21 arguments as well as a written draft order that addresses the
22 technical findings that are the subject of this hearing,
23 including the hydrologic connectivity of the basin, asking
24 that they reserve final resolution of the jointly managed

Page 879

1 boundary for the next phase of management discussions.
2 We also feel that there's ample evidence that
3 groundwater pumping should not be allowed to increase and new
4 permanent use is not being allowed within the five basin area
5 while we continue to set out on a path for decreasing water
6 use in this general managed area.
7 Q. Thank you. Now, I have some questions for
8 Mr. Burns and Ms. Drici.
9 Both have been pre-qualified in this proceeding
10 based upon being qualified in prior State Engineer hearings.
11 Mr. Burns was qualified in prior hearings and is qualified
12 here in this hearing in the areas of groundwater hydrology,
13 surface water hydrology and hydrogeology.
14 Ms. Drici was previously qualified and is
15 qualified in this proceeding in the area of groundwater
16 modeling and groundwater hydrology.
17 And, Mr. Burns, Exhibit 3 that SNWA's provided is
18 your resume. Is that a true and correct copy of your resume?
19 MR. BURNS: Yes, sir.
20 MR. TAGGART: Okay. And then, Ms. Drici,
21 Exhibit Number 4 is your resume. Same question to you?
22 MS. DRICI: Yes.
23 BY MR. TAGGART:
24 Q. And we have done a pre-qualifying exercise to

Page 880

1 avoid spending time, significant time on voir dire and
 2 questioning witnesses. But I would like, if you could for the
 3 record, to briefly describe your background in the areas that
 4 you're about to testify about so that the record's clear on
 5 your level of qualifications.
 6 So can we start with you, Mr. Burns?
 7 ANSWERS BY MR. BURNS:
 8 A. Sure. Well, my background is a hydrologist.
 9 I've worked in this area, in the Great Basin range province my
 10 whole career. I started at the Nevada test site, principal
 11 responsibilities being data acquisition and data analysis. I
 12 worked there for about six years with Ms. Drici and
 13 Dr. Waddell on the test area project.
 14 Subsequent to that, I worked for the State of
 15 Nevada and the Colorado River Commission in doing Colorado
 16 river modeling.
 17 Moved to the Southern Nevada Water Authority
 18 where I continued to do the Colorado River modeling. And then
 19 at about 2002/2001 time frame, worked in earnest on this area,
 20 setting up monitoring networks, doing investigations as we'll
 21 talk about today.
 22 So I've been working not only in this area, but
 23 in the eastern Nevada for other groundwater projects, doing
 24 this of type of work.

Page 881

1 Q. Okay. Thank you.
 2 Ms. Drici, could you please describe for the
 3 State Engineer briefly your background and experience?
 4 ANSWERS BY MS. DRICI:
 5 A. Sure. Warda Drici. So my education is in
 6 petroleum engineering and management. However, my whole
 7 experience has been in dealing with the groundwater and
 8 surface water problems.
 9 So I started out by working for the Kansas
 10 Geological Survey for a few years. From there, I moved to
 11 Long Beach to work with First Technology, the people who
 12 drilled all the wells for the MX project in Nevada. I wasn't
 13 there when they did it, though. I came in after.
 14 And then from there, I went to work for
 15 contractors for the Department of Energy. And like Andrew
 16 said, for a while, we worked on the Death Valley model for the
 17 DOE with Andrew and Dr. Waddell, too. And after that, I came
 18 to work with SNW -- for Parson's, but on SNWA projects.
 19 And since 2010, I've been working with SNWA on
 20 projects relating to groundwater and surface water.
 21 Q. Thank you. And did each of you participate in
 22 the development of the report that was submitted to the State
 23 Engineer and has been marked as State Engineer Exhibit
 24 Number 7?

Page 882

1 MR. BURNS: Yes.
 2 MS. DRICI: Yes.
 3 MR. TAGGART: And did each of you sign that
 4 report?
 5 MR. BURNS: Yes.
 6 MS. DRICI: Yes.
 7 MR. TAGGART: And then also did each of you work
 8 and contribute to what is marked as SNWA Exhibit 9, and did
 9 you sign that report?
 10 MR. BURNS: Yes.
 11 MS. DRICI: Yes.
 12 MR. TAGGART: And just for the hearing officer,
 13 those reports also include biological resource assessments and
 14 so the biological witnesses that testify on Monday will be
 15 presented. And after they're presented, then we will offer
 16 those into evidence.
 17 HEARING OFFICER FAIRBANK: So the report
 18 regarding the Lower White River Flow System assessments are so
 19 admitted and we will admit the biological reports at that
 20 time.
 21 MR. TAGGART: Okay. Thank you.
 22 BY MR. TAGGART:
 23 Q. All right. So, Mr. Burns, could you describe how
 24 SNWA went about -- how and why SNWA went about developing the

Page 883

1 two reports I just described?
 2 ANSWERS BY MR. BURNS:
 3 A. Sure. First, we appreciate the opportunity to
 4 present our summary conclusions in this presentation, and I'll
 5 first just review the general approach to how we went about
 6 analyzing -- collecting, analyzing and reporting on the data
 7 pertinent to this Order 1303.
 8 And the first part of our effort, of course, was
 9 a compilation processing of data, literature review, that sort
 10 of thing. Groundwater levels are from various sources of EWR
 11 website.
 12 Our own data basis is the USGS precipitation data
 13 from NOAA, ground water production data available to everyone
 14 to on NWRD website, and then USGS data surface water, stream
 15 flow data, perennial stream flow data, of course, and spring
 16 data. So that was the first step in our effort.
 17 Next, we performed a quality assessment. So
 18 these are time series data that we've collected and we've
 19 compiled and now we wanted to look at them in a qualitative
 20 sense through time to see what they -- how they informed our
 21 knowledge of the system as behavior. We had -- and I'll go
 22 through a series of these hydrographs, but --
 23 (Reporter interrupted proceedings.)
 24 MR. BURNS: So we looked at winter season

Page 884

1 precipitation from Nevada climate division 4, as I mentioned,
 2 groundwater levels from wells throughout this domain, spring
 3 discharge, perennial screen flow, groundwater production. And
 4 so that was a -- we looked at this and these time series data
 5 in a qualitative sense to see how they formed and told us what
 6 was happening with this system, given various stress
 7 conditions we know are occurring, whether it's climate related
 8 or man related.
 9 So after looking at those hydrographs, we saw
 10 some relationships. We also -- we performed simple linear
 11 regression analyses to assess correlation between water levels
 12 responses and what we refer to as representative carbonate
 13 wells in these basins with EH-4.
 14 And as you heard described previous testimony,
 15 EH-4 is an indicator well of the conditions, the groundwater
 16 conditions at the spring area, principally, the Pederson
 17 Spring area, which is in close proximity. We considered that
 18 an index well.
 19 Then we know that there's been, as a result of
 20 the test, drawdown responses measured in the MX-4. So we
 21 wanted to see what we thought we saw and confirm that with
 22 linear regression analysis to assess the correlation of these
 23 same wells with drawdown responses that we know were measured
 24 at MX-4.

Page 885

1 Next, we had looked at the same type of analysis,
 2 but using EH-4, our index well, with spring discharge. And
 3 these are the high elevation springs of Pederson Spring
 4 complex and Warm Springs West Gage.
 5 Next, we performed a multi-linear regression
 6 analysis to assess the effects of individual basin carbonate
 7 production on EH-4 water levels and then we performed a ratio
 8 analysis to estimate the contribution of various springs to
 9 the total Muddy River Springs discharge over a period of
 10 several years and under different stress conditions.
 11 And when we refer to total -- well, I'll call it
 12 MRSA discharge, we're talking about the Muddy River flow
 13 itself. ET in the area, groundwater production, fluid
 14 groundwater production. So that constitutes the total
 15 discharge that we're talking about.
 16 In that analysis, we're approximating the slope
 17 of the lines correlating a given spring record to this total
 18 discharge. And we estimate a change in the discharge basin
 19 not a change of the Warm Springs West Gage for that same
 20 period.
 21 And then finally, we observed, in the flow
 22 record, a long-term tend of declining flow and we wanted to
 23 investigate that try to identify its causes. We had our
 24 suspicions, but we wanted to go through the analysis to come

Page 886

1 to a definitive conclusion.
 2 In doing so, we quantified what we were terming a
 3 Muddy River flow deficit. This is a depletion, in essence, on
 4 the river and we did that for a period of 1993 to 2018. So
 5 that's the general approach we took and I'll go through these
 6 in that order.
 7 So first, you can take a look at a map and I know
 8 you've seen a lot of water level and a lot of hydrographs this
 9 week, but I appreciate your patience in giving us time to give
 10 our perspective on what we've seen.
 11 This figure is a figure in our report and it's of
 12 the Lower White River Flow System domain, and we have water
 13 levels, carbonate wells, alluvial wells depicted here
 14 throughout.
 15 And what I want to go through is -- first is this
 16 qualitative assessment that we performed and here's -- under
 17 these orange circles are the wells that we're going to look at
 18 and to give you perspective on where they are within
 19 relationship to other wells within the flow system.
 20 So on the next slide, we look at well CSVM-1 and
 21 this is a well just down the road on 168 across from MX-5 in
 22 very close proximity. And then I had mentioned EH-4, if you
 23 can go back, I'll try to point these out.
 24 So here is CSVM-1, EH-4, here by the springs.

Page 887

1 And then next is the Paiute TH-2 well in the California Wash,
 2 the GB-1 well, which is on the boundary of Hidden Valley and
 3 Garnet Valley. And then to the very south is BMDL-2, which is
 4 in the Black Mountains area.
 5 And so this next to the slide, what we're showing
 6 here is just the time series data of water levels at these
 7 locations over the period 1993 to 2020 or 2019. On the Y axis
 8 is the elevation of the water level.
 9 The bottom panel, as I mentioned before, we
 10 looked at the Nevada division or climate division 4, and
 11 what's represented here is the percent of winter season
 12 precipitation.
 13 We used October through March as the definition
 14 for the winter season and we computed the average for 1990 to
 15 2019. And what these bars represent is a percentage of that
 16 average over this period of record.
 17 So blue bars are above normal. And then so if
 18 you look at 2005, what I'll talk -- and I'll present in
 19 hydrographs, that's about almost 300 percent of normal. So if
 20 the average was, let's say, four inches, that would be about
 21 12 inches that year.
 22 On the bottom is below normal or below average of
 23 percent of average winter season precipitation. Those are the
 24 red bars. And, of course, those can only go to zero, and you

Page 888

1 can see how the distribution of these red and blue bars over
2 time.
3 Now, then we look at what we see in the
4 hydrographs when you do this assessment, and the first thing
5 we see is that all of these look very similar. They have very
6 similar seasonal change.
7 They have very similar long-term trends. What
8 always pops out first is the 2005 effect from this 300 --
9 almost 300 percent of normal precipitation, winter season
10 precipitation.
11 We see a general decline and then we see, in the
12 gray shaded area, this is the period of the test, your 1169
13 pumping test, and we see declines there as well. And so
14 this -- we wanted to look at these a little closer and so we
15 did so. So I want to go back to look at these a couple at a
16 time.
17 So that -- this slides shows you, it's the two
18 I'm going to talk about, which is, again, CSVM-1 and GB-1.
19 CSVM-1 by MX-5, GB-1 on the boundary of Hidden and Garnet
20 Valleys.
21 Okay. So I've added something to this panel as
22 well at the very -- the bottom panel, which is carbonate
23 groundwater production. This is -- and the reason we choose
24 this period, the 1993 to 2019, is because that's when all of

Page 889

1 the data series are available to us.
2 So on this bottom panel, this carbonate
3 groundwater production by basin within the Lower White River
4 Flow System, you can see that it starts at about 1993 in the
5 Muddy River Springs area and then starts to increase with
6 Black Mountains production and so on.
7 And then you can see in 2006, it begins -- it
8 sort of levels off from 1999, 2005, increases in 2006 with
9 Coyote Spring pumping. Then you can see the test effects of
10 production in 2011, '12 and '13. In that period, the increase
11 is about almost 3,000-acre-feet at its peak between 2012 and
12 2013, for example.
13 So at any rate, we have those indicators as well.
14 And here we see at the top panel, CSVM-1, and we see the
15 effect that this 2005 precipitation has had on the record.
16 Water levels increased somewhat dramatically with respect to
17 the rest of the record and then the -- they go down, and then
18 right before the test, you can see the influence of production
19 from MX-5 and the test itself.
20 Q. Mr. Burns, just for the record, could you
21 describe how far is CSVM-1 to where the pumping occurred at
22 MX-5?
23 A. CSVM-1, I -- off the top of my head, I'm not sure
24 exactly the distance, but it's about maybe a quarter mile down

Page 890

1 the road off 168, towards Muddy River Springs area. And it's
2 just on the shoulder of the highway. If you go back to the
3 map, I'll -- so MX-5 is just right here and CSVM-1 is right
4 there on 168.
5 Q. Thank you.
6 A. Now, so what we notice in these records is we go
7 to the south at the boundary between Hidden and Garnet Valleys
8 is the same -- essentially what we see is the same record in a
9 different well. And you have this peak from 2005 and you have
10 an observed decline during the test period. And then some
11 recovery, all be it, it looks muted, and then water level
12 declines since.
13 Next, I'd like to talk about EH-4 and Paiute
14 Tribe well TH-2. So EH-4, you can't see on the screen very
15 well, but EH-4 is just opposite -- just upgradient from the
16 Pederson Springs complex on the other side of Battleship Wash.
17 And the well there is important, as we heard in previous
18 testimony, because it's representative of the conditions, the
19 head conditions at the springs themselves.
20 The next one was TH-2, which is on -- in
21 California Wash and so the next slide will show you
22 hydrographs there. And TH-2 has some intermittent record, but
23 you can generally see the same pattern. EH-4 and EH-5B are
24 wells that have the longest period of record, and you can see

Page 891

1 that there's a pretty consistent decline since 1998, 2004.
2 And then in 2005, we, again, have our
3 precipitation effect or -- I'll call it -- it's really -- we
4 use precipitation as an indicator, but it's really a recharge
5 effect. And then, of course, we see the decline during the
6 Order 1169 test period, a slight recovery, and what we view as
7 a declining trend since about 2016.
8 Okay. Next, we talk -- I want to talk about
9 KMW-1, which is on the boundary of the Kane Springs Valley and
10 Coyote Spring Valley and then CSVM-4, which is also near the
11 boundary by carbonate rock outcrop. These are both monitor
12 wells located to the northern third of Coyote Spring Valley on
13 the east side.
14 So, again, we see here, CSVM-4 record. You see
15 this, the effect, but it looks a little bit delayed or taking
16 a little bit longer to see this recharge influence from 2005,
17 the stabilization of water levels pretty much. And then
18 during the test period, a noticeable decrease or decline
19 during the test. Subsequent to that, water levels come up a
20 little bit and stabilize and then look -- appear to be going
21 downward after.
22 CMW is a shorter period record that exhibits very
23 similar traits as CSVM-4. The declines, the variations are --
24 aren't as dramatic as these other wells, but we think we can

Page 892

1 still see the effects from not only the recharge of that, but
2 also the pumping at MX-5.
3 So with that qualitative assessment, we've seen
4 how these -- we think that these water levels behave in
5 concert with each other. We believe that they were correlated
6 well with EH-4, and so our next step was to perform linear
7 regression analysis to assess the correlation of these
8 variables.
9 Q. Mr. Burns, can I just ask you a couple questions
10 quickly about the qualitative assessment that you completed?
11 Based on that qualitative assessment, were you
12 able to observe these -- any similarity in groundwater level
13 declines between where pumping occurred in Coyote Spring
14 Valley and Garnet Valley, for instance?
15 A. Yeah -- excuse me, yes. We see it as very
16 similar pattern in CSVM-1, for example, which is next to MX-4
17 on the east side of Coyote Spring Valley, and then also GB-1,
18 which I talked about, which essentially has the same patterns
19 to it.
20 Q. Okay. Same question with respect to California
21 Wash?
22 A. California Wash, the Paiute TH-2 well, again,
23 although the record's a little -- there's some missing parts
24 early on, the record shows very -- to me, it was very clear,

Page 893

1 has a very clear response as the other wells do to the various
2 stresses, whether they're climate related or pumping related.
3 Q. Okay. And finally the same question with respect
4 to the Muddy River Springs area?
5 A. Yeah. So we use, as I said EH-4 as our index
6 well. And you saw in the hydrographs I presented that
7 those -- all of these wells that I mentioned appear to have
8 very strong correlation with each other, and therefore, that
9 implies an interconnected nature of this aquifer in this area.
10 Q. Thank you. And then did you attempt to
11 statistically analyze the data to confirm your observations?
12 A. Yes.
13 Q. Could you describe that, please?
14 A. Right. So the process that we've gone through
15 here is we computed monthly average values for the entire
16 period of record for these wells.
17 And we wanted to see -- because EH-4 and the
18 conditions at the spring are so important, we wanted to see
19 how well these wells throughout the basins correlate with
20 that -- the water levels at that location.
21 And so we just did a simple linear regression on
22 the data and we found a linear relationship and high
23 correlation between all of them, as we suspected when we did
24 our qualitative assessment. And those are presented on

Page 894

1 Figure 510 of our report. We have ours squared here, but the
2 national correlation coefficient is higher. But you can see
3 that they're all very high, all in the 90's and above.
4 The lowest one is CSVM-4, which is .82, and I
5 attribute that to the Kane Springs fault and perhaps low --
6 lesser permeability units between the pumping centers -- or
7 between EH-4 and this well to have an attenuating effect on
8 water levels, whether they're affected by recharge or other
9 stresses. And so what we did is observe a trial and error
10 effort -- or trial and error.
11 We looked at it doing it repeatedly lagging
12 months from no lag to 12 months of lag. And we found the best
13 fit to be a three-month lag for the correlation with EH-4.
14 Q. Okay. And then did you also see if there was a
15 statistical correlation during the pumping test period?
16 A. Yes. Well, before I get there, so what this
17 indicates with these high correlations is that these wells all
18 are highly correlated with responses measured in EH-4, and
19 this implies the interconnected nature of this system
20 throughout, independent of the stress condition. So these
21 water levels in these wells behave the same way, whether it's
22 reacting to a climate stress or a pumping stress.
23 But what we really wanted to look at then is
24 since the pumping test was of keen interest to all of us, we

Page 895

1 wanted to see how these wells correspond to a known pumping
2 stress measured at MX-4. So we just took the monthly average
3 values at MX-4 for the period of the test, and of course, MX-4
4 is maybe 200 feet away from MX-5.
5 So during the pumping test, we can attribute the
6 drawdowns or the water level declines at MX-4 predominantly to
7 the -- as a result of the pumping at MX-5. So that's the
8 predominant stress of lowering the water tables at MX-4. We
9 wanted to see how these other representative wells correspond
10 to those water levels that were measured.
11 So we did the same analysis for the same wells
12 and those are listed in Figure 514 of our report, and again,
13 we find a high degree of correlation between these wells at
14 the MX-4 drawdown.
15 So now we can confirm that these wells also --
16 not only are they interconnected, but they also respond in the
17 same way to MX-4 drawdown. And so there's a connection there
18 as well.
19 Q. All right. Thank you. Did you then look at
20 spring flows?
21 A. Right. So we did the same assessment. We did a
22 qualitative assessment on the spring flows and our interest
23 primarily is a high elevation springs, Pederson Spring
24 complex, and the Warm Springs West Gage, which measures the

Page 896

1 confluence of that discharge.
 2 I have here a Figure 6.1 from our report. This
 3 Figure 1, it shows the distribution of springs throughout the
 4 Muddy River Springs area. On the lower right-hand side is the
 5 Muddy River near Moapa Gage, and I have elevations posted next
 6 to the spring names.
 7 And you -- and on the backdrop is the
 8 elevation -- digital elevation model with the darker colors
 9 being the higher elevation and the lower colors -- or the
 10 lighter colors being lower elevations. And so this just --
 11 this shows you a distribution of the springs with respect to
 12 elevation as well.
 13 Now, I noted again the elevation of the springs
 14 behind their name. So if we focus on Pederson Springs here on
 15 the refuge, the highest -- the one we're looking at is
 16 Pederson Spring Gage, itself, at 1811 feet in elevation. And
 17 so we wanted -- we did a qualitative assessment there as well,
 18 looking at Pederson Springs and Warm Springs west.
 19 Q. And just one quick -- a couple quick questions.
 20 So is Pederson at the highest elevation of all the springs?
 21 A. Yes.
 22 Q. And why the focus on high elevation springs in
 23 your analysis?
 24 A. Well, one, they're the most sensitive because of

Page 897

1 the elevation of the orifice with respect the potential metric
 2 surface of the carbonate aquifer. So the driving force is
 3 small. The driving force defined by the heads in the aquifer
 4 with respect to the spring elevation is small relative to
 5 those on the basin floor like Big Muddy Springs, for example,
 6 which is quite a bit lower.
 7 So it's -- I think Tim Mayer gave an eloquent
 8 discussion on why this spring is so sensitive, but it -- our
 9 interest is because of the sensitivity, we can measure sort of
 10 detailed effects of groundwater pumping from the carbonate
 11 aquifer at this location based on the head elevations measured
 12 at EH-4.
 13 Q. And do you expect this to be the first place
 14 you'd see a signal from groundwater pumping?
 15 A. Yes.
 16 Q. Okay. Could you turn to Figure 5-7 and explain
 17 what's shown there?
 18 A. So as I mentioned before, you know, in our
 19 process, we look at the time series qualitatively. We try to
 20 identify trends or certain instances that we can relate to
 21 other factors.
 22 We have two panels at the top, Pederson Spring
 23 first and then Warm Springs West Gage next, and then again,
 24 the same winter season precipitation chart and groundwater

Page 898

1 production at the bottom.
 2 And what we see here, what I see is a response
 3 similar to those measured in the wells that I just discussed,
 4 and I also have shaded here is the test period for the Order
 5 1169 test. And here we see another decline like we see in the
 6 wells, and we see a slight recovery and then it looks to be
 7 declined after.
 8 And then similar to the Warm Springs West Gage,
 9 you see previous to this long-term decline, the effect, you
 10 know, from '98 to 2004, let's say. And then the effect of the
 11 recharge event in 2005, the start of the test at the end of
 12 2012 and this decline by 2013 and beyond really.
 13 Now, on this chart I also have listed or marked
 14 the initial trigger level for the 2006 MOA, which is the
 15 3.2 CFS.
 16 Q. And how close does the hydrograph indicate the
 17 flows came to 3.2 CFS at any time in the data set?
 18 A. Well, right -- so the test ended at the end of
 19 2012, but the pumping at MX-5 continued through April, mid
 20 April of 2013. And you can see, you know, after the springs,
 21 at least at Warm Springs west, continued to decline almost
 22 reaching 3.2, but not reaching it for any period of time or
 23 extended period of time.
 24 Q. And could you describe your understanding of the

Page 899

1 source of water for the springs versus the source of water for
 2 which MX-5 was pumping?
 3 A. Well, it's the same source. So this is the
 4 carbonate rock aquifer that underlies and interconnects the
 5 basins of Lower White River Flow System. So they are the same
 6 source.
 7 Q. Okay. Did you do additional analysis of the data
 8 related to these surface -- or these flow records?
 9 A. Yes. So we wanted to look at, again, is how --
 10 since we use well EH-4 as an indicator for groundwater
 11 conditions at the springs themselves, we wanted to see how
 12 those head levels at that location correlate to the spring
 13 discharge.
 14 And we figured it would be a linear relationship
 15 when we did our regression analysis. This is very similar to
 16 what Tim Mayer did and presented the other day.
 17 But high correlation between hydraulic head at
 18 EH-4 with spring discharge at Pederson Spring. So we know
 19 there's certainly a connection between head levels in the
 20 carbonate system and spring discharge at Pederson Spring.
 21 We did the same thing for Warm Springs West Gage,
 22 which is -- measures the confluence of the Pederson Spring
 23 complex and any gains from the spring orifice to the Warm
 24 Springs West Gage, and we did the same analysis.

Page 900

1 We showed that the head levels, again, in the
2 carbonate system at EH-4 with respect to Warm Springs West
3 Gage were highly correlated and linear in nature.
4 Q. So, Mr. Burns, did the statistical analysis you
5 just described confirm what you observed when you reviewed the
6 hydrographs?
7 A. What we saw in our qualitative assessment of the
8 hydrographs, these time series plots was confirmed by the
9 regression analysis that we performed, the high correlation
10 that we found with respect to the representative wells in EH-4
11 represent an interconnected nature of the carbonate rock
12 aquifer in this area.
13 Further, we found or confirmed that the discharge
14 from the springs was highly correlated to the head levels in
15 the EH-4 well, which is representative of the aquifer
16 conditions at that location at the spring heads.
17 Q. And when you say the aquifer at that location, is
18 that the carbonate aquifer?
19 A. Correct.
20 Q. And going forward, do you consider EH-4 to be an
21 index well?
22 A. Index -- yes, I do.
23 Q. Okay.
24 A. It's an index for the conditions, the groundwater

Page 901

1 conditions observed at the springs, themselves, and underlying
2 the springs.
3 Q. All right. A couple quick questions before we
4 move onto the next part of the analysis was that performed.
5 Could you describe the conceptual model of how
6 the carbonate aquifer is related to the river or the springs
7 and how the alluvial aquifer is related to the river or the
8 springs, and how this empirical information from the pumping
9 test compared to that previous conceptual model?
10 A. Well, if I understand your question, you're
11 asking about what we viewed as a conceptual model at the Muddy
12 River Springs area, which is the -- we think of the alluvial
13 system there as an alluvial reservoir as we call it, and that
14 water is sourced by the carbonate aquifer.
15 But you also have discrete springs, such as
16 Pederson Spring and others that are -- that discretely source
17 to the carbonate aquifer and they behave, I guess, separately.
18 So what we've seen is you can pump the alluvial
19 reservoir without impacting the springs, but you -- when you
20 pump the carbonate aquifer, you can affect the spring
21 discharge as we just described by that relationship. And that
22 ultimately captures flow, any diffuse flow that would go into
23 the alluvial reservoir or discharge from discrete springs like
24 Pederson Springs.

Page 902

1 Q. And there's been some discussion of water budgets
2 in prior testimony at the hearing.
3 Do you have a view of the role water budgets can
4 play in making hydrological conclusions about the
5 connectedness of the Lower White River Flow System versus the
6 type of empirical data you've been describing?
7 A. Well, I don't think that water budgets are, at
8 this point, very informative with I think the data that we've
9 collected or collectively.
10 It's certainly more informed because we're at
11 a -- we're not really litigating or debating water budgets so
12 much as how pumping affects this system, affects discharge,
13 affects depletions in the Muddy River. And it's those
14 responses that I think are more important than a debate on
15 water budgets themselves.
16 Q. All right. And lastly, when you went through the
17 observations of the hydrographs for groundwater or groundwater
18 levels, and this was in Figure 5-5 and 5-14 -- I'm sorry, 5-5
19 and 5-12, was there a similar recovery signal in those
20 hydrographs as well?
21 A. Yes, I'm looking at Figure 5-12, page 6 of the
22 handout, and yeah, I mentioned before that you can see the
23 recovery beginning -- and this is at CSVM-1, promptly
24 beginning after the MX-5 well is shut off. And it appears to

Page 903

1 recover by the first quarter of 2016.
2 And I see the same thing in GB-1, which is,
3 again, at Hidden and Garnet Valley boundary. That one may be
4 attenuated -- or affected by local pumping in Garnet Valley,
5 so it does appear that recovery was as high.
6 Let's see. But you see this recovery throughout
7 at TH-2 in California Wash, EH-4, Muddy River Springs area,
8 and even to the far north of CSVM-4. All be it somewhat
9 muted, you can still see a recovery by about 2016, half part
10 of 2016.
11 Q. All right. Thank you.
12 Ms. Drici, I'm going to now have some questions
13 for you.
14 ANSWERS BY MS. DRICI:
15 A. Yes.
16 Q. Did you perform any further analysis of the cause
17 of change in water levels and spring flows based on the 1169
18 pumping test?
19 A. Yes. The analysis that I performed is the MLR.
20 So MLR stands for "multiple linear regression," and basically
21 it's just a little bit more complex form of the simple linear
22 equation that Andrew was describing.
23 Instead of having -- so you have an -- in the
24 simple linear regression, you have Y equals AX plus B. So the

Page 904

1 A is like a slope of the line that correlates two variables.
2 Y is the dependent variable, for example, spring discharge,
3 and X is, for example, the water level at EH-4 in the -- some
4 of the correlations that he showed.
5 In the multiple linear regression, so you have
6 the same Y, but you have an intersect, the B in these
7 equations, but you have several independent variables, like
8 X-1, X-2, X-3.
9 And the way I used it is to answer the question,
10 how much each of the basin groundwater production contributes
11 to, for example, the water level at EH-4 because what you
12 measure at, for example, EH-4, you see a curve.
13 But that curve is like a combination of the
14 effects of different stresses, including, you know,
15 productions from different basins and then recharge pulses
16 coming in at different times. And you can't really -- for
17 recharge, you can't really separate that, because like I
18 really -- I don't know.
19 I just know that it's coming in as pulses at
20 different times from the different recharge areas. But I
21 can't quantify -- I don't want to use any proxies. I just
22 want to separate the responses to the groundwater production
23 from the different basins.
24 So in this MLR, Y is the EH-4 water levels and

Page 905

1 the X's are the -- X-1, for example, the first one might be
2 the total production in the Black Mountain area, excludes the
3 total production in the California Wash, et cetera. So 5, 6
4 basins basically, six X's or independent variables.
5 So the reason we can do this, you know, we use
6 principles superposition where in an aquifer like this, that's
7 highly interconnected and we saw that it is acting like a
8 combined aquifer. So therefore, it acts -- it behaves in a
9 linear fashion because the transmissivity is constant. It
10 doesn't change with changing water levels.
11 So when we conduct this analysis and we extract
12 the responses to the individual basin groundwater production
13 from the carbonate aquifer, and if you look at the first graph
14 there, the slide, that would be the Black Mountain area. And
15 it appears, from this analysis, that the groundwater
16 production from Black Mountain is not really affecting the
17 water levels at EH-4.
18 So it's an indication that, perhaps, the boundary
19 down there might be a little bit off because the boundary was
20 defined based on the observation well, the VMDL-2, I believe.
21 And VMDL-2 did respond to the MX-5 pumping during
22 the Order 1169 aquifer test, and these wells, the production
23 wells are just a little bit south of there. So this is an
24 indication that, perhaps, the boundary might be a little bit

Page 906

1 off.
2 Q. And, Ms. Drici, just for the record, you're
3 referring to Figure A-3 in your expert report?
4 A. Yes.
5 Q. Okay. And now, can you continue on talking about
6 those figures?
7 A. Sure. The second figure is the response to
8 groundwater production from the carbonate aquifer in the
9 California Wash. In this one, we see that the groundwater
10 production is not really a lot. It's relatively small, and
11 yet, it produces a significant response at well EH-4. Next
12 slide, please.
13 The next figure, Figure A-5, we see the response
14 to groundwater production from the Coyote Spring Valley. And
15 in this one, you see that there's a lot of -- a lot of
16 pumping, especially during the Order 1169 pumping test.
17 But here the response, I mean, is not huge and
18 this is because of the higher transmissivity in that area.
19 When you have very high transmissivity, you might not see a
20 great response, as great as you think.
21 Figure A-6 is the response to groundwater pumping
22 in Garnet Valley. As you can see, the response for the
23 magnitude or the changes in the groundwater production. And
24 the last one, Figure A-7, is the response to groundwater

Page 907

1 pumping from the Muddy River Springs area. Again, the
2 response follows the magnitude of the pumping to time.
3 But perhaps it's not as significant as you might
4 think it is, is because it's close. But the response at a
5 given observation well is not just a function of the distance.
6 It's also a function of the level of connectivity between the
7 groundwater production and the observation well.
8 And the last figure I have here, Figure 3-2, this
9 is basically the -- putting together, adding up all those --
10 the responses to groundwater pumping from all the basins at
11 EH-4. And I show in comparing them with the observed, so the
12 orange line is the calculated EH-4 water levels and the blue
13 is the observed EH-4 water level.
14 Now, when you do the regression, you always have
15 residuals. In theory, if you knew what all the stresses were,
16 you would be able to extract the responses to every one of
17 them and the residuals would only represent the errors.
18 And they would be randomly distributed and they
19 would show up as, you know, random points about the zero line.
20 It's like you would be -- you would want to be error, whatever
21 is left zero, like the residuals, the difference between
22 observed and calculated.
23 But in this case, because I could not extract
24 specifically the response to the recharge variations, I left

Page 908

1 it in with the residuals.
 2 So the residuals in this case, they are some kind
 3 of indicator of the effect of recharge on EH-4 water levels
 4 during this period that I looked at, which is from 1993 to
 5 2018. And this period represents the period during which
 6 carbonate pumping was occurring.
 7 I know that the carbonate -- the pumping, the
 8 carbonate production from the carbonate aquifer started a
 9 little bit earlier.
 10 But the records -- I don't know if they were not
 11 kept, we could not find them, we did not want to use any
 12 estimated -- anything, we wanted to stick with the data and so
 13 this is what we get.
 14 As you can see, the downward trend in the water
 15 levels at EH-4 is clearly caused by groundwater production in
 16 all these basins of the system. And the drop caused by
 17 groundwater pumping from '93 to 2018 is about four feet,
 18 whereas the recharge variations have been causing like,
 19 perhaps, a maximum of like 1.4 feet around like in 2013, you
 20 see that deviation from the zero line for the residuals.
 21 So the relative contribution of the recharge to
 22 the water levels or the decline in EH-4 water levels is
 23 relatively small compared to the effect of groundwater
 24 production.

Page 909

1 Q. Thank you. And when you -- in your last
 2 statement about recharge and its role in affecting the
 3 hydrograph, does that recharge term include climate and the
 4 types of precipitation that's been talked about at this
 5 hearing already?
 6 A. Yes, definitely include. I mean, the recharge
 7 is -- starts as precipitation on high elevations and it's
 8 mostly precipitation during the winters that turns into
 9 recharge and moves down the system.
 10 Q. Okay. Now, I'd like to ask you, Ms. Drici, about
 11 a separate analysis that you performed. And so let's move
 12 again to Figure 6-1.
 13 And did you then perform an analysis of
 14 proportional flow at springs versus the Muddy River to
 15 determine the long-term annual quantity of groundwater that
 16 could be pumped from the Lower White River Flow System?
 17 A. Yes. In this analysis, I was trying very hard to
 18 answer the question that the State Engineer asked, which was
 19 basically, you know, how much can we produce from this
 20 carbonate aquifer in the sustainable manner. And like we said
 21 before, sustainable can mean different things.
 22 So this analysis is mostly concerning the Moapa
 23 Dace. And to do this, based on the conceptual model that
 24 Andrew was describing that all the springs in the MRSA are fed

Page 910

1 by the carbonate aquifer as represented by EH-4 as the index
 2 well.
 3 So based on that model, conceptual model, I think
 4 that the flow that you see at any spring and, for example,
 5 Warm Springs West Gage, which is like a -- represents spring
 6 discharge from the group of springs, the Pederson Springs and
 7 some seeps in between would behave in a linear fashion with
 8 the total discharge in the spring area.
 9 Now, the total discharge in the spring area
 10 cannot be managed directly because we don't have just a bunch
 11 of discrete springs. And so we could like just measure each
 12 one of them and add them up and come up with like, okay, this
 13 is the total discharge to this area.
 14 We have a combination of springs and then seepage
 15 into the alluvial reservoir. And so the only way that we can
 16 estimate what the total discharge in the springs area is by
 17 using the Moapa Gage on the Muddy River.
 18 And the way to do that is if you look at
 19 Table 6-1, the way we do that is we take the flow as measured
 20 at the Moapa Gage adjusted for like over land flow, and we add
 21 all the losses that occur above the gage.
 22 And the losses include the stream diversions, the
 23 alluvial groundwater production from the alluvial reservoir in
 24 the Muddy River Springs area, and the ET that occurs above the

Page 911

1 Moapa Gage.
 2 So if you are looking at this table, let me see.
 3 The cone, 1, 2, 3, 4, 5, 6, 7, the seventh column, which is
 4 labeled "total MRSA discharge," gives you the estimated total
 5 discharge to this area.
 6 Q. Ms. Drici, let me look -- there's a lot of
 7 information on this table. So let me just make sure I -- the
 8 record's clear.
 9 So we're looking at Table 6-1, and in the first
 10 column is the year obviously. And that second column, is that
 11 annual -- average annual CFS; is that a value from a
 12 measurement?
 13 A. Yes.
 14 Q. Okay. And the column total or annual total, is
 15 that just a conversion of that CFS into acre feet?
 16 A. Yes.
 17 Q. Okay. And then the next three columns that are
 18 all under the heading "losses above MR Moapa Gage," just could
 19 you describe again what those three columns are?
 20 A. Okay. So the first one is the total three-year
 21 of all the stream diversions that occur above the gage.
 22 Q. Okay. And what about the next one?
 23 A. The next one is the total annual production from
 24 the alluvial reservoir, which is located above the gage, too.

Page 912

1 Q. And then ET?
2 A. And the ET also is the annual ET from -- there's
3 an ET area within the Muddy River Springs area that is above
4 the gage. So this is what those numbers represent.
5 Q. And what's the source of those numbers?
6 A. The source of those numbers. They're
7 measurements and -- let me see. I have a little cheat sheet
8 here. The diversion data came from NEWR, NV Energy, and NVWD
9 and some of it from USGS.
10 The alluvial production came from NEWR, NV Energy
11 and NVWD. What else? The DET -- oh, yeah, I need to say
12 this. ET, we don't have measurements of ET all the time. But
13 for this period of time that I considered, and this is why I
14 considered this -- sorry, I should have said this before.
15 The reason we're looking at only from 2001
16 through 2002 is because a study was conducted to estimate ET
17 above in the MRSA area for those years.
18 Q. And those years being 2001 through 2012?
19 A. Yes. And so these were estimated during that
20 study for other years. All we have before was Eakin 1964
21 estimate or -- and I don't know.
22 Right now, we could probably try to figure out
23 the other years by looking at satellite imagery and all that,
24 but we did not. We just used what we had.

Page 913

1 Q. And that work was done by Justin Huntington?
2 A. Yes.
3 Q. Okay. And then those three columns, losses above
4 the gage were added together to reach the total MRSA
5 discharge?
6 A. Exactly.
7 Q. All right. And then what did you do?
8 A. Well, after we had that, I mean, we obtained
9 measurements for the Warm Springs West Gage, which are
10 measurements at that gage, and we took them -- again, we
11 converted from CFS to acre feet.
12 I mean, you could do these -- the last column is
13 the ratio basically. You just take the Warm Springs West
14 discharge for a given year, divided by the total MRSA
15 discharge for that year, and you get the ratio.
16 This ratio is something I did not mention in the
17 report because I was trying to keep it as simple as possible,
18 represents the slope of the line that correlates these two
19 measurements. Warm Springs West Gage discharge versus the
20 total MRSA discharge.
21 So because if you plot these and you try to fit a
22 line, because the MRSA -- the full MRSA discharge is not
23 measured -- it's not known very accurately, you do see a trend
24 that looks like, you know, a linear trend. But the scatter is

Page 914

1 relatively large so that you couldn't really figure out what
2 the slope would be.
3 So that's why I calculated the ratios and these
4 ratios are, in my opinion, approximations of that slope. And
5 knowing the slope would allow us to basically say, hey, if the
6 discharge at Warm Springs varies, say, by .1 CFS, what does
7 that correspond to in terms of the total discharge to the
8 MRSA.
9 And then you could use that number and say, well,
10 what if this reduction in total discharge is caused by
11 production from the carbonate aquifer.
12 So you could use that number to say if I don't
13 want to bring down Warm Springs West by more than, you know,
14 this much, then I shouldn't be pumping more than this
15 proportional quantity of groundwater.
16 Q. And did -- were you able to make a conclusion
17 about whether there was a proportional relationship between
18 Warm Springs West flow and MRSA discharge?
19 A. Yes. To confirm it farther that basically this
20 would be applicable to different springs in the area, if you
21 look at the Figure 6-2, you can see that for the same period
22 of time, the Baldwin Springs and Jones Springs also show a
23 relatively constant ratio with a total discharge of spring
24 data.

Page 915

1 Q. And on Figure 6-2, is that in the lower two rows,
2 Baldwin and Jones?
3 A. Yes.
4 Q. Okay. In preparation for this hearing, did you
5 discover a clerical error in this table?
6 A. Yes. The first -- well, the second row. The
7 first row is the year and the second row is supposed to be the
8 total Muddy River Springs area discharge.
9 In putting this figure table combination
10 together, we inadvertently used the ET values from the table,
11 rather than the total MRSA discharge numbers.
12 Q. Okay. And do you have a new version of the
13 table?
14 A. Yes, it is the one shown here. It says
15 "corrected".
16 Q. Okay. And did this clerical mistake affect your
17 analysis?
18 A. No. It was just a presentation.
19 Q. Okay. And just for the hearing officer, we had a
20 copy of the corrected Figure 6-2 that we'd like to offer into
21 evidence as our next exhibit in order, which I think is
22 Number 85?
23 HEARING OFFICER FAIRBANK: So basically what --
24 if I'm understanding you correctly, you're just offering that

Page 916

1 as an errata to this particular form. We'll accept it as an
2 errata.
3 MR. TAGGART: Thank you.
4 (Exhibit 85 admitted into evidence.)
5 BY MR. TAGGART:
6 Q. So did looking at Baldwin and Jones Spring
7 confirm what you found with respect to Warm Springs West?
8 A. Yes.
9 Q. Okay.
10 A. It appears that there is linear relationships
11 between discharge at these springs and total discharge to the
12 MRSA to the carbonate aquifer.
13 Q. All right. Now, I'd like to ask you what you did
14 next and we've got a slide up on the screen relating to Eakin
15 1964?
16 A. Okay. So in search of a good approximation of
17 this slope between Warm Springs West and the total discharge
18 with the MRSA, I found a -- I think a more accurate value,
19 looking into the literature, namely the work of Eakin in the
20 60's.
21 So the reason I think that this would -- his
22 numbers would provide more accurate estimate of the slope of
23 the linear relationship is because he measured the -- all the
24 springs he could measure at the time. He measured the

Page 917

1 discharge at various times between 1963 and 1964 and he also
2 measured the flow at the Moapa Gage on the Muddy River.
3 And so at that time, he had a measurement at Warm
4 Springs West of 3.78 CFS, whereas the total MRSA flow or
5 discharge was at 49.8 CFS. And at the time, what he said is
6 it wasn't much human activity going on there, except maybe for
7 a few irrigation wells that were -- he accounted -- he put
8 them like within the ET.
9 And he figured that in -- if he measured the flow
10 in the river in January, that ET would be minimal at that
11 time, and so therefore, because he didn't have any other
12 production going on upstream from the gage or in the carbonate
13 aquifer in the '60's, so therefore, the January measurement of
14 the Muddy River at the Moapa Gage represents a total discharge
15 to that whole area.
16 So from there, you take the -- you divide the
17 Warm Springs West by the discharge, by the total discharge
18 coming in, and you get a ratio of 0.076.
19 And this ratio is probably representative, it's
20 the most accurate representation of the slope of the line
21 correlating these two discharges. And I want to add that
22 these relationships with the springs are only valid when the
23 springs are flowing.
24 I disagree with anybody that takes them below

Page 918

1 that and takes them to zero or negative numbers or whatever.
2 They don't mean anything.
3 Q. Okay. And, Ms. Drici, was that one of the
4 critiques against this approach that was presented in rebuttal
5 reports?
6 A. Yes.
7 Q. Okay. So if all the springs are flowing, that's
8 an assumption in your approach?
9 A. Yeah, this is -- I think this is a good
10 approximation if all the springs are flowing.
11 Q. Okay. Now, how -- compare -- I'm sorry. Strike
12 that, please.
13 Of the Eakin number that you have on the screen,
14 is that comparable to the values that were calculated for the
15 ratio between 2001 and 2012?
16 A. Yes, it is.
17 Q. Okay. Now, once you derived that ratio, what did
18 you do next?
19 A. Okay. So the -- that ratio was used to estimate
20 the decrease in the total discharge that would be -- that
21 would correlate with a decrease in Warm Springs West. And we
22 did this in Table 6-2 by using the Warm Springs flow
23 conditions that were in the MOA, 2006. And so this table, if
24 you look at it, it has in the first column the Warm Springs

Page 919

1 flow conditions.
2 The first one is the -- what it was or what we
3 estimated it was during predevelopment conditions as
4 calculated from 1945 to 1962. So it's like an average of what
5 was going on there at that time.
6 And I think that starting from that value rather
7 than from what we see now is conservative, so that you're not
8 taking into account, you know, the variations in recharge and
9 considering the extraordinary recharge spikes that we saw, for
10 example, in 2005 because, of course, you can't count on that
11 to develop groundwater. We have to use like a -- some kind of
12 a base or basic number.
13 So we went back to predevelopment conditions and
14 we started from the average of 3.82, and then we moved down
15 by, you know, 2, 3.6, 2.4, 2.2, 3, 2.9, 2.8 and 2.7. Some of
16 these, I think starting at 3.2 down to 2.7 were in the MOA.
17 Q. And just quickly, when you say they're in the
18 MOA, those are values for triggers in the MOA?
19 A. Yes.
20 Q. Okay.
21 A. They were defined as triggers to protect the
22 Moapa Dace. So from there, we go to Column 2. It's -- that's
23 just a difference between, so 3.82, the first number in column
24 one minus the next one, basically the decrease from average

Page 920

1 predevelopment conditions.
2 So you go down the line that way. From the third
3 column, we convert those numbers into acre feet per year, and
4 in the fourth column, we calculate the corresponding volume of
5 water that the total discharge to the springs area would
6 decrease by.
7 And this decrease, of course, could be caused by
8 different stresses. It could be climate or it could be
9 production. But in our calculation, we're saying it --
10 would attribute these to groundwater production for management
11 purposes because we can't control what the climate does. We
12 can only control what we do, educating the production from the
13 carbonate aquifer.
14 Q. Okay. And then in the columns related to MRSA
15 discharge, what is contained there?
16 A. Well, that is the basically the number in CFS,
17 you just take the Warm Springs West discharge and CFS, and of
18 course you don't do it for the first one, but you would be
19 dividing -- you know -- well, you would get zero anyway.
20 But anyway you take the decrease in the Warm
21 Springs West discharge, for example, 0.22, you divide that by
22 the ratio of 0.076 and you get a 2.89 decrease in the MRSA
23 discharge.
24 Convert it to acre feet, that means if the Warm

Page 921

1 Springs West, it drops to divide .22 CFS -- no, I was in acre
2 feet. If the Warm Springs West discharge drops by 159 in acre
3 feet per year, that would mean that the total discharge to the
4 MRSA is going down by about a couple thousand acre feet.
5 And if all that's going on is groundwater
6 production from the carbonate aquifer, you could equate that
7 to the groundwater carbonate aquifer. You turn it around and
8 you say, if I pump a couple thousand acre-feet, the Warm
9 Springs West discharge will go drop by about 0.2 CFS.
10 Q. And according to this analysis, what amount of
11 carbonate pumping can occur in the Lower White River Flow
12 System to maintain the 3.2 CFS at Warm Springs West Gage?
13 A. Well, on this table, if you look at the rows --
14 the row where the Warm Springs West in the first column is at
15 3.2 CFS, you go across and you see that's the corresponding
16 decrease in the discharge in the springs area is about
17 6,000-acre-feet per year.
18 I'm not going to say that these numbers are a
19 hundred percent accurate. They are approximate again, because
20 the analysis, we don't have like extremely accurate data.
21 That's why we chose a range rather than a number.
22 Q. And you chose 6,000, is that what you mean by --
23 A. Well, we said that to protect the Warm Springs
24 West discharge or keep it at about 3.2 CFS per year. We

Page 922

1 shouldn't be pumping more than 4 to 6,000-acre-feet per year
2 from the carbonate aquifer.
3 Q. And that's rounding up from the 5908?
4 A. Yeah.
5 Q. Based on the limitations of the approach that you
6 just described?
7 A. Yeah, definitely. I mean, we kept the -- all the
8 significant digits here just for tracing the calculations.
9 But we know it's not going to be down.
10 Q. Okay.
11 A. To that level of accuracy.
12 Q. Now, at the beginning of your discussion of this
13 proportional flow analysis, you indicated that this was
14 related to the Moapa Dace.
15 Is there a different analysis for what amount of
16 pumping is allowable without impacting senior groundwater
17 rights -- or let me ask it differently.
18 Is this a separate and distinct concept from what
19 would be required regarding senior groundwater rights?
20 A. Yes, definitely.
21 Q. Okay. All right. We're going to move to another
22 topic. This might be a good time for a break.
23 HEARING OFFICER FAIRBANK: We've been going for
24 about an hour and a half, but we can go ahead and take a break

Page 923

1 right now if that works, if that's convenient for everybody.
2 MR. TAGGART: I think that would be good.
3 HEARING OFFICER FAIRBANK: Okay. Let's go ahead
4 and take a ten-minute break and we'll get back at 10:15.
5 MR. TAGGART: Thank you.
6 (Recess at 10:05 a.m.)
7 HEARING OFFICER FAIRBANK: Okay. Let's go ahead
8 and go back on the record. Mr. Taggart, you may continue.
9 MR. TAGGART: Thank you.
10 BY MR. TAGGART:
11 Q. All right. Welcome back. And my next set of
12 questions are to you, Mr. Burns.
13 The number of experts in this proceeding have
14 offered opinions regarding weather. The Lower White River
15 Flow System groundwater levels are in a steady state condition
16 or are continuing to decline. Have you reviewed that
17 question?
18 ANSWERS BY MR. BURNS:
19 A. I have.
20 Q. Okay. And what is your view on that question?
21 A. Well, when I look at the water levels in the
22 carbonate system throughout the domain, I see, after the
23 recovery period, that I believe sort of obtained it's peak in
24 2016. About the first quarter, I see after that period of

Page 924

1 time, that water level trends have been declining in the wells
2 I've looked at.
3 Q. All right. I want to show you Figure 3-3 from
4 your rebuttal report, which is Exhibit SNWA Exhibit 9. Could
5 you describe that, please?
6 A. Okay.
7 Q. And please describe whether this figure is
8 significant with respect to your opinion regarding whether
9 water levels in the Lower White River Flow System are at
10 steady state or are continuing to decline?
11 A. Correct. This is a figure with -- I'm going to
12 go back to hydrographs, and I want you to look at this period
13 after 2016 or at the peak of the view as recovery, 2016 to
14 current. If you could back up a slide in your presentation, I
15 want to show you, again, where these wells are located.
16 The first one, CSVM-1, again, is maybe a quarter
17 mile, half a mile to the east of MX-5 pumping well on the way
18 to Muddy River Springs area.
19 Again, there's GB-1, which is at the boundary of
20 Hidden Valley and Garnet Valley and then Paiute TH-2 is in
21 California Wash. All these are carbonate completed wells.
22 So if we look at that period from 2016 to
23 current, what I did here was to take the maximum water level
24 that occurred in the year, and typically that's in the first

Page 925

1 quarter of the year, and with those four values, just
2 developed a trend line. And that's depicted on the chart.
3 And, of course, you can see for each of these three wells, the
4 trend line is going down.
5 Now, I want to make a point here of some of the
6 other conditions occurring during this time frame. One, if
7 you look at the bottom panel, it's not that easy to see on
8 this figure, but we can maybe go to the table and I'll show
9 you. But what you see from 2016 to 2018 that groundwater
10 production has actually gone down.
11 In this period, 2017 -- or in the same period,
12 2016 is essentially a normal year, but the -- two of the three
13 years after are above the -- I'm sorry, let me back up. The
14 precipitation index is greater than normal in 2017 and 2019.
15 So the average annual percent of winter season
16 precipitation is higher than average. 2018, it's actually
17 lower. So what I see here, and we're talking southern Coyote
18 Spring Valley, northern Garnet Valley, and then California
19 Wash is there -- is a declining trend.
20 So my impression here and my conclusion is that
21 the system, at least in these areas, has not attained the, as
22 some people call, steady state condition, that water levels
23 are still declining.
24 If you go to the next page, I think I can maybe

Page 926

1 illustrate with some of the numbers of production. Here, if
2 we look at 2016, for example, the last three rows of this
3 Table 2016, 2017, 2018, at the top we have Coyote Spring
4 Valley from left to right. Coyote Spring Valley, Black
5 Mountains area, Garnet Valley, California Wash, Muddy River
6 Springs area.
7 Q. And, I'm sorry, Mr. Burns, this is Table C-3?
8 A. Yes, sir.
9 Q. Okay. Go ahead.
10 A. And then on the far side is the total production
11 and this is carbonate aquifer and groundwater production. So
12 I mentioned earlier about these declining trends in these
13 wells.
14 I'd like you to look at the total on the very far
15 right-hand side, and these are the production numbers during
16 that period, about 7800 in 2016, less than that, 2017, and
17 then 7,630 and in 2018, 7,344.
18 Q. Mr. Burns, what about specifically in Muddy River
19 Springs area? What was the change in production from 2017 to
20 2018?
21 A. Well, in 2016 and 2017, it's about the same,
22 around 2800. But it -- production was reduced by about, let's
23 say, 150-acre-feet in that area. If you'll oblige, I'd like
24 to talk about California Wash as well and some of these other

Page 927

1 basins.
2 In California Wash, production from 2016 to 2018
3 also declined from 200-acre-feet to 24. In Garnet Valley,
4 peak production in 2016 at 2242, down in 2018 to 1751.
5 However, in Black Mountains area, there's a
6 slight increase from 1434 in 2016 to about 200-acre-feet more
7 at 1623 in 2018. I'll point out, though, the net production
8 between Black Mountains area and Garnet Valley, I think, has
9 actually gone down if you combine those two. And then Coyote
10 Spring Valley in 2016, production at 1117 increased to almost
11 basically 1400 in 2017 and then almost 2,000, 2018 at 1,967.
12 So the point here is, well, while production --
13 we see these water level declines coincident with groundwater
14 production being reduced coincident with a period of time
15 where we've had above normal winter season precipitation.
16 And so this tells me -- this is -- the response
17 is something different than you might expected. You had
18 production lowered and higher than normal precipitation, you
19 might expect that the water levels are steady or even
20 increasing, perhaps, and that's not what I see.
21 Q. Did you also review the EH-4 hydrograph with the
22 same questions in mind?
23 A. Yeah, I took a look at EH-4 as well, EH-4 and
24 EH-5B. Now, remember, EH-4 is just adjacent to the gradient

Page 928

1 Pederson Springs complex. E-5B is to the northeast of that or
2 basically north near the Arrow Canyon wells, production wells.
3 And so these wells on this next figure --
4 Q. Let me just, for the record, identify it. Is
5 this the document that's been submitted as SNWA Exhibit 81?
6 A. That's correct.
7 Q. All right. Go ahead.
8 A. Okay. So if we look at EH-4 and EH-5B, and
9 starting about 1998, we see a very linear decline to the end
10 of 2004. And we can look at the production at the bottom and
11 see that production had increased during that time frame.
12 Then 2005 is the extraordinary recharge year that kicked the
13 water levels up. And then, of course, we see the test again,
14 starting in 2011 and the water levels responding accordingly.
15 Here, the recovery period, again, about the first
16 quarter of 2016, I've applied the same process and it's very
17 simple of taking the maximum water level in each of those
18 years and using that to develop the trend lines. And in both
19 of these cases, I see the trend declining.
20 Q. Okay.
21 A. Now, one thing I might note is in this period, I
22 just recited for you some of the production in this area. So
23 in 2018, it was reduced by a little over 800-acre-feet.
24 And I think when we see -- when we look 2018,

Page 929

1 that first quarter, it's actually a little higher than 2017
2 and 2019. And I attribute that to that change in pumping
3 operation at the Arrow Canyon wells.
4 Q. So, again, at this EH-4 location that's depicted
5 on Exhibit 81, what would you expect to be happening at this
6 location if groundwater pumping was down and precipitation was
7 above average in two of the last three years?
8 A. Well, frankly, with respect to the precipitation
9 index or indicator, we actually don't see much in terms of --
10 in the hydrographs, we don't see much in terms of response to
11 these years where you're approximately normal or below normal,
12 you know, 100 percent or even when it -- the signals that we
13 see are these extraordinary events like in 2005.
14 But what I would expect to see with the decline
15 in groundwater production and these above normal years in 2017
16 and 2019, at least -- I would at least see that the water
17 levels are flat or no trend or perhaps even rising.
18 Q. And does this declining trend that you've
19 described in EH-4, does it have implications on whether flows
20 at Warm Springs West will remain stable or will begin to
21 decline?
22 A. Well, earlier in our presentation, I established
23 that the change in heads at EH-4 have proportional change in
24 flows at the Pederson Warm Springs complex. So I would expect

Page 930

1 a proportional change up in those flows or reduction in flows
2 if this -- if there's a declining trend from here to the
3 future.
4 Q. And I'd like to show you again Exhibit 5-7.
5 Would continued decline in the flow at Warm Springs West
6 potentially lead to the initial trigger of 3.2 at that gage?
7 A. Right. Absolutely. If the potentiometric
8 surface as measured by the water levels in EH-4 continue to go
9 down, of course, the discharge from this spring complex will
10 also go down.
11 Q. And could you describe that in relation to the
12 solid line on that Figure 5-7, which is identified as the
13 initial trigger level?
14 A. Okay. On Figure 5-7, the second from top
15 hydrograph is the Warm Springs West near Moapa Gage record,
16 and what you see here after a test, we encroached upon the 3.2
17 initial trigger of 3.2 CFS. They recovered and then it looks
18 to me as it's declined, maybe sort of bouncing around as a
19 steady level around 3.4 max.
20 Q. Okay. And then this new last three-year decline,
21 do you view that as a decline in this hydrograph as well?
22 A. From 2016 to first quarter of 2019, yes.
23 Q. Okay. So do you believe that current pumping
24 levels in the Lower White River Flow System, the gage record

Page 931

1 at Warm Springs West could fall below 3.2?
2 A. Yes, I mean if what we see continues, we'll
3 continue to see declines in the head levels at the springs,
4 themselves, and as I said earlier, a proportional decrease in
5 flow.
6 And so it's not -- you know, we're not there yet,
7 but I think if water levels continue to decline, we will be at
8 some point.
9 Q. Okay. Now, Ms. Drici, I want to ask you now
10 about this question of steady state versus continuing to
11 decline in the Lower White River Flow System.
12 Can you turn to Figure 6-3 of the SNWA report,
13 Exhibit Number 7?
14 ANSWERS BY MS. DRICI:
15 A. Yeah, I'm there.
16 Q. And explain what we're looking at here?
17 A. Okay. So this -- to get to this analysis was to
18 approximately calculate where we're at in terms of the capture
19 by the ongoing groundwater production from the carbonate
20 aquifer. So the way this was done is, again, going back to
21 that ratio between Warm Springs West and total discharge.
22 So, again, we look at the historical record of
23 the Warm Springs West Gage and we looked at it from basically
24 the estimated start of groundwater production from the

Page 932

1 carbonate aquifer, which is like from 1991 to 2018 on using
2 annual data.

3 So if you take the decrease in the Warm Springs
4 West Gage from -- at the start, from 1991 and you go down
5 every year and you see how it's been decreasing, you can use
6 the ratio to calculate the corresponding decrease in the total
7 discharge of the MRSA. And that total -- the discharge in the
8 total MRSA discharge could be equated to the capture by the
9 groundwater production from the carbonate aquifer.

10 So this graph shows the cumulative MRSA discharge
11 capture in green through the years. The total groundwater
12 production is the blue line -- is it blue or purple? Blue
13 line on top.

14 And so from there, you take the total groundwater
15 production for each year and you subtract the amount captured
16 from the spring discharge. You get -- the difference would be
17 the volume of groundwater captured from storage of the
18 carbonate aquifer.

19 So this basically -- that shows that by the time
20 you get to 2018, we're -- we haven't reached steady state
21 definitely because we're still capturing groundwater from
22 storage.

23 We see the blue area is still going up, because
24 if you were getting close to a steady state, that line would

Page 933

1 be flattening, signalling that there is no more change in
2 groundwater storage.

3 So in my opinion, considering the approximation
4 of the ratio and the lack of production data before like 1990,
5 approximately I could say that was probably around 50/50, for
6 capturing 50 percent of the groundwater production from the
7 carbonate aquifer from the spring discharge and about
8 50 percent from groundwater storage.

9 Q. Thank you. Now, I'd like to move onto a new
10 topic. Mr. Burns, I'm going to ask you about the question of
11 the relationship between pumping in the Muddy River, carbonate
12 pumping in the Muddy River.

13 So let's turn to Figure 7-1, 7-1. And with that,
14 could you -- I'm going to begin asking you about the Muddy
15 River depletion analysis that you conducted.

16 But before we do, could you orient the State
17 Engineer and his staff to the major points on this map that
18 we'll be talking about?

19 ANSWERS BY MR. BURNS:

20 A. Certainly. This is the aerial extent of the
21 Muddy River Springs area where the springs that we've been
22 talking about occur, Pederson Springs. This is the -- you
23 need to go -- this -- there you go, there you go.

24 Okay. Sorry about that. So Pederson Springs

Page 934

1 here. What's of interest to this analysis is the gage record
2 at the Muddy River near Moapa Gage. But just to identify some
3 of the other features, we have -- this area on your imagery,
4 this is areas of evapotranspiration, whether it's irrigation
5 or natural. That's the extent.

6 We have production wells in the area. We have
7 the Lewis well field to the northeast. We have LDS Central
8 east and west, alluvial wells, those are all production wells
9 that draw from the -- or have historically drawn from the
10 alluvial reservoir and then Perkins down to the south --
11 (Reporter interrupted proceedings.)
12 -- Perkins production well and Beamer production
13 well below the gage to the south in your lower right-hand
14 quadrant of the figure. And so that gives you a sense of the
15 layout and you have Arrow Canyon production up in the
16 northwest corner.

17 And so what we -- I think not just we, I think
18 anyone who's looked at the gage record of the Muddy River near
19 Moapa Gage has observed that since about mid 1960's, there's
20 been a decline in flow. We have that in our report, the
21 hydrograph for that. But what we've seen is this decline has
22 persisted over time and we wanted to know what that was
23 attributable to.

24 The obvious factors include surface water

Page 935

1 diversions above the gage. What's not depicted here is that
2 there's a Nevada Power Energy diversion right above the gage,
3 and there's some diversions from the springs in this system as
4 well. So those are obvious factors that could contribute to
5 this decline.

6 Others could be land use changes, perhaps, or
7 changes in ET or even long-term climate trends that have
8 reduced flows. And we looked at each of those and found that
9 they were not significant with respect to the magnitude of the
10 decline.

11 And we attribute -- so what we did is we -- if
12 you turn to the next slide, is if we were to assume
13 predevelopment condition of 34,000-acre-feet in this area of
14 surface water discharge, as the predevelopment condition, I'm
15 looking -- let me back up. I'm looking at a period 1992 to
16 2018 here.

17 And if we assume that we can see that this bottom
18 line, that we were substantially below that predevelopment
19 condition. So something, in our mind, has depleted the river
20 flows in this area of over this time period.

21 This bottom line is what we refer to as a flood
22 adjusted flow. So it's a -- what we're interested in is the
23 base flow that's measured by the gage and we've adjusted that
24 flow to remove the overland flow and flash flooding events and

Page 936

1 that's what's represented there.
 2 We derive a flood adjusted natural flow, so this
 3 is the natural flow that would occur. We -- in doing so, we
 4 add the surface water diversion back to create this natural
 5 flow record.
 6 And on the next page, what we see then is we have
 7 the bottom line, which is the record. We've added in the blue
 8 part, which is the Muddy River diversions. But we're still
 9 left with -- we're turning the Muddy River flow deficit.
 10 These are what we identify as the depletions in the river
 11 system as measured at the Moapa Gage.
 12 And so as I said earlier, we don't think ET,
 13 which varied, as Warda's described earlier in a study from
 14 2001 to 2012, varied around 800-acre-feet over that time
 15 period, a decline. But that doesn't account for, you know,
 16 about 6 or 7,000-acre-feet in -- at its maximum here.
 17 We looked at long-term trends. We look at the
 18 winter season precipitation pre- and post-1965 when experts
 19 began -- groundwater experts began and surface water
 20 diversions.
 21 We find that was actually slightly higher 1965 to
 22 present than it was pre-1965. So we rule out this being
 23 attributable to climate factors. That's not to say that
 24 there's some variability with flow record due to that -- those

Page 937

1 factors. But we all feel that that can attribute for this
 2 entire deficit.
 3 So what we did next is looked at this low
 4 deficit. So we attribute the deficit to groundwater
 5 production and here's a ground -- here's a figure, this is
 6 Figure 4-5 of our report. This is the inset that we just
 7 showed earlier where groundwater production occurs. You have
 8 base -- alluvial reservoir pumping, you have Arrow Canyon
 9 carbonate production in this Muddy River Springs.
 10 But outside this area, we have these other
 11 pumping centers. And Warda earlier mentioned about, in her
 12 MLR analysis, attributing some of the declines at EH-4 to
 13 these pumping centers. So in Coyote Spring Valley, we have
 14 the SNWA's MX-5 well, CSI production wells, there's a CSVRW-2
 15 that's not been operated. You have in California Wash, the
 16 Paiute ECP-1, 2 and 3 wells, and then you have a series of
 17 production wells in Garnet Valley as well.
 18 And, of course, at the far southern end is
 19 pumping the Black Mountains, EBM-4, 5 and 6. So all of those,
 20 as Warda showed earlier, contribute to declines at the EH-4
 21 well site and the heads as measured by that well.
 22 And so if we go to the next page, what I'm
 23 presenting here is this red line is what is the actual Muddy
 24 River Flow deficit. These are what we view as the depletions

Page 938

1 in the river system above the Moapa Gage.
 2 Underneath the line is a stacked bar chart and I
 3 stacked these based on proximity of the wells to the gage --
 4 or to the river system. So we have the alluvial pumping on
 5 the bottom, Arrow Canyon on top of that and then I only
 6 included the Coyote Spring production here. But this was
 7 done -- this analysis was -- or this assessment was done prior
 8 to the MLR analysis.
 9 So in retrospect, I probably would've -- because
 10 the contributions from all these production wells in the
 11 basin, I probably would have just had this as a single blue
 12 bar.
 13 So at any rate, that is what we view as
 14 depletions over this period of time ranging from, you know,
 15 around -- max, around, you know, 7200 or so down to the
 16 current level of about 2300. And so these have been occurring
 17 over time. This is what we've estimated for this period and
 18 these are what we view as the effect of pumping on this river
 19 system.
 20 And, of course, I think most folks I've -- well,
 21 all the folks I've talked to believe that the alluvial pumping
 22 is -- occurs as the -- the impacts of alluvial pumping occurs
 23 at a one-to-one basis. So one volume of -- one volume of
 24 pumped water from the alluvial reservoir is equivalent to one

Page 939

1 volume depleted from the river.
 2 And then we have the same -- at least for when we
 3 look at the MRSA production from the carbonate system, if that
 4 were the sole contributor to the declines at EH-4, that would
 5 be the contribution and that would approach one to one.
 6 Q. And, Mr. Burns, do you agree with the opinion you
 7 just described that others have talked about, the one-to-one
 8 depletion rate?
 9 A. Yes.
 10 Q. Now, as a result of your Muddy River depletion
 11 analysis, you were able to determine in acre feet, the amount
 12 of depletion from the river had occurred over this time
 13 period?
 14 A. Yes.
 15 Q. And did you then convert that depletion into ICS
 16 credits or intentionally created surplus credits on the Muddy
 17 River?
 18 A. Right. So let me explain. So when these
 19 depletions occur, there's two systems that we -- that I think
 20 of on this river with respect to how we derived ICS credits.
 21 We have an upper Muddy River system where we have
 22 rights and those are unaffected because we had the river --
 23 sufficient water in the river to make those demands or those
 24 obligations.

Page 940

1 The depletions really affect the water that's
 2 delivered at Moapa -- or the Muddy Valley Irrigation Company
 3 at wells sighting diversion down in Lower Moapa Valley. And
 4 so if you look -- I guess I'll look at the figure real quick.
 5 What I was describing here is sort of a delineation between an
 6 upper and lower system. As I said, there's sufficient water
 7 in the upper system to meet these right obligations, decreed
 8 rights.
 9 The depletions actually are realized here at the
 10 well sighting diversion in Lower Moapa Valley. What this
 11 analysis accounts for is just the effects of those depletions
 12 above the Moapa Gage and their impact to the flows delivered
 13 to the irrigation company at well sighting diversion. So just
 14 as a demonstration for --
 15 Q. Oh, just a second, please. Just a point of
 16 clarification, why is it that it's that water delivery at well
 17 sighting that it's where the depletion occurs? Is that a
 18 hydrologic issue or is that something different?
 19 A. Well, the depletion, itself, is a hydrologic
 20 issue. It's called -- well, maybe it's a hybrid. The
 21 depletion is caused by pumping operation that's depleted the
 22 flow of the river, whether it's alluvial pumping or carbonate
 23 pumping. The effect is realized by decreased flows at the
 24 delivery point at the well site diversion.

Page 941

1 Q. And is the well site diversion significant from a
 2 decrease standpoint or from a water rights standpoint?
 3 A. Well, it's my understanding that the irrigation
 4 company there is entitled to the entire flow of the river, at
 5 that point, less any amount used in the upper system. So to
 6 the extent there's water unused in the upper system by those
 7 other decreed rights, the remaining water is assigned by
 8 decree to the Muddy Valley Irrigation Company at the well site
 9 diversion.
 10 Q. Okay. Thank you.
 11 A. So if you look at the next slide, please,
 12 Figure 7-2. What we list in here is our certified ICS credits
 13 that we develop from our irrigation company shares. We have
 14 purchased shares and leased shares in the Muddy River
 15 Irrigation Company.
 16 The water that arrives at the diversion is
 17 distribute based on those shares, so it can vary from year to
 18 year. But in the first two columns, we have year from the
 19 program's inception in 2008 to 2017, and these are certified
 20 ICS credits listed for those years. And when I mean
 21 certified, these are amounts certified by the State Engineer
 22 and the Bureau of Reclamation.
 23 What I want to demonstrate here is what the
 24 potential ICS credits would have been if there was no

Page 942

1 depletion on the river, and so we assume this
 2 34,000-acre-feet. And under -- we -- for a certified credit,
 3 there's a natural flow condition that was observed in that
 4 time. So, for example, 4983 in 2008 under a flow condition of
 5 29,016-acre-feet, which happens to be about 86 percent of the
 6 predevelopment base well.
 7 So it's a simple calculation of what would our
 8 potential ICS credit have been if we had 100 percent of the
 9 river flow to 34,000, and that's simply computed by dividing
 10 the certified right by .86. And you get this in the 1, 2,
 11 3 -- the fifth column, potential ICS credits under 100 percent
 12 predevelopment base flow.
 13 So without these depletions, that's what we would
 14 have realized, that with our shares in the irrigation company.
 15 The next column, the impact, I demonstrate here that the
 16 impact in this year is simply the difference between the
 17 potential and what was certified, 811-acre-feet. And for the
 18 period of analysis here, it's about approximate
 19 12,000-acre-feet.
 20 Q. All right. A couple of follow-up questions
 21 there. I asked you about -- now, we are moving on to a new
 22 subject.
 23 I asked you about your opinion regarding the
 24 capture ratio between alluvial pumping and river depletion and

Page 943

1 you indicated your opinion on that. What about pumping of
 2 carbonate water versus river flow?
 3 Could you describe what your view is on what the
 4 rate of capture is from carbonate pumping?
 5 A. Well, I can't tell you what the rate of capture
 6 is. Warda has an analysis that shows you our estimation of
 7 what's happened. But if we look out long term and we think
 8 about -- when I say "long-term," it's not five years or
 9 10 years from now. It's decades. It's what happens when you
 10 pump this water, what are you capturing? What source of water
 11 can you capture?
 12 The only discharge in this flow system is the ET
 13 and the spring flows and the river flows in this area. And at
 14 some point in the future, I think I would expect that
 15 carbonate groundwater pumping would essentially be one for one
 16 and capture that flow.
 17 Now, how long that takes, I can't fathom a guess.
 18 It is also possible that the carbonate production could
 19 capture a boundary flow, perhaps some amount of -- some
 20 limited amount of underflow or outflow to some other basin.
 21 But given the framework, I don't view that outflow is
 22 significant.
 23 One of the things that we've seen with our
 24 qualitative and regression analysis is that throughout this

Page 944

1 system, we have very high degree of connectivity. These wells
 2 are very responsive to pumping changes, and I just don't see
 3 how -- where you could put a well, at least in the areas we've
 4 examined, and pump that well without having some effect at
 5 EH-4 and, of course, the proportional effect at springs.
 6 Q. Mr. Burns, SNWA submitted a report after the 1169
 7 pumping test. How does the inclusions in the report that you
 8 submitted here relate to that and the conclusions in that
 9 report? How does this report add to what was done in the
 10 past?
 11 A. Well, what adds to the analysis is the six or so
 12 years of data that we've collected since the test is over and
 13 since those reports, those first analyses were provided to the
 14 State Engineer.
 15 What's changed is we've seen what the recovery
 16 is. We stop pumping about 3,000-acre-feet from the MX-5 well,
 17 and frankly, I was expecting more of a recovery. But I think
 18 the recovery was suppressed by ongoing pumping. I think I
 19 lost your question. What's your question?
 20 Q. How does the analysis that's done in the report
 21 that you're presenting to the State Engineer supplement what
 22 was done in 2013?
 23 A. Well, this report here is -- I would say is more
 24 comprehensive view of the issues, using more data and more

Page 945

1 data analysis.
 2 Q. All right. Now, I'd like to ask you some
 3 questions about some of the testimony that's been offered
 4 before your testimony here at this hearing.
 5 In your rebuttal report, there's a Figure 2-4,
 6 and let's put that up on the screen. And there was testimony
 7 from Mr. Reich about the location of a fault in Coyote Spring
 8 Valley and the -- and in his view, the fault being not
 9 permeable or having limited permeability.
 10 Do you recall that?
 11 A. I do.
 12 Q. What's your opinion about the fault structure
 13 that he described and its level of permeability?
 14 A. Well, what I demonstrate in this chart, what I
 15 want to show you is a series of hydrographs. And you can see
 16 for yourself that they all behave in the same manner as we
 17 confirmed in our regression analysis.
 18 But one well, this top one, CSVM-2 is located --
 19 if you can go to the map, please. CSVM-2 is located in
 20 southern Coyote Spring Valley.
 21 This is on the west side of the highway and you
 22 can see how it responds to the various stresses during this
 23 period of record. And it's the same as CSVM-1, which is, as I
 24 said, next to MX-5 pumping well and in the same for UMVM-1 to

Page 946

1 the east.
 2 If you compare CSVM-2 to UMVM-1, they look very,
 3 very similar, identical in essence. And then further to the
 4 east at EH-4 at the springs area, again, the same. And then
 5 to the very far south is GB-1 and that one, as well, very
 6 similar.
 7 So what this shows me or tells me is that, first
 8 off, between the CSVM-1 and these eastern -- easterly located
 9 wells in the carbonate system, there is no real difference.
 10 There's no attenuating effect by these faults.
 11 I don't see any attenuating effect by the horse
 12 that sits there, the structural block that's much discussed
 13 the last couple days. I just don't see it. If it was there,
 14 I would -- you know, we wouldn't see these responses from the
 15 MX-5 pumping. And this shows the degree of connectivity in
 16 this area.
 17 Q. All right. And could you turn to Figure 2-5 from
 18 your rebuttal report, figure number 9 and describe what this
 19 shows?
 20 A. Let's go to a map first. Well, first off, what
 21 this shows are the records for CSI-1, 3 and 4. And then below
 22 there is CSVM-1, again, next to MX-5. But if you could go to
 23 the map. That's hard to see.
 24 But this map figure is the hydrogeologic map of

Page 947

1 Rowley, 2011. And what I've done is posted the well locations
 2 on this map to show -- just to orient you where these wells
 3 are in proximity to MX-5 and some of the other structural
 4 features that are prominent in this area.
 5 First off, along Highway 168 is the CSI-1 well
 6 and it's right here in the middle of the map. To the east of
 7 that is CSVM-1 here, which is on -- within that structural
 8 block, and then CSI-4, which is along the highway to the
 9 north, and CSVM-3, which is in the middle of this structural
 10 block that's been talked about.
 11 And so it extends -- I mean, CSMAT data has moved
 12 this fault a little closer to the mountain -- the range front.
 13 But this structural block extends to the central part of the
 14 valley and that was characterized by Mr. Reich as an
 15 impermeable boundary. Also, the same, I think, with the
 16 faults that they mapped.
 17 So here -- I guess here's the story as I
 18 understand it. They're purporting that CSI-4, CSI-1 and CSI-3
 19 are in a separate compartment, in essence, than the other
 20 wells to the east and to the springs area.
 21 So if I go back to the hydrograph, if we first
 22 look at the bottom panel, which is CSVM-1, which is very --
 23 like I said, right next to this MX-5 pumping well. If we just
 24 focus on the test period, which is the gray area, we can see

Page 948

1 that prior to 2011, they're starting the pump, getting it
2 ready for the test, and then it starts in 2011.

3 And then about at the end of the first quarter of
4 the year, MX-5 shuts off and you see CSVM-1 respond
5 accordingly, water levels come up. The pump is then turned
6 back on, water levels decline. And then they shut off again,
7 the well shuts off and the water level recovers.

8 And then the remainder of the test continues and
9 you have this decline to the end, to the end of MX-5 pumping.

10 Now, when I look at CSI-1, I can see the same
11 sort of responses to this pump shut down at MX-5. I see the
12 water level come up when it's shut off. I see that it goes
13 down when it's turned on, and then come back up when it's
14 turned off, and then for the remainder of the test, the
15 decline. So at this well, I see that there is no real feature
16 that attenuates the well -- the drawdown response.

17 Incidentally, if you go from the beginning of the
18 test, you can see it's -- I have a list in my table report,
19 but you can see a decline over the period of the test of --
20 let's see, 1, 2, about 3 feet or so.

21 Going to CSI-3, I think it's -- the record is a
22 little, there's some missing data, I suppose, or missing
23 measurements and -- but you can still see that when the pump's
24 turned on, you have a decline. When the pump is shut off, an

Page 949

1 increase and then a decline.

2 Now, superimposed on here is -- are the pumping
3 effects, responses of the well itself. And so the record is a
4 little by complicated in that regard and the same for CSI-4.
5 But what you can see here is the start of the test to the end
6 of the test, there's certainly an effect.

7 Now, CSI-4, same story, we're missing some
8 important data here that might show what happened when the
9 pump was turned off in the early first quarter of 2011.

10 But you can see 2012, when the pump was turned
11 on, the water level declined and it pops it back up when the
12 pump shut off. And we just don't have much data after that,
13 except for this little record of five points that is lower
14 than it was.

15 So what I see here are clear responses to the
16 MX-5 production. The response is compounded by some of the
17 production from the well itself, but you can see the signals
18 of the MX-5 in this record.

19 So I conclude here that the structural block is
20 not impermeable, nor are the faults on the west side of that
21 block.

22 Q. So do you believe production of water, it had
23 significant levels, for instance, 4,000-acre-feet could occur
24 at CSI-1, 3 and 4 without impacting the Muddy River Springs?

Page 950

1 A. I don't think that's the case.

2 Q. Okay. Moving on to your next slide, there's been
3 some discussion about CSVM-5. Are you familiar with that
4 monitor well?

5 A. I am familiar.

6 Q. And why are you familiar with that monitor well?

7 A. Well, that was a monitor well that was installed
8 by SNWA. I was the contracted administrator for that. It was
9 some time ago, I mean, 2003 time frame. But I think as Sue
10 Braumiller said the other day, this well was sited by the TRP,
11 is my recollection and it's about -- I think it's about
12 1800 feet, the water level is about 1080.

13 So it's deep, depth to water. In all these CSVM
14 wells, we tried to have about 700-foot saturated thickness
15 penetrated by the well as is the case with this one.

16 As she said and as we -- you can see when you
17 drive out there, this well is in -- at a site where there's
18 overturned beds -- not overturned, but near the vertical beds
19 and those are influenced by, I think, the Glendale. They're
20 the gas peak thrust fault.

21 But regardless, depth to water is deep here. It
22 appears to me that -- well, the data shows that it's not
23 connected as others have concluded to the structural base, the
24 wells in the structural basin of the flow system.

Page 951

1 However, you see this little blip in 2005 that
2 we've seen in the other wells. So it is receiving recharge
3 from the Sheep Range, it looks like. I don't know what else
4 you want to know. I mean, it looks to me like the materials
5 are tight.

6 They're not very -- it's not very responsive to
7 recharge pulses unless they're extraordinary and that's sort
8 of the case for all these wells.

9 Q. Okay. And I think my last question is -- has to
10 do with a 2011 report that SNWA prepared and it -- are you
11 familiar with the 2011 report SNWA prepared that included
12 Darcy Flux equation calculations in the Lower White River Flow
13 System?

14 A. Yes.

15 Q. And there's been some discussion of those
16 calculations in some of your reports that are submitted here.
17 Do you have a position on the role of that information in this
18 proceeding?

19 A. Well, we can't rule out that there is -- well,
20 there's obviously flow throughout this system. The two
21 calculations in this area that I recall was one was in the --
22 below the Muddy River springs and that was a calculation to
23 estimate a flux to the Muddy Creek formation at that location
24 just below the springs.

Page 952

1 We also did another one here south of -- I think
 2 it was south of CSVM-2. I forget the exact number, but it was
 3 on the order of 8,000 or so acre feet. The previous one was
 4 about 9900 and those were -- in our conceptual model, we --
 5 the issue with this area near CSVM-2 was that based on the
 6 isotopic composition of waters in Garnet Valley and California
 7 Wash, we thought -- and I still I think that there's got to be
 8 some amount of water going into Garnet Valley.
 9 We don't know what that is. But based on that
 10 isotopic composition, it couldn't just be local recharge. And
 11 so we computed Darcy Flux just to try to get a sense of what
 12 it could be potentially and then we did the same thing over in
 13 the Muddy Creek formation, south of the springs.
 14 Q. Has -- in your opinion, is there any evidence of
 15 any wells being able to capture any of that water yet?
 16 A. Well, what we've seen is that because of the high
 17 degree of connectivity in this area from -- at least from --
 18 extending from the wells that we've looked at and in between,
 19 it's hard to imagine that you could put a well in this system
 20 without impacting EH-4, for example.
 21 So there might be underflow there, but I don't
 22 know -- I can't think of what means of finding the well
 23 location that would only -- it's only going to capture this
 24 outflow, wherever it occurs.

Page 953

1 Q. All right. Now, let's turn to your next slide.
 2 And can you summarize your conclusions, please?
 3 A. Sure. I'm just going to read these so it's
 4 clear. We have conclusions for each of the points of -- in
 5 the Order 1303. First item, A, Lower White River Flow System
 6 geographic boundary.
 7 Our conclusion here is the boundary defined by
 8 the State Engineer is appropriate. However, any applications
 9 or permits close to the boundary should be scrutinized, and
 10 this is a point that Colby elaborated on at the opening.
 11 B, the hydrologic responses to the cessation of
 12 Order 1169 aquifer test. The linear regression analyses that
 13 we completed confirmed hydraulic connectivity throughout the
 14 system.
 15 The recovery of water levels blended by continued
 16 carbonate production. Carbonate water levels and high
 17 elevation spring discharge have resumed a declining trend.
 18 Item C, groundwater production and the capture of
 19 the Muddy River springs and river flows. Linear regression
 20 analysis confirmed high correlation and linear relationship
 21 between carbonate water levels at the Muddy River Springs area
 22 and spring discharge.
 23 The Muddy River Flow deficit analysis quantified
 24 estimated impacts to river flows due to groundwater

Page 954

1 production. Ratio analysis quantified potential changes and
 2 total Muddy River discharge based on the changes in the Warm
 3 Springs West discharge for the same period.
 4 And then our main conclusion on this point, if
 5 the conflicts with senior water right holders are adequately
 6 addressed, these depletions we've talked about, the total
 7 annual carbonate groundwater production should be banned
 8 between 4 to 6,000-acre-feet over the long term to maintain
 9 3.2 CFS at Warm Springs West Gage in order to protect the
 10 endangered Moapa Dace.
 11 Lastly, D, the effects of moving water rights
 12 between alluvial wells and carbonate wells. Changing points
 13 of diversion to move groundwater production on the Muddy River
 14 Springs area alluvial reservoir to locations sourced by the
 15 carbonate aquifer will not mitigate impacts. It will only
 16 delay their inevitable occurrence.
 17 Such changes would exacerbate issues associated
 18 with the already over appropriate carbonate aquifer by
 19 accelerating the timing of impacts to the high elevation
 20 springs due to the additional groundwater production.
 21 The timing of impacts, of course, will vary based
 22 on the magnitude, the duration and location of groundwater
 23 production. Detectable impacts may occur relatively quickly,
 24 within weeks or months, if additional groundwater production

Page 955

1 were to occur in areas directly upgradient from the Muddy
 2 River Springs area.
 3 Detectable impacts of groundwater production in
 4 areas farther away may take longer, but as we demonstrated,
 5 the properties of the aquifer are such that these impacts will
 6 eventually result in reduced spring discharge and depletions
 7 of the Muddy River stream flow.
 8 MR. TAGGART: Thank you, Mr. Burns. And that
 9 concludes our direct exam, and we'd like to reserve the
 10 remainder of our time for redirect.
 11 HEARING OFFICER FAIRBANK: Okay. Thank you. So
 12 based upon today's presentation, we will go ahead and assign
 13 14 minutes to each of the participants for questioning. And,
 14 similarly, as we've done in the previous days, if there's
 15 addition time, then after the State Engineer has their
 16 opportunity to ask questions, then we will go ahead and reopen
 17 that up for additional questions by the participants. And we
 18 will start this morning with Coyote Spring Investments.
 19 MR. HERREMA: Good morning. My name is Brad
 20 Herrema, and I represent Coyote Spring Investment in this fact
 21 gathering proceeding.
 22 CROSS-EXAMINATION
 23 BY MR. HERREMA:
 24 Q. Initially, I had a couple questions on the

Page 956

1 July 3, 2019, report. It's labeled SNWA Exhibit 7. That
 2 report is signed by two other folks who aren't at the table
 3 today, Casey Collins and James Watrus. What did they do in
 4 the preparation of the report?
 5 ANSWERS BY MR. BURNS:
 6 A. Casey Collins is a hydrologist that works for me
 7 in my division. His main effort was in data compilation and
 8 presentation. So all these fantastic hydrographs you see in
 9 some of these charts and figures, he prepared.
 10 Jim Watrus, who also -- he's a senior hydrologist
 11 for us. He and his staff helped compile some of the
 12 information in the report. He helped considerably on
 13 Section 7, which is the depletion of Muddy River Spring flow
 14 and impacts to SNWA.
 15 Did you ask about both reports or just this one?
 16 Q. Yeah, I don't believe they signed the other
 17 report.
 18 A. Okay. So I don't know. That's correct.
 19 Q. Did they draft any portions of the -- of your
 20 July 2019 report?
 21 A. I have a June -- okay. I've got dated June 2019,
 22 but it's the July submittal, you mean.
 23 Q. Exhibit 7, yes.
 24 A. Yes. Yes, they did parts, I would say primarily

Page 957

1 in Section 7. And Section 3, Jim Watrus assisted with the
 2 discussion.
 3 Q. Are any of the conclusions in those sections
 4 their conclusions?
 5 A. I think we share all of these conclusions.
 6 Q. So you reviewed their work and came to similar
 7 conclusions?
 8 A. Yes, sir.
 9 Q. Okay. If I could turn your attention to one of
 10 slides 6, 8 or 10 from your presentation this morning. The
 11 carbonate groundwater production graphic that's at the bottom
 12 of each of these slides shows total annual pumping by basin.
 13 Did you analyze groundwater level response in each basin based
 14 on pumping in that basin as opposed to the total pumping?
 15 A. No.
 16 Q. Did you analyze impacts in individual basins
 17 compared to pumping on the west side of Coyote Spring Valley
 18 and then analyze it with the comparisons of pumping on the
 19 east side?
 20 A. I presented an analysis that it talked about
 21 CSVM-2. So in that respect, I think so, the answer is yes if
 22 I understand your question.
 23 Q. Okay.
 24 A. CSVM-2 is on the west side of these faults in

Page 958

1 that structural block and I showed a series of hydrographs
 2 comparing that well with wells on the eastern side of that
 3 structural block and faults.
 4 Q. Did you compare pumping from the east side and
 5 the west side or were you just looking at effects on the east
 6 side versus the west side?
 7 A. Both.
 8 Q. Okay. I think you mentioned in response to -- or
 9 your response to a question from Mr. Taggart about water
 10 budgets was that they were not useful for determining
 11 connectedness of an aquifer. Do you recall that?
 12 A. I recall having a discussion on that.
 13 Q. My recollection is that is what you said. Do you
 14 agree with that?
 15 A. Well, maybe, let me clarify. With respect to
 16 water budgets and volumes of water, I think that's less
 17 important at this stage in the process than how pumping a well
 18 impacts other wells conditions in the aquifer and how those
 19 impacts or those effects manifest themselves at spring
 20 locations, and ultimately depletions on the spring discharge
 21 or the Muddy River.
 22 So I think it's the pumping and response data
 23 that's more important than water budget analysis at this
 24 point.

Page 959

1 Q. For the purposes of managing a basin?
 2 A. Yes.
 3 Q. Okay. The administrative area is roughly a
 4 thousand square miles and composed of six basins. Did you
 5 describe the empirical test that you relied on -- that you
 6 would rely on to manage the basin?
 7 A. From which perspective from a water rights
 8 perspective, an effects perspective, manage effects in the
 9 system or how to manage water rights? I'm not sure what --
 10 could you clarify it, please?
 11 Q. Managing the total that could be sustained and
 12 pumped from the basin?
 13 A. Okay. That might be a question for you. We
 14 performed the ratio analysis, a portion of a ratio analysis
 15 and we concluded 4 to 6,000-acre-feet as a range to manage
 16 this system.
 17 This is carbonate groundwater production we're
 18 talking about that would maintain a level at the Warm Springs
 19 West Gage at three point -- approximately 3.2 CFS. And the
 20 biologists inform us that that's a level of flow that's needed
 21 to maintain the current populations of the Moapa Dace.
 22 Q. Are there other pump tests that you relied on
 23 other than the Order 1169 pumping test?
 24 A. Not for this analysis.

Page 960

1 Q. Okay. There were no pumping tests from
2 California Wash or Garnet Valley?
3 A. Not for this analysis.
4 Q. Would pumping tests in California Wash or Garnet
5 Valley help you develop a better understanding of the basin?
6 A. California Wash and what was the other one, I'm
7 sorry?
8 Q. Garnet Valley?
9 A. Well, let me say this. If it's a pumping test
10 like Order 1169, certainly. What I see for this system is
11 that you need a significant stress imposed on the system to
12 elicit the response data that can be analyzed and done with
13 the Order 1169.
14 So it would need to be something of that
15 magnitude to be more informative than what we've already
16 learned from response data we've observed and the regression
17 analyses that we've performed that confirmed the
18 interconnected nature of the system.
19 If it's just an aquifer test that's, you know, a
20 five-day or 72-hour test, that tells us a little bit of
21 something about the test, the material between the test well
22 and the observation well. But I'm not sure it would be
23 meaningful for informing us any more than what we already
24 know.

Page 961

1 Q. Okay. If I could turn your attention to
2 Slide 25. This is Table 6-2, limits on carbonate aquifer
3 production based on selective discharge rates at Warm Springs
4 West Gage. I think you were just talking about this analysis.
5 Does this analysis assume that all pumping in the carbonate
6 aquifer affects the Warm Springs West Gage?
7 ANSWERS BY MS. DRICI:
8 A. Yes, it does.
9 Q. Does it account for flow paths from other areas,
10 such as have been discussed over the past couple days
11 regarding the difference between Big Muddy Spring and Pederson
12 Springs?
13 A. Well, implicitly, it does. As far as the Big
14 Muddy, in our conceptual model, it's a source is a carbonate
15 aquifer.
16 Q. So if there are flow paths, then this accounts
17 for them?
18 A. Yes, if there is water coming from somewhere
19 else, it wouldn't be accounted for. But I do not believe that
20 there is water coming from somewhere else based on the
21 analysis that I did.
22 Q. Does this analysis assume that carbonate pumping
23 anywhere in the Lower White River Flow System will affect
24 spring flow on a one-to-one basis?

Page 962

1 A. In the long run, yes. When you get near steady
2 state conditions and steady state conditions.
3 Q. Is there an assumption of what that time frame
4 would be?
5 A. Well, we saw from the analysis I did on the
6 capture that thus far, I mean, we started production like
7 mid 80's up to 2018. We roughly captured about 50 percent of
8 the total production from the springs.
9 So -- and we know from doing simulations that you
10 capture the first half a lot faster than you capture the
11 second half. So it will take a much longer time to get to a
12 new steady state, but I cannot tell you how long exactly.
13 Q. Okay. And in terms of a number of years, was
14 there an assumption that carbonate pumping anywhere in the
15 Lower White River Flow System would affect spring flow on a
16 one-to-one basis? Do you have an estimate of the number of
17 years?
18 A. Oh, the effect? Well, from the Order 1169 test,
19 when we compared like the hydrographs from daily data at the
20 observation points where we have data, it looked like you got
21 there like within a day. They were all responding the same.
22 Q. And so this analysis assumes a one day response?
23 A. Which analysis?
24 Q. The analysis here on Table 6-2?

Page 963

1 A. No. This would be -- this is kind of independent
2 of how long it takes. But we're assuming that, for example,
3 if you want to maintain the Warm Springs West at a given level
4 shown on the first column, you would have to be pumping the
5 volume on that last column kind of like on a continuing basis.
6 So at steady state, yeah, you would be getting
7 that much water and you would be maintaining the Warm Springs
8 West flow at that given level.
9 Q. Okay.
10 A. Discharge.
11 Q. I'll move on. Did you compare the results of
12 your theoretical analysis to observe data like actual flows at
13 Warm Springs West or the -- in the Muddy River?
14 A. Yes, I did. I did not -- we did not put it in
15 the presentation, but there's a comparison in the report --
16 you want to see what page that is, please. And it should be
17 right here after the figure. Yeah, if you look -- do you have
18 the report in front of you?
19 Q. I do, yes.
20 A. Okay. Like on page 610.
21 Q. Okay. I'll take a look at that later. I want to
22 move onto Slide 27.
23 A. Okay. So the first paragraph right after the
24 figure that shows the capture analysis.

Page 964

1 Q. All right. Thank you. In regard to Slide 27,
2 Mr. Burns, could the water levels in the past four years on
3 the top three graphs on this page be declining due to climate?
4 ANSWERS BY MR. BURNS:
5 A. There's been a debate for a long time about
6 whether these effects are climate or pumping. The fact is the
7 responses are due to both because they're both implicit in the
8 water level measurement. So they would be a component of the
9 change that's observed.
10 But I'll note that in 2017 and 2019, for those
11 years, the percent of average annual winter season
12 precipitation was greater than normal, not less than normal.
13 Q. Did you perform a rainfall recharge analysis to
14 assess under what conditions recharge occurs?
15 A. I did not.
16 Q. And do you believe that groundwater recharge
17 occurs every year there's rainfall?
18 A. I believe it does, but I believe in dry years,
19 like in 2002, it's probably very small amount. In this area
20 with the potential evapotranspiration rates, I wouldn't
21 expect a lot of it to be -- to make it past the demands of
22 the plants and the soil for years like that, but I still think
23 there's some that occurs. I have no measure of it, though.
24 MR. HERREMA: Okay. Thank you.

Page 965

1 HEARING OFFICER FAIRBANK: Okay. Next will be
2 the United States Fish and Wildlife Service.
3 MR. MILLER: No questions.
4 HEARING OFFICER FAIRBANK: Seeing no questions
5 from Fish and Wildlife Service, National Park Service.
6 MS. GLASGOW: No questions.
7 HEARING OFFICER FAIRBANK: Seeing no questions
8 from National Park Service, the Moapa Band of Paiute Indians.
9 CROSS-EXAMINATION
10 BY MS. BALDWIN:
11 Q. Good morning. This is Beth Baldwin for the Moapa
12 Band of Paiutes. If we could go to Slide 17, I believe it
13 was. Okay. And this is for whoever can answer the question,
14 I'm not sure who the best person is.
15 If I'm not mistaken, the graph on the bottom is
16 the California Wash results compared to EH-4; is that correct?
17 ANSWERS BY MS. DRICI:
18 A. Yes, it is.
19 Q. So, am I -- I don't know if I'm reading this
20 right. It suggests that there's a -- there's two feet in
21 drawdown at EH-4 that you're attributing to increased
22 production in California Wash?
23 A. Yes. It was not me personally, it's the numbers
24 in the analysis.

Page 966

1 Q. I get it. I'm trying to -- I'm just trying to
2 understand what I'm looking at. And you talked a little bit
3 about the residuals, and I assume that's some sort of error
4 estimation?
5 A. Usually, yes, if you can account for all the
6 explanatory variables, which, you know, I included all the
7 production -- well production from all the basins. But I
8 could not include the specific effect of recharge because I
9 don't know. I cannot quantify recharge like I can the
10 production, the groundwater production.
11 Q. Okay. If you had to say you were -- your
12 relative level of confidence in this estimation, where would
13 you put it? High in the confident, low, somewhere in the
14 middle?
15 A. Well, with all of them, if you look at the
16 appendix, we did include all the statistics that resulted from
17 the analysis, including the P values, and therefore, this one
18 and all of them, except for Black Mountain area, the P values
19 were below that .005. So it tells me that within 95 percent
20 confidence, the -- this is happening.
21 Q. But you're not considering recharge?
22 A. Recharge was left with the residuals because,
23 again, I could not extract it.
24 Q. Okay.

Page 967

1 A. This, alone, should just show the effect of
2 production on the water levels at EH-4, if nothing else was
3 happening.
4 Q. So it assumes everything else is staying the
5 same?
6 A. It assumes that -- it's basically like if you had
7 the level at EH-4 at the basic level, which was somewhere
8 around 18, 17, and you were only pumping California Wash that
9 much, that's what you would get. That's what you would see.
10 MR. BURNS: If I could add?
11 BY MS. BALDWIN:
12 Q. Sure.
13 ANSWERS BY MR. BURNS:
14 A. If you turned you turn to Slide 11, you asked
15 about the certainty of the relationship, and I think this
16 could help answer your question.
17 The Paiutes TH-2 well versus EH-4 regression
18 analysis, you can see that the correlation between that well
19 and EH-4 is extremely high.
20 Q. Okay.
21 A. And so that gives us certainty that the response
22 that's measured at EH-4 attributable to EH-42 is also high.
23 Q. All right. So now that we're on Slide 11,
24 Andrew, I do have a question about it. I think you said the

Page 968

1 wells were responding to the same stresses, whether that's
2 climate or pumping, the same stresses are applying throughout
3 the system?
4 A. That's correct.
5 Q. Okay. And in your opinion, that supports the
6 idea that the aquifer's all interconnected?
7 A. That does, yes.
8 Q. All right. If we try -- and I know that this is
9 difficult, but if we try and think about separating climate
10 out from pumping, could it be just a reflection that the wells
11 are all sharing the same recharge area?
12 A. It could be that and all other factors that are
13 influencing the water level record.
14 Q. Okay.
15 A. Now, when it comes to the pumping, itself, if you
16 turn to page 11, in this analysis, we tried to isolate the
17 pumping effect at MX-4. And we know that that's a pumping
18 effect because it's right next to the pumping well, a well
19 that's pumping probably 3,000 gallons a minute.
20 So we know that the response there is
21 predominantly from the pumping well. And so we do the same
22 analysis with EH-4. We can see, again, a very, very high
23 correlation to that pumping response. So we can look at it
24 both ways and that's how we looked at it.

Page 969

1 Q. And I'm not sure exactly which slide this was,
2 but there's -- there are a whole bunch of slides where you
3 have the blue bars showing the carbonate pumping?
4 A. (Nodded head.)
5 Q. Did you look at alluvial pumping at all in those
6 analyses?
7 A. Well, in the location of these -- well, in these
8 areas where these wells are, there's not a lot or if any
9 alluvial pumping. The alluvial pumping any significant amount
10 is at the bedrock aimed to the northern Coyote Spring Valley
11 did not look at that, and I did not look at the alluvial --
12 pumping from the alluvial reservoir to Muddy River Springs
13 area and its effect on these carbonate wells.
14 Q. Okay. And I would like to talk a little bit
15 about Big Muddy Spring. And we've heard the other experts
16 earlier in the week talk about how Big Muddy Springs seems to
17 respond differently or have a different hydrograph.
18 Did you look at Big Muddy Springs hydrograph when
19 you were looking at the other spring discharges?
20 A. No, not in any detail. When this issue came up,
21 I looked at the -- you know, the trend the other day, but
22 we've done no particular analysis to see what that spring is
23 doing and what it's responding to and what factors may
24 contribute to its record.

Page 970

1 What I can tell you, though, is I've been to the
2 spring. It's highly managed above the gage. I mean, there's
3 a pool for one, I'm not sure that affects the long-term
4 record.
5 But there's also alluvial pumping around that
6 spring and it's the lowest elevation spring. And I think some
7 due diligence is owed to looking at all of those factors and
8 how they may or may not influence the record. I have not done
9 that.
10 Q. Okay. Does Big Muddy Spring contribute to Muddy
11 River flows?
12 A. It does.
13 Q. Do you have any guess of what percentage of the
14 flows it contributes?
15 A. As I recall, Big Muddy is about seven CFS, and if
16 we assume a -- well, I think its flow at about 40, so seven
17 over 40, whatever that percentage is.
18 Q. Is it greater than the contribution of Warm
19 Springs West?
20 A. It is.
21 Q. To the Muddy River?
22 A. Yes.
23 Q. But you -- but more work should be done in that
24 area, looking at Big Muddy's contributions?

Page 971

1 A. To the extent someone really wants to understand
2 it and be definitive about its source and how it responds to
3 pumping, wherever it occurs, I think for certain.
4 Our conceptual model is that even with these low
5 elevation springs with respect to Pederson Spring, we think
6 that they're connected to the same system, same carbonate
7 system, that Pederson Springs is, for example, and that any
8 diminished potential that's driving the spring discharge would
9 affect its discharge. But it'd be less -- it's less sensitive
10 to these high elevation springs.
11 Q. We've heard other experts express varying
12 opinions about whether there is a lag in hydrographs showing a
13 response to climate variability.
14 Do you -- do either of you have an opinion about
15 whether there is a lag, and if so, how it appears?
16 A. I didn't look, I didn't analyze any lag. The
17 only lags we looked at is how effects propagated to northern
18 Coyote Spring Valley and the impact or the attenuating effect
19 of the Kane Springs Wash fault zone. With respect to
20 recharge, we did not look at time lags in the records.
21 MS. DRICI: If you look at the 2005 extraordinary
22 precipitation event and you compare that to the hydrographs,
23 you can see that the recharge from that -- from the local
24 mountains probably showed up in the hydrographs like probably

Page 972

1 within a month. But as far as recharge from other areas
2 located farther, I can't tell you.
3 I did a lot of theories about that. I think that
4 they come in pulses, like every year, you know, the
5 precipitation of the mountains infiltrates down and creates
6 like a recharge pulse and it moves down.
7 So this is probably a bunch of those coming down.
8 So people think like recharge from thousands of years ago, you
9 know, are coming down. So it's like a continuous and we
10 cannot really -- we can't see that from, identify them from
11 the record.
12 BY MS. BALDWIN:
13 Q. So water levels could be responding to all sorts
14 of climate variability going back tens, hundreds, thousands of
15 years?
16 A. It could be. But like in the analysis that I
17 showed for the period since we've been pumping from the
18 carbonate aquifer, the effect of recharge during that time
19 period is much smaller than the effects of pumping.
20 It was probably like maximum 1.4 foot due --
21 changing the water level at EH-4 due to recharge changes
22 versus four feet changed from like the early '90's to 2018 due
23 to groundwater production to the carbonate aquifer.
24 Q. And that -- so that period, early 90's to 2018,

Page 973

1 that's only about 30 years?
2 A. Yeah.
3 Q. So the water levels could be responding to
4 something happening before that 30-year period?
5 A. Yeah, sure. In that recharge within the
6 residual, it's like the effects of all of it. I can't
7 separate it.
8 MS. BALDWIN: Okay. That's all. Thank you.
9 MS. DRICI: You're welcome.
10 HEARING OFFICER FAIRBANK: Next is the Moapa
11 Valley Water District.
12 CROSS-EXAMINATION
13 BY MR. MORRISON:
14 Q. Morning, everybody. I'm Greg Morrison with Moapa
15 Valley Water District. I just wanted to follow up on a couple
16 questions regarding the efforts SNWA put into preparing its
17 Order 1303 report.
18 So whoever would like to answer, feel free. I'll
19 direct these at Mr. Burns, but if there's someone better.
20 So in your role as the water resources division
21 manager, did you oversee and/or coordinate SNWA's efforts in
22 preparing the Order 1303 report?
23 ANSWERS BY MR. BURNS:
24 A. Yes, I did.

Page 974

1 Q. All right. And you're aware of SNWA's
2 scientific, be it, geologic or geohydrological efforts that
3 resulted in the reports' conclusions?
4 A. Yes.
5 Q. And in between October 2018 and July 2019, did
6 SNWA conduct or contract to have conducted on its behalf any
7 geohydrological studies specific to boundary flows between
8 Kane Springs Valley and Coyote Springs Valley?
9 A. Not to my recollection, no.
10 Q. And SNWA didn't conduct or contract to have
11 conducted on its behalf any geohydrological studies in
12 northern Coyote Springs Valley?
13 A. No.
14 MR. MORRISON: Okay. That's all I have. Thank
15 you.
16 HEARING OFFICER FAIRBANK: Lincoln County and
17 Vidler Water Company.
18 CROSS-EXAMINATION
19 BY MS. PETERSON:
20 Q. Good morning, panel. Karen Peterson here,
21 representing Lincoln County Water District and Vidler Water
22 Company.
23 And, Mr. Burns, I just put in front of you a page
24 from Nevada State Engineer Exhibit 245, which is -- it's

Page 975

1 page 36 of the SNWA June 27, 2013, Order 1169 report.
2 And do you have that in front of you, the
3 one-page document I gave you?
4 ANSWERS BY MR. BURNS:
5 A. Yes, ma'am.
6 Q. And at the top of the paragraph there, there is a
7 statement having to do with CSVM-4; do you see that?
8 A. Yes.
9 Q. And is it true that this report -- your report --
10 SNWA's report, sorry, lets everybody know that the transducer
11 in CSVM-4 has had a high failure rate due to the high water
12 temperature in the well, so fluctuations of a foot or less
13 should not be used to infer an absolute response.
14 Do you see that?
15 A. I see that.
16 Q. And do you -- I'm going to show you the thick
17 document I gave you was State Engineer's Exhibit 115, which is
18 the water level data from that CSVM-4?
19 A. (Nodded head.)
20 Q. Do you have that?
21 A. Yes, ma'am.
22 Q. Okay. And if you could look at the second page,
23 it looks like the transducer was removed 10/14/2013; do you
24 see that?

Page 976

1 A. Could you say the date again, please?
2 Q. 10/14/2013. It's on the second page.
3 A. Yes, I see that.
4 Q. All right. And that aquifer test, the 1169 test
5 was conducted between November 2010 and April 2013; is that
6 correct?
7 A. The test ended at the end of 2012, but MX-5
8 pumping continued into April of 2013.
9 Q. And the transducer was pulled after the end of
10 all the pumping by about six months?
11 A. Are you talking from 10/14 to 5/6 -- what's your
12 reference again?
13 Q. I'm sorry. When did the MX-5 pumping end?
14 A. Oh, in April of 2013.
15 Q. Okay. So between April 2013 and when the
16 transducer was pulled in 10 of 2013, we're still having the
17 suspect transducer or the error transducer taking those water
18 level measurements; is that correct?
19 A. Well, it looks to me -- yeah, there was a
20 failure. Failure could not connect the transducer. So for
21 the period -- I'm just looking at the measurements and there
22 is data.
23 So it's likely that once it's failed, we've
24 installed a new transducer, but supplementing the transducer

Page 977

1 record are periodic measurements as well.
2 Q. Correct. But after 10/2013, it looks like
3 they're all sounder measurements; is that correct?
4 A. After -- well, I'm going the wrong --
5 Q. Yeah, you've got to go up?
6 A. Okay. All right. That makes more sense now.
7 Yes, they are E takes, yes.
8 Q. Okay. And has SNWA indicated in this page from
9 Nevada Power State Engineer Exhibit 245, what -- how long that
10 transducer data is suspect for that CSVM-4?
11 A. It doesn't appear so.
12 Q. And did you take that transducer failure
13 information into effect when you were analyzing your
14 hydrographs?
15 A. We use -- let me look at the hydrograph, just a
16 sec. We have both reflected in the record, so there's a
17 transducer and a periodic measurement.
18 Q. Right.
19 A. So --
20 Q. But there's no -- you know how sometimes you --
21 like you put on those hydrographs when the 1169 test was or
22 there's a break because there's no data, that kind of thing.
23 You don't have anything in your hydrographs that explains this
24 transducer area of a foot, is there?

Page 978

1 A. No.
2 Q. And has anybody that you've heard testify earlier
3 this week indicated in any of their hydrographs that they've
4 accounted for this transducer error failure of a foot or so?
5 A. Not that I heard.
6 Q. All right. And the drawdowns that were -- or the
7 impacts, I guess, or the effects that everybody's been talking
8 about this week with regard to CSVM-4 are in that one-foot
9 range; aren't they?
10 A. Yes.
11 Q. All right. Directing your attention to Slide 11?
12 A. Okay.
13 Q. Was there an R-squared criteria that you were
14 using?
15 A. I'm not sure I understand your question.
16 Q. Was there any kind of target R-squared criteria
17 that you were trying to get to?
18 A. Oh, for any -- for CSVM-4, the maximum.
19 Q. Which is?
20 A. Well, in this case, .82.
21 Q. All right. And I know you indicated in your
22 testimony that you thought maybe that was the maximum because
23 of the Kane Spring Wash Fault, that there was lower
24 permeability; is that correct?

Page 979

1 A. Well, let me clarify, if you'll indulge me for
2 just a second.
3 Q. Just a second.
4 A. Okay. I'm sorry, as quick as possible. What I
5 was saying is that the effects that we see at CSVM-4
6 attenuated by the fabric of the Kane Springs fault structure
7 or some other lower permeability, relatively lower
8 permeability feature.
9 And we use this analysis to estimate what -- the
10 lag time that those attenuating features have on the response
11 measured at the well.
12 Q. And if there was an another new fault in that
13 area, would your analysis still be the same with regard to the
14 attenuated effects?
15 A. Yeah, the fault -- I mean, what's there is there.
16 Q. (Nodded head.)
17 A. So whether we map two more faults, five more
18 faults, this would be the same response.
19 Q. Okay.
20 A. You know, what's there is there, right.
21 Q. What -- is there a scientific reference or where
22 did you get this idea to do a regression analysis to determine
23 interconnectedness by comparing water levels between wells?
24 A. Well, if you remember at the start of our

Page 980

1 presentation, I walked through our general approach, and in
2 the first step in that approach was to look at these time
3 series data in a qualitative sense.
4 And when we review that information as a
5 professional hydrologist or geologists, we have a sense of
6 cause and effect relationship. And those cause and effect
7 relationships are what we test with this analysis.
8 And what we find, because of the high degree of
9 correlation, is that these wells all respond in the same way
10 as EH-4 does for the period of record and as does MX-4 for the
11 pumping period.
12 Q. Right. But -- I'm sorry, were you done?
13 A. I think so.
14 Q. Okay. But other than you, you and your team
15 doing that, are there any -- are there any other scientists
16 that agreed with this?
17 I mean, for example, we looked at your reference
18 that you have here on A-7 that's at the end of the section
19 with regard to your regression analysis, and we don't find --
20 we don't find any other, you know, like peer reviewed or any
21 other scientific basis, I guess, or reference that uses
22 regression analysis comparing water levels?
23 A. Well, we may be talking two different things.
24 I'm trying to get to A-7. My apologies. I don't have A-7 --

Page 981

1 oh, this reference. So there's two things. The multilinear
2 regression analysis that Ms. Drici did and then there's this
3 simple linear regression analysis that I did. That one is
4 well chronicled in Dr. Mayer's testimony the other day.
5 Q. Right.
6 A. Perhaps you can answer for her, the other.
7 Q. Well, wait, do you mind -- well, go ahead. I'm
8 sorry. Go ahead.
9 MS. DRICI: Okay. Well, this reference is a USGS
10 reference describing statistical methods and it has basically
11 every type of statistics you can apply to -- like it says
12 here, water resources investigations, and it describes a
13 single linear regression, multiple linear regression and other
14 types of statistics. It has all kinds of examples, how you
15 can relate, you know, to a time series.
16 And the first thing when do you -- like he's
17 saying, is the quantitative analysis, if you look at two times
18 series and they appear to be moving in parallel like these
19 hydrographs do, that's a strong indication that they are
20 varying in a linear fashion.
21 Q. Right. But the concept that you can do a
22 regression analysis and compare water levels, and therefore,
23 conclude that there's some kind of connectivity between them,
24 where -- who -- what scientific basis is there for that

Page 982

1 principle?
2 MR. BURNS: Well, first, I think there's a
3 professional judgment. We're trained, as observers of data,
4 to understand what these responses are, what these -- what
5 factors would contribute to these responses.
6 And it's not difficult, you don't maybe need to
7 even be a hydrologist to see that these time series plots
8 behaved in a same way and in a linear fashion, as Ms. Drici
9 described, and that's what we tested with the analysis.
10 BY MS. PETERSON:
11 Q. Okay. So it's your professional judgment?
12 A. I think it's more than that. I think it's a
13 standard approach.
14 Q. But can you give me a site?
15 A. Well, not off the top of my head, but it's
16 something professional hydrologists are trained to.
17 MS. DRICI: Again, this reference has all kinds
18 of examples in water resources.
19 MS. PETERSON: Right. Which -- and we couldn't
20 find any that -- specifically in this application, that's what
21 I'm getting at.
22 So let me move on, okay, because I don't have a
23 lot of time. So looking at figure -- page 11 of your slides
24 and page 12 of your slides where you did this analysis to

Page 983

1 CSVN-4 versus the MX-4 well, if your hydrographs are off by a
2 foot, are these -- your data is going to plot different on
3 these two graphs, charts; is that right?
4 ANSWERS BY MR. BURNS:
5 A. If they're off a foot? Well, if they're all off
6 a foot, I think the relationship would be the same if I
7 understand your question.
8 Q. Right. But with the transducer --
9 A. Systematic error, I wouldn't expect the
10 correlation to change.
11 Q. Were you here for Dr. Mayer's linear regression
12 testimony on Tuesday?
13 A. I was not here, but I viewed some of his
14 testimony.
15 Q. He said that his acceptable P value coefficient
16 was less than .05?
17 A. I did hear that.
18 Q. All right. And did you have an acceptable level
19 for your P value coefficient?
20 A. In fact, we did. I went -- we looked -- we
21 didn't post it here on this chart, but there were .000000
22 something, so certainly below .05 threshold that he cited.
23 Q. But I'm going to go to -- I guess it's
24 Appendix A-4 and you've got your P values there for your

1 figures that Ms. Drici talked about?
 2 ANSWERS BY MS. DRICI:
 3 A. Yes.
 4 HEARING OFFICER FAIRBANK: You can finish this
 5 question and then we'll move on.
 6 MS. PETERSON: Okay. Thank you.
 7 BY MS. PETERSON:
 8 Q. So I'm looking at your P values there in that
 9 table. Do you have that figure A-1?
 10 A. Yes.
 11 Q. Okay. And Garnet Valley's the only low -- the
 12 P value I see?
 13 A. Well, the way I see it, all of them are below the
 14 .05 threshold, except for Black Mountain area and the Muddy
 15 River Springs area.
 16 So for the Black Mountain area, it's 0.69, which
 17 is larger than 0.05. But we already showed the results that
 18 we think that Black Mountain area production wells probably
 19 should not be within the Lower White River Flow System
 20 boundary.
 21 As for the Muddy River Springs area, I do not
 22 just go by the statistical results. I have to use facts and
 23 like what I know. Does anybody think that production from the
 24 carbonate aquifer in the MRSA does not affect EH-4 water

1 levels.
 2 So this value is a little bit higher than the
 3 .05, but I still believe and I know that production in the
 4 Muddy River Springs area does affect water levels in EH-4
 5 because they're in the same basin.
 6 MS. PETERSON: Thank you. Sorry. I'm out of
 7 time.
 8 MS. DRICI: Sorry. Bye.
 9 HEARING OFFICER FAIRBANK: Okay. So we've
 10 reached the noon hour and let's go ahead and reconvene at --
 11 let's go ahead and do five after 1:00, and we'll get back
 12 going after lunch. Thank you.
 13 (Lunch recess at 12:01 p.m.)
 14
 15
 16
 17
 18
 19
 20
 21
 22
 23
 24

1 STATE OF NEVADA)
) ss.
 2 CARSON CITY)
 3
 4 I, MICHEL LOOMIS, a Certified Court Reporter, do
 5 hereby certify;
 6 That on the 27th of September, 2019, in Carson
 7 City, Nevada, I was present and took stenotype notes of the
 8 hearing held before the Nevada Department of Conservation and
 9 Natural Resources, Division of Water in the within entitled
 10 matter, and thereafter transcribed the same into typewriting
 11 as herein appears;
 12 That the foregoing transcript, consisting of
 13 pages 864 through 985 hereof, is a full, true and correct
 14 transcription of my stenotype notes of said hearing to the
 15 best of my ability.
 16
 17 Dated at Carson City, Nevada, this 28th day of
 18 September, 2019.
 19
 20
 21
 22 _____
 MICHEL LOOMIS, RPR
 NV CCR #228
 23
 24

#	880:11 acre (9) 911:15;913:11; 920:3,24;921:1,2,4; 939:11;952:3	933:20 affect (8) 901:20;915:16; 940:1;961:23;962:15; 971:9;984:24;985:4	910:15,23,23;911:24; 912:10;934:8,10; 937:8;938:4,21,22,24; 940:22;942:24;954:12, 14;969:5,9,9,11,12; 970:5	973:21 Andrew (8) 868:20;869:10; 876:21;881:15,17; 903:22;909:24;967:24
#228 (1) 986:22	acre-feet (1) 921:8	affected (2) 894:8;903:4	almost (6) 887:19;888:9; 889:11;898:21;927:10, 11	A-N-D-R-E-W (1) 869:10
A	across (3) 875:21;886:21; 921:15	affecting (2) 905:16;909:2	alone (1) 967:1	Angeles (1) 865:23
A-1 (1) 984:9	Acting (2) 865:4;905:7	affects (5) 902:12,12,13;961:6; 970:3	along (4) 876:7,8;947:5,8	annual (12) 877:10;909:15; 911:11,11,14,23;912:2; 925:15;932:2;954:7; 957:12;964:11
A-3 (1) 906:3	activities (1) 871:11	again (35) 872:5;873:8;876:20; 888:18;891:2,14; 892:22;895:12;896:13; 897:23;899:9;900:1; 903:3;907:1;909:12; 911:19;913:10;921:19; 924:15,16,19;928:13, 15;929:4;930:4; 931:20,22;946:4,22; 948:6;966:23;968:22; 976:1,12;982:17	although (1) 892:23	apologies (1) 980:24
A-4 (1) 983:24	activity (3) 872:23;873:4;917:6	agains (35) 872:5;873:8;876:20; 888:18;891:2,14; 892:22;895:12;896:13; 897:23;899:9;900:1; 903:3;907:1;909:12; 911:19;913:10;921:19; 924:15,16,19;928:13, 15;929:4;930:4; 931:20,22;946:4,22; 948:6;966:23;968:22; 976:1,12;982:17	always (2) 888:8;907:14	appear (5) 891:20;893:7;903:5; 977:11;981:18
A-5 (1) 906:13	acts (1) 905:8	against (1) 918:4	amount (10) 921:10;922:15; 932:15;939:11;941:5; 943:19,20;952:8; 964:19;969:9	APPEARANCES (2) 865:1;866:1
A-6 (1) 906:21	actual (2) 937:23;963:12	agencies (2) 870:3,18	amounts (1) 941:21	appears (6) 902:24;905:15; 916:10;950:22;971:15; 986:11
A-7 (4) 906:24;980:18,24,24	actually (8) 871:5;925:10,16; 927:9;929:1,9;936:21; 940:9	agency (1) 870:18	ample (1) 879:2	appendix (2) 966:16;983:24
ability (1) 986:15	Adam (1) 865:5	ago (2) 950:9;972:8	analyses (5) 884:11;944:13; 953:12;960:17;969:6	application (1) 982:20
able (5) 892:12;907:16; 914:16;939:11;952:15	add (6) 910:12,20;917:21; 936:4;944:9;967:10	agree (2) 939:6;958:14	analysis (83) 880:11;884:22; 885:1,6,8,16,24;892:7; 895:11;896:23;899:7; 15,24;900:4,9;901:4; 903:16,19;905:11,15; 909:11,13,17,22; 915:17;921:10,20; 922:13,15;931:17; 933:15;934:1;937:12; 938:7,8;939:11; 940:11;942:18;943:6, 24;944:11,20;945:1, 17;953:20,23;954:1; 957:20;958:23;959:14, 14,24;960:3;961:4,5, 21,22;962:5,22,23,24; 963:12,24;964:13; 965:24;966:17;967:18; 968:16,22;969:22; 972:16;979:9,13,22; 980:7,19,22;981:2,3, 17,22;982:9,24	applications (3) 871:20;872:20;953:8
above (19) 887:17;894:3; 910:21,24;911:18,21, 24;912:3,17;913:3; 925:13;927:15;929:7, 15;935:1,2;938:1; 940:12;970:2	added (4) 875:14;888:21; 913:4;936:7	agreed (1) 980:16	analyses (5) 884:11;944:13; 953:12;960:17;969:6	applied (1) 928:16
absolute (1) 975:13	adding (1) 907:9	agreement (1) 871:4	analysis (83) 880:11;884:22; 885:1,6,8,16,24;892:7; 895:11;896:23;899:7; 15,24;900:4,9;901:4; 903:16,19;905:11,15; 909:11,13,17,22; 915:17;921:10,20; 922:13,15;931:17; 933:15;934:1;937:12; 938:7,8;939:11; 940:11;942:18;943:6, 24;944:11,20;945:1, 17;953:20,23;954:1; 957:20;958:23;959:14, 14,24;960:3;961:4,5, 21,22;962:5,22,23,24; 963:12,24;964:13; 965:24;966:17;967:18; 968:16,22;969:22; 972:16;979:9,13,22; 980:7,19,22;981:2,3, 17,22;982:9,24	apply (1) 981:11
Absolutely (1) 930:7	addition (2) 870:19;955:15	agreements (4) 871:2,5;872:11,13	analysis (83) 880:11;884:22; 885:1,6,8,16,24;892:7; 895:11;896:23;899:7; 15,24;900:4,9;901:4; 903:16,19;905:11,15; 909:11,13,17,22; 915:17;921:10,20; 922:13,15;931:17; 933:15;934:1;937:12; 938:7,8;939:11; 940:11;942:18;943:6, 24;944:11,20;945:1, 17;953:20,23;954:1; 957:20;958:23;959:14, 14,24;960:3;961:4,5, 21,22;962:5,22,23,24; 963:12,24;964:13; 965:24;966:17;967:18; 968:16,22;969:22; 972:16;979:9,13,22; 980:7,19,22;981:2,3, 17,22;982:9,24	applying (1) 968:2
accelerate (1) 876:1	additional (4) 899:7;954:20,24; 955:17	ahead (14) 868:5,10,23;922:24; 923:3,7;926:9;928:7; 955:12,16;981:7,8; 985:10,11	analysis (83) 880:11;884:22; 885:1,6,8,16,24;892:7; 895:11;896:23;899:7; 15,24;900:4,9;901:4; 903:16,19;905:11,15; 909:11,13,17,22; 915:17;921:10,20; 922:13,15;931:17; 933:15;934:1;937:12; 938:7,8;939:11; 940:11;942:18;943:6, 24;944:11,20;945:1, 17;953:20,23;954:1; 957:20;958:23;959:14, 14,24;960:3;961:4,5, 21,22;962:5,22,23,24; 963:12,24;964:13; 965:24;966:17;967:18; 968:16,22;969:22; 972:16;979:9,13,22; 980:7,19,22;981:2,3, 17,22;982:9,24	appreciate (3) 878:18;883:3;886:9
accelerating (1) 954:19	addressed (1) 954:6	aimed (1) 969:10	analysis (83) 880:11;884:22; 885:1,6,8,16,24;892:7; 895:11;896:23;899:7; 15,24;900:4,9;901:4; 903:16,19;905:11,15; 909:11,13,17,22; 915:17;921:10,20; 922:13,15;931:17; 933:15;934:1;937:12; 938:7,8;939:11; 940:11;942:18;943:6, 24;944:11,20;945:1, 17;953:20,23;954:1; 957:20;958:23;959:14, 14,24;960:3;961:4,5, 21,22;962:5,22,23,24; 963:12,24;964:13; 965:24;966:17;967:18; 968:16,22;969:22; 972:16;979:9,13,22; 980:7,19,22;981:2,3, 17,22;982:9,24	approach (9) 883:5;886:5;918:4,8; 922:5;939:5;980:1,2; 982:13
accept (2) 878:20;916:1	addresses (1) 878:21	Alex (1) 866:7	analysis (83) 880:11;884:22; 885:1,6,8,16,24;892:7; 895:11;896:23;899:7; 15,24;900:4,9;901:4; 903:16,19;905:11,15; 909:11,13,17,22; 915:17;921:10,20; 922:13,15;931:17; 933:15;934:1;937:12; 938:7,8;939:11; 940:11;942:18;943:6, 24;944:11,20;945:1, 17;953:20,23;954:1; 957:20;958:23;959:14, 14,24;960:3;961:4,5, 21,22;962:5,22,23,24; 963:12,24;964:13; 965:24;966:17;967:18; 968:16,22;969:22; 972:16;979:9,13,22; 980:7,19,22;981:2,3, 17,22;982:9,24	appropriate (3) 873:15;953:8;954:18
acceptable (2) 983:15,18	adds (1) 944:11	allocation (1) 870:5	analysis (83) 880:11;884:22; 885:1,6,8,16,24;892:7; 895:11;896:23;899:7; 15,24;900:4,9;901:4; 903:16,19;905:11,15; 909:11,13,17,22; 915:17;921:10,20; 922:13,15;931:17; 933:15;934:1;937:12; 938:7,8;939:11; 940:11;942:18;943:6, 24;944:11,20;945:1, 17;953:20,23;954:1; 957:20;958:23;959:14, 14,24;960:3;961:4,5, 21,22;962:5,22,23,24; 963:12,24;964:13; 965:24;966:17;967:18; 968:16,22;969:22; 972:16;979:9,13,22; 980:7,19,22;981:2,3, 17,22;982:9,24	appropriated (1) 872:2
according (1) 921:10	adequately (1) 954:5	allowed (4) 875:15;876:6;879:3, 4	analysis (83) 880:11;884:22; 885:1,6,8,16,24;892:7; 895:11;896:23;899:7; 15,24;900:4,9;901:4; 903:16,19;905:11,15; 909:11,13,17,22; 915:17;921:10,20; 922:13,15;931:17; 933:15;934:1;937:12; 938:7,8;939:11; 940:11;942:18;943:6, 24;944:11,20;945:1, 17;953:20,23;954:1; 957:20;958:23;959:14, 14,24;960:3;961:4,5, 21,22;962:5,22,23,24; 963:12,24;964:13; 965:24;966:17;967:18; 968:16,22;969:22; 972:16;979:9,13,22; 980:7,19,22;981:2,3, 17,22;982:9,24	approximate (2) 921:19;942:18
accordingly (2) 928:14;948:5	adjacent (3) 876:4,6;927:24	allow (2) 871:3;914:5	analysis (83) 880:11;884:22; 885:1,6,8,16,24;892:7; 895:11;896:23;899:7; 15,24;900:4,9;901:4; 903:16,19;905:11,15; 909:11,13,17,22; 915:17;921:10,20; 922:13,15;931:17; 933:15;934:1;937:12; 938:7,8;939:11; 940:11;942:18;943:6, 24;944:11,20;945:1, 17;953:20,23;954:1; 957:20;958:23;959:14, 14,24;960:3;961:4,5, 21,22;962:5,22,23,24; 963:12,24;964:13; 965:24;966:17;967:18; 968:16,22;969:22; 972:16;979:9,13,22; 980:7,19,22;981:2,3, 17,22;982:9,24	approximately (5) 878:3;929:11; 931:18;933:5;959:19
account (4) 919:8;936:15;961:9; 966:5	adjusted (4) 910:20;935:22,23; 936:2	allowable (1) 922:16	analysis (83) 880:11;884:22; 885:1,6,8,16,24;892:7; 895:11;896:23;899:7; 15,24;900:4,9;901:4; 903:16,19;905:11,15; 909:11,13,17,22; 915:17;921:10,20; 922:13,15;931:17; 933:15;934:1;937:12; 938:7,8;939:11; 940:11;942:18;943:6, 24;944:11,20;945:1, 17;953:20,23;954:1; 957:20;958:23;959:14, 14,24;960:3;961:4,5, 21,22;962:5,22,23,24; 963:12,24;964:13; 965:24;966:17;967:18; 968:16,22;969:22; 972:16;979:9,13,22; 980:7,19,22;981:2,3, 17,22;982:9,24	approximating (1) 885:16
accounted (3) 917:7;961:19;978:4	ADMINISTRATION (1) 864:7	allowed (4) 875:15;876:6;879:3, 4	analysis (83) 880:11;884:22; 885:1,6,8,16,24;892:7; 895:11;896:23;899:7; 15,24;900:4,9;901:4; 903:16,19;905:11,15; 909:11,13,17,22; 915:17;921:10,20; 922:13,15;931:17; 933:15;934:1;937:12; 938:7,8;939:11; 940:11;942:18;943:6, 24;944:11,20;945:1, 17;953:20,23;954:1; 957:20;958:23;959:14, 14,24;960:3;961:4,5, 21,22;962:5,22,23,24; 963:12,24;964:13; 965:24;966:17;967:18; 968:16,22;969:22; 972:16;979:9,13,22; 980:7,19,22;981:2,3, 17,22;982:9,24	approximation (3) 916:16;918:10;933:3
accounts (2) 940:11;961:16	administrative (1) 959:3	allowing (1) 875:20	analysis (83) 880:11;884:22; 885:1,6,8,16,24;892:7; 895:11;896:23;899:7; 15,24;900:4,9;901:4; 903:16,19;905:11,15; 909:11,13,17,22; 915:17;921:10,20; 922:13,15;931:17; 933:15;934:1;937:12; 938:7,8;939:11; 940:11;942:18;943:6, 24;944:11,20;945:1, 17;953:20,23;954:1; 957:20;958:23;959:14, 14,24;960:3;961:4,5, 21,22;962:5,22,23,24; 963:12,24;964:13; 965:24;966:17;967:18; 968:16,22;969:22; 972:16;979:9,13,22; 980:7,19,22;981:2,3, 17,22;982:9,24	approximations (1) 914:4
accuracy (1) 922:11	administrator (1) 950:8	alluvial (30) 877:1,2;886:13; 901:7,12,13,18,23;	analysis (83) 880:11;884:22; 885:1,6,8,16,24;892:7; 895:11;896:23;899:7; 15,24;900:4,9;901:4; 903:16,19;905:11,15; 909:11,13,17,22; 915:17;921:10,20; 922:13,15;931:17; 933:15;934:1;937:12; 938:7,8;939:11; 940:11;942:18;943:6, 24;944:11,20;945:1, 17;953:20,23;954:1; 957:20;958:23;959:14, 14,24;960:3;961:4,5, 21,22;962:5,22,23,24; 963:12,24;964:13; 965:24;966:17;967:18; 968:16,22;969:22; 972:16;979:9,13,22; 980:7,19,22;981:2,3, 17,22;982:9,24	April (6) 898:19,20;976:5,8, 14,15
accurate (5) 916:18,22;917:20; 921:19,20	admit (1) 882:19			
accurately (1) 913:23	ADMITTED (3) 867:11;882:19;916:4			
acquisition (1)	aerial (1)			

aquifer (53) 872:24;873:1,6,14; 893:9;897:2,3,11; 899:4;900:12,15,17,18; 901:6,7,14,17,20; 905:6,8,13,22;906:8; 908:8;909:20;910:1; 914:11;916:12;917:13; 920:13;921:6,7;922:2; 926:11;931:20;932:1, 9,18;933:7;953:12; 954:15,18;955:5; 958:11,18;960:19; 961:2,6,15;972:18,23; 976:4;984:24	868:14 assess (5) 884:11,22;885:6; 892:7;964:14 assessment (12) 883:17;886:16; 888:4;892:3,10,11; 893:24;895:21,22; 896:17;900:7;938:7 assessments (2) 882:13,18 assign (1) 955:12 assigned (1) 941:7 assisted (1) 957:1 associated (2) 871:9;954:17 assume (7) 935:12,17;942:1; 961:5,22;966:3;970:16 assumes (3) 962:22;967:4,6 assuming (1) 963:2 assumption (3) 918:8;962:3,14 attained (1) 925:21 attempt (1) 893:10 attention (3) 957:9;961:1;978:11 attenuated (3) 903:4;979:6,14 attenuates (1) 948:16 attenuating (5) 894:7;946:10,11; 971:18;979:10 attributable (3) 934:23;936:23; 967:22 attribute (7) 894:5;895:5;920:10; 929:2;935:11;937:1,4 attributing (2) 937:12;965:21 Authority (8) 868:9,13;869:5,8,16; 870:2;871:14;880:17 available (3) 871:24;883:13;889:1 average (15) 887:14,16,20,22,23; 893:15;895:2;911:11; 919:4,14,24;925:15,16; 929:7;964:11 avoid (1) 880:1 aware (1) 974:1	away (2) 895:4;955:4 AX (1) 903:24 axis (1) 887:7 B back (21) 871:12;874:2; 886:23;888:15;890:2; 919:13;923:4,8,11; 924:12,14;925:13; 931:20;935:15;936:4; 947:21;948:6,13; 949:11;972:14;985:11 backdrop (1) 896:7 background (3) 880:3,8;881:3 Baldwin (9) 867:5;914:22;915:2; 916:6;965:10,11; 967:11;972:12;973:8 Band (3) 871:5;965:8,12 banned (1) 954:7 bar (2) 938:2,12 Barnes (1) 865:8 bars (5) 887:15,17,24;888:1; 969:3 base (6) 919:12;935:23; 937:8;942:6,12;950:23 based (20) 874:19;878:2; 879:10;892:11;897:11; 903:17;905:20;909:23; 910:3;922:5;938:3; 941:17;952:5,9;954:2, 21;955:12;957:13; 961:3,20 basic (2) 919:12;967:7 basically (16) 903:20;905:4;907:9; 909:19;913:13;914:5, 19;915:23;919:24; 920:16;927:11;928:2; 931:23;932:19;967:6; 981:10 BASIN (26) 864:9,10,11,13; 875:14;878:14,23; 879:4;880:9;885:6,18; 889:3;897:5;904:10; 905:12;938:11;943:20; 950:24;957:12,13,14;	959:1,6,12;960:5; 985:5 basins (18) 871:9;875:9,15,21; 876:4,6;884:13; 893:19;899:5;904:15, 23;905:4;907:10; 908:16;927:1;957:16; 959:4;966:7 basis (7) 883:12;938:23; 961:24;962:16;963:5; 980:21;981:24 Battleship (1) 890:16 Beach (1) 881:11 Beamer (1) 934:12 Bedroc (1) 866:11 bedrock (1) 969:10 beds (2) 950:18,18 began (8) 872:24;873:2,8,8; 874:1,3;936:19,19 begin (2) 929:20;933:14 beginning (4) 902:23,24;922:12; 948:17 begins (1) 889:7 behalf (2) 974:6,11 behave (5) 892:4;894:21; 901:17;910:7;945:16 behaved (1) 982:8 behaves (1) 905:8 behavior (1) 883:21 behind (1) 896:14 Belaustegui (1) 865:19 belief (1) 871:23 below (13) 887:22,22;917:24; 929:11;931:1;934:13; 935:18;946:21;951:22, 24;966:19;983:22; 984:13 Benedict (1) 865:11 best (3) 894:12;965:14; 986:15	Beth (1) 965:11 better (2) 960:5;973:19 beyond (1) 898:12 Big (9) 897:5;961:11,13; 969:15,16,18;970:10, 15,24 Biologic (2) 866:15;874:14 biological (4) 868:17;882:13,14,19 biologists (1) 959:20 bit (15) 871:13;875:11; 891:15,16,20;897:6; 903:21;905:19,23,24; 908:9;960:20;966:2; 969:14;985:2 BLACK (15) 864:9;875:23;887:4; 889:6;905:2,14,16; 926:4;927:5,8;937:19; 966:18;984:14,16,18 blended (1) 953:15 blip (1) 951:1 Bliss (1) 865:14 block (8) 946:12;947:8,10,13; 949:19,21;958:1,3 blue (10) 887:17;888:1; 907:12;932:12,12,12, 23;936:7;938:11;969:3 BMDL-2 (1) 887:3 Both (9) 879:9;891:11; 928:18;956:15;958:7; 964:7,7;968:24;977:16 bottom (14) 887:9,22;888:22; 889:2;898:1;925:7; 928:10;935:17,21; 936:7;938:5;947:22; 957:11;965:15 bouncing (1) 930:18 boundaries (1) 876:11 boundary (23) 875:2,8;876:2,6,7; 879:1;887:2;888:19; 890:7;891:9,11;903:3; 905:18,19,24;924:19; 943:19;947:15;953:6, 7,9;974:7;984:20
--	---	--	---	--

Brad (2) 873:11;955:19	952:6;960:2,4,6; 965:16,22;967:8	9,18;933:7,11;937:9; 939:3;940:22;943:2,4, 15,18;946:9;953:16,16, 21;954:7,12,15,18; 957:11;959:17;961:2, 5,14,22;962:14;969:3, 13;971:6;972:18,23; 984:24	change (15) 876:12;877:6; 885:18,19;888:6; 903:17;905:10;926:19; 929:2,23,23;930:1; 933:1;964:9;983:10	953:9
Braumiller (1) 950:10	call (4) 885:11;891:3; 901:13;925:22	career (1) 880:10	changes (9) 877:16;906:23; 935:6,7;944:2;954:1,2, 17;972:21	closer (4) 875:16,24;888:14; 947:12
break (4) 922:22,24;923:4; 977:22	called (1) 940:20	Carson (5) 865:17;868:1;986:2, 6,17	changed (2) 944:15;972:22	closing (1) 878:20
Bridget (1) 865:14	came (7) 881:13,17;898:17; 912:8,10;957:6;969:20	case (6) 907:23;908:2;950:1, 15;951:8;978:20	changes (9) 877:16;906:23; 935:6,7;944:2;954:1,2, 17;972:21	CMW (1) 891:22
brief (1) 876:20	can (80) 868:22;877:11,22; 878:4,9,12,13;880:6; 886:7,23;887:24; 888:1;889:4,7,9,18; 890:23,24;891:24; 892:9;894:2;895:5,15; 897:9,20;898:20; 901:18,20;902:3,22; 903:9;905:5;906:5,22; 908:14;909:19,21; 910:15;914:21;920:12; 921:11;922:24;925:3, 8,24;928:10;931:12; 932:5;935:17;937:1; 941:17;943:11;945:15, 19,22;947:24;948:10, 18,19,23;949:5,10,17; 950:16;953:2;960:12; 965:13;966:5,9; 967:18;968:22,23; 970:1;971:23;981:6, 11,15,21;982:14;984:4	Carey (2) 956:3,6	characterized (1) 947:14	coefficient (3) 894:2;983:15,19
briefly (5) 869:20;870:1,8; 880:3;881:3	capture (19) 871:24;877:19; 878:7;931:18;932:8, 11;942:24;943:4,5,11, 16,19;952:15,23; 953:18;962:6,10,10; 963:24	cause (3) 903:16;980:6,6	chart (6) 897:24;898:13; 925:2;938:2;945:14; 983:21	coincident (2) 927:13,14
bring (1) 914:13	Canyon (5) 928:2;929:3;934:15; 937:8;938:5	caused (5) 908:15,16;914:10; 920:7;940:21	changing (3) 905:10;954:12; 972:21	Colby (3) 868:19;869:6;953:10
Brownstein (1) 865:22	capture (19) 871:24;877:19; 878:7;931:18;932:8, 11;942:24;943:4,5,11, 16,19;952:15,23; 953:18;962:6,10,10; 963:24	causes (1) 885:23	charts (2) 956:9;983:3	collected (3) 883:18;902:9;944:12
budget (2) 872:7;958:23	capture (19) 871:24;877:19; 878:7;931:18;932:8, 11;942:24;943:4,5,11, 16,19;952:15,23; 953:18;962:6,10,10; 963:24	causing (1) 908:18	cheat (1) 912:7	collecting (1) 883:6
budgets (7) 902:1,3,7,11,15; 958:10,16	Canyon (5) 928:2;929:3;934:15; 937:8;938:5	Caviglia (1) 865:24	Chief (2) 865:7,10	collectively (1) 902:9
bunch (3) 910:10;969:2;972:7	capture (19) 871:24;877:19; 878:7;931:18;932:8, 11;942:24;943:4,5,11, 16,19;952:15,23; 953:18;962:6,10,10; 963:24	CCR (1) 986:22	choose (1) 888:23	Collins (2) 956:3,6
Bureau (1) 941:22	capture (19) 871:24;877:19; 878:7;931:18;932:8, 11;942:24;943:4,5,11, 16,19;952:15,23; 953:18;962:6,10,10; 963:24	Center (1) 866:15	chose (2) 921:21,22	Colorado (4) 870:5;880:15,15,18
Burns (40) 868:20;869:10,10; 873:17;874:22;879:8, 11,17,19;880:6,7; 882:1,5,10,23;883:2, 24;889:20;892:9; 900:4;923:12,18; 926:7,18;933:10,19; 939:6;944:6;955:8; 956:5;964:2,4;967:10, 13;973:19,23;974:23; 975:4;982:2;983:4	capture (19) 871:24;877:19; 878:7;931:18;932:8, 11;942:24;943:4,5,11, 16,19;952:15,23; 953:18;962:6,10,10; 963:24	centers (3) 894:6;937:11,13	chronicled (1) 981:4	colors (3) 896:8,9,10
B-U-R-N-S (1) 869:11	capture (19) 871:24;877:19; 878:7;931:18;932:8, 11;942:24;943:4,5,11, 16,19;952:15,23; 953:18;962:6,10,10; 963:24	Central (2) 934:7;947:13	City (6) 865:17;868:1; 870:16;986:2,7,17	column (15) 911:3,10,10,14; 913:12;918:24;919:22, 23;920:3,4;921:14; 942:11,15;963:4,5
Bye (1) 985:8	capture (19) 871:24;877:19; 878:7;931:18;932:8, 11;942:24;943:4,5,11, 16,19;952:15,23; 953:18;962:6,10,10; 963:24	certain (2) 897:20;971:3	claims (1) 871:8	columns (5) 911:17,19;913:3; 920:14;941:18
C	capture (19) 871:24;877:19; 878:7;931:18;932:8, 11;942:24;943:4,5,11, 16,19;952:15,23; 953:18;962:6,10,10; 963:24	certainly (7) 873:21;899:19; 902:10;933:20;949:6; 960:10;983:22	clarification (1) 940:16	combination (3) 904:13;910:14;915:9
C-3 (1) 926:7	capture (19) 871:24;877:19; 878:7;931:18;932:8, 11;942:24;943:4,5,11, 16,19;952:15,23; 953:18;962:6,10,10; 963:24	certainty (2) 967:15,21	clarify (4) 874:21;958:15; 959:10;979:1	combine (1) 927:9
calculate (3) 920:4;931:18;932:6	capture (19) 871:24;877:19; 878:7;931:18;932:8, 11;942:24;943:4,5,11, 16,19;952:15,23; 953:18;962:6,10,10; 963:24	certified (8) 941:12,19,21,21; 942:2,10,17;986:4	City (6) 865:17;868:1; 870:16;986:2,7,17	combined (1) 905:8
calculated (5) 907:12,22;914:3; 918:14;919:4	capture (19) 871:24;877:19; 878:7;931:18;932:8, 11;942:24;943:4,5,11, 16,19;952:15,23; 953:18;962:6,10,10; 963:24	certify (1) 986:5	claims (1) 871:8	coming (8) 873:5;904:16,19; 917:18;961:18,20; 972:7,9
calculation (3) 920:9;942:7;951:22	capture (19) 871:24;877:19; 878:7;931:18;932:8, 11;942:24;943:4,5,11, 16,19;952:15,23; 953:18;962:6,10,10; 963:24	cessation (1) 953:11	clarification (1) 940:16	Commission (1) 880:15
calculations (4) 922:8;951:12,16,21	capture (19) 871:24;877:19; 878:7;931:18;932:8, 11;942:24;943:4,5,11, 16,19;952:15,23; 953:18;962:6,10,10; 963:24	cetera (1) 905:3	clarify (4) 874:21;958:15; 959:10;979:1	common (1) 870:18
California (21) 865:23;887:1; 890:21;892:20,22; 903:7;905:3;906:9; 924:21;925:18;926:5, 24;927:2;937:15;	capture (19) 871:24;877:19; 878:7;931:18;932:8, 11;942:24;943:4,5,11, 16,19;952:15,23; 953:18;962:6,10,10; 963:24	CFS (20) 878:3;898:15,17; 911:11,15;913:11; 914:6;917:4,5;920:16, 17;921:1,9,12,15,24; 930:17;954:9;959:19; 970:15	clear (6) 880:4;892:24;893:1; 911:8;949:15;953:4	Company (11) 870:11;871:6;940:2, 13;941:4,8,13,15; 942:14;974:17,22

comparison (1) 963:15	894:20;923:15; 925:22;935:13,14,19; 942:3,4	919:9;933:3;966:21	coordinate (1) 973:21	870:4;939:16
comparisons (1) 957:18	conditions (21) 884:7,15,16;885:10; 890:18,19;893:18; 899:11;900:16,24; 901:1;918:23;919:1,3, 13;920:1;925:6; 958:18;962:2,2;964:14	consistent (1) 891:1	copy (2) 879:18;915:20	creates (1) 972:5
compartment (1) 947:19		consisting (1) 986:12	corner (1) 934:16	credit (2) 942:2,8
compilation (2) 883:9;956:7		constant (2) 905:9;914:23	corrected (3) 867:12;915:15,20	credits (7) 939:16,16,20; 941:12,20,24;942:11
compile (1) 956:11		constitute (1) 877:17	correctly (1) 915:24	Creek (2) 951:23;952:13
compiled (1) 883:19	conduct (3) 905:11;974:6,10	constitutes (1) 885:14	correlate (3) 893:19;899:12; 918:21	criminal (1) 878:10
completed (3) 892:10;924:21; 953:13	conducted (5) 912:16;933:15; 974:6,11;976:5	constructed (1) 872:16	correlated (4) 892:5;894:18;900:3, 14	criteria (2) 978:13,16
complex (8) 885:4;890:16; 895:24;899:23;903:21; 928:1;929:24;930:9	cone (1) 911:3	contemplate (1) 876:10	correlates (2) 904:1;913:18	critiques (1) 918:4
compliance (1) 871:8	confidence (2) 966:12,20	continuation (1) 868:6	correlating (2) 885:17;917:21	CROSS (1) 867:2
complicated (1) 949:4	confident (1) 966:13	continue (8) 871:4;876:3;879:5; 906:5;923:8;930:8; 931:3,7	correlation (16) 884:11,22;892:7; 893:8,23;894:2,13,15; 895:13;899:17;900:9; 953:20;967:18;968:23; 980:9;983:10	CROSS-EXAMINATION (4) 955:22;965:9; 973:12;974:18
component (1) 964:8	confirm (6) 884:21;893:11; 895:15;900:5;914:19; 916:7	continued (6) 880:18;898:19,21; 930:5;953:15;976:8	correlations (2) 894:17;904:4	CSI (4) 865:19,22;873:11; 937:14
composed (1) 959:4	confirmed (6) 900:8,13;945:17; 953:13,20;960:17	continues (2) 931:2;948:8	correspond (3) 895:1,9;914:7	CSI-1 (5) 946:21;947:5,18; 948:10;949:24
composition (2) 952:6,10	conflicting (1) 877:23	continuing (5) 876:22;923:16; 924:10;931:10;963:5	corresponding (3) 920:4;921:15;932:6	CSI-3 (2) 947:18;948:21
compounded (1) 949:16	conflicts (4) 877:24;878:6,8; 954:5	continuous (1) 972:9	costly (1) 878:9	CSI-4 (4) 947:8,18;949:4,7
comprehensive (1) 944:24	confluence (2) 896:1;899:22	contract (2) 974:6,10	count (1) 919:10	CSMAT (1) 947:11
computed (4) 887:14;893:15; 942:9;952:11	connect (1) 976:20	contracted (1) 950:8	County (3) 866:2;974:16,21	CSVM (1) 950:13
concept (2) 922:18;981:21	connected (4) 875:22;876:1; 950:23;971:6	contractors (1) 881:15	couple (11) 888:15;892:9; 896:19;901:3;921:4,8; 942:20;946:13;955:24; 961:10;973:15	CSVM-1 (17) 886:20,24;888:18, 19;889:14,21,23; 890:3;892:16;902:23; 924:16;945:23;946:8, 22;947:7,22;948:4
conceptual (9) 871:16;901:5,9,11; 909:23;910:3;952:4; 961:14;971:4	connectedness (2) 902:5;958:11	contribute (6) 882:8;935:4;937:20; 969:24;970:10;982:5	course (15) 883:8,15;887:24; 891:5;895:3;919:10; 920:7,18;925:3; 928:13;930:9;937:18; 938:20;944:5;954:21	CSVM-2 (7) 945:18,19;946:2; 952:2,5;957:21,24
concern (1) 874:3	connection (2) 895:17;899:19	contributes (2) 904:10;970:14	CSVM-3 (1) 947:9	CSVM-4 (13) 891:10,14,23;894:4; 903:8;975:7,11,18; 977:10;978:8,18; 979:5;983:1
concerning (1) 909:22	connectivity (11) 875:7,7,19;876:15; 878:23;907:6;944:1; 946:15;952:17;953:13; 981:23	contribution (4) 885:8;908:21;939:5; 970:18	Court (1) 986:4	CSVM-5 (1) 950:3
concert (1) 892:5	consequences (1) 876:9	contributions (2) 938:10;970:24	Coyote (26) 870:12,21,23;873:7; 874:7;889:9;891:10, 12;892:13,17;906:14; 925:17;926:3,4;927:9; 937:13;938:6;945:7, 20;955:18,20;957:17; 969:10;971:18;974:8, 12	CSVW-2 (1) 937:14
conclude (2) 949:19;981:23	CONSERVATION (2) 864:2;986:8	contributor (1) 939:4	create (1) 936:4	cumulative (1) 932:10
concluded (3) 873:2;950:23;959:15	conservative (1) 919:7	control (2) 920:11,12	created (2)	current (6) 877:1;924:14,23; 930:23;938:16;959:21
concludes (1) 955:9	consider (2) 878:13;900:20	controls (1) 870:9		curve (2) 904:12,13
conclusion (9) 873:17;875:5;878:2, 16;886:1;914:16; 925:20;953:7;954:4	considerably (1) 956:12	convenient (1) 923:1		
conclusions (11) 873:14;883:4;902:4; 944:8;953:2,4;957:3,4, 5,7;974:3	considered (4) 873:20;884:17; 912:13,14	conversion (1) 911:15		
condition (8)	considering (3)	convert (3) 920:3,24;939:15		
		converted (1) 913:11		

D	876:22;888:11; 890:10;891:1,5,18; 898:5,9,12,21;908:22; 923:16;924:10;928:9; 929:14,21;930:5,20,21; 931:7,11;934:20,21; 935:5,10;936:15; 948:6,9,15,19,24;949:1	demands (2) 939:23;964:21 demonstrate (3) 941:23;942:15; 945:14 demonstrated (1) 955:4 demonstration (1) 940:14 DEPARTMENT (3) 864:2;881:15;986:8 dependent (1) 904:2 depends (1) 975:8 depicted (4) 886:13;925:2;929:4; 935:1 depleted (3) 935:19;939:1;940:21 depletion (12) 886:3;933:15;939:8, 10,12,15;940:17,19,21; 942:1,24;956:13 depletions (12) 902:13;936:10; 937:24;938:14;939:19; 940:1,9,11;942:13; 954:6;955:6;958:20 depth (2) 950:13,21 derive (1) 936:2 derived (2) 918:17;939:20 describe (17) 868:16;871:1,10; 880:3;881:2;882:23; 889:21;893:13;898:24; 901:5;911:19;924:5,7; 930:11;943:3;946:18; 959:5 described (10) 883:1;884:14;900:5; 901:21;922:6;929:19; 936:13;939:7;945:13; 982:9 describes (1) 981:12 describing (5) 902:6;903:22; 909:24;940:5;981:10 designated (2) 873:12,23 DET (1) 912:11 detail (1) 969:20 detailed (1) 897:10 Detectable (2) 954:23;955:3 determine (4)	872:20;909:15; 939:11;979:22 determining (1) 958:10 develop (4) 919:11;928:18; 941:13;960:5 developed (1) 925:2 developer (1) 873:9 developing (1) 882:24 Development (6) 870:23;873:7;874:1, 5,10;881:22 deviation (1) 908:20 difference (6) 907:21;919:23; 932:16;942:16;946:9; 961:11 different (17) 885:10;890:9; 904:14,15,16,20,20,23; 909:21;914:20;920:8; 922:15;927:17;940:18; 969:17;980:23;983:2 differently (2) 922:17;969:17 difficult (2) 968:9;982:6 diffuse (1) 901:22 digital (1) 896:8 digits (1) 922:8 diligence (1) 970:7 diminished (1) 971:8 dire (1) 880:1 DIRECT (4) 867:2;869:1;955:9; 973:19 Directing (1) 978:11 direction (1) 874:15 directly (2) 910:10;955:1 Director (1) 869:7 disagree (2) 873:16;917:24 discharge (76) 877:12;884:3;885:2, 9,12,15,18,18;896:1; 899:13,18,20;900:13; 901:21,23;902:12; 904:2;910:6,8,9,13,16;	911:4,5;913:5,14,15, 19,20,22;914:6,7,10, 18,23;915:8,11;916:11, 11,17;917:1,5,14,17, 17;918:20;920:5,15,17, 21,23;921:2,3,9,16,24; 930:9;931:21;932:7,7, 8,10,16;933:7;935:14; 943:12;953:17,22; 954:2,3;955:6;958:20; 961:3;963:10;971:8,9 discharges (2) 917:21;969:19 discover (1) 915:5 discrete (3) 901:15,23;910:11 discretely (1) 901:16 discussed (3) 898:3;946:12;961:10 discussion (7) 897:8;902:1;922:12; 950:3;951:15;957:2; 958:12 discussions (1) 879:1 distance (3) 875:13;889:24;907:5 distinct (1) 922:18 distribute (1) 941:17 distributed (1) 907:18 distribution (3) 888:1;896:3,11 District (16) 868:10,13;869:9,12, 22;870:4,14,17,19,21; 871:7,15;874:3; 973:11,15;974:21 diversion (12) 876:7;912:8;935:2; 936:4;940:3,10,13,24; 941:1,9,16;954:13 diversions (6) 910:22;911:21; 935:1,3;936:8,20 divide (3) 917:16;920:21;921:1 divided (1) 913:14 dividing (2) 920:19;942:9 DIVISION (8) 864:3;869:11;884:1; 887:10,10;956:7; 973:20;986:9 document (3) 928:5;975:3,17 DOE (1) 881:17
----------	--	--	--	---

<p>domain (3) 884:2;886:12;923:22</p> <p>done (16) 872:19;879:24; 913:1;931:20;938:7,7; 944:9,20,22;947:1; 955:14;960:12;969:22; 970:8,23;980:12</p> <p>down (28) 886:21;889:17,24; 905:19;909:9;914:13; 919:14,16;920:2; 921:4;922:9;925:4,10; 927:4,9;929:6;930:9, 10;932:4;934:10; 938:15;940:3;948:11, 13;972:5,6,7,9</p> <p>downward (2) 891:21;908:14</p> <p>Dr (4) 880:13;881:17; 981:4;983:11</p> <p>draft (2) 878:21;956:19</p> <p>dramatic (1) 891:24</p> <p>dramatically (1) 889:16</p> <p>draw (1) 934:9</p> <p>drawdown (6) 884:20,23;895:14, 17;948:16;965:21</p> <p>drawdowns (2) 895:6;978:6</p> <p>drawn (2) 876:6;934:9</p> <p>Drici (37) 868:20;869:13,13, 14;873:18;874:23; 875:23;879:8,14,20,22; 880:12;881:2,4,5; 882:2,6,11;903:12,14; 906:2;909:10;911:6; 918:3;931:9,14;961:7; 965:17;971:21;973:9; 981:2,9;982:8,17; 984:1,2;985:8</p> <p>drilled (1) 881:12</p> <p>drive (1) 950:17</p> <p>driving (3) 897:2,3;971:8</p> <p>drop (2) 908:16;921:9</p> <p>drops (2) 921:1,2</p> <p>dry (1) 964:18</p> <p>due (10) 936:24;953:24; 954:20;964:3,7;970:7;</p>	<p>972:20,21,22;975:11</p> <p>duration (1) 954:22</p> <p>during (18) 890:10;891:5,18,19; 894:15;895:5;905:21; 906:16;908:4,5;909:8; 912:19;919:3;925:6; 926:15;928:11;945:22; 972:18</p> <p style="text-align: center;">E</p> <p>E-5B (1) 928:1</p> <p>Eakin (4) 912:20;916:14,19; 918:13</p> <p>earlier (11) 908:9;926:12; 929:22;931:4;936:12, 13;937:7,11,20; 969:16;978:2</p> <p>early (4) 892:24;949:9; 972:22,24</p> <p>earnest (1) 880:19</p> <p>easier (1) 875:6</p> <p>east (11) 891:13;892:17; 924:17;934:8;946:1,4; 947:6,20;957:19; 958:4,5</p> <p>easterly (1) 946:8</p> <p>eastern (3) 880:23;946:8;958:2</p> <p>easy (1) 925:7</p> <p>EBM-4 (1) 937:19</p> <p>economic (2) 872:23;873:3</p> <p>ECP-1 (1) 937:16</p> <p>educating (1) 920:12</p> <p>education (1) 881:5</p> <p>effect (28) 888:8;889:15;891:3, 5,15;894:7;898:9,10; 908:3,23;938:18; 940:23;944:4,5; 946:10,11;949:6; 962:18;966:8;967:1; 968:17,18;969:13; 971:18;972:18;977:13; 980:6,6</p> <p>effects (19) 885:6;889:9;892:1;</p>	<p>897:10;904:14;940:11; 949:3;954:11;958:5, 19;959:8,8;964:6; 971:17;972:19;973:6; 978:7;979:5,14</p> <p>effort (4) 883:8,16;894:10; 956:7</p> <p>efforts (3) 973:16,21;974:2</p> <p>EH-4 (64) 884:13,15;885:2,7; 886:22,24;890:13,14, 15,23;892:6;893:5,17; 894:7,13,18;897:12; 899:10,18;900:2,10,15, 20;903:7;904:3,11,12, 24;905:17;906:11; 907:11,12,13;908:3,15, 22;910:1;927:21,23,23, 24;928:8;929:4,19,23; 930:8;937:12,20; 939:4;944:5;946:4; 952:20;965:16,21; 967:2,7,17,19,22; 968:22;972:21;980:10; 984:24;985:4</p> <p>EH-42 (1) 967:22</p> <p>EH-5B (3) 890:23;927:24;928:8</p> <p>either (1) 971:14</p> <p>elaborated (1) 953:10</p> <p>elevation (18) 885:3;887:8;895:23; 896:8,8,9,12,13,16,20, 22;897:1,4;953:17; 954:19;970:6;971:5,10</p> <p>elevations (4) 896:5,10;897:11; 909:7</p> <p>elicit (1) 960:12</p> <p>eloquent (1) 897:7</p> <p>else (6) 912:11;951:3; 961:19,20;967:2,4</p> <p>empirical (3) 901:8;902:6;959:5</p> <p>encroached (1) 930:16</p> <p>end (12) 898:11,18;928:9; 937:18;948:3,9,9; 949:5;976:7,9,13; 980:18</p> <p>endangered (3) 875:18;877:18; 954:10</p> <p>ended (2)</p>	<p>898:18;976:7</p> <p>Energy (6) 865:24;872:13; 881:15;912:8,10;935:2</p> <p>Engineer (25) 865:4;869:20; 871:16,19;872:7,19; 874:9,15,19;876:16; 877:3;878:16;879:10; 881:3,23,23;909:18; 933:17;941:21;944:14, 21;953:8;955:15; 974:24;977:9</p> <p>engineering (1) 881:6</p> <p>Engineer's (2) 878:18;975:17</p> <p>ensure (1) 876:4</p> <p>entered (1) 872:11</p> <p>entire (3) 893:15;937:2;941:4</p> <p>entitled (2) 941:4;986:9</p> <p>equals (1) 903:24</p> <p>equate (1) 921:6</p> <p>equated (1) 932:8</p> <p>equation (2) 903:22;951:12</p> <p>equations (1) 904:7</p> <p>equivalent (1) 938:24</p> <p>errata (2) 916:1,2</p> <p>error (8) 894:9,10;907:20; 915:5;966:3;976:17; 978:4;983:9</p> <p>errors (1) 907:17</p> <p>especially (1) 906:16</p> <p>Esq (6) 865:18,20,24;866:4, 7,13</p> <p>essence (3) 886:3;946:3;947:19</p> <p>essentially (8) 870:2;874:7;876:22; 877:5;890:8;892:18; 925:12;943:15</p> <p>established (1) 929:22</p> <p>estimate (10) 885:8,18;910:16; 912:16,21;916:22; 918:19;951:23;962:16; 979:9</p>	<p>estimated (7) 908:12;911:4; 912:19;919:3;931:24; 938:17;953:24</p> <p>estimation (3) 943:6;966:4,12</p> <p>ET (16) 885:13;905:3; 910:24;912:1,2,2,3,12, 12,16;915:10;917:8, 10;935:7;936:12; 943:12</p> <p>evapotranspiration (2) 934:4;964:20</p> <p>even (7) 903:8;927:19; 929:12,17;935:7; 971:4;982:7</p> <p>event (2) 898:11;971:22</p> <p>events (2) 929:13;935:24</p> <p>eventually (1) 955:6</p> <p>everybody (3) 923:1;973:14;975:10</p> <p>everybody's (1) 978:7</p> <p>everyone (2) 877:15;883:13</p> <p>evidence (6) 872:5;879:2;882:16; 915:21;916:4;952:14</p> <p>EWR (1) 883:10</p> <p>exacerbate (1) 954:17</p> <p>exact (1) 952:2</p> <p>exactly (4) 889:24;913:6; 962:12;969:1</p> <p>exam (1) 955:9</p> <p>EXAMINATION (2) 867:2;869:1</p> <p>examined (1) 944:4</p> <p>example (18) 875:12;889:12; 892:16;897:5;904:2,3, 11,12;905:1;910:4; 919:10;920:21;926:2; 942:4;952:20;963:2; 971:7;980:17</p> <p>examples (2) 981:14;982:18</p> <p>except (4) 917:6;949:13; 966:18;984:14</p> <p>excludes (1) 905:2</p> <p>excuse (1)</p>
---	--	--	--	--

892:15 exercise (1) 879:24 Exhibit (17) 879:17,21;881:23; 882:8;915:21;916:4; 924:4,4;928:5;929:5; 930:4;931:13;956:1, 23;974:24;975:17; 977:9 EXHIBITS (2) 867:11;891:22 expect (7) 897:13;927:19; 929:5,14,24;943:14; 983:9 expected (1) 927:17 expecting (1) 944:17 expects (1) 964:21 experience (2) 881:3,7 expert (6) 872:5;873:13,16,21; 874:22;906:3 experts (6) 873:23;923:13; 936:18,19;969:15; 971:11 explain (3) 897:16;931:16; 939:18 explains (1) 977:23 explanation (1) 869:21 explanatory (1) 966:6 express (1) 971:11 expressing (2) 873:8;874:3 extended (1) 898:23 extending (1) 952:18 extends (2) 947:11,13 extensive (1) 876:14 extent (4) 933:20;934:5;941:6; 971:1 extract (4) 905:11;907:16,23; 966:23 extraordinary (5) 919:9;928:12; 929:13;951:7;971:21 extremely (2) 921:20;967:19	F	934:3;947:4;979:10 fed (1) 909:24 feel (3) 879:2;937:1;973:18 feet (17) 895:4;896:16; 908:17,19;911:15; 913:11;920:3,24; 921:2,3,4;939:11; 948:20;950:12;952:3; 965:20;972:22 few (4) 872:12;875:10; 881:10;917:7 field (1) 934:7 fifth (1) 942:11 Figure (47) 867:12;886:11,11; 894:1;895:12;896:2,3; 897:16;902:18,21; 906:3,7,13,13,21,24; 907:8,8;909:12; 912:22;914:1,21; 915:1,9,20;924:3,7,11; 925:8;928:3;930:12, 14;931:12;933:13; 934:14;937:5,6;940:4; 941:12;945:5;946:17, 18,24;963:17,24; 982:23;984:9 figured (2) 899:14;917:9 figures (3) 906:6;956:9;984:1 final (1) 878:24 finally (2) 885:21;893:3 find (7) 895:13;908:11; 936:21;980:8,19,20; 982:20 finding (1) 952:22 findings (1) 878:22 finish (1) 984:4 first (48) 869:18;871:22; 878:19;881:11;883:3, 5,8,16;886:7,15;888:4, 8;897:13,23;903:1; 905:1,13;911:9,20; 915:6,7;918:24;919:2, 23;920:18;921:14; 923:24;924:16,24; 928:15;929:1;930:22; 941:18;944:13;946:7, 20,20;947:5,21;948:3;	949:9;953:5;962:10; 963:4,23;980:2; 981:16;982:2 Fish (4) 871:7;877:18;965:2, 5 fit (2) 894:13;913:21 five (5) 879:4;943:8;949:13; 979:17;985:11 five-day (1) 960:20 Flangas (1) 866:7 flash (1) 935:24 flat (1) 929:17 flattening (1) 933:1 flood (2) 935:21;936:2 flooding (1) 935:24 floor (1) 897:5 FLOW (81) 864:8;868:7;869:22; 875:3;876:5;877:11, 13;878:2;882:18; 883:15,15;884:3; 885:12,21,22;886:3,12, 19;889:4;899:5,8; 901:22,22;902:5; 909:14,16;910:4,19,20; 914:18;917:2,4,9; 918:22;919:1;921:11; 922:13;923:15;924:9; 930:5,24;931:5,11; 934:20;935:22,23,24, 24;936:2,3,5,9,24; 937:24;940:22;941:4; 942:3,4,9,12;943:2,12, 16,19;950:24;951:12, 20;953:5,23;955:7; 956:13;959:20;961:9, 16,23,24;962:15,15; 963:8;970:16;984:19 flowing (3) 917:23;918:7,10 flows (20) 895:20,22;898:17; 903:17;929:19,24; 930:1,1;935:8,20; 940:12,23;943:13,13; 953:19,24;963:12; 970:11,14;974:7 fluctuations (1) 975:12 fluid (1) 885:13 Flux (3)	951:12,23;952:11 focus (3) 896:14,22;947:24 folks (3) 938:20,21;956:2 follow (1) 973:15 follows (1) 907:2 follow-up (1) 942:20 foot (7) 972:20;975:12; 977:24;978:4;983:2,5, 6 force (2) 897:2,3 foregoing (1) 986:12 forget (1) 952:2 form (2) 903:21;916:1 formation (2) 951:23;952:13 formed (2) 878:2;884:5 forward (1) 900:20 found (7) 893:22;894:12; 900:10,13;916:7,18; 935:8 four (6) 874:20;887:20; 908:17;925:1;964:2; 972:22 fourth (2) 877:2;920:4 frame (5) 880:19;925:6; 928:11;950:9;962:3 framework (1) 943:21 frankly (2) 929:8;944:17 free (1) 973:18 FRIDAY (2) 864:20;868:1 front (4) 947:12;963:18; 974:23;975:2 full (2) 913:22;986:13 function (2) 907:5,6 Further (3) 900:13;903:16;946:3 future (3) 870:16;930:3;943:14
---	----------	--	---	---

<p>G</p> <p>Gage (50) 878:3;885:4,19; 895:24;896:5,16; 897:23;898:8;899:21, 24;900:3;910:5,17,20, 21;911:1,18,21,24; 912:4;913:4,9,10,19; 917:2,12,14;921:12; 930:6,15,24;931:23; 932:4;934:1,2,13,18, 19;935:1,2,23;936:11; 938:1,3;940:12;954:9; 959:19;961:4,6;970:2</p> <p>gains (1) 899:23</p> <p>gallons (1) 968:19</p> <p>GARNET (22) 864:10;870:14; 872:15;887:3;888:19; 890:7;892:14;903:3,4; 906:22;924:20;925:18; 926:5;927:3,8;937:17; 952:6,8;960:2,4,8; 984:11</p> <p>gas (1) 950:20</p> <p>gathering (1) 955:21</p> <p>gave (3) 897:7;975:3,17</p> <p>GB-1 (7) 887:2;888:18,19; 892:17;903:2;924:19; 946:5</p> <p>General (9) 870:21;872:24; 873:1;874:3;879:6; 883:5;886:5;888:11; 980:1</p> <p>generally (1) 890:23</p> <p>geographic (2) 875:2;953:6</p> <p>geohydrological (3) 974:2,7,11</p> <p>geologic (1) 974:2</p> <p>Geological (1) 881:10</p> <p>Geologist (1) 865:13</p> <p>geologists (1) 980:5</p> <p>given (7) 884:6;885:17;907:5; 913:14;943:21;963:3,8</p> <p>gives (3) 911:4;934:14;967:21</p> <p>giving (1)</p>	<p>886:9</p> <p>Glasgow (2) 866:14;965:6</p> <p>Glendale (1) 950:19</p> <p>goes (1) 948:12</p> <p>Good (11) 868:4,11;869:3,13; 916:16;918:9;922:22; 923:2;955:19;965:11; 974:20</p> <p>gradient (1) 927:24</p> <p>graph (3) 905:13;932:10; 965:15</p> <p>graphic (1) 957:11</p> <p>graphs (2) 964:3;983:3</p> <p>gray (2) 888:12;947:24</p> <p>great (4) 872:8;880:9;906:20, 20</p> <p>greater (3) 925:14;964:12; 970:18</p> <p>green (1) 932:11</p> <p>Greg (1) 973:14</p> <p>ground (2) 883:13;937:5</p> <p>groundwater (86) 870:19;871:9; 876:13;877:10,16; 879:3,12,15,16;880:23; 881:7,20;883:10; 884:2,3,15;885:13,14; 888:23;889:3;892:12; 897:10,14,24;899:10; 900:24;902:17,17; 904:10,22;905:12,15; 906:8,9,14,21,23,24; 907:7,10;908:15,17,23; 909:15;910:23;914:15; 919:11;920:10;921:5, 7;922:16,19;923:15; 925:9;926:11;927:13; 929:6,15;931:19,24; 932:9,11,14,17,21; 933:2,6,8;936:19; 937:4,7;943:15; 953:18,24;954:7,13,20, 22,24;955:3;957:11, 13;959:17;964:16; 966:10;972:23</p> <p>group (1) 910:6</p> <p>guess (8) 901:17;940:4;</p>	<p>943:17;947:17;970:13; 978:7;980:21;983:23</p> <p>H</p> <p>half (6) 870:10;903:9; 922:24;924:17;962:10, 11</p> <p>handout (1) 902:22</p> <p>happened (2) 943:7;949:8</p> <p>happening (5) 884:6;929:5;966:20; 967:3;973:4</p> <p>happens (2) 942:5;943:9</p> <p>hard (4) 876:10;909:17; 946:23;952:19</p> <p>hardest (1) 875:4</p> <p>head (13) 889:23;890:19; 897:11;899:12,17,19; 900:1,14;931:3;969:4; 975:19;979:16;982:15</p> <p>heading (1) 911:18</p> <p>heads (4) 897:3;900:16; 929:23;937:21</p> <p>hear (1) 983:17</p> <p>heard (6) 884:14;890:17; 969:15;971:11;978:2,5</p> <p>HEARING (32) 864:4;865:7;868:4,6, 22;871:21;873:10,19; 878:17,22;879:12; 882:12,17;902:2; 909:5;915:4,19,23; 922:23;923:3,7;945:4; 955:11;965:1,4,7; 973:10;974:16;984:4; 985:9;986:8,14</p> <p>hearings (2) 879:10,11</p> <p>held (1) 986:8</p> <p>help (2) 960:5;967:16</p> <p>helped (2) 956:11,12</p> <p>hereby (1) 986:5</p> <p>herein (1) 986:11</p> <p>hereof (1) 986:13</p> <p>here's (4)</p>	<p>886:16;937:5,5; 947:17</p> <p>Herrema (9) 867:4;873:10,11,11, 24;955:19,20,23; 964:24</p> <p>hey (1) 914:5</p> <p>Hidden (6) 870:15;887:2; 888:19;890:7;903:3; 924:20</p> <p>high (26) 875:6;885:3;893:22; 894:3,17;895:13,23; 896:22;899:17;900:9; 903:5;906:19;909:7; 944:1;952:16;953:16, 20;954:19;966:13; 967:19,22;968:22; 971:10;975:11,11; 980:8</p> <p>higher (8) 894:2;896:9;906:18; 925:16;927:18;929:1; 936:21;985:2</p> <p>highest (2) 896:15,20</p> <p>highly (5) 894:18;900:3,14; 905:7;970:2</p> <p>highway (4) 890:2;945:21;947:5, 8</p> <p>historical (1) 931:22</p> <p>historically (2) 871:13;934:9</p> <p>history (1) 874:6</p> <p>holders (1) 954:5</p> <p>horse (1) 946:11</p> <p>hour (2) 922:24;985:10</p> <p>huge (1) 906:17</p> <p>human (1) 917:6</p> <p>hundred (1) 921:19</p> <p>hundreds (1) 972:14</p> <p>Huntington (1) 913:1</p> <p>Hyatt (1) 865:22</p> <p>hybrid (1) 940:20</p> <p>hydraulic (2) 899:17;953:13</p> <p>hydrogeologic (1)</p>	<p>946:24</p> <p>hydrogeology (1) 879:13</p> <p>hydrograph (10) 898:16;909:3; 927:21;930:15,21; 934:21;947:21;969:17, 18;977:15</p> <p>HYDROGRAPHIC (1) 864:11</p> <p>hydrographs (26) 883:22;884:9;886:8; 887:19;888:4;890:22; 893:6;900:6,8;902:17, 20;924:12;929:10; 945:15;956:8;958:1; 962:19;971:12,22,24; 977:14,21,23;978:3; 981:19;983:1</p> <p>hydrologic (9) 868:15;874:14; 875:19;876:15;877:14; 878:23;940:18,19; 953:11</p> <p>hydrological (2) 876:17;902:4</p> <p>hydrologist (6) 869:15;880:8;956:6, 10;980:5;982:7</p> <p>hydrologists (1) 982:16</p> <p>Hydrology (4) 865:10;879:12,13,16</p> <p>hypotheticals (1) 875:10</p> <hr/> <p>I</p> <hr/> <p>ICS (7) 939:15,20;941:12, 20,24;942:8,11</p> <p>idea (2) 968:6;979:22</p> <p>identical (1) 946:3</p> <p>identified (1) 930:12</p> <p>identify (7) 875:6;885:23; 897:20;928:4;934:2; 936:10;972:10</p> <p>illustrate (1) 926:1</p> <p>imagery (2) 912:23;934:3</p> <p>imagine (1) 952:19</p> <p>impact (6) 875:17;876:8; 940:12;942:15,16; 971:18</p> <p>impacting (5) 876:4;901:19;</p>
---	--	---	---	---

922:16;949:24;952:20 impacts (18) 872:3;875:13;876:1; 877:7,7;938:22; 953:24;954:15,19,21, 23;955:3,5;956:14; 957:16;958:18,19; 978:7 impermeable (2) 947:15;949:20 implemented (1) 871:3 implications (1) 929:19 implicit (1) 964:7 implicitly (1) 961:13 implies (2) 893:9;894:19 important (6) 890:17;893:18; 902:14;949:8;958:17, 23 imposed (1) 960:11 impression (1) 925:20 Improvement (2) 870:21;874:3 inadvertently (1) 915:10 inception (1) 941:19 inches (2) 887:20,21 Incidentally (1) 948:17 include (8) 870:6;882:13;909:3, 6;910:22;934:24; 966:8,16 included (3) 938:6;951:11;966:6 including (4) 877:11;878:23; 904:14;966:17 inclusions (1) 944:7 increase (5) 879:3;889:5,10; 927:6;949:1 increased (4) 889:16;927:10; 928:11;965:21 increases (1) 889:8 increasing (1) 927:20 independent (4) 894:20;904:7;905:4; 963:1 INDEX (10)	867:1;884:18;885:2; 893:5;900:21,22,24; 910:1;925:14;929:9 Indians (1) 965:8 indicate (1) 898:16 indicated (6) 871:23;922:13; 943:1;977:8;978:3,21 indicates (2) 872:5;894:17 indication (3) 905:18,24;981:19 indicator (5) 884:15;891:4; 899:10;908:3;929:9 indicators (1) 889:13 individual (3) 885:6;905:12;957:16 indulge (1) 979:1 inevitable (1) 954:16 infer (1) 975:13 infiltrates (1) 972:5 influence (3) 889:18;891:16;970:8 influenced (1) 950:19 influencing (1) 968:13 inform (1) 959:20 information (8) 868:15,15;901:8; 911:7;951:17;956:12; 977:13;980:4 informative (2) 902:8;960:15 informed (2) 883:20;902:10 informing (1) 960:23 initial (4) 898:14;930:6,13,17 Initially (1) 955:24 inset (1) 937:6 installed (2) 950:7;976:24 instance (2) 892:14;949:23 instances (1) 897:20 Instead (1) 903:23 intentionally (1) 939:16	interconnected (7) 893:9;894:19; 895:16;900:11;905:7; 960:18;968:6 interconnectedness (1) 979:23 interconnects (1) 899:4 interest (4) 894:24;895:22; 897:9;934:1 interested (1) 935:22 intermittent (1) 890:22 interpretations (1) 873:22 interrupted (2) 883:23;934:11 intersect (1) 904:6 into (19) 872:11;874:6;876:1; 882:16;901:22;909:8; 910:15;911:15;915:20; 916:4,19;919:8;920:3; 939:15;952:8;973:16; 976:8;977:13;986:10 introduce (1) 868:21 investigate (1) 885:23 investigations (2) 880:20;981:12 Investment (1) 955:20 Investments (1) 955:18 involved (1) 874:11 irreversible (1) 872:2 Irrigation (11) 870:11;871:6;917:7; 934:4;940:2,13;941:3, 8,13,15;942:14 isolate (1) 968:16 isotopic (2) 952:6,10 issue (4) 940:18,20;952:5; 969:20 issues (4) 868:17;878:13; 944:24;954:17 item (2) 953:5,18	January (2) 917:10,13 Jim (2) 956:10;957:1 jointly (2) 875:9;878:24 Jon (1) 865:11 Jones (3) 914:22;915:2;916:6 judgment (2) 982:3,11 July (4) 956:1,20,22;974:5 June (3) 956:21,21;975:1 Justin (1) 913:1 Justina (1) 865:24	lack (1) 933:4 lag (7) 894:12,12,13; 971:12,15,16;979:10 lagging (1) 894:11 lags (2) 971:17,20 laid (1) 878:19 land (2) 910:20;935:6 large (1) 914:1 larger (1) 984:17 largest (2) 870:3,17 Las (9) 868:9,13;869:8,12, 22;870:3,13,16,20 last (12) 873:3;878:15; 906:24;907:8;909:1; 913:12;926:2;929:7; 930:20;946:13;951:9; 963:5 lastly (3) 877:9;902:16;954:11 later (2) 872:16;963:21 Laura (1) 866:13 Law (1) 866:11 layout (1) 934:15 LDS (1) 934:7 lead (1) 930:6 learned (1) 960:16 lease (1) 870:11 leased (1) 941:14 least (7) 898:21;925:21; 929:16,16;939:2; 944:3;952:17 led (2) 871:11;874:10 left (5) 907:21,24;926:4; 936:9;966:22 less (9) 875:22;926:16; 941:5;958:16;964:12; 971:9,9;975:12;983:16 lesser (1) 894:6	
		J	K		
		James (1) 956:3	Kane (6) 891:9;894:5;971:19; 974:8;978:23;979:6 Kansas (1) 881:9 Karen (3) 866:4,14;974:20 keen (1) 894:24 keep (2) 913:17;921:24 Kent (1) 865:20 kept (2) 908:11;922:7 kicked (1) 928:12 kind (8) 877:21;908:2; 919:11;963:1,5; 977:22;978:16;981:23 kinds (2) 981:14;982:17 KMW-1 (1) 891:9 knew (1) 907:15 knowing (1) 914:5 knowledge (1) 883:21 known (2) 895:1;913:23 knows (1) 877:15	L	
			labeled (2) 911:4;956:1		

<p>lets (1) 975:10</p> <p>level (38) 880:5;886:8;887:8; 890:11;892:12;895:6; 898:14;904:3,11; 907:6,13;922:11; 924:1,23;927:13; 928:17;930:13,19; 938:16;945:13;948:7, 12;949:11;950:12; 957:13;959:18,20; 963:3,8;964:8;966:12; 967:7,7;968:13; 972:21;975:18;976:18; 983:18</p> <p>levels (59) 875:6;876:22; 877:16;883:10;884:2, 11;885:7;886:13; 887:6;889:8,16; 891:17,19;892:4; 893:20;894:8,21; 895:10;899:12,19; 900:1,14;902:18; 903:17;904:24;905:10, 17;907:12;908:3,15,22, 22;923:15,21;924:9; 925:22;927:19;928:13, 14;929:17;930:8,24; 931:3,7;948:5,6; 949:23;953:15,16,21; 964:2;967:2;972:13; 973:3;979:23;980:22; 981:22;985:1,4</p> <p>Lewis (1) 934:7</p> <p>light (1) 875:11</p> <p>lighter (1) 896:10</p> <p>likely (1) 976:23</p> <p>limitations (1) 922:5</p> <p>limited (2) 943:20;945:9</p> <p>limits (1) 961:2</p> <p>Lincoln (3) 866:2;974:16,21</p> <p>line (19) 904:1;907:12,19; 908:20;913:18,22; 917:20;920:2;925:2,4; 930:12;932:12,13,24; 935:18,21;936:7; 937:23;938:2</p> <p>linear (26) 884:10,22;892:6; 893:21,22;899:14; 900:3;903:20,21,24; 904:5;905:9;910:7;</p>	<p>913:24;916:10,23; 928:9;953:12,19,20; 981:3,13,13,20;982:8; 983:11</p> <p>lines (2) 885:17;928:18</p> <p>list (2) 941:12;948:18</p> <p>listed (3) 895:12;898:13; 941:20</p> <p>literature (2) 883:9;916:19</p> <p>litigating (1) 902:11</p> <p>litigation (1) 878:9</p> <p>little (24) 871:13;875:11; 888:14;891:15,16,20; 892:23;903:21;905:19, 23,24;908:9;912:7; 928:23;929:1;947:12; 948:22;949:4,13; 951:1;960:20;966:2; 969:14;985:2</p> <p>local (3) 903:4;952:10;971:23</p> <p>located (7) 891:12;911:24; 924:15;945:18,19; 946:8;972:2</p> <p>location (13) 877:12;893:20; 897:11;899:12;900:16, 17;929:4,6;945:7; 951:23;952:23;954:22; 969:7</p> <p>locations (4) 887:7;947:1;954:14; 958:20</p> <p>long (12) 877:23;878:4,6; 881:11;943:7,17; 954:8;962:1,12;963:2; 964:5;977:9</p> <p>longer (3) 891:16;955:4;962:11</p> <p>longest (1) 890:24</p> <p>long-term (9) 877:10;885:22; 888:7;898:9;909:15; 935:7;936:17;943:8; 970:3</p> <p>look (56) 878:1;883:19;886:7, 17,20;887:18;888:3,5, 14,15;891:20;894:23; 895:19;897:19;899:9; 905:13;910:18;911:6; 914:21;918:24;921:13; 923:21;924:12,22;</p>	<p>925:7;926:2,14; 927:23;928:8,10,24; 931:22;936:17;939:3; 940:4,4;941:11;943:7; 946:2;947:22;948:10; 963:17,21;966:15; 968:23;969:5,11,11,18; 971:16,20,21;975:22; 977:15;980:2;981:17</p> <p>looked (19) 883:24;884:4;885:1; 887:10;894:11;908:4; 924:2;931:23;934:18; 935:8;936:17;937:3; 952:18;962:20;968:24; 969:21;971:17;980:17; 983:20</p> <p>looking (21) 884:9;896:15,18; 902:21;911:2,9; 912:15,23;916:6,19; 931:16;935:15,15; 958:5;966:2;969:19; 970:7,24;976:21; 982:23;984:8</p> <p>looks (10) 890:11;891:15; 898:6;913:24;930:17; 951:3,4;975:23; 976:19;977:2</p> <p>Loomis (2) 864:24;986:4</p> <p>Los (1) 865:23</p> <p>losses (4) 910:21,22;911:18; 913:3</p> <p>lost (1) 944:19</p> <p>lot (15) 875:4,8;876:21; 877:21;886:8,8; 906:10,15,15;911:6; 962:10;964:21;969:8; 972:3;982:23</p> <p>low (6) 872:24;894:5;937:3; 966:13;971:4;984:11</p> <p>Lower (35) 868:6;869:21;875:2; 876:5;877:11;882:18; 886:12;889:3;896:4,9, 10;897:6;899:5;902:5; 909:16;915:1;921:11; 923:14;924:9;925:17; 930:24;931:11;934:13; 940:3,6,10;949:13; 951:12;953:5;961:23; 962:15;978:23;979:7, 7;984:19</p> <p>lowered (1) 927:18</p> <p>lowering (2)</p>	<p>877:17;895:8</p> <p>lowest (2) 894:4;970:6</p> <p>Ltd (1) 865:16</p> <p>lunch (2) 985:12,13</p> <p style="text-align: center;">M</p> <p>ma'am (2) 975:5,21</p> <p>magnitude (5) 906:23;907:2;935:9; 954:22;960:15</p> <p>main (2) 954:4;956:7</p> <p>maintain (5) 921:12;954:8; 959:18,21;963:3</p> <p>maintaining (1) 963:7</p> <p>major (1) 933:17</p> <p>makes (1) 977:6</p> <p>making (2) 875:2;902:4</p> <p>man (1) 884:8</p> <p>manage (5) 870:4;959:6,8,9,15</p> <p>managed (5) 875:9;878:24;879:6; 910:10;970:2</p> <p>management (5) 875:20;876:13; 879:1;881:6;920:10</p> <p>Manager (3) 869:11;878:11; 973:21</p> <p>managing (3) 876:3;959:1,11</p> <p>manifester (1) 958:19</p> <p>manner (2) 909:20;945:16</p> <p>map (11) 886:7;890:3;933:17; 945:19;946:20,23,24, 24;947:2,6;979:17</p> <p>mapped (1) 947:16</p> <p>March (1) 887:13</p> <p>marked (3) 881:23;882:8;898:13</p> <p>material (1) 960:21</p> <p>materials (1) 951:4</p> <p>MATTER (4) 864:7;876:5;877:6;</p>	<p>986:10</p> <p>max (2) 930:19;938:15</p> <p>maximum (7) 908:19;924:23; 928:17;936:16;972:20; 978:18,22</p> <p>may (12) 868:10;871:24; 875:19;877:6;903:3; 923:8;954:23;955:4; 969:23;970:8,8;980:23</p> <p>maybe (12) 873:3;889:24;895:4; 917:6;924:16;925:8, 24;930:18;940:20; 958:15;978:22;982:6</p> <p>Mayer (2) 897:7;899:16</p> <p>Mayer's (2) 981:4;983:11</p> <p>mean (19) 906:17;909:6,21; 913:8,12;918:2;921:3, 22;922:7;931:2; 941:20;947:11;950:9; 951:4;956:22;962:6; 970:2;979:15;980:17</p> <p>meaningful (1) 960:23</p> <p>means (2) 920:24;952:22</p> <p>measure (5) 897:9;904:12; 910:11;916:24;964:23</p> <p>measured (19) 884:20,23;894:18; 895:2,10;897:11; 898:3;910:19;913:23; 916:23,24;917:2,9; 930:8;935:23;936:11; 937:21;967:22;979:11</p> <p>measurement (5) 911:12;917:3,13; 964:8;977:17</p> <p>measurements (10) 912:7,12;913:9,10, 19;948:23;976:18,21; 977:1,3</p> <p>measures (2) 895:24;899:22</p> <p>meet (2) 870:15;940:7</p> <p>member (2) 870:3,18</p> <p>memorandum (1) 871:4</p> <p>mention (1) 913:16</p> <p>mentioned (11) 870:17;872:12; 884:1;886:22;887:9; 893:7;897:18;902:22;</p>
---	--	--	---	---

926:12;937:11;958:8 message (1) 874:7 methods (1) 981:10 metric (1) 897:1 Michel (2) 864:24;986:4 MICHELINE (2) 864:4;865:2 Michelle (1) 865:8 mid (3) 898:19;934:19;962:7 middle (3) 947:6,9;966:14 might (12) 905:1,19,24;906:19; 907:3;922:22;927:17, 19;928:21;949:8; 952:21;959:13 mile (3) 889:24;924:17,17 miles (1) 959:4 MILLER (1) 965:3 mind (3) 927:22;935:19;981:7 minimal (1) 917:10 minus (1) 919:24 minute (1) 968:19 minutes (1) 955:13 missing (4) 892:23;948:22,22; 949:7 mistake (1) 915:16 mistaken (1) 965:15 mitigate (1) 954:15 MLR (5) 903:19,20;904:24; 937:12;938:8 MOA (7) 870:24;872:11; 898:14;918:23;919:16, 18,18 Moapa (31) 866:9;871:5,6; 875:18;877:20;878:1; 896:5;909:22;910:17, 20;911:1,18;917:2,14; 919:22;922:14;930:15; 934:2,19;936:11; 938:1;940:2,3,10,12; 954:10;959:21;965:8,	11;973:10,14 model (11) 881:16;896:8;901:5, 9,11;909:23;910:3,3; 952:4;961:14;971:4 modeling (3) 879:16;880:16,18 models (1) 871:16 Monday (2) 868:18;882:14 monitor (4) 891:11;950:4,6,7 monitoring (1) 880:20 month (1) 972:1 monthly (2) 893:15;895:2 months (4) 894:12,12;954:24; 976:10 more (25) 872:24;873:3;876:1; 902:10,14;903:21; 914:13,14;916:18,22; 922:1;927:6;933:1; 944:17,23,24,24; 958:23;960:15,23; 970:23;977:6;979:17, 17;982:12 morning (13) 868:4,5,8,11,14; 869:3,13;955:18,19; 957:10;965:11;973:14; 974:20 Morrison (4) 867:6;973:13,14; 974:14 most (3) 896:24;917:20; 938:20 mostly (2) 909:8,22 Mountain (8) 905:2,14,16;947:12; 966:18;984:14,16,18 Mountains (9) 875:23;887:4;889:6; 926:5;927:5,8;937:19; 971:24;972:5 move (13) 875:15,16,20;877:6; 901:4;909:11;922:21; 933:9;954:13;963:11, 22;982:22;984:5 Moved (4) 880:17;881:10; 919:14;947:11 moves (2) 909:9;972:6 moving (7) 875:24;876:24;	877:1;942:21;950:2; 954:11;981:18 MRSA (23) 885:12;909:24; 911:4;912:17;913:4, 14,20,22,22;914:8,18; 915:11;916:12,18; 917:4;920:14,22; 921:4;932:7,8,10; 939:3;984:24 much (17) 874:8;875:5;878:13; 891:17;902:12;904:10; 909:19;914:14;917:6; 929:9,10;946:12; 949:12;962:11;963:7; 967:9;972:19 MUDDY (77) 864:12;870:10,10; 871:6;872:14;877:7, 13,13,15,24;878:7; 885:9,12;886:3;889:5; 890:1;893:4;896:4,5; 897:5;901:11;902:13; 903:7;907:1;909:14; 910:17,24;912:3; 915:8;917:2,14; 924:18;926:5,18; 933:11,12,14,21;934:2, 18;936:8,9;937:9,23; 939:10,16,21;940:2; 941:8,14;949:24; 951:22,23;952:13; 953:19,21,23;954:2,13; 955:1,7;956:13; 958:21;961:11,14; 963:13;969:12,15,16, 18;970:10,10,15,21; 984:14,21;985:4 Muddy's (1) 970:24 multilinear (1) 981:1 multi-linear (1) 885:5 multiple (3) 903:20;904:5;981:13 muted (2) 890:11;903:9 MX (1) 881:12 MX-4 (13) 884:20,24;892:16; 895:2,3,3,6,8,14,17; 968:17;980:10;983:1 MX-5 (27) 886:21;888:19; 889:19,22;890:3; 892:2;895:4,7;898:19; 899:2;902:24;905:21; 924:17;937:14;944:16; 945:24;946:15,22; 947:3,23;948:4,9,11;	949:16,18;976:7,13 myriad (1) 870:7 N name (4) 868:11;869:4; 896:14;955:19 namely (1) 916:19 names (1) 896:6 National (4) 866:14;894:2;965:5, 8 NATURAL (7) 864:2;934:5;936:2,3, 4;942:3;986:9 nature (5) 893:9;894:19;900:3, 11;960:18 NCA (1) 866:7 near (9) 891:10;896:5;928:2; 930:15;934:2,18; 950:18;952:5;962:1 need (6) 878:1;912:11; 933:23;960:11,14; 982:6 needed (1) 959:20 needs (2) 870:15,16 negative (2) 876:8;918:1 negatively (1) 876:4 net (1) 927:7 networks (1) 880:20 NEVADA (23) 864:1;865:17;868:1, 9,12;869:5,8,15;870:1; 880:10,15,17,23; 881:12;884:1;887:10; 935:2;974:24;977:9; 986:1,7,8,17 new (10) 873:5;875:14;879:3; 915:12;930:20;933:9; 942:21;962:12;976:24; 979:12 NEWR (2) 912:8,10 next (43) 876:12;879:1; 883:17;885:1,5; 886:20;887:1,5; 890:13,20,21;891:8;	892:6,16;896:5; 897:23;901:4;906:11, 13;911:17,22,23; 915:21;916:14;918:18; 919:24;923:11;925:24; 928:3;935:12;936:6; 937:3,22;941:11; 942:15;945:24;946:22; 947:23;950:2;953:1; 965:1;968:18;973:10 NOAA (1) 883:13 Nodded (3) 969:4;975:19;979:16 noon (1) 985:10 nor (1) 949:20 normal (13) 887:17,19,22;888:9; 925:12,14;927:15,18; 929:11,11,15;964:12, 12 north (4) 870:16;903:8;928:2; 947:9 northeast (2) 928:1;934:7 northern (5) 891:12;925:18; 969:10;971:17;974:12 northwest (1) 934:16 note (2) 928:21;964:10 noted (1) 896:13 notes (2) 986:7,14 notice (1) 890:6 noticeable (1) 891:18 November (1) 976:5 Number (16) 879:21;881:24; 914:9,12;915:22; 918:13;919:12,23; 920:16;921:21;923:13; 931:13;946:18;952:2; 962:13,16 numbers (11) 912:4,5,6;915:11; 916:22;918:1;920:3; 921:18;926:1,15; 965:23 NV (5) 865:24;872:13; 912:8,10;986:22 NVWD (2) 912:8,11 NWRD (1)
--	--	---	---	---

883:14	915:24	opposed (1) 957:14	owning (1) 870:19	889:11;890:9; 923:23;924:13;927:4; 950:20
O	OFFICER (21) 864:4;865:7;868:4, 22;873:10,19;882:12, 17;915:19,23;922:23; 923:3,7;955:11;965:1, 4,7;973:10;974:16; 984:4;985:9	opposite (1) 890:15	P	Pederson (22) 884:16;885:3; 890:16;895:23;896:14, 16,18,20;897:22; 899:18,20,22;901:16, 24;910:6;928:1; 929:24;933:22,24; 961:11;971:5,7
o0o- (1) 868:2	once (2) 918:17;976:23	orange (2) 886:17;907:12	page (15) 902:21;925:24; 936:6;937:22;963:16, 20;964:3;968:16; 974:23;975:1,22; 976:2;977:8;982:23,24	peer (1) 980:20
obligations (2) 939:24;940:7	One (49) 871:4,14,22;890:20; 894:4;896:15,19,24; 903:3;905:1;906:9,15, 24;907:16;910:12; 911:20,22,23;915:14; 918:3;919:2,24,24; 920:18;924:16;925:6; 928:21;938:23,23,24; 939:5,5;943:15,15,23; 945:18,18;946:5; 950:15;951:21;952:1, 3;956:15;957:9;960:6; 962:22;966:17;970:3; 981:3	Order (26) 868:7,16;871:3; 872:10,17;876:18; 877:3;878:21;883:7; 886:6;891:6;898:4; 905:22;906:16;915:21; 952:3;953:5,12;954:9; 959:23;960:10,13; 962:18;973:17,22; 975:1	Pages (2) 864:19;986:13	Pellegrino (8) 868:19;869:6,6,19, 24;873:12;874:13; 878:15
oblige (1) 926:23	one-foot (1) 978:8	orient (2) 933:16;947:2	Paiute (6) 887:1;890:13; 892:22;924:20;937:16; 965:8	P-E-L-L-E-G-R-I-N-O (1) 869:7
observation (5) 905:20;907:5,7; 960:22;962:20	one-page (1) 975:3	orifice (2) 897:1;899:23	Paiutes (3) 871:5;965:12;967:17	penalties (1) 878:10
observations (2) 893:11;902:17	one-to-one (4) 938:23;939:7; 961:24;962:16	originally (2) 870:4,13	PANEL (13) 867:2;868:14,16,21, 24;887:9;888:21,22; 889:2,14;925:7; 947:22;974:20	penetrated (1) 950:15
observe (3) 892:12;894:9;963:12	ongoing (3) 876:23;931:19; 944:18	others (4) 901:16;935:6;939:7; 950:23	panels (1) 897:22	people (3) 881:11;925:22;972:8
observed (11) 885:21;890:10; 900:5;901:1;907:11, 13,22;934:19;942:3; 960:16;964:9	only (20) 871:17;873:20; 880:22;887:24;892:1; 895:16;907:17;910:15; 912:15;917:22;920:12; 938:5;943:12;952:23, 23;954:15;967:8; 971:17;973:1;984:11	ours (1) 894:1	paragraph (2) 963:23;975:6	per (5) 920:3;921:3,17,24; 922:1
observers (1) 982:3	opening (1) 953:10	ourselves (1) 871:7	parallel (1) 981:18	percent (15) 887:11,19,23;888:9; 921:19;925:15;929:12; 933:6,8;942:5,8,11; 962:7;964:11;966:19
obtained (2) 913:8;923:23	opened (1) 937:15	out (14) 878:19;879:5;881:9; 886:23;888:8;912:22; 914:1;927:7;936:22; 943:7;950:17;951:19; 968:10;985:6	Park (3) 866:14;965:5,8	percentage (3) 887:15;970:13,17
obvious (2) 934:24;935:4	operation (2) 929:3;940:21	outcrop (1) 891:11	Parson's (1) 881:18	perennial (2) 883:15;884:3
obviously (2) 911:10;951:20	operator (2) 870:20;874:2	outflow (3) 943:20,21;952:24	part (6) 872:7;883:8;901:4; 903:9;936:8;947:13	perform (4) 892:6;903:16; 909:13;964:13
occur (10) 877:7;910:21; 911:21;921:11;933:22; 936:3;939:19;949:23; 954:23;955:1	operated (1) 937:15	outside (1) 937:10	participants (2) 955:13,17	performed (11) 883:17;884:10; 885:5,7;886:16;900:9; 901:4;903:19;909:11; 959:14;960:17
occurred (4) 889:21;892:13; 924:24;939:12	operation (2) 929:3;940:21	outstanding (1) 872:20	participate (1) 881:21	perhaps (10) 894:5;905:18,24; 907:3;908:19;927:20; 929:17;935:6;943:19; 981:6
occurrence (1) 954:16	operator (2) 870:20;874:2	over (19) 885:9;887:7,16; 888:1;910:20;928:23; 934:22;935:20;936:14; 938:14,17;939:12; 944:12;948:19;952:12; 954:8,18;961:10; 970:17	particular (2) 916:1;969:22	period (54) 872:18,22;885:9,20; 886:4;887:7,16; 888:12,24;889:10; 890:10,24;891:6,18,22; 893:16;894:15;895:3; 898:4,22,23;908:4,5,5; 912:13;914:21;923:23, 24;924:12,22;925:11, 11;926:16;927:14; 928:15,21;935:15,20; 936:15;938:14,17; 939:13;942:18;945:23;
occurring (5) 873:4;884:7;908:6; 925:6;938:16	opinion (11) 874:9;914:4;924:8; 933:3;939:6;942:23; 943:1;945:12;952:14; 968:5;971:14	overland (1) 935:24	parts (2) 892:23;956:24	
occurs (10) 910:24;937:7; 938:22,22;940:17; 952:24;964:14,17,23; 971:3	opinions (4) 873:14,21;923:14; 971:12	oversee (1) 973:21	party (1) 870:24	
O'Connor (1) 865:18	opportunity (2) 883:3;955:16	overturned (2) 950:18,18	past (4) 944:10;961:10; 964:2,21	
October (2) 887:13;974:5		owed (1) 970:7	path (1) 879:5	
off (21) 889:8,23;890:1; 902:24;905:19;906:1; 946:8,20;947:5;948:4, 6,7,12,14,24;949:9,12; 982:15;983:1,5,5		own (3) 870:11;872:5;883:12	paths (2) 961:9,16	
offer (2) 882:15;915:20		owned (1) 870:13	patience (1) 886:9	
offered (2) 923:14;945:3			pattern (2) 890:23;892:16	
offering (1)			patterns (1) 892:18	
			Paul (1) 868:12	
			peak (6)	

947:24;948:19;954:3; 972:17,19,24;973:4; 976:21;980:10,11	plots (2) 900:8;982:7	895:8	923:13;951:18;955:21	919:21;921:23;954:9
periodic (2) 977:1,17	plus (1) 903:24	predominantly (2) 895:6;968:21	proceedings (3) 869:23;883:23; 934:11	protecting (1) 878:2
Perkins (2) 934:10,12	pm (1) 985:13	preparation (2) 915:4;956:4	process (7) 874:11;878:18,20; 893:14;897:19;928:16; 958:17	provide (3) 868:14;869:20; 916:22
permanent (1) 879:4	point (14) 886:23;902:8;925:5; 927:7,12;931:8; 940:15,24;941:5; 943:14;953:10;954:4; 958:24;959:19	prepared (5) 872:10;874:15; 951:10,11;956:9	processing (1) 883:9	provided (3) 873:17;879:17; 944:13
permeability (6) 894:6;945:9,13; 978:24;979:7,8	points (7) 876:7;907:19; 933:17;949:13;953:4; 954:12;962:20	preparing (2) 973:16,22	produce (1) 909:19	provider (1) 870:2
permeable (1) 945:9	populations (1) 959:21	pre-qualified (1) 879:9	produces (1) 906:11	province (1) 880:9
permits (1) 953:9	pool (1) 970:3	pre-qualifying (1) 879:24	production (102) 883:13;884:3;885:7, 13,14;888:23;889:3,6, 10,18;898:1;904:10, 22;905:2,3,12,16,22; 906:8,10,14,23;907:7; 908:8,15,24;910:23; 911:23;912:10;914:11; 917:12;920:9,10,12; 921:6;925:10;926:1, 10,11,15,19,22;927:2, 4,7,10,12,14,18;928:2, 10,11,22;929:15; 931:19,24;932:9,12,15; 933:4,6;934:6,8,12,12, 15;937:5,7,9,14,17; 938:6,10;939:3; 943:18;949:16,17,22; 953:16,18;954:1,7,13, 20,23,24;955:3; 957:11;959:17;961:3; 962:6,8;965:22;966:7, 7,10,10;967:2;972:23; 984:18,23;985:3	proxies (1) 904:21
perpetuity (1) 874:5	pops (2) 888:8;949:11	presentation (9) 883:4;915:18; 924:14;929:22;955:12; 956:8;957:10;963:15; 980:1	productions (1) 904:15	proximity (4) 884:17;886:22; 938:3;947:3
perplexing (1) 875:11	PORTION (3) 864:9;876:12;959:14	presented (8) 871:23;882:15,15; 893:6,24;899:16; 918:4;957:20	professional (4) 980:5;982:3,11,16	pulled (2) 976:9,16
persisted (1) 934:22	portions (1) 956:19	presenting (2) 937:23;944:21	program's (1) 941:19	pulse (1) 972:6
person (1) 965:14	position (2) 869:5;951:17	pretty (3) 872:22;891:1,17	prohibit (1) 877:20	pulses (4) 904:15,19;951:7; 972:4
personally (1) 965:23	possible (3) 913:17;943:18;979:4	previous (6) 884:14;890:17; 898:9;901:9;952:3; 955:14	project (2) 880:13;881:12	pump (17) 871:3;872:10,17; 873:2;901:18,20; 921:8;943:10;944:4; 948:1,5,11,24;949:9, 10,12;959:22
perspective (5) 886:10,18;959:7,8,8	post (2) 871:3;983:21	previously (2) 872:12;879:14	projects (3) 880:23;881:18,20	pumped (8) 877:11,22;878:4,6, 13;909:16;938:24; 959:12
pertinent (1) 883:7	post-1965 (1) 936:18	primarily (2) 895:23;956:24	prominent (1) 947:4	pumping (113) 871:17;875:16; 876:18,23;877:1,2,12; 879:3;888:13;889:9, 21;892:2,13;893:2; 894:6,15,22,24;895:1, 5,7;897:10,14;898:19; 899:2;901:8;902:12; 903:4,18;905:21; 906:16,16,21;907:1,2, 10;908:6,7,17;914:14; 921:11;922:1,16; 924:17;929:2,6; 930:23;933:11,12; 937:8,11,13,19;938:4, 18,21,22;940:21,22,23; 942:24;943:1,4,15; 944:2,7,16,18;945:24; 946:15;947:23;948:9; 949:2;957:12,14,14,17, 18;958:4,17,22; 959:23;960:1,4,9; 961:5,22;962:14; 963:4;964:6;967:8; 968:2,10,15,17,17,18, 19,21,23;969:3,5,9,9, 12;970:5;971:3; 972:17,19;976:8,10,13;
Peterson (9) 866:4;867:7;974:19, 20;982:10,19;984:6,7; 985:6	posted (2) 896:5;947:1	principal (1) 880:10	promptly (1) 902:23	
petroleum (1) 881:6	potential (9) 875:16;897:1; 941:24;942:8,11,17; 954:1;964:20;971:8	principally (1) 884:16	properties (1) 955:5	
phase (2) 878:19;879:1	potentiometric (1) 930:7	principle (1) 982:1	proportional (8) 909:14;914:15,17; 922:13;929:23;930:1; 931:4;944:5	
pile (1) 876:7	power (4) 870:15;872:15; 935:2;977:9	principles (1) 905:6	protect (3)	
pipeline (1) 872:16	pre- (1) 936:18	prior (5) 879:10,11;902:2; 938:7;948:1		
place (1) 897:13	pre-1965 (1) 936:22	probably (12) 912:22;917:19; 933:5;938:9,11; 964:19;968:19;971:24, 24;972:7,20;984:18		
plan (1) 868:17	precipitation (23) 883:12;884:1; 887:12,23;888:9,10; 889:15;891:3,4; 897:24;909:4,7,8; 925:14,16;927:15,18; 929:6,8;936:18; 964:12;971:22;972:5	problem (1) 875:21		
planning (1) 870:6	predevelopment (8) 919:3,13;920:1; 935:13,14,18;942:6,12	problems (1) 881:8		
plants (3) 870:16;872:15; 964:22	predominant (1)	proceed (1) 868:10		
play (1) 902:4		proceeding (6) 871:15;879:9,15;		
played (1) 871:10				
Please (14) 875:1;881:2;893:13; 906:12;918:12;924:5, 7;940:15;941:11; 945:19;953:2;959:10; 963:16;976:1				
plot (2) 913:21;983:2				

<p>980:11 pump's (1) 948:23 purchased (1) 941:14 purple (1) 932:12 purporting (1) 947:18 purposes (2) 920:11;959:1 put (9) 917:7;944:3;945:6; 952:19;963:14;966:13; 973:16;974:23;977:21 putting (2) 907:9;915:9</p>	<p>871:20 R rainfall (2) 964:13,17 ramp (1) 874:1 ramping (1) 873:8 random (1) 907:19 randomly (1) 907:18 range (6) 880:9;921:21; 947:12;951:3;959:15; 978:9 ranging (1) 938:14 rate (6) 889:13;938:13; 939:8;943:4,5;975:11 rates (2) 961:3;964:20 rather (3) 915:11;919:6;921:21 ratio (18) 885:7;913:13,15,16; 914:23;917:18,19; 918:15,17,19;920:22; 931:21;932:6;933:4; 942:24;954:1;959:14, 14 ratios (2) 914:3,4 reach (2) 875:5;913:4 reached (2) 932:20;985:10 reaching (2) 898:22,22 reacting (1) 894:22 read (2) 871:20;953:3 reading (1) 965:19 ready (1) 948:2 real (3) 940:4;946:9;948:15 realization (1) 873:5 realized (3) 940:9,23;942:14 really (19) 873:5,8;875:8,13; 876:9;891:3,4;894:23; 898:12;902:11;904:16, 17,18;905:16;906:10; 914:1;940:1;971:1; 972:10</p>	<p>reason (4) 888:23;905:5; 912:15;916:21 reasonably (1) 878:12 rebuttal (4) 918:4;924:4;945:5; 946:18 recall (5) 945:10;951:21; 958:11,12;970:15 receiving (1) 951:2 Recess (2) 923:6;985:13 recession (1) 872:23 recharge (38) 891:4,16;892:1; 894:8;898:11;904:15, 17,20;907:24;908:3,18, 21;909:2,3,6,9;919:8,9; 928:12;951:2,7; 952:10;964:13,14,16; 966:8,9,21,22;968:11; 971:20,23;972:1,6,8, 18,21;973:5 recited (1) 928:22 Reclamation (1) 941:22 recollection (3) 950:11;958:13;974:9 recommendation (5) 875:1;876:11;877:4, 5,9 recommendations (3) 874:19;876:19; 878:17 reconvene (1) 985:10 record (41) 869:4,4;874:21; 880:3;885:17,22; 887:16;889:15,17,20; 890:8,22,24;891:14,22; 892:24;893:16;906:2; 923:8;928:4;930:15, 24;931:22;934:1,18; 936:5,7,24;945:23; 948:21;949:3,13,18; 968:13;969:24;970:4, 8;972:11;977:1,16; 980:10 records (5) 890:6;899:8;908:10; 946:21;971:20 record's (3) 880:4;892:23;911:8 recover (1) 903:1 recovered (1) 930:17</p>	<p>recovering (1) 873:6 recovers (1) 948:7 recovery (18) 871:18;873:1,14; 890:11;891:6;898:6; 902:19,23;903:5,6,9; 923:23;924:13;928:15; 944:15,17,18;953:15 red (3) 887:24;888:1;937:23 REDIRECT (2) 867:2;955:10 reduced (5) 926:22;927:14; 928:23;935:8;955:6 reduction (2) 914:10;930:1 refer (3) 884:12;885:11; 935:21 reference (8) 976:12;979:21; 980:17,21;981:1,9,10; 982:17 referring (1) 906:3 reflected (1) 977:16 reflection (1) 968:10 refuge (1) 896:15 regard (5) 949:4;964:1;978:8; 979:13;980:19 regarding (12) 868:6;872:14;875:2; 876:19;877:10;882:18; 922:19;923:14;924:8; 942:23;961:11;973:16 regardless (2) 876:2;950:21 region (2) 876:15;877:14 regional (1) 870:6 regression (26) 884:11,22;885:5; 892:7;893:21;899:15; 900:9;903:20,24; 904:5;907:14;943:24; 945:17;953:12,19; 960:16;967:17;979:22; 980:19,22;981:2,3,13, 13,22;983:11 Reich (2) 945:7;947:14 relate (3) 897:20;944:8;981:15 related (11) 868:15;871:8;884:7,</p>	<p>8;893:2,2;899:8;901:6, 7;920:14;922:14 relating (2) 881:20;916:14 relation (1) 930:11 relationship (13) 872:13;873:20; 886:19;893:22;899:14; 901:21;914:17;916:23; 933:11;953:20;967:15; 980:6;983:6 relationships (5) 877:12;884:10; 916:10;917:22;980:7 relative (3) 897:4;908:21;966:12 relatively (7) 872:18;906:10; 908:23;914:1,2,3; 954:23;979:7 relied (3) 873:22;959:5,22 rely (1) 959:6 relying (1) 874:4 remain (1) 929:20 remainder (3) 948:8,14;955:10 remaining (1) 941:7 remember (2) 927:24;979:24 remove (1) 935:24 removed (1) 975:23 reopen (1) 955:16 repeatedly (1) 894:11 report (39) 881:22;882:4,9,17; 886:11;894:1;895:12; 896:2;906:3;913:17; 924:4;931:12;934:20; 937:6;944:6,7,9,9,20, 23;945:5;946:18; 948:18;951:10,11; 956:1,2,4,12,17,20; 963:15,18;973:17,22; 975:1,9,9,10 Reported (1) 864:24 Reporter (3) 883:23;934:11;986:4 reporting (1) 883:6 reports (8) 874:13;882:13,19; 883:1;918:5;944:13;</p>
<p>Q quadrant (1) 934:14 qualifications (1) 880:5 qualified (6) 873:12;879:10,11, 11,14,15 qualitative (12) 883:19;884:5; 886:16;892:3,10,11; 893:24;895:22;896:17; 900:7;943:24;980:3 qualitatively (1) 897:19 quality (1) 883:17 quantified (3) 886:2;953:23;954:1 quantify (2) 904:21;966:9 quantitative (1) 981:17 quantities (1) 871:23 quantity (5) 872:1;877:10,22; 909:15;914:15 quarter (10) 889:24;903:1; 923:24;924:16;925:1; 928:16;929:1;930:22; 948:3;949:9 quick (5) 896:19,19;901:3; 940:4;979:4 quickly (3) 892:10;919:17; 954:23 quite (1) 897:6 quote (1) 872:5 quotes (1)</p>				

<p>951:16;956:15 reports' (1) 974:3 represent (6) 868:12;887:15; 900:11;907:17;912:4; 955:20 representation (1) 917:20 representative (6) 884:12;890:18; 895:9;900:10,15; 917:19 represented (3) 887:11;910:1;936:1 representing (1) 974:21 represents (4) 908:5;910:5;913:18; 917:14 required (2) 872:17;922:19 reserve (2) 878:24;955:9 reservoir (11) 901:13,19,23; 910:15,23;911:24; 934:10;937:8;938:24; 954:14;969:12 residual (1) 973:6 residuals (8) 907:15,17,21;908:1, 2,20;966:3,22 resolution (1) 878:24 resolved (1) 872:9 Resource (2) 869:11;882:13 RESOURCES (9) 864:2,3;869:7; 870:21;874:14;973:20; 981:12;982:18;986:9 respect (19) 876:24;877:4; 889:16;892:20;893:3; 896:11;897:1,4;900:2, 10;916:7;924:8;929:8; 935:9;939:20;957:21; 958:15;971:5,19 respond (5) 895:16;905:21; 948:4;969:17;980:9 responding (6) 928:14;962:21; 968:1;969:23;972:13; 973:3 responds (2) 945:22;971:2 response (33) 873:1;874:8;893:1; 898:2;906:7,11,13,17,</p>	<p>20,21,22,24;907:2,4, 24;927:16;929:10; 948:16;949:16;957:13; 958:8,9,22;960:12,16; 962:22;967:21;968:20, 23;971:13;975:13; 979:10,18 responses (18) 876:17;884:12,20, 23;894:18;902:14; 904:22;905:12;907:10, 16;946:14;948:11; 949:3,15;953:11; 964:7;982:4,5 responsibilities (2) 870:6;880:11 responsible (2) 870:22,22 responsive (2) 944:2;951:6 rest (1) 889:17 result (5) 876:23;884:19; 895:7;939:10;955:6 resulted (2) 966:16;974:3 results (4) 963:11;965:16; 984:17,22 resume (3) 879:18,18,21 resumed (1) 953:17 retrospect (1) 938:9 review (4) 883:5,9;927:21; 980:4 reviewed (4) 900:5;923:16;957:6; 980:20 revisited (1) 876:12 Ricci (1) 871:21 R-I-C-I (1) 869:15 right (54) 882:23;889:18; 890:3,3;893:14; 895:19,21;898:18; 901:3;902:16;903:11; 912:22;913:7;916:13; 922:21;923:1,11; 924:3;926:4;928:7; 930:7;935:2;939:18; 940:7;942:10,20; 945:2;946:17;947:6, 23;953:1;954:5; 963:17,23;964:1; 965:20;967:23;968:8, 18;974:1;976:4;977:6,</p>	<p>18;978:6,11,21; 979:20;980:12;981:5, 21;982:19;983:3,8,18 right-hand (3) 896:4;926:15;934:13 rights (17) 870:7,19;875:12,14, 17;877:8,19;878:1; 922:17,19;939:22; 940:8;941:2,7;954:11; 959:7,9 rising (1) 929:17 RIVER (112) 864:8,12;868:6; 869:21;870:5,10; 872:14;875:3;876:5; 877:7,11,13,13,15,24; 878:7;880:15,16,18; 882:18;885:9,12; 886:3,4,12;889:3,5; 890:1;893:4;896:4,5; 899:5;901:6,7,12; 902:5,13;903:7;907:1; 909:14,16;910:17,24, 912:3;915:8;917:2,10, 14;921:11;923:14; 924:9,18;926:5,18; 930:24;931:11;933:11, 12,15,21;934:2,18; 935:19;936:8,9,10; 937:9,24;938:1,4,18; 939:1,10,12,17,20,21, 22,23;940:22;941:4, 14;942:1,9,24;943:2, 13;949:24;951:12,22; 953:5,19,19,21,23,24; 954:2,13;955:2,7; 956:13;958:21;961:23; 962:15;963:13;969:12; 970:11,21;984:15,19, 21;985:4 road (2) 886:21;890:1 Robison (2) 865:19,20 rock (3) 891:11;899:4;900:11 role (8) 869:21;871:1,10; 874:2;902:3;909:2; 951:17;973:20 room (1) 877:15 roughly (2) 959:3;962:7 rounding (1) 922:3 row (4) 915:6,7,7;921:14 Rowley (1) 947:1 rows (3)</p>	<p>915:1;921:13;926:2 RPR (1) 864:24 R-squared (2) 978:13,16 rule (2) 936:22;951:19 run (1) 962:1</p> <p style="text-align: center;">S</p> <p>Same (53) 879:21;884:23; 885:1,19;890:8,8,23; 892:18,20;893:3; 894:21;895:11,11,17, 21;897:24;899:3,5,21, 24;903:2;904:6; 914:21;925:11;926:21; 927:22;928:16;939:2; 945:16,23,24;946:4; 947:15;948:10;949:4, 7;952:12;954:3; 962:21;967:5;968:1,2, 11,21;971:6,6;979:13, 18;980:9;982:8;983:6; 985:5;986:10 SAS (1) 878:10 satellite (1) 912:23 saturated (1) 950:14 saw (7) 884:9,21;893:6; 900:7;905:7;919:9; 962:5 saying (3) 920:9;979:5;981:17 scatter (1) 913:24 Schreck (1) 865:22 Schroeder (2) 866:11,13 scientific (4) 974:2;979:21; 980:21;981:24 scientists (1) 980:15 screen (5) 884:3;890:14; 916:14;918:13;945:6 scrutinized (1) 953:9 search (1) 916:16 season (10) 883:24;887:11,14, 23;888:9;897:24; 925:15;927:15;936:18; 964:11</p>	<p>seasonal (1) 888:6 sec (1) 977:16 second (12) 876:16;906:7; 911:10;915:6,7; 930:14;940:15;962:11; 975:22;976:2;979:2,3 Section (6) 865:7,10;956:13; 957:1,1;980:18 sections (1) 957:3 seeing (3) 873:3;965:4,7 seems (1) 969:16 seepage (1) 910:14 seeps (1) 910:7 selective (1) 961:3 sending (1) 874:7 senior (9) 875:14,17;877:8,19; 878:1;922:16,19; 954:5;956:10 sense (7) 883:20;884:5; 934:14;952:11;977:6; 980:3,5 sensitive (3) 896:24;897:8;971:9 sensitivity (1) 897:9 separate (7) 878:12;904:17,22; 909:11;922:18;947:19; 973:7 separately (1) 901:17 separating (1) 968:9 SEPTEMBER (4) 864:20;868:1;986:6, 18 series (17) 871:2,5;872:13; 883:18,22;884:4; 887:6;889:1;897:19; 900:8;937:16;945:15; 958:1;980:3;981:15, 18;982:7 seriously (1) 878:11 serves (1) 870:23 Service (6) 866:14;871:8;965:2, 5,5,8</p>
---	--	--	--	--

SESSION (1) 868:1	side (16) 890:16;891:13;	969:1;978:11	977:3	11,14,16,24;912:3;
set (4) 877:24;879:5; 898:17;923:11	892:17;896:4;926:10, 15;945:21;949:20;	slides (6) 888:17;957:10,12; 969:2;982:23,24	source (10) 899:1,1,3,6;901:16; 912:5,6;943:10; 961:14;971:2	913:9,13,19;914:6,13, 18,20,22,22;915:8; 916:7,11,17,24;917:4, 17,22,23;918:7,10,21, 22,24;920:5,17,21; 921:1,2,9,12,14,16,23; 924:18;926:6,19; 928:1;929:20,24; 930:5,15;931:1,3,21, 23;932:3;933:21,21,22, 24;935:3;937:9;944:5; 946:4;947:20;949:24; 951:22,24;952:13; 953:19,21;954:3,9,14, 20;955:2;959:18; 961:3,6,12;962:8; 963:3,7,13;969:12,16, 18;970:19;971:5,7,10, 19;974:8,8,12;979:6; 984:15,21;985:4
setting (1) 880:20	957:17,19,24;958:2,4, 5,6,6	slight (3) 891:6;898:6;927:6	sourced (2) 901:14;954:14	square (1) 959:4
settling (1) 871:8	sighting (4) 940:3,10,13,17	slightly (1) 936:21	sources (1) 883:10	squared (1) 894:1
seven (3) 870:2;970:15,16	sign (2) 882:3,9	slope (9) 885:16;904:1; 913:18;914:2,4,5; 916:17,22;917:20	south (9) 887:3;890:7;905:23; 934:10,13;946:5; 952:1,2,13	stabilization (1) 891:17
seventh (1) 911:3	signal (2) 897:14;902:19	small (5) 897:3,4;906:10; 908:23;964:19	Southern (10) 868:9,12;869:5,8,15; 870:1;880:17;925:17; 937:18;945:20	stabilize (1) 891:20
several (4) 872:11;874:8; 885:10;904:7	signalling (1) 933:1	smaller (1) 972:19	specific (2) 966:8;974:7	stable (1) 929:20
shaded (2) 888:12;898:4	signed (2) 956:2,16	SNW (1) 881:18	specifically (3) 907:24;926:18; 982:20	stacked (2) 938:2,3
share (2) 870:18;957:5	significant (15) 871:17,23;872:22; 873:3;880:1;906:11; 907:3;922:8;924:8; 935:9;941:1;943:22; 949:23;960:11;969:9	SNWA (29) 865:16;867:12; 869:12,21,22;870:8,18, 24;871:10;875:1; 881:18,19;882:8,24,24; 924:4;928:5;931:12; 944:6;950:8;951:10, 11;956:1,14;973:16; 974:6,10;975:1;977:8	spell (1) 869:4	staff (3) 870:18;933:17; 956:11
shares (6) 870:11;941:13,14, 14,17;942:14	significantly (1) 876:7	SNWA's (10) 874:13,19;876:18; 877:4,9;879:17; 937:14;973:21;974:1; 975:10	spending (1) 880:1	stage (1) 958:17
sharing (1) 968:11	similar (12) 888:5,6,7;891:23; 892:16;898:3,8; 899:15;902:19;946:3, 6;957:6	soil (1) 964:22	spikes (1) 919:9	stakeholder (1) 869:23
Sharp (1) 865:19	similarity (1) 892:12	sole (1) 939:4	Spring (79) 870:13,23;873:7; 883:15;884:2,16,17; 885:2,3,17;889:9; 891:10,12;892:13,17; 893:18;895:20,22,23; 896:6,16;897:4,8,22; 899:12,18,18,20,20,22, 23;900:16;901:16,20; 903:17;904:2;906:14; 910:4,5,8,9;914:23; 916:6;925:18;926:3,4; 927:10;930:9;932:16; 933:7;937:13;938:6; 943:13;945:7,20; 953:17,22;955:6,18,20; 956:13;957:17;958:19, 20;961:11,24;962:15; 969:10,15,19,22;970:2, 6,6,10;971:5,8,18; 978:23	stands (1) 903:20
Sheep (1) 951:3	Similarly (2) 875:22;955:14	solid (1) 930:12	SPRINGS (156) 864:12;870:21; 874:7;875:13,17,24; 877:8,13,18,19;878:3; 885:3,4,8,9,19;886:24; 889:5;890:1,16,19; 891:9;893:4;894:5; 895:23,24;896:3,4,11, 13,14,18,18,20,22; 897:5,23;898:8,20,21; 899:1,11,21,24;900:2, 14;901:1,2,6,8,12,15, 19,23,24;903:7;907:1; 909:14,24;910:5,6,6,	start (7) 880:6;898:11; 931:24;932:4;949:5; 955:18;979:24
sheet (1) 912:7	simple (8) 884:10;893:21; 903:21,24;913:17; 928:17;942:7;981:3	someone (2) 971:1;973:19		started (6) 868:5;880:10;881:9; 908:8;919:14;962:6
shine (1) 875:10	simply (2) 942:9,16	sometimes (1) 977:20		starting (6) 868:8;919:6,16; 928:9,14;948:1
short (1) 872:18	simulations (1) 962:9	somewhat (2) 889:16;903:8		starts (4) 889:4,5;909:7;948:2
shorter (1) 891:22	single (2) 938:11;981:13	somewhere (4) 961:18,20;966:13; 967:7		STATE (43) 864:1;865:4;869:4, 20;871:16,19;872:6, 19;874:8,15,19;876:3, 16;877:3;878:16,18,
shoulder (1) 890:2	site (7) 880:10;937:21; 940:24;941:1,8; 950:17;982:14	sooner (1) 875:18		
show (13) 890:21;907:11,19; 914:22;924:3,15; 925:8;930:4;945:15; 947:2;949:8;967:1; 975:16	sited (1) 950:10	sorry (14) 902:18;912:14; 918:11;925:13;926:7; 933:24;960:7;975:10; 976:13;979:4;980:12; 981:8;985:6,8		
showed (8) 900:1;904:4;937:7, 20;958:1;971:24; 972:17;984:17	sits (1) 946:12	sort (9) 883:9;889:8;897:9; 923:23;930:18;940:5; 948:11;951:7;966:3		
showing (3) 887:5;969:3;971:12	six (5) 880:12;905:4; 944:11;959:4;976:10	sorts (1) 972:13		
shown (3) 897:17;915:14;963:4	slide (19) 886:20;887:5; 890:21;905:14;906:12; 916:14;924:14;935:12; 941:11;950:2;953:1; 961:2;963:22;964:1; 965:12;967:14,23;	sounder (1)		
shows (14) 888:17;892:24; 896:3,11;932:10,19; 943:6;946:7,15,19,21; 950:22;957:12;963:24				
shut (6) 902:24;948:6,11,12, 24;949:12				
shuts (2) 948:4,7				

20;879:10;880:14; 881:3,22,23;909:18; 923:15;924:10;925:22; 931:10;932:20,24; 933:16;941:21;944:14, 21;953:8;955:15; 962:2,2,12;963:6; 974:24;975:17;977:9; 986:1	strong (2) 893:8;981:19 structural (10) 946:12;947:3,7,9,13; 949:19;950:23,24; 958:1,3 structure (2) 945:12;979:6 studies (2) 974:7,11 study (3) 912:16,20;936:13 subject (2) 878:22;942:22 submit (1) 872:18 submittal (1) 956:22 submitted (6) 874:14;881:22; 928:5;944:6,8;951:16 Subsequent (2) 880:14;891:19 substantially (1) 935:18 subtract (1) 932:15 Sue (1) 950:9 sufficient (2) 939:23;940:6 suggestion (1) 872:6 suggests (1) 965:20 Sullivan (1) 865:5 summarize (3) 872:4;874:18;953:2 summarizing (2) 871:21;874:21 summary (1) 883:4 superimposed (1) 949:2 superposition (1) 905:6 supervision (1) 874:16 supplement (1) 944:21 supplementing (1) 976:24 supply (1) 870:6 support (1) 874:5 supported (1) 874:22 supports (1) 968:5 suppose (1) 948:22	supposed (1) 915:7 suppressed (1) 944:18 Sure (15) 880:8;881:5;883:3; 889:23;906:7;911:7; 953:3;959:9;960:22; 965:14;967:12;969:1; 970:3;973:5;978:15 surface (13) 870:9;872:14; 879:13;881:8,20; 883:14;897:2;899:8; 930:8;934:24;935:14; 936:4,19 surplus (1) 939:16 Survey (1) 881:10 suspect (2) 976:17;977:10 suspected (1) 893:23 suspicious (1) 885:24 sustainable (2) 909:20,21 sustained (1) 959:11 swear (2) 868:20,23 sworn (1) 868:24 SYSTEM (62) 864:8;868:7;869:22; 870:23;872:9;875:3; 876:5;877:11;882:18; 883:21;884:6;886:12, 19;889:4;894:19; 899:5,20;900:2; 901:13;902:5,12; 908:16;909:9,16; 921:12;923:15,22; 924:9;925:21;930:24; 931:11;935:3;936:11; 938:1,4,19;939:3,21; 940:6,7;941:5,6; 943:12;944:1;946:9; 950:24;951:13,20; 952:19;953:5,14; 959:9,16;960:10,11,18; 961:23;962:15;968:3; 971:6,7;984:19 Systematic (1) 983:9 systems (1) 939:19	911:2,7,9;915:5,9,10, 13;918:22,23;921:13; 925:8;926:3,7;948:18; 956:2;961:2;962:24; 984:9 tables (1) 895:8 Taggart (26) 865:16,16;867:3; 868:10,11,12;869:2,17; 873:16;874:12;879:20, 23;882:3,7,12,21,22; 916:3,5;923:2,5,8,9,10; 955:8;958:9 talk (12) 871:12;875:23; 876:13;880:21;887:18; 888:18;890:13;891:8, 8;926:24;969:14,16 talked (9) 892:18;909:4; 938:21;939:7;947:10; 954:6;957:20;966:2; 984:1 talking (11) 885:12,15;906:5; 925:17;933:18,22; 959:18;961:4;976:11; 978:7;980:23 target (1) 978:16 team (1) 980:14 technical (1) 878:22 Technology (1) 881:11 tells (4) 927:16;946:7; 960:20;966:19 temperature (1) 975:12 tend (1) 885:22 ten-minute (1) 923:4 tens (1) 972:14 term (6) 877:23;878:4,6; 909:3;943:7;954:8 terming (1) 886:2 terms (5) 914:7;929:9,10; 931:18;962:13 test (56) 871:3;872:11,17,19; 873:2;876:18;880:10, 13;884:20;888:12,13; 889:9,18,19;890:10; 891:6,18,19;894:15,24; 895:3,5;898:4,5,11,18;	901:9;903:18;905:22; 906:16;928:13;930:16; 944:7,12;947:24; 948:2,8,14,18,19; 949:5,6;953:12;959:5, 23;960:9,19,20,21,21; 962:18;976:4,4,7; 977:21;980:7 tested (1) 982:9 testify (3) 880:4;882:14;978:2 testimony (18) 871:21,22;872:4; 873:20,22;874:22; 876:14,21;884:14; 890:18;902:2;945:3,4, 6;978:22;981:4; 983:12,14 tests (3) 959:22;960:1,4 TH-2 (8) 887:1;890:14,20,22; 892:22;903:7;924:20; 967:17 theoretical (1) 963:12 theories (1) 972:3 theory (1) 907:15 thereafter (1) 986:10 therefore (6) 893:8;905:8;917:11, 13;966:17;981:22 thick (1) 975:16 thickness (1) 950:14 third (2) 891:12;920:2 though (4) 881:13;927:7; 964:23;970:1 thought (3) 884:21;952:7;978:22 thousand (3) 921:4,8;959:4 thousands (2) 972:8,14 three (9) 911:17,19;913:3; 925:3,12;926:2;929:7; 959:19;964:3 three-month (1) 894:13 three-year (2) 911:20;930:20 threshold (2) 983:22;984:14 throughout (11) 884:2;886:14;
		T		
		table (20) 877:17;910:19;		

893:19;894:20;896:3; 903:6;923:22;943:24; 951:20;953:13;968:2	transducer (15) 975:10,23;976:9,16, 17,17,20,24,24;977:10, 12,17,24;978:4;983:8	typewriting (1) 986:10	955:12	893:15;895:3; 915:10;918:14;919:18; 925:1;966:17,18; 983:24;984:8
thrust (1) 950:20	transmissivity (3) 905:9;906:18,19	typically (1) 924:24	upper (5) 939:21;940:6,7; 941:5,6	variability (3) 936:24;971:13; 972:14
thus (1) 962:6	trend (14) 891:7;908:14; 913:23,24;925:2,4,19; 928:18,19;929:17,18; 930:2;953:17;969:21	U	upstream (1) 917:12	variable (1) 904:2
tight (1) 951:5	trends (6) 888:7;897:20;924:1; 926:12;935:7;936:17	ultimately (4) 874:10;876:2; 901:22;958:20	use (17) 872:15;879:4,6; 891:4;893:5;899:10; 904:21;905:5;908:11; 914:9,12;919:11; 932:5;935:6;977:15; 979:9;984:22	variables (5) 892:8;904:1,7;905:4; 966:6
Tim (3) 865:18;897:7;899:16	trial (2) 894:9,10	UMVM-1 (2) 945:24;946:2	used (9) 870:15;872:19; 887:13;904:9;912:24; 915:10;918:19;941:5; 975:13	variations (4) 891:23;907:24; 908:18;919:8
times (5) 874:8;904:16,20; 917:1;981:17	Tribe (1) 890:14	unable (1) 872:6	useful (1) 958:10	varied (2) 936:13,14
timing (3) 877:6;954:19,21	tried (2) 950:14;968:16	unaffected (1) 939:22	uses (1) 980:21	varies (1) 914:6
today (5) 868:19;871:11; 874:11;880:21;956:3	trigger (4) 898:14;930:6,13,17	uncertainty (1) 872:8	USGS (4) 883:12,14;912:9; 981:9	various (6) 883:10;884:6;885:8; 893:1;917:1;945:22
today's (1) 955:12	triggers (2) 919:18,21	under (9) 874:15;876:17; 885:10;886:16;911:18; 942:2,4,11;964:14	using (7) 885:2;910:17; 918:22;928:18;932:1; 944:24;978:14	vary (2) 941:17;954:21
together (4) 875:9;907:9;913:4; 915:10	TRP (1) 950:10	underflow (2) 943:20;952:21	Usually (1) 966:5	varying (2) 971:11;981:20
told (1) 884:5	true (3) 879:18;975:9;986:13	underground (1) 872:1	V	Vegas (9) 868:9,13;869:8,12, 22;870:3,13,16,20
took (5) 886:5;895:2;913:10; 927:23;986:7	try (8) 885:23;886:23; 897:19;912:22;913:21; 952:11;968:8,9	underlies (1) 899:4	valid (1) 917:22	version (1) 915:12
top (11) 889:14,23;897:22; 926:3;930:14;932:13; 938:5;945:18;964:3; 975:6;982:15	trying (6) 909:17;913:17; 966:1,11;978:17;980:24	underlying (1) 901:1	validated (1) 871:17	versus (10) 899:1;902:5;909:14; 913:19;931:10;943:2; 958:6;967:17;972:22; 983:1
topic (3) 873:17;922:22; 933:10	Tuesday (1) 983:12	Underneath (1) 938:2	VALLEY (63) 864:10,11;866:9; 868:9,13;869:8,12,22; 870:3,11,13,14,15,20; 871:6,7;872:15;874:8; 881:16;887:2,3;891:9, 10,12;892:14,14,17; 903:3,4;906:14,22; 924:20,20;925:18,18; 926:4,4,5;927:3,8,10; 937:13,17;940:2,3,10; 941:8;945:8,20; 947:14;952:6,8; 957:17;960:2,5,8; 969:10;971:18;973:11, 15;974:8,8,12	vertical (1) 950:18
total (46) 885:9,11,14,17; 905:2,3;910:8,9,13,16; 911:4,4,14,14,20,23; 913:4,14,20;914:7,10, 23;915:8,11;916:11, 17;917:4,14,17; 918:20;920:5;921:3; 926:10,14;931:21; 932:6,7,8,11,14;954:2, 6;957:12,14;959:11; 962:8	turn (11) 897:16;921:7; 931:12;933:13;935:12; 946:17;953:1;957:9; 961:1;967:14;968:16	unintended (1) 876:9	view (12) 891:6;902:3;923:20; 924:13;930:21;937:24; 938:13,18;943:3,21; 944:24;945:8	Vidler (2) 974:17,21
towards (1) 890:1	turned (7) 948:5,13,14,24; 949:9,10;967:14	unique (1) 877:14	viewed (2) 901:11;983:13	viewing (1) 878:10
tracing (1) 922:8	turning (1) 936:9	United (1) 965:2	violating (1) 878:10	VMDL-2 (2) 905:20,21
trained (2) 982:3,16	turns (1) 909:8	units (1) 894:6	voir (1) 880:1	volume (6) 920:4;932:17; 938:23,23;939:1;963:5
traits (1) 891:23	two (24) 870:18;871:20; 877:21;878:12;883:1; 888:17;897:22;904:1; 913:18;915:1;917:21; 925:12;927:9;929:7; 939:19;941:18;951:20; 956:2;965:20;979:17; 980:23;981:1,17;983:3	unknown (1) 871:24	volumes (1) 958:16	
transcribed (1) 986:10	type (4) 880:24;885:1;902:6; 981:11	unless (1) 951:7	W	
transcript (1) 986:12	types (2) 909:4;981:14	unreasonable (2) 872:2;877:17	Waddell (2) 880:13;881:17	
transcription (1) 986:14		unused (1) 941:6		
		up (29) 873:8;874:2;876:7; 880:20;891:19;907:9, 19;910:12,12;916:14; 922:3;924:14;925:13; 928:13;930:1;932:23; 934:15;935:15;945:6; 948:5,12,13;949:11; 955:17;962:7;969:20; 971:24;973:15;977:5	value (7) 911:11;916:18; 919:6;983:15,19; 984:12;985:2	
		upgradient (2) 890:15;955:1	values (10)	
		upon (7) 873:22;874:4;875:8; 878:2;879:10;930:16;		

wait (1) 981:7	943:2,10,10;948:5,6,7, 12;949:11,22;950:12, 13,21;952:8,15;953:15, 16,21;954:5,11;958:9, 16,16,23;959:7,9; 961:18,20;963:7; 964:2,8;967:2;968:13; 972:13,21;973:3,11,15, 20;974:17,21,21; 975:11,18;976:17; 979:23;980:22;981:12, 22;982:18;984:24; 985:4;986:9	17;917:4,17;918:21; 920:17,21;921:1,2,9, 12,14,24;929:20;930:5, 15;931:1,21,23;932:4; 934:8;945:21;949:20; 954:3,9;957:17,24; 958:5,6;959:19;961:4, 6;963:3,8,13;970:19	916:19;957:6;970:23	984:16
walked (1) 980:1			worked (5) 880:9,12,14,19; 881:16	000000 (1) 983:21
wants (1) 971:1			working (3) 880:22;881:9,19	005 (1) 966:19
W-A-R-D (1) 869:14			works (2) 923:1;956:6	05 (4) 983:16,22;984:14; 985:3
Warda (8) 868:20;869:13,14; 876:21;881:5;937:11, 20;943:6		what's (14) 874:10;887:11; 897:17;912:5;934:1; 935:1;936:1;943:7; 944:15,19;945:12; 976:11;979:15,20	written (2) 878:20,21	1
Warda's (1) 936:13	waters (1) 952:6		wrong (1) 977:4	1 (5) 896:3;911:3;914:6; 942:10;948:20
Warm (50) 878:3;885:4,19; 895:24;896:18;897:23; 898:8,21;899:21,23; 900:2;910:5;913:9,13, 19;914:6,13,18;916:7, 17;917:3,17;918:21,22, 24;920:17,20,24;921:2, 8,12,14,23;929:20,24; 930:5,15;931:1,21,23; 932:3;954:2,9;959:18; 961:3,6;963:3,7,13, 970:18	Watruss (3) 956:3,10;957:1	whereas (2) 908:18;917:4	X	1,967 (1) 927:11
Wash (23) 887:1;890:16,21; 892:21,22;903:7; 905:3;906:9;924:21; 925:19;926:5,24; 927:2;937:15;952:7; 960:2,4,6;965:16,22; 967:8;971:19;978:23	way (15) 871:1;877:20; 878:12;894:21;895:17; 904:9;910:15,18,19; 920:2;924:17;931:20; 980:9;982:8;984:13	wherever (2) 952:24;971:3	X-1 (2) 904:8;905:1	1.4 (2) 908:19;972:20
	ways (4) 875:5,19;877:21; 968:24	WHITE (22) 864:8;868:6;869:21; 875:2;876:5;877:11; 882:18;886:12;889:3; 899:5;902:5;909:16; 921:11;923:14;924:9; 930:24;931:11;951:12; 953:5;961:23;962:15; 984:19	X-2 (1) 904:8	1:00 (1) 985:11
	weather (1) 923:14	whole (5) 874:6;880:10;881:6; 917:15;969:2	X-3 (1) 904:8	10 (3) 943:9;957:10;976:16
	website (2) 883:11,14	wholesale (1) 870:2	X's (2) 905:1,4	10/14 (1) 976:11
	week (4) 886:9;969:16;978:3, 8	who's (1) 934:18	Y	10/14/2013 (2) 975:23;976:2
	weeks (1) 954:24	Wildlife (3) 871:7;965:2,5	year (23) 887:21;911:10; 913:14,15;915:7; 920:3;921:3,17,24; 922:1;924:24;925:1, 12;928:12;932:5,15; 941:17,18,18;942:16; 948:4;964:17;972:4	10/2013 (1) 977:2
WATER (176) 864:3;868:9,9,12,13; 869:5,7,8,8,11,12,15, 22;870:1,2,4,6,7,9,12, 14,14,21,22,23;871:7, 14,15,24;872:1,7,14, 15;874:4,9;875:12,14, 15,17,20,24;876:22; 877:8,17,19,22,24; 878:1,4,5,7,11,13; 879:5,13;880:17; 881:8,20;883:13,14; 884:11;885:7;886:8, 12;887:6,8;889:16; 890:11;891:17,19; 892:4;893:20;894:8, 21;895:6,8,10;899:1,1; 901:14;902:1,3,7,11, 15;903:17;904:3,11, 24;905:10,17;907:12, 13;908:3,14,22,22; 920:5;923:21;924:1,9, 23;925:22;927:13,19; 928:13,14,17;929:16; 930:8;931:7;934:24; 935:14;936:4,19; 938:24;939:23;940:1, 6,16;941:2,6,7,16;	welcome (2) 923:11;973:9	who's (1) 934:18	years (28) 872:12;873:3; 880:12;881:10;885:10; 912:17,18,20,23; 925:13;928:18;929:7, 11,15;932:11;941:20; 943:8,9;944:12; 962:13,17;964:2,11,18, 22;972:8,15;973:1	100 (3) 929:12;942:8,11
	wells (69) 877:1,2;881:12; 884:2,13,23;886:13,13, 17,19;890:24;891:12, 24;893:1,7,16,19; 894:17,21;895:1,9,11, 13,15;898:3,6;900:10; 905:22,23;917:7; 924:1,15,21;925:3; 926:13;928:2,2,3; 929:3;934:6,8,8; 937:14,16,17;938:3,10; 940:3;944:1;946:9; 947:2,20;950:14,24; 951:2,8;952:15,18; 954:12,12;958:2,18; 968:1,10;969:8,13; 979:23;980:9;984:18	winters (1) 909:8	Z	100 (3) 929:12;942:8,11
	weren't (1) 877:18	WITHIN (18) 864:8;872:18;873:2; 876:15;879:4;886:18, 19;889:3;912:3;917:8; 947:7;954:24;962:21; 966:19;972:1;973:5; 984:19;986:9	zero (6) 887:24;907:19,21; 908:20;918:1;920:19	1080 (1) 950:12
	West (53) 878:3;885:4,19; 895:24;896:18;897:23; 898:8,21;899:21,24; 900:2;910:5;913:9,13, 19;914:13,18;916:7,	without (12) 872:2,8,9;874:8; 877:23;878:6;901:19; 922:16;942:13;944:4; 949:24;952:20	zone (1) 971:19	11 (5) 967:14,23;968:16; 978:11;982:23
		witness (3) 873:13,21;874:1	0	1117 (1) 927:10
		witnesses (4) 868:23;872:6;880:2; 882:14	0.05 (1) 984:17	115 (1) 975:17
		work (9) 880:24;881:11,14, 18;882:7;913:1;	0.076 (2) 917:18;920:22	1169 (19) 871:3;872:10,17; 876:18;888:12;891:6; 898:5;903:17;905:22; 906:16;944:6;953:12; 959:23;960:10,13; 962:18;975:1;976:4; 977:21
			0.2 (1) 921:9	12 (4) 887:21;889:10; 894:12;982:24
			0.22 (1) 920:21	12,000-acre-feet (1) 942:19
			0.69 (1)	12:01 (1) 985:13
				13 (1) 889:10
				1303 (9) 868:7,16;874:20; 876:17;877:3;883:7;

953:5;973:17,22 14 (1) 955:13 1400 (1) 927:11 1434 (1) 927:6 150-acre-feet (1) 926:23 159 (1) 921:2 1623 (1) 927:7 168 (4) 886:21;890:1,4; 947:5 17 (2) 965:12;967:8 1751 (1) 927:4 18 (1) 967:8 1800 (1) 950:12 1811 (1) 896:16 1945 (1) 919:4 1960's (1) 934:19 1962 (1) 919:4 1963 (1) 917:1 1964 (3) 912:20;916:15;917:1 1965 (1) 936:21 1990 (2) 887:14;933:4 1991 (3) 870:4;932:1,4 1992 (1) 935:15 1993 (5) 886:4;887:7;888:24; 889:4;908:4 1998 (2) 891:1;928:9 1999 (1) 889:8	2.7 (2) 919:15,16 2.8 (1) 919:15 2.89 (1) 920:22 2.9 (1) 919:15 20,000-acre-feet (1) 870:9 200 (1) 895:4 2001 (5) 871:19;912:15,18; 918:15;936:14 2002 (2) 912:16;964:19 2002/2001 (1) 880:19 2003 (1) 950:9 2004 (3) 891:1;898:10;928:10 2005 (13) 887:18;888:8;889:8, 15;890:9;891:2,16; 898:11;919:10;928:12; 929:13;951:1;971:21 2006 (4) 889:7,8;898:14; 918:23 2008 (2) 941:19;942:4 200-acre-feet (2) 927:3,6 2010 (2) 881:19;976:5 2011 (8) 889:10;928:14; 947:1;948:1,2;949:9; 951:10,11 2012 (8) 889:11;898:12,19; 912:18;918:15;936:14; 949:10;976:7 2013 (11) 889:12;898:12,20; 908:19;944:22;975:1; 976:5,8,14,15,16 2016 (20) 891:7;903:1,9,10; 923:24;924:13,13,22; 925:9,12;926:2,3,16, 21;927:2,4,6,10; 928:16;930:22 2017 (11) 925:11,14;926:3,16, 19,21;927:11;929:1, 15;941:19;964:10 2018 (21) 886:4;908:5,17; 925:9,16;926:3,17,20; 927:2,4,7,11;928:23,	24;932:1,20;935:16; 962:7;972:22,24;974:5 2019 (16) 864:20;868:1;887:7, 15;888:24;925:14; 929:2,16;930:22; 956:1,20,21;964:10; 974:5;986:6,18 2020 (1) 887:7 210 (1) 864:9 215 (1) 864:10 217 (1) 864:11 218 (1) 864:12 219 (1) 864:13 22 (1) 921:1 2200-acre-feet (1) 870:14 2242 (1) 927:4 2300 (1) 938:16 24 (1) 927:3 2-4 (1) 945:5 245 (2) 974:24;977:9 25 (1) 961:2 2-5 (1) 946:17 27 (5) 864:20;868:1; 963:22;964:1;975:1 27th (1) 986:6 2800 (1) 926:22 28th (1) 986:17 29,016-acre-feet (1) 942:5	919:16;921:12,15,24; 930:6,16,17;931:1; 954:9;959:19 3.4 (1) 930:19 3.6 (1) 919:15 3.78 (1) 917:4 3.82 (2) 919:14,23 30 (1) 973:1 300 (3) 887:19;888:8,9 30-year (1) 973:4 3-2 (1) 907:8 3-3 (1) 924:3 34,000 (1) 942:9 34,000-acre-feet (2) 935:13;942:2 348 (1) 872:16 36 (1) 975:1	895:12 5-14 (1) 902:18 5-5 (2) 902:18,18 5-7 (4) 897:16;930:4,12,14 5908 (1) 922:3
				6
				6 (6) 902:21;905:3;911:3; 936:16;937:19;957:10 6,000 (1) 921:22 6,000-acre-feet (5) 878:4;921:17;922:1; 954:8;959:15 6.1 (1) 896:2 60's (2) 916:20;917:13 6-1 (3) 909:12;910:19;911:9 610 (1) 963:20 6-2 (7) 867:12;914:21; 915:1,20;918:22; 961:2;962:24 6-3 (1) 931:12
				7
				7 (7) 881:24;911:3; 931:13;956:1,13,23; 957:1 7,000-acre-feet (1) 936:16 7,344 (1) 926:17 7,630 (1) 926:17 700-foot (1) 950:14 7-1 (2) 933:13,13 7-2 (1) 941:12 7200 (1) 938:15 72-hour (1) 960:20 7800 (1) 926:16
				8
				8 (1)
2		3	4	5
2 (6) 911:3;919:15,22; 937:16;942:10;948:20 2,000 (1) 927:11 2.2 (1) 919:15 2.4 (1) 919:15		3 (11) 873:3;879:17;911:3; 919:15;937:16;942:11; 946:21;948:20;949:24; 956:1;957:1 3,000 (1) 968:19 3,000-acre-feet (2) 889:11;944:16 3.2 (14) 878:3;898:15,17,22;	4 (11) 873:3;878:3;879:21; 884:1;887:10;911:3; 922:1;946:21;949:24; 954:8;959:15 4,000-acre-feet (1) 949:23 40 (2) 970:16,17 4-5 (1) 937:6 49.8 (1) 917:5 4983 (1) 942:4	5 (3) 905:3;911:3;937:19 5/6 (1) 976:11 50 (3) 933:6,8;962:7 50/50 (1) 933:5 510 (1) 894:1 5-12 (2) 902:19,21 514 (1)

957:10 8,000 (1) 952:3 800-acre-feet (2) 928:23;936:14 80's (1) 962:7 81 (2) 928:5;929:5 811-acre-feet (1) 942:17 82 (2) 894:4;978:20 85 (3) 867:12;915:22;916:4 86 (2) 942:5,10 864 (1) 986:13 864-986 (1) 864:19 869 (1) 867:3				
9				
9 (3) 882:8;924:4;946:18 9,000-acre-feet (1) 870:12 90's (3) 894:3;972:22,24 916 (1) 867:12 93 (1) 908:17 95 (1) 966:19 955 (1) 867:4 965 (1) 867:5 973 (1) 867:6 974 (1) 867:7 98 (1) 898:10 985 (1) 986:13 9900 (1) 952:4				

In The Matter Of:

*DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES*

*Vol. V
September 27, 2019*

*Capitol Reporters
123 W. Nye Lane, Ste 107

Carson City, Nevada 89706*

Original File 092719water pm.txt

Min-U-Script® with Word Index

SE ROA 53384

JA_17781

Page 987

1 STATE OF NEVADA
 2 DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
 3 DIVISION OF WATER RESOURCES
 4 BEFORE MICHELINE N. FAIRBANK, HEARING OFFICER
 5
 6
 7 IN THE MATTER OF THE ADMINISTRATION
 AND MANAGEMENT OF THE LOWER
 8 WHITE RIVER FLOW SYSTEM WITHIN
 COYOTE SPRING VALLEY HYDROGRAPHIC
 9 BASIN (210), A PORTION OF BLACK
 MOUNTAINS AREA HYDROGRAPHIC
 10 BASIN (215), GARNET VALLEY
 HYDROGRAPHIC BASIN (216), HIDDEN
 11 VALLEY HYDROGRAPHIC BASIN (217),
 CALIFORNIA WASH HYDROGRAPHIC BASIN
 12 (218), AND MUDDY RIVER SPRINGS AREA
 (AKA UPPER MOAPA VALLEY HYDROGRAPHIC
 13 BASIN (219)).
 _____ /
 14
 15
 16 TRANSCRIPT OF PROCEEDINGS
 17 PUBLIC HEARING
 18 HEARING ON ORDER 1303
 19 VOLUME V
 (P.M. SESSION, PAGES 987-1091)
 20
 21 FRIDAY, SEPTEMBER 27, 2019
 22
 23
 24 Reported by: Kathy Terhune, RPR

Page 988

1 APPEARANCES:
 2 Micheline N. Fairbank,
 Hearing Officer
 3
 4 Tim Wilson,
 Acting State Engineer
 5 Adam Sullivan,
 Deputy State Engineer
 6
 7 Melissa Flatley,
 Chief of the Hearing Officer Section
 8 Michelle Barnes,
 Supervising Professional Engineer
 9
 10 Levi Kryder,
 Chief of the Hydrology Section
 11 John Benedict,
 Hydrologist
 12
 13 Christi Cooper,
 Geologist
 14 Bridget Bljss,
 Basin Engineer
 15
 16 For SNWA: Taggart & Taggart, Ltd.
 By: Paul G. Taggart, Esq.
 17 Carson City, Nevada
 -and-
 18 Tim O'Connor, Esq.
 19 For CSI: Robison, Belaustegui, Sharp
 & Low
 By: Kent R. Robison, Esq.
 20 Reno, Nevada
 21
 22 For CSI: Brownstein Hyatt Farber
 Schreck
 By: Brad Herrema, Esq.
 23 Los Angeles, California
 24

Page 989

1 APPEARANCES:
 2 For NV Energy: Justina Caviglia, Esq.
 Reno, Nevada`
 3
 4 For Lincoln County
 Water District
 -and-
 5 Vidler Water Company: Allison MacKenzie
 By: Karen Peterson, Esq.
 6 Carson City, Nevada
 7 For Moapa Band of Paiutes: Beth Baldwin, Esq.
 8 For NCA: Alex Flangas, Esq.
 Reno, Nevada
 9
 10 For Moapa Valley
 Water District: Greg Morrison, Esq.
 11
 12 For Bedroc: Schroeder Law
 By: Laura Schroeder, Esq.
 13 For City of North Las Vegas: Schroeder Law
 By: Laura Schroeder, Esq.
 14
 15 For National Park Service: Karen Glasgow, Esq.
 16
 17 For Center for Biologic
 Diversity: Patrick Donnelly, Esq.
 18 For U.S. Fish and Wildlife: Luke Miller, Esq.
 Ass. Regional Solicitor
 Sacramento, CA
 19 For Muddy Valley Irrigation
 Company: Steve King, Esq.
 20
 21
 22
 23
 24

Page 990

1
 2
 3
 4
 5 By Ms. Ure 991
 6 By Mr. Donnelly 996
 7 By Ms. Harrison 957
 8 By Mr. Flangas 1017
 9 By Ms. Ure 1024
 10 By Ms. Caviglia 1025
 11 By Ms. Cooper 1030
 12 By Mr. Benedict 1035
 13 By Mr. Sullivan 1046
 14 By the Hearing Officer 1048
 15 By the State Engineer 1050
 16 RECROSS
 17 By Mr. Herrema 1052
 18 By Ms. Peterson 1058
 19 By Mr. Donnelly 1063
 20 By Mr. Flangas 1069
 21 By Ms. Cooper 1071
 22 By Mr. Benedict 1074
 23 By Ms. Barnes 1073
 24 By Mr. Taggart 1081

Page 991

1 SEPTEMBER 27, 2019; 1:12 P.M.; CARSON CITY, NEVADA.
2
3 -o0o-
4 HEARING OFFICER FAIRBANK: So we'll go ahead
5 and reconvene the hearing. And next up is the City of
6 North Las Vegas.
7
8 CROSS-EXAMINATION
9 BY MS. URE:
10 Q. Good afternoon. My name is Tracy Ure and I'm
11 representing the City of North Las Vegas. And I have a
12 few questions for you.
13 In your presentation you had some values for
14 Garnet Springs Pumping, I believe they were on slide
15 28, and my question is where did you obtain the data
16 for these?
17 ANSWERS BY MR. BURNS:
18 A. These data were obtained from the NVWR website,
19 the pumping inventories.
20 Q. Okay. So, for the area between 1992 and 1995
21 for Garnet Valley, did you obtain those values from the
22 pumpage inventory as well?
23 A. Yes, ma'am.
24 Q. Okay. Are you aware of the facilities in

Page 992

1 Garnet Valley in the 1980s and operating in the late
2 1980s to 1990s that were pumping in Garnet Valley?
3 A. I'm not wear.
4 Q. Okay. So then you are not aware by the mid
5 1990s, that there was approximately 1100-acre-feet of
6 certificated water rights in Garnet Valley?
7 A. No.
8 Q. So, if this data was not or these data were not
9 included in your report, does that throw off your
10 regression analyses?
11 A. It would for the multilinear regression. But I
12 trust that this data is reliable.
13 Q. Okay. Has your -- or has the Garnet Valley
14 pumpage equilibrated and achieved a maximum capture at
15 this point in time?
16 A. It doesn't appear so.
17 Q. Okay. Would equilibrated pumping in Garnet
18 Valley achieve a one-to-one capture at some point?
19 A. Based on the correlation analysis that we did,
20 and given the framework around this area, and the sole
21 discharge part at Muddy River Springs area, I believe
22 at some point in time. If you look at our figures you
23 can see that this area, like other areas to the south
24 in Black Mountain areas of very highly correlated with

Page 993

1 water levels at EH4 so, to the extent water levels
2 change effect EH-4, I would expect spring discharge to
3 also have a proportional decrease.
4 Q. Okay. Were you here when Mr. Waddell was
5 testifying?
6 A. I was not.
7 Q. Okay. Is it possible that there is flow from
8 Las Vegas Valley into Garnet Valley?
9 A. I don't believe so.
10 Q. Okay.
11 A. I'm sorry. I misunderstood. From Las Vegas
12 Valley into Garnet Valley?
13 Q. Correct.
14 A. It's possible but I guess I would caution on
15 that. I say that because there -- we found a new well.
16 We didn't find it. A new well was drilled in Las Vegas
17 Valley, just on the other -- it would be on the west
18 side of apex in Las Vegas Valley, carbonate well. And
19 the elevation of that well is higher than those wells
20 that we've measured in Garnet Valley. So that implies
21 there is a gradient. But then you have to figure out
22 from that where is water coming from. We had Las Vegas
23 shear zone to the west of that well and, you know, two,
24 three kilometers of basin fill. So my question -- to

Page 994

1 say -- I wouldn't say yes, but I would acknowledge
2 there is a gradient at that location.
3 Q. Okay.
4 A. At the boundary.
5 Q. So, assuming that there was a possibility that
6 there is some flow from Las Vegas Valley into Garnet
7 Valley, if there was capture of that flow, in part,
8 from a well in Garnet Valley, would that cause a
9 one-to-one capture from the Muddy River Springs area?
10 A. If that was part of the capture -- if that made
11 up part of the pumping from that well, then no, it
12 wouldn't be one-for-one.
13 Q. Okay. Is it your position that the one-to-one
14 capture of the Muddy River Springs area is from any
15 pumping, anywhere, in the Lower White River Flow
16 System?
17 A. There's two -- I guess there's two things I
18 would say about that.
19 First the alluvial pumping. Certainly that
20 adds impacts, one-for-one impacts to the river. We
21 measured those of the those are the Muddy River flow
22 deficit depletion I mentioned. With respect to the
23 carbonate pumping, that's the only discharge in the
24 regional -- in this system, excepting for any amount of

Page 995

1 outflow. So, over time, over a long time, as water
2 levels in EH-4 and carbonate system at the springs
3 decline, I would expect the proportional decline in the
4 spring flow.
5 Q. Okay. And so when you were talking about the
6 alluvium, it's the alluvium in that Muddy River Springs
7 area; is that correct?
8 A. Yes.
9 Q. Okay. And what are the main variables when you
10 are talking about this one -- I guess that go into this
11 one-to-one capture of spring flow? Like when you look
12 at or when you opine that there is going to be a
13 one-to-one capture of the spring flow from pumping in
14 the carbonate or in the Muddy River Springs area, what
15 are some of the variables that you look at to assess
16 that one-to-one capture?
17 A. The first one is where is the water discharged.
18 Ultimately over time, a long period of time, I don't
19 know how long, but that is the water that would be
20 captured. At a point when capture, capture of storage
21 is complete.
22 Now, it's possible that there is other water
23 that could be captured like outflow, could induce flow
24 are a boundary outside the White River flow system that

Page 996

1 could also be captured.
2 Q. Okay. Does magnitude of pumping also play into
3 that?
4 A. Yes. Magnitude, duration, location. All have
5 some influence on how the drawdown cone propagates.
6 Q. Okay. Thank you.
7 HEARING OFFICER FAIRBANK: Center for
8 Biological Diversity.
9
10 CROSS-EXAMINATION
11 BY MR. DONNELLY:
12 Q. Thank you. Patrick Donnelly, Center For
13 Biological Diversity.
14 Excuse me. I'm going to direct my first few
15 questions to Ms. Pellegrino. Given that you're a fact
16 witness I will be asking you facts.
17 I will refer to the Moapa dace, and the 3.2 CFS
18 level but only in reference to Southern Nevada Water
19 Authority's previous statements or interaction with
20 those entities.
21 Just to start with to get on the record, did
22 the Southern Nevada Water Authority and the Center for
23 Biological Diversity coordinate in any substance
24 attached and prior to this hearing?

Page 997

1 ANSWERS BY MS. PELLEGRINO:
2 A. No.
3 Q. Just wanted to get set on the record.
4 To your awareness have the Southern Nevada
5 Water Authority and Center for Biological Diversity
6 ever coordinated?
7 A. No. No.
8 Q. Loud and clear.
9 I'm going to ask you about your criteria for
10 evaluation of some of the points in Order 1303.
11 Specifically, Order 1303, Section 6-2-C says we're
12 trying to determine or offer input on the long-term
13 quantity of groundwater that may be pumped from the
14 Lower White River Flow; does that sound right?
15 A. Yes.
16 Q. And would your say you ICS credits are a
17 constraint on the amount of water that can be pumped
18 out of the flow system?
19 A. I would say the capture of Muddy River flow is
20 a constraint. Because the decree appropriated the
21 entire flow for Muddy River of which our ICS credits
22 are derived from.
23 Q. Understood. And what are the ICS credits used
24 for?

Page 998

1 A. ICS is a program that was created by the Bureau
2 of Reclamation to allow water users essentially to
3 store water in Lake Mead year-to-year which was not
4 allowed under the operation guidelines before 2007.
5 So, water users take extraordinary measures to allow
6 additional water to flow into Lake Mead, and to get
7 credit for it.
8 It was a very large benefit to southern Nevada,
9 because it allowed us to take water that was on
10 tributaries like the Muddy and Virgin and instead of
11 having to construct very expensive pipeline to deliver
12 that water directly to Las Vegas, it allowed us to put
13 it into the Colorado River, account for it entering
14 Lake Mead and withdraw that water from our existing
15 facilities.
16 Q. And so the Southern Nevada Water Authority has
17 a substantial supply stored in Lake Mead right now from
18 ICS credits?
19 A. Yes. Roughly speaking we put about
20 30,000-acre-feet a year in, since the program started,
21 and to date we have not withdrawn that water.
22 Q. Is that supply intended for emergency use?
23 A. No.
24 Q. If it is flowing in an unimpaired condition, is

Page 999

1 the Muddy River a reliable source of water for Lake
2 Mead perhaps as compared to the Colorado River?
3 MR. TAGGART: Objection; reliable and is vague.
4 MR. DONNELLY: Withdrawn.
5 BY MR. DONNELLY:
6 Q. What is Southern Nevada Water Authority's
7 interest in the Moapa dace?
8 A. The Southern Nevada Water Authority I guess, as
9 part of our operating regime, is to be a good steward
10 of the environment where we are developing our water
11 resources, because we cannot rely upon those resources
12 in the long run if we are impacting endangered species.
13 So, we've taken a myriad of actions, a lot of which the
14 panel on Monday, much more qualified to talk about than
15 me, to protect the Moapa dace, because of all of the
16 water resources that we have in this area.
17 Q. Would you say, in some ways, that the Moapa
18 dace and the flow in the Muddy River are tied together?
19 A. Yes.
20 Q. Would you say then that in some ways that the
21 fate of Moapa dace is tied to Las Vegas's drinking
22 water supply?
23 A. No.
24 Q. Would you say that the fate of the Moapa dace

Page 1000

1 is, in some ways, tied to Las Vegas's ability to store
2 water in Lake Mead?
3 A. No.
4 Q. Okay. In coming up with your assessment of the
5 Order 1303 6-2(c) question, of the sustainable
6 long-term pumpage, were you focused your assessment on
7 senior water rights and instream flows, or on the
8 sustainable amount for the Moapa dace?
9 A. As I mentioned today, we have a two-part answer
10 of which Andrew and Ward are presented both sides of
11 that coin. Which is the amount of water that we think
12 can be developed in the long term without conflicting
13 with senior water rights by capturing Muddy River flow
14 is zero, assuming that those conflicts with senior
15 water rights are mitigable. There is a finite amount
16 that can be developed without adversely impacting the
17 Moapa dace, and that's 4- to 6,000-acre-feet.
18 Q. Thank you.
19 I'll have some more hydrologic questions for
20 Dr. Burns.
21 Your data strongly suggests declining carbonate
22 groundwater levels since 2016, correct?
23 A. That's correct.
24 Q. And this is despite declining -- this is

Page 1001

1 despite increased precipitation levels during those
2 times to some degree?
3 A. To some degree. To two of the four years.
4 Q. Does this imply that current carbonate pumping
5 is lowering groundwater levels?
6 A. That's my observation.
7 Q. Based on figure 6-3, in your report, showing
8 the relationship between storage and discharge capture,
9 there appears to still be an ongoing decline in
10 storage, correct?
11 ANSWERS BY MS. DRICI:
12 A. Accumulative storage is actually increasing.
13 So it's still capturing groundwater from storage.
14 Q. So, accumulative storage is increasing, yes,
15 thank you.
16 A. Yes.
17 Q. Does that imply we are not in steady state yet?
18 A. Yes, exactly.
19 Q. This may go back to Dr. Burns. Are you aware
20 that yesterday USGS reported Warm Springs gage at 3.23
21 CFS?
22 ANSWERS BY MR. BURNS:
23 A. I'm not aware of that.
24 And just to clarify, for the record, I'm not a

Page 1002

1 Doctor Burns. I have a brother who's a Dr. Burns. I'm
2 Mr. Burns.
3 Q. Mr. Burns. I apologize. Thank you for
4 clarifying.
5 At current pumping, is it likely the gage will
6 fall blow 3.2?
7 A. Yeah, I mean it looks that way. I think -- but
8 I'm not certain of the time frame. And continued
9 monitoring will let us know.
10 Q. As far as an order of magnitude 110 or hundred
11 years, can you get that close to an estimate?
12 A. Well, we're very close as it stands. When I
13 looked in my report last value I had was about 3.4 as
14 the max around this year. The data you're talking
15 about is probably provisional, so I would hold on that
16 number. I'd like it see what it says once its final;
17 but, I think, based on what we see, there's two things.
18 One, I see water levels continuing to decline.
19 I don't see a prospect of a new -- of another 2005
20 precipitation recharge event. That was the highest in
21 the period of record. And that's the recharge that's
22 sort of reset these trends at a higher level but those
23 trends, to me, have continued to decline. And now
24 we're near the 3.2 CFS. And it would not surprise me,

1 within the next ten years or less, that we reached that
2 value.
3 Q. Thank you.
4 Referring to slide 25, the chart relating
5 discharge and Warm Spring well, Warm Spring gage flows.
6 As I understand it this chart, the data in this chart,
7 are the basis for the determination of the 4- to
8 6,000-acre-foot recommendation. Is that correct, in
9 part?
10 ANSWERS BY MS. DRICI:
11 A. Yes.
12 Q. Thank you.
13 A. You're welcome.
14 Q. I'm not sure who's going to answer this
15 question. Given that we know that 3.2 is what the MOA
16 sets forth for the Warm Springs dace, is 3.2 sufficient
17 to meet senior water rights on the river?
18 ANSWERS BY MR. BURNS:
19 A. No.
20 Q. So we are --
21 A. So let me elaborate.
22 Q. Sure. Thank you.
23 A. I say no because, you know, I just went through
24 some testimony and some demonstration of the impacts

1 much carbonate water can come out while maintaining
2 these levels at Warm Spring West, did that factor in,
3 do these numbers factor in the loss of carbonate water
4 to alluvial flow, upward flow?
5 ANSWERS BY MS. DRICI:
6 A. Yes, it does. In the measurements of the total
7 area.
8 Q. Okay. Thank you.
9 How would we know if steady state was reached
10 at 4- to 6,000-acre-feet of pumping. What would be the
11 indication that steady state has been reached?
12 ANSWERS BY MR. BURNS:
13 A. Well, one indication is to do what we've done
14 the last 20 years is to monitor how these effects have
15 propagate under different pumping regimes. And to
16 recess steady state, we would expect to see water
17 levels flatten about, you know, there might be some
18 variation, I suppose, due to recharge events over a
19 year or two. But we'd expect those to flatten out.
20 We'd expect the same for discharge of the springs. And
21 we use, as I said and others have said, the Pederson
22 Spring complex and Warm Springs West gage, as
23 indicators, for conditions in the Springs area.
24 Q. How many years of flat data would we want to be

1 that alluvial pumping has had on the river flows, these
2 depletions.
3 The reduced discharge from the springs also has
4 a contribution to the depletion, albeit much smaller
5 than the alluvial pumping. But, it's measurable, at
6 least during the test. When we saw Pederson Springs
7 decline almost 60 percent or so.
8 And Warm Springs about ten percent.
9 Those are small in terms of magnitude, not
10 discernible in the Muddy River record. But we know
11 that it's not going to the river itself.
12 Q. If we have any hope of reaching, excuse me.
13 If we have any hope of fulfilling senior water
14 rights on the river, am I hearing you saying it's going
15 to be necessary to stay above 3.2?
16 A. Yes.
17 Q. With regard to the question of alluvial
18 pumping, did your data or analysis account for upward
19 flow from the carbonate into the alluvial subsequent to
20 alluvial pumping?
21 A. That's part of our conceptual model. Maybe
22 explain where you are speaking of.
23 Q. I'm speaking of the conceptual model that led
24 to this chart, ultimately, and the calculations of how

1 certain that steady state has been reached, given that
2 a miscalculation could result in really catastrophic
3 impacts for endangered species among other resources?
4 A. I'm not -- we would always want a period of
5 record that's longer.
6 Q. Sure.
7 A. And I'm not sure I can answer your question. I
8 mean I wouldn't be the -- I'm not the management entity
9 who would make that decision. But as a professional, I
10 would think if we have, let's take now, for example,
11 last three years or four years. I think in the next
12 two years, we'll have a pretty good indication of what
13 this system is really doing. Because there is --
14 apparently, there is still apparently some debate on
15 whether the system in steady state now or if it's not.
16 What I observe is declining water levels in some of the
17 these indicator wells.
18 And two years more of data or three or ten,
19 however much we need. But I think the more you have,
20 the better indication you will have of where you are at
21 with respect to steady state. And so if the State
22 Engineer decides to put a limit on the amount of total
23 overall pumping somewhere between 4- and
24 6,000-acre-feet, we would then want several years of

Page 1007

1 data to determine if that was effective?
2 A. I think so.
3 Q. I believe I'm at 14 minutes. I have more
4 questions, but I'll come back.
5 HEARING OFFICER FAIRBANK: You have 18, 17, 16
6 seconds.
7 Georgia Pacific/Republic.
8
9 CROSS-EXAMINATION
10 BY MS. HARRISON:
11 Q. Good afternoon, panel. Sylvia Harrison for
12 George Pacific and Republic Environmental Technologies.
13 I guess I just want to pick up where CBD left off and
14 talk about the interaction between the alluvial and the
15 carbonate aquifer. I believe Mr. Burns, that you said
16 your conceptual model assumed there would be some
17 recharge from the carbonate aquifer into the alluvium;
18 is that correct?
19 ANSWERS BY MR. BURNS:
20 A. Yes. Maybe to clarify or to simplify, I
21 believe the source of water in that alluvial reservoir
22 is from the carbonate system.
23 Q. Do you have any direct evidence of that
24 conclusion?

Page 1008

1 A. One is that I don't see that there is a lot of
2 recharge in that small basin that would contribute to
3 different source of water to that reservoir.
4 Q. What about a different source to the Muddy
5 Springs? Have you taken that into consideration?
6 A. Well, yeah. I think -- I guess what I'm trying
7 to say is that conceptually we have -- we can have some
8 diffuse flow from the carbonate system into this
9 reservoir. We also have some discrete springs like
10 Pederson Springs, for example, directly from the
11 carbonate system that flow out into the ground. And I
12 suppose can contribute to the storage in that
13 reservoir. But I sort of view it all as the same
14 source of water from the carbonate system.
15 Q. Okay. But you don't have any temperature data,
16 or isotope data or anything like geochemical data that
17 would demonstrate conclusively that water from the
18 carbonate system was being introduced into the aquifer
19 at least at this point in time?
20 A. Not in this report but that data is available.
21 I think it's widely recognized the in scientific
22 community that the source of water in the alluvial
23 system there is the carbonate aquifer.
24 Q. And you suggested that would be diffuse flow or

Page 1009

1 would it be discrete area, where there may be the
2 equivalent of underground springs, for example?
3 A. It could be both.
4 Q. What would be the mechanism for diffuse flow
5 from the carbonate into the alluvial aquifer?
6 A. Well, if you have, let's say, a fault that runs
7 along the boundary, you can have water that comes up
8 along that fault and into the alluvial reservoir, for
9 example.
10 Q. But that would be a structural feature,
11 correct?
12 A. A fault is a structural feature.
13 Q. Not necessarily just because there is a contact
14 between the carbonate and the basin fill doesn't
15 necessarily mean that there is water flowing from the
16 basin fill to the -- I mean from the carbonate aquifer
17 to the basin fill, correct?
18 A. Could you repeat that?
19 Q. If there is simply a contact between the
20 carbonate and the basin fill, would you assume that
21 there is necessarily diffuse flow from the
22 carbonate into the basin fill?
23 A. Well, I mean --
24 Q. Just to stratigraphic contact?

Page 1010

1 A. Well, maybe this will help. Another way to
2 look at it is the tension-metric surface of the
3 carbonate aquifer is higher than the elevation of the
4 basin fill, right? So there is however -- whatever
5 opportunities there are, whether it's through maybe a
6 cemented pipe in essence right into the basin fill or
7 whether it's through a contact, like you suggest, there
8 are different mechanisms by which that water can get
9 into that reservoir.
10 Q. But there is, at this point in time, no
11 quantification of that amount or where it actually
12 occurs within the lower Lower White River Flow; is that
13 correct?
14 A. I suppose you can quantify it by some of the
15 spring flow measurements.
16 Q. At the Muddy Springs you mean?
17 A. That could be one. And there's gaining reaches
18 along those small streams before they go to the river.
19 The main stem of the river. Those can be measured and
20 those gaining streams are in -- that source of water to
21 those streams are to the alluvial system. So, I guess
22 what I'm saying there is multiple sources that feed
23 these streams.
24 Q. Okay.

1 A. I'm not sure how else I can --
2 Q. Okay.
3 I want to pick up on a question that
4 Ms. Peterson asked you about the potential for doing a
5 pump test to evaluate the effects of Garnet Valley
6 pumping. On EH-4 or the MRSA. And you mentioned that
7 just before we broke that a significant stress would be
8 needed.
9 Can you give me an idea of the values and
10 duration that would be necessary to make an effective
11 pump test or design an effective pump test with Garnet
12 Valley?
13 A. Well, first let me say we have established a
14 connection between Garnet Valley, and EH-4. We can see
15 that on the hydrographs, we can see that in our
16 regression analysis, or correlation analysis is really
17 what we're doing.
18 With respect to a pumping test, over some
19 period of time, we observe what happened with the Order
20 1169 test; and it's my opinion that you need something
21 on that order, some stress of that magnitude in
22 duration to have a discernible effect that separates it
23 from the other stresses that are ongoing.
24 Does that make sense?

1 that may effect it.
2 Q. And that could make the well elevation appear
3 to be higher or yeah, than it actually is?
4 A. Perhaps.
5 Q. And would that effect the actual hydraulic
6 gradients?
7 A. From which point?
8 Q. From the wellhead to, for example, pumping
9 source or receptor?
10 A. It could. We think the pumping source would be
11 the controlling mechanism that creates the gradient if
12 it's close by.
13 Q. Okay. So, if -- in order to -- let's just take
14 GV-1, for an example. In order to conduct a pump test
15 that overcomes that five-foot difference in gradient,
16 does that suggest that you might need an even a larger
17 stress than was illustrated by the 1169 test, to see
18 any kind of effect of the EH-4?
19 A. I think I'd have to see.
20 Q. So you can't say for sure that just even a pump
21 test of magnitude of 1169 would be a sufficient
22 stressor to detect the effect of pumping in Garnet
23 Valley?
24 A. I think a stress like 3000-acre-feet in Garnet

1 Q. Yes. I mean sort of.
2 The -- what is the elevation or the water level
3 elevation at EH-4?
4 A. It's 18 -- let me. Standby, I'll -- while I
5 look, I'll just mention that they are variable. EH-4
6 most recently is a little under 1812.
7 Q. And what's the elevation of GV-1? And these
8 are -- I was looking at figure 3.6, if that helps?
9 A. What page?
10 Q. It's figure 3 -- 3-6.
11 A. For this -- on this figure it's 1808.
12 Q. So five-foot difference?
13 A. Yes.
14 Q. And there are nearby wells in Garnet Valley.
15 Do you know whether the water elevation in any of those
16 wells is affected by the water quality? In other
17 words, is there a significant salinity or are you aware
18 whether there is significant salinity in any of those
19 wells that may effect the water level?
20 A. I'm not wear of any significant salinity in
21 those wells that would effect the water level.
22 Q. If there were, would it effect the water level
23 or could it?
24 A. I suppose there could be a density contrast

1 Valley, I think we would see that signal throughout.
2 Q. And does that consider the possibility of other
3 sources of flow? In other words, if there is inflow
4 from other sources, that make up some the volume that's
5 being pump amended, would that suggest you could get
6 and incorrect -- you could draw incorrect conclusions
7 or that the pumping test would not be as accurate as it
8 would otherwise be?
9 A. Well, for something like that, I would think we
10 would design a test with as many assurances that we
11 have those factors monitored. And by that I mean, to
12 the extent you would induce groundwater flow to the
13 well from another area, you would probably want to put
14 a monitor well between that boundary and the pumping
15 well. So, you could see how that -- you can see what's
16 going on there.
17 Q. So potentially, without more data or
18 information, you are not confident that you could
19 design a reliable pump test at Garnet Valley just based
20 upon her conceptual model at this point in time?
21 A. I haven't thought -- I haven't thought about
22 that.
23 Q. Does it follow that it's a bit speculative to
24 assume that any pumping at Garnet Valley is going to

Page 1015

1 effect the MRSA area?
2 Q. I didn't catch the last part?
3 A. I said isn't -- would you agree that it's still
4 a bit speculative to assume that any pumping at Garnet
5 Valley is going to effect the MRSA? The Muddy Spring
6 area?
7 A. Well, I think what multi letter regression
8 analysis shows is that we have monitored -- we have
9 measured those affects at EH-4.
10 Q. Going backwards from the well, okay?
11 A. Yeah.
12 Q. Just this is kind of an open-ended question.
13 Can you look at figure 5 point or 5 dash --
14 five- what's five -- I don't have my glasses on.
15 Figure 5-4? Sorry.
16 A. I could not hear.
17 Q. I'm sorry, 5-4.
18 A. Okay. I'm there.
19 Q. This isn't any fancy statistical analysis or
20 anything. But would you agree that there is at least a
21 strong visual correlation between the alluvial pumping
22 and the Muddy River deficit that's illustrated in that
23 figure?
24 A. I would agree with that.

Page 1016

1 Q. And if you were to remove the alluvial pumping
2 and simply look at the amount of carbonate pumping,
3 would you see a similar decline or deficit?
4 A. You would see like you see in 2018, that the
5 deficit would be going down. You see in 2018, there is
6 alluvial pumping?
7 Q. Yes. So I'm saying if you -- if you simply
8 removed the alluvial pumping from that, and you look
9 simply at the relationship between the Muddy River
10 deficit and the amount of carbonated pumping, would you
11 see such a strong correlation?
12 A. Well, you'd have to -- I'm not sure how -- this
13 is a hypothetical.
14 Q. Yeah, it is.
15 A. Right? And --
16 Q. That's why I said it was open-ended.
17 A. Okay. Certainly is, no doubt about that word.
18 If we pretend that there is no alluvial
19 pumping, we would see something similar I would think.
20 Q. Okay.
21 A. But not to this magnitude. You would have to
22 recompute this deficit because you would be -- you
23 would see more water in the river. You're not
24 capturing it from the basin fill.

Page 1017

1 Q. Okay. You are assuming that the -- that the
2 carbonates would somehow -- the amount of carbonate on
3 the blue bars would be larger, is that what you are
4 saying?
5 A. I'm not sure what we're assuming at this point.
6 Q. Okay.
7 A. Honestly.
8 HEARING OFFICER FAIRBANK: All right.
9 Ms. Harrison, you're out of time.
10 MS. HARRISON: Thank you.
11 HEARING OFFICER FAIRBANK: You can go ahead and
12 move on.
13 Nevada Cogeneration.
14
15 CROSS-EXAMINATION
16 BY MR. FLANGAS:
17 Q. Good afternoon. My name is Alex Flangas. Just
18 a couple of questions. And I really mean that.
19 A. I appreciate that.
20 Q. I'm focussed on your rebuttal report for a
21 moment, which is SNWA Exhibit 9. At Page 16 and 17,
22 there is a statement that is made, that was summarized
23 a couple times here today by Ms. Drici that the current
24 production wells in the Black Mountains area are

Page 1018

1 probably not within the Lower White River System, and
2 the boundaries should probably be adjusted. So, in
3 some ways I would focus this to Ms. Drici.
4 But my first question is the report was signed
5 by Mr. Burns and Ms. Drici. Did you both reach that
6 same conclusion?
7 MR. TAGGART: Objection, that mischaracterizes
8 the evidence. And witness's name is Drici.
9 MR. FLANGAS: I'm sorry.
10 MR. TAGGART: You mischaracterized the
11 testimony.
12 HEARING OFFICER FAIRBANK: The objection --
13 just so I can make it clear so that those that are
14 attending or viewing the hearing remotely, so the
15 objection is that it mischaracterizes the testimony.
16 MR. TAGGART: Yes. The question was that the
17 testimony was that the boundaries should change. I
18 don't think that's what the testimony was.
19 BY MR. FLANGAS:
20 Q. Let me ask Ms. Drici.
21 Ms. Drici, earlier today didn't you say the
22 boundary was not accurate?
23 ANSWERS BY MS. DRICI:
24 A. I said it may not be. The analysis I performed

Page 1019

1 indicates that the production from the Black Mountain
2 area, according to the analysis, it appears not to
3 effect water levels at EH-4.
4 To make that determination that production
5 should not be in the Lower White River Flow System, I
6 think we would need some additional lines of evidence.
7 Q. Well, the exact statement you made, and just so
8 we're clear, the exact statement you made in the
9 rebuttal report, I'm reading the last -- this is the
10 last paragraph on Page 16, first paragraph, first
11 portion of the paragraph on Page 17 of the rebuttal
12 report.
13 "This indicates that while well BM-DL2 is
14 undoubtedly within the carbonate aquifer of the LWRFS.
15 The current production wells, figure 2-8, are probably
16 not."
17 Now, that means "are probably not" within the
18 carbon aquifer of the LWRFS; isn't that correct?
19 Isn't that what that means?
20 ANSWERS BY MS. DRICI:
21 A. Yes, it is. But, the word probably has some
22 meaning there. It means I'm not sure. The analysis
23 indicates that it may not be in there. But I cannot
24 say, you know, with hundred percent certainty that it

Page 1020

1 is true. I mean to demonstrate things like this, you
2 would need to look at it from different angles. So,
3 this analysis indicates that maybe they are not in
4 there, it's probably other things that we need to look
5 at to confirm it, and honestly, I did not. The only
6 thing I looked at was like the completion of the wells.
7 Like the observation well, BMDL-2, was quite a bit
8 deeper than those production wells, a little bit south
9 of there. Does that have -- is that the explanation?
10 I'm not sure. Maybe there is a structure in between
11 there, somehow. I did not look into it in any more
12 detail than this.
13 Q. So back to my first question, Mr. Burns, did
14 you concur in that analysis.
15 ANSWERS BY MR. BURNS:
16 A. Yes. Yes. We did. Yeah, this is our
17 analysis.
18 Q. And were there any other hydrologists that
19 reviewed this report besides you and Ms. Drici that
20 came to that same conclusion?
21 A. Well, my staff reviewed this. We didn't go
22 through an external review process, no.
23 Q. I don't mean outside the area. I'm talking
24 about your staff of hydrologists that worked on this

Page 1021

1 process?
2 A. Yeah, it was basically Warda and myself and Jim
3 Rogers.
4 Q. Ms. Drici, in reaching part of that conclusion
5 I believe you talked about the P values earlier that
6 were shown on Exhibit A-1 to that report. I think its
7 in appendix A-1.
8 ANSWERS BY MS. DRICI:
9 A. Yes.
10 Q. Was that some of what led you to that
11 conclusion?
12 A. Yes. The P value is larger than the 0.05. But
13 you can also look at the graph. You know, as compared
14 to the others, it appears that in figure A-3, despite
15 the production from those production wells, it appears
16 that if it causes any water level decline at EH-4, it's
17 small to none. But I cannot say with certainty,
18 because there is a certain level of uncertainty in all
19 the numbers that we have.
20 Q. Okay. And just so that we're clear for the
21 State Engineer, the production wells we're talking
22 about are EB-2, -5 and -6, correct?
23 A. Yeah, I believe so.
24 Q. Those are the wells that are operated by Nevada

Page 1022

1 Cogeneration Associates?
2 A. Yeah, just south of BMDL-2. The observation
3 well.
4 Q. But the production wells that you referred to
5 that you say are not -- those are the production wells
6 we're referring to, those are Nevada Cogeneration
7 Associates' wells?
8 A. I believe so. I mean I lumped all the
9 production from the portion of the Black Mountain area.
10 That has been included in the Lower White River Flow
11 System by the definition of the boundary there by the
12 State Engineer.
13 Q. Okay. Mr. Burns, do you know that we're
14 talking about EB-5 and -6 and EB-2?
15 ANSWERS BY MR. BURNS:
16 A. I believe so. But, I'd have to maybe --
17 A. (Ms. Drici) It's over there in the appendix.
18 Q. I'm just trying to clarify when we refer to the
19 production wells we're not referring to any other
20 production wells in the Black Mountains area?
21 A. (Mr. Burns) Well, let's take a look.
22 A. (Ms. Drici) I think be in Appendix A.
23 A. (Mr. Burns) Here we go.
24 It looks like the pumping that was EVM-4.

1 Here.
2 A. (Ms. Drici) I think in the first. So, Black
3 Mountain area. We have these three right here. Yeah.
4 EVM. What's this?
5 A. (Mr. Burns) 62 and -3.
6 Q. Thank you.
7 HEARING OFFICER FAIRBANK: Can you say that
8 again, a little more loudly. Difficult to hear what
9 you said.
10 A. (Mr. Burns) EBM-6, EBP-2, EGB-3. Is that
11 right? I'm sorry, I got it wrong. EBM-5.
12 A. (Ms. Drici) here, we have an indication of
13 which ones are the pumping wells. These three. So
14 EBM-4. Sorry. Getting old, can't see.
15 EBM-5, EBM-6, and EBP-2.
16 Q. Thank you.
17 A. (Ms. Drici) you're welcome.
18 Q. You didn't work with anyone from Nevada Co
19 General. This was an independent analysis; isn't that
20 correct?
21 ANSWERS BY MR. BURNS:
22 A. That's correct.
23 Q. There was entirely your analysis, Southern
24 Nevada Water Authority; isn't that correct?

1 Q. And what areas would those be?
2 A. The only area I'm aware of is to the north, a
3 portion of Coyote Springs Valley where Bedrock has some
4 wells. I think pumping those won't impact the
5 carbonate system.
6 Q. Okay. Thank you.
7 HEARING OFFICER FAIRBANK: Nevada Energy.
8 Nevada Energy.
9
10 CROSS-EXAMINATION
11 BY MS. CAVIGLIA:
12 Q. So we started looking at some of your analyses,
13 and tried to look at how they work together. Starting
14 on slide 17, this is for Ms. Drici, please.
15 And Justina Cavaglia on behalf of NV Energy?
16 So, when we look at slide 17, we focused on
17 2015 and it looks like there was a 1.7-foot drawdown
18 forum and EH-4 from pumping that year. Is that about
19 accurate?
20 ANSWERS BY MS. DRICI:
21 A. Which figure?
22 Q. Oh, I'm sorry. On the lower one. So the lower
23 one where California Wash is pumping, it looks like
24 there is about a 1.7-foot drawdown from 2015?

1 A. That's correct.
2 Q. You don't have any contractual relationship as
3 far as working on this, with any other engineers or any
4 outside consultants working with Nevada Cogen; is that
5 correct?
6 A. That's correct.
7 MR. FLANGAS: I have no further questions.
8 Thank you.
9 HEARING OFFICER FAIRBANK: Muddy Valley
10 Irrigation Company.
11 MR. KING: No questions.
12 HEARING OFFICER FAIRBANK: Seeing no questions.
13 Bedrock?
14
15 RECROSS-EXAMINATION
16 BY MS. URE:
17 Q. Hello again. So I'm Tracy Ure representing
18 Bedrock. And I just have a few quick questions for
19 you.
20 Do you believe that it is possible to pump from
21 an alluvium aquifer within the proposed Lower Whites
22 River Flow System boundary without causing a one-to-one
23 impact on the Muddy River?
24 A. In certain areas.

1 A. Yeah, approximately.
2 Q. Okay. And it looks like on Page 28, there is
3 probably about 400 acre-feet of pumping that year,
4 based on the information that you've provided?
5 A. Okay.
6 Q. Now, looking at Page 16, looking at the effects
7 of EH-4 on discharge at Moapa gage, with this level
8 1.57. Yeah that's it. And it looks like if you
9 compare the two if you multiply the 1.57 by the 1.7,
10 you get roughly .267 CFS at the Warm Springs West gage,
11 if we do the math correctly. Is that correct, roughly?
12 MR. TAGGART: Objection as to clarity. I don't
13 think the question's clear.
14 HEARING OFFICER FAIRBANK: The question, I
15 guess is do you understand the question that is being
16 asked?
17 MS. DRICI: No, I don't.
18 BY MR. CAVIGLIA:
19 Q. Okay. So, we'll go back it 17.
20 So you would agree that there is a 1.7-foot
21 decline?
22 ANSWERS BY MS. DRICI:
23 A. Yes, approximately.
24 Q. -- vertically?

Page 1027

1 Q. Okay. So when we use that number based upon
2 your curve on Page 16 with your trend line, so, a
3 1.7-foot drop times by the 1.57 slope would
4 approximately be about a .267 CFS in decline if we used
5 the numbers from that, that you used in this graph?
6 A. Okay. I can't calculate in my head but I trust
7 you. You used a calculator?
8 Q. We did.
9 A. Okay.
10 Q. We used a calculator.
11 So looking at that and then looking at the
12 total contribution to the Warm Springs decline and
13 looking at Page 22 or slide 22, it looks like with the
14 ratios that are in there, which is a .78 on average,
15 and that's the ratios from Warm Springs West flow to
16 total Muddy Springs discharge.
17 A. Okay.
18 Q. When we look at that if you apply that ratio to
19 .267 CFS?
20 A. Okay.
21 Q. You get 3.42 CFS in discharge from California
22 Wash or from --
23 So you get a total discharge, or so the total
24 Muddy Springs recharge discharge for that figure would

Page 1028

1 be three point, sorry looking back at our math. 3.42
2 CFS. Would that be approximate, correct?
3 MR. TAGGART: Objection, again, not clear what
4 the question is. Whether it's a statement or a
5 question.
6 HEARING OFFICER FAIRBANK: I agree. I was
7 having a difficult time following the question as well.
8 Ms. Caviglia, please restate the question.
9 BY MS. CAVIGLIA:
10 Q. So if we compare on Page 17 to 16 with the
11 1.7-foot decline, and we use your numbers, and there is
12 -- would you agree that that would -- if we used your
13 numbers it would be a .267 CFS decline. Decrease in
14 what Warm Springs West if we compare the two charts,
15 for the same.
16 A. The correlation between the Spring and EH-4?
17 Q. Yes.
18 A. -- the one with the correlation. 17 is it.
19 That one.
20 Okay. Just taking 1.7. I have to use a
21 calculator.
22 MR. TAGGART: Again, we're going to object
23 because I have no idea what the question is. If the
24 witness understands the question, she might want to

Page 1029

1 answer it, fine. But I have no idea what this question
2 is.
3 HEARING OFFICER FAIRBANK: I believe the
4 witness understands the question, but I --
5 MS. DRICI: So far.
6 HEARING OFFICER FAIRBANK: But I observe --
7 your objection is duly noted.
8 ANSWERS BY MS. DRICI:
9 A. Can you say that again?
10 Of the 1.7 --
11 Q. So back on Page 17 it looks like there is --
12 according to your numbers in your multiple linear
13 regression model, there is a 1.7-foot reduction from
14 the 2015 pumping in EH-4.
15 A. Okay.
16 Q. If we take that 1.7-foot reduction, and we
17 apply it to the trend line that you've provided on Page
18 16, our math shows that that would -- result in a 0.267
19 CFS?
20 A. Yes.
21 Q. Reduction?
22 A. That's correct.
23 Q. Okay. And then looking at Page 22 or we'll do
24 24. And we're looking at the ratio 0.76 from Warm

Page 1030

1 Springs West to Muddy River Spring area. Okay. And if
2 you apply that ratio to .267 CFS?
3 A. Okay.
4 Q. We get approximately 3.42 CFS of Muddy River
5 reduction.
6 A. Yeah, I get that about 2.5. But close enough.
7 Q. Okay. So that would be equivalent to
8 2450-acre-feet of Muddy River reduction; is that
9 correct?
10 A. Conversion 2.5 CFS to acre-feet. Yeah.
11 Q. Okay. So, according to your analysis,
12 400-acre-feet of pumping in 2015 in California Wash has
13 caused 2400-acre-feet of depletion in total Muddy
14 Spring River discharge in that year only, is that
15 possible in reality?
16 A. Well, the only way I have to tell you whether
17 it's possible or not, is the analysis I did.
18 MS. CAVIGLIA: No further questions.
19 HEARING OFFICER FAIRBANK: At this time I'll go
20 ahead and open up questions to the State Engineer and
21 Water Resources, Division of Water Resources staff.
22 EXAMINATION
23 BY MS. COOPER:
24 Q. Hi. Christy Cooper for the record.

1 Could you go to slide 35, please. And maybe
 2 you said this, and I missed it, but, for some
 3 clarification.
 4 Where are you getting your values for, your
 5 Muddy River diversions?
 6 Is that like a table, was it table B-1.
 7 ANSWERS BY MR. BURNS:
 8 A. Yeah.
 9 Q. C-3?
 10 A. B-1. Surface water diversions above the Moapa
 11 -- Muddy River Moapa gage in the Muddy River Springs
 12 area.
 13 Q. Okay. So, to follow up, just so I understand,
 14 if its B-1, and say in 2017 cumulative between Nevada
 15 Energy diversions and the Moapa Valley Water District
 16 diversions was 126. Is that why the line is flat, are
 17 you saying none, or how is that?
 18 A. It may be typographical. Because it looks --
 19 maybe the line might be on top of a little sliver of
 20 blue. If I think I understand what you are saying.
 21 But, there should be blue in 2017 on this chart.
 22 Q. Okay. Yeah, it's small. And then subsequently
 23 after that like in 2018, when it went up to 802, that's
 24 why you see it opening up a bit more?

1 A. Yes.
 2 Q. What transmissivity value did you use in your
 3 MLR analysis?
 4 A. The MLR does not require any transmissivity
 5 analysis.
 6 Q. Okay.
 7 A. It's just a tool to break down a response to
 8 several stressors. And because the carbonate aquifer
 9 behaves like a confined which means the linear
 10 behaviors you can just like take different stressors,
 11 calculate their effects and then add them up, and you
 12 get the composite response. In this case we're doing
 13 that but in reverse. So we start from the EH-4 water
 14 levels time series rears and we break it down into
 15 responses from different stresses.
 16 Q. Okay. And table 6-1, let me see what page that
 17 was in there. It was where you came up with all the
 18 ratio numbers. Thank you.
 19 Is there a reason that you only went through
 20 2012 in the analysis?
 21 A. Yes. The reason was that those were the only
 22 years for which we had estimates of ET. Because ET is
 23 a loss above the gage. And it needs to be added back
 24 into the reading of the Moapa gage, along with the

1 A. Correct.
 2 Q. Okay. Just because I was trying to count on
 3 the Y axis and the secondary. If there was some kind
 4 of -- I couldn't really follow which one that you were
 5 saying was in the presentation if I were to --
 6 A. At this scale, 15,000-acre-feet, that that
 7 126,000, I'm sorry, 126-acre-feet is hard to see.
 8 Q. Okay. I did have another question. Thank you
 9 for clarifying that one.
 10 Specific to the basin fill monitor wells in
 11 Coyote Spring Valley, have you seen the decline that
 12 you've observed from -- in the carbonate wells from
 13 2016 to present?
 14 A. There is -- I haven't looked recently. I
 15 remember Rick Waddell, yesterday, brought up CSV-3, is
 16 my recollection, and thought he saw a decline or some
 17 influence, is my recollection. I did not look at those
 18 wells, so, to observe this decline.
 19 Q. Okay. So you are not sure if they are actually
 20 going down?
 21 A. I'm not prepared to say. I'd have to look.
 22 Q. Okay.
 23 And Ms. Drici?
 24 ANSWERS BY MS. DRICI:

1 diversions, and the carbonate -- I mean the alluvial
 2 production upstream to recompose the total water volume
 3 that's coming up below the springs area. Because we
 4 don't have any other way to measure how much water
 5 total is coming into the MRSA discharge area except
 6 from the reading at the Moapa gage on the river. And
 7 like I said before, under predictable conditions, it
 8 was easier because you didn't have any of these losses
 9 except for ET. So if you took the January measurement
 10 when ET is low negligible, then the total discharge to
 11 the MRSA area would be equal to the measurements at the
 12 Moapa gage. Does that make sense?
 13 Q. Uh-hum. So, maybe hypothetically, if you were
 14 to assume like an average ET or something similar, that
 15 has been since 2012, do you think that if you did the
 16 calculation with the pumpage from 2013 to 2018, would
 17 your ratio change?
 18 A. I think the ratio stays the same as long as you
 19 know you have flow at Warm Springs West. It's --
 20 because there is a linear relationship between that
 21 spring discharge and the total discharge. It's the
 22 slope of that line. Unfortunately, you know like I
 23 said, I had to estimate the total discharge.
 24 So, if you plot, if you plot those values on

1 the X axis, one on the Y axis you do see a linear trend
2 but the scatter is significant that you cannot figure
3 out what that slope is exactly. That's why I went back
4 to the measurements made by Eakin. And used that ratio
5 as an approximation. Because that's the cleanest data
6 point that we have along that line.

7 MS. COOPER: That's all. Thank you. That's
8 all for me. Maybe.

9
10 EXAMINATION
11 BY MR. BENEDICT:

12 Q. Jon Benedict for the record.

13 I'd like to go to the slide 10, please, from
14 your presentation.

15 So if we back up to CSVM-4, there was some
16 discussion about the quality of those data with respect
17 to the transducer.

18 I just want to make sure I understand what
19 those data are and how they were used, if possible. I
20 know that on this plot of CSVM-4, I think the blue dots
21 are manual measurements and the green lines are
22 transducer?

23 ANSWERS BY MR. BURNS:

24 A. That's correct.

1 know?

2 A. Off the top of my head, generally all of our
3 wells that we monitor have are equipped with
4 transducers. Now, I should say when we set the
5 transducer, we know set depth, we make a manual
6 measurement at that time. And from that point on, we
7 can account for a drift in the transducer and we can
8 account for any stretch in the cable, adjust that
9 record to those manual measurements, which are good to
10 about a hundredth of a foot.

11 With respect to our wells, I don't have a count
12 for you, but, it's our practice to install transducers
13 in all of them.

14 Q. But can you use the manual measurements to
15 correct any drift or error in those?

16 A. If it needs it.

17 Q. Okay.

18 A. They are really used almost as a calibration in
19 some respects. You have a manual measurement but
20 calibrated E tape, and that is -- so we can compare
21 that measurement with what the transducer is reading.
22 And if we find that it's maybe the cable slipped, maybe
23 it's stretched when it's new, those are instances which
24 aren't frequent but those are instances, where you

1 Q. So in the correlations and various analyses
2 that were done, which were used? Were the quota
3 fusion. Could you describe which data were used and
4 how?

5 A. For the -- yes, so for correlation analysis,
6 both were used. So for a given month you will have a
7 mean daily value. You will have maybe a periodic
8 measurement as well. And those are averaged. So value
9 for that month. And these are correlated with either
10 in our report, EH-4, or MX-4.

11 Q. Do you have a sense of which are likely to be
12 more accurate or less accurate, based on those issues
13 that have been described?

14 A. I believe the periodic measurement would be
15 more accurate. But I see really that they plot --
16 better put on my spectacles. They plot pretty much on
17 top of each other. So I wouldn't expect that one would
18 -- I think they'd be approximately the same.

19 Q. Do -- and this is another question I don't have
20 an answer to and maybe you can help me with because I
21 haven't looked at all the data recently. But were all
22 the wells employing transducers or were there some that
23 were only water level measurements? What was of the
24 distribution of those data that were collected? Do you

1 might correct that continuous record. To get it back
2 on the observed, what we call the observed periodic
3 measurement.

4 Q. Okay. Thank you.

5 And another question, then on the actual data
6 for CSVM-4. The response in this hydrograph has been
7 suggested to be attenuated, and maybe to have lags in
8 it based on some of the work that's been done here.

9 And I wonder if you would provide an opinion on -- if
10 that tells us anything about the recharge and/or the
11 pumping in connection with respect to the fact that
12 recharge may be coming from somewhere else rather than
13 where the pumping comes from, and yet what I think I'm
14 hearing you saying based on the statistics is that the
15 recharge lag and the lag in the pumping are similar.
16 Is that wrong, or is that --

17 A. I think they are similar because when we look
18 at, for example, regression analysis for that well,
19 which is on the next slide, we see that CSCM-4 or EH-4.
20 EH-4, you know, represents the recharge in that record
21 that represents pumping in that area or elsewhere as we
22 find out now. So to the extent that that well is
23 correlated with the other well, we find that
24 connection.

1 When we have a correlation factor of maybe .85,
2 I'm sure. I'd have to calculate but this is R Squared,
3 but it's significant.

4 And I guess maybe, you asked about the lag.

5 Q. I was just curious because if the lags are
6 similar between recharging and pumping, it suggests
7 that those sources are coming from a similar vector, I
8 guess, if you will, potentially. Maybe that's
9 simplifying things too much. I'm trying to get some
10 sense out of what that attenuation might be telling us.

11 A. Well, because we don't know the exact location
12 of the recharge source, the closest is probably the
13 Delamar Mountains to the north.

14 But, with respect to the pumping part, we did
15 the same analysis, and correlated with MX-4, compared
16 those two variables CSVM-4 to MX-4 and we found lesser
17 correlation but still significant. Here it's in
18 R squared of .78. So the square root of that would be
19 our so correlation coefficient. And that's still good,
20 and significant I would say.

21 Of course, that's applying a three -- let's
22 see, our lag here was three months.

23 Q. Okay. Fair enough.

24 Let's see, I'd like to go to slide, I'd say

1 conservative, or maybe overestimate drawdown. Either
2 way, I don't know. But I'm trying to kind of reconcile
3 this concept between not being at steady state
4 therefore water levels would continue to go down with a
5 certain amount of pumping and relationships that
6 show predictive water levels that remain stable with a
7 constant amount of pumpage.

8 A. I think what this particular slide is telling
9 us, is that these particular, the production in this in
10 the MRSA would be causing this level of decline, and if
11 you keep pumping at this level, it could be stabilizing
12 what with respect to this production.

13 But, to look at the whole, the effects of all
14 the other basins, then, you have to look at the next I
15 think it's the next slide where we put everything
16 together. And it doesn't look like it's stabilizing,
17 still going down. In slide 20.

18 No, I'm sorry. Page 19. Slight -- okay. When
19 you put all of them together, their combined effects is
20 making the water level at EH-4, causing it to go down.
21 And if you look at 2017, 2018, you know, you might see,
22 oh, maybe it's stabilizing or going up. But, you
23 cannot base that, you know, equilibrium, just like on a
24 year or two. You have to go, I would just use like

1 maybe slide 19 is a good one.

2 So we had some discussion about reaching
3 equilibrium or steady state. And separate from looking
4 at these correlations, I'm trying to piece these two
5 things together. I note it is that in a lot of these
6 graphs where pumpage is uniform and doesn't change over
7 a period of time, the water levels as well don't show a
8 change, suggests -- and maybe this is common sense, but
9 that relationship which is empirical is really set up
10 so that it's time independent. So in other words,
11 basically you are describing I think a relationship
12 which is almost like steady state.

13 Correct me if I'm wrong. But the way I kind of
14 envision this, at least I look at years from 1999, for
15 example, 2005 wherein the pumping based on this graph
16 is very similar, and the water levels remain pretty
17 much the same.

18 Would you agree with that? At least on this
19 plot?

20 ANSWERS BY MS. DRICI:

21 A. Yeah on this plot. Yeah.

22 Q. So I just wonder how that fits with the concept
23 that equilibrium isn't recently reached. And whether
24 that suggests that is these results are either

1 longer term or longer periods to figure it out.

2 Like in here, I'm not looking at, you know,
3 daily or, you know, earlier we were saying Oh, did you
4 know that Warm Springs West went down to 3.2 yesterday.
5 You have to look at it in bigger terms of time for
6 quite a while before you can say it has stabilized.

7 A. (Mr. Burns) And I might add, if that's okay.
8 That this is a single point EH-4 in the system, so
9 whereas it might look like it's declining or it's
10 stable here, we observe elsewhere in the system that
11 it's not. Like Garnet Valley, for example, some of the
12 other locations we talked about. When you look at
13 figure 19, I'm sorry, page 19, you can see that the
14 production in this area, the Muddy River Spring area
15 actually declined -- I mentioned this earlier -- about
16 850 acre-feet or so. And so we see a response here at
17 EH-4 of some higher value than 2017.

18 So I wouldn't -- I'd caution to use a single
19 point in a system of 1100 square miles as the indicator
20 for whether or not the flow system is in equilibrium.
21 We need to look at the body of evidence, the body of
22 the data that explains other areas and what's happening
23 there?

24 Q. Okay. Thank you.

1 Another question about I guess maybe this is a
2 Garnet Valley question.
3 It's been suggested there may be -- there could
4 be some other source of capture, and that was one that
5 was pointed to, and in thinking about the results of
6 the 1169 test would, you had mentioned, well, if
7 another test were to be done down there, you'd want to
8 have monitoring wells that were between that pumping
9 well, and a given boundary so that you could see that.
10 Would the Garnet Valley well represent such a
11 monitoring well for the 1169 test?
12 Would you expect to see it drawdown in Garnet
13 Valley well where it would show you something about
14 whether there was a boundary nearby you could capture
15 water from?
16 ANSWERS FROM MR. BURNS:
17 A. If I'm following your question, I don't know if
18 -- if that was the production well or a monitor well.
19 Q. If it was a monitoring well. I guess what I'm
20 thinking of is a lot of times when you've got that a
21 monitoring site close to boundary condition you can
22 induce flow from, the water levels tends to be muted or
23 unless, for example, you got a well next to a river,
24 you pump from an area away from that, that water level

1 rather than Muddy River Springs discharge. And first
2 off, what we see based on these correlations is this
3 connection between these areas and the springs. But
4 there is some that think you can also capture a large
5 percentage of this groundwater flow, underflow let's
6 say or flow to somewhere outside the basin.
7 And those are thoughts. I think what is owed
8 to you, is an explanation for where that water is
9 coming from, and where is it going to, through which
10 rocks is this water flowing, to what point is it
11 discharging, is there a commitment on that water if
12 it's leaving the basin. And I didn't see those
13 discussions in any of the stakeholder reports. For
14 those folks that have offered this concept of capturing
15 outflow as opposed to Muddy River Springs flow, that's
16 the extent of conversation -- the extent of the
17 analysis as far as I can tell, just a postulate that
18 it's there, and their wells could capture it. I think
19 you would need to have some at least initially, an
20 explanation for where that water's coming from, like I
21 said, through which is rocks if it's going along what
22 gradient to where, which point, where is it
23 discharging. And then we can really have a sense of
24 how to design the test to see.

1 will be relatively fixed because you're drawing water
2 from the river. Similarly, if you had a boundary
3 condition where you could induce flow, and may be
4 Garnet Valley one would be an example. If you had a
5 boundary condition somewhere down there that you could
6 induce flow, maybe the water levels might not be as
7 large there, compared to other places.
8 So I'm just wondering, if there is anything in
9 the data that suggests whether or not there are other
10 boundary conditions that exist out there, that you
11 could derive flow from based on data we currently
12 have?
13 A. I'm not sure I know the answer.
14 Q. Okay.
15 A. I don't think so. But if we're designing a
16 test, and we had a boundary that we're -- we thought
17 was a boundary, maybe the idea is you put a well on the
18 other side of that boundary, and then that would be
19 more definitive on whether or not -- it would be more
20 definitive about it's character, on whether or not it's
21 a permeable or impermeable. When it comes to
22 groundwater flow in these areas, I'm not sure if that
23 was some of the commentary. There's been some
24 discussion about being able to capture groundwater flow

1 If you are going to capture that outflow.
2 What we've shown today, what we've
3 demonstrated, is there is a hydraulic connection
4 throughout this area, strong hydraulic connection. And
5 we feel if you'll pump in those areas, it will impact
6 the conditions underlying the springs, and therefore,
7 have a proportional effect on the discharge there.
8 MR. BENEDICT: Okay. Thank you.
9
10 EXAMINATION
11 BY MR. SULLIVAN:
12 Q. Earlier, Mr. Burns, you mentioned an estimate
13 that SNWA had done several years ago about 10,000
14 acre-feet bypassing the Muddy River Springs area.
15 Based on the description that you just gave, do you
16 think that -- what is your feeling about that estimate
17 now?
18 ANSWERS BY MR. BURNS:
19 A. Let me make sure we're clear on what the
20 estimate was.
21 It's in, as I recall, Appendix D of our report,
22 issued in 2011 for that hearing.
23 That was a boundary or a Darcy flux
24 calculation, and I don't have the report here.

1 With my recollection, just south of the spring,
2 the spring area in California Wash, and what we're
3 trying to look at is what is the flux in the basin fill
4 there. So the properties we used for the
5 transmissivity, for example, were derived from what we
6 could find for the Muddy Creek formation.
7 Sadly, I guess, none of the those estimates
8 were in that area. So, I'd say the estimate is pretty
9 uncertain.
10 But there was a flux to calculate or there was
11 calculation to determine or estimate the flux through
12 that material at that location.
13 With respect to capturing that water, I think
14 Nevada Power Company back years ago in the early '90s,
15 maybe late '80s, tried to -- they had a well field they
16 put in south of their I guess it'd be south and east of
17 the springs, in the Muddy Creek formation, trying to
18 capture some of that water.
19 And my recollection was that water levels
20 declined over a period of years, and then water quality
21 decreased and they abandoned well field. So I don't
22 think production from that area promising.
23 Elsewhere, in the basin we find because of this
24 connection, I find it would be hard to construct a well

1 with those questions. But I do think demonstrating the
2 impact of depleted flows at the Muddy Valley Irrigation
3 Company is important. One of the -- I can't remember
4 which letter, but, I believe it was -- actually I can
5 tell you. One of the letters about capture of Muddy
6 River flows, and spring flows. I think it relates to
7 that to that.
8 C. It's actually C. C as I paraphrased here
9 in conclusions Groundwater Production and Capture of
10 Muddy River Springs and River Flows.
11 The costs, impacts in terms of cost don't
12 relate to this. But the analysis, that illustrates the
13 depletion on this river as result of capture of Muddy
14 River and spring flows I think is pertinent.
15 Q. So I guess just as a quick follow up, so based
16 upon that, is that an inference that SNWA may be
17 amenable to financial mitigation of conflicts if SNWA
18 decreed Muddy River surface water rights are depleted.
19 MR. TAGGART: I'm going to object. I thought
20 this case was about facts and not about management.
21 HEARING OFFICER FAIRBANK: You presented the
22 evidence, Mr. Taggart.
23 MR. TAGGART: You specifically told us this was
24 not a conflicts hearing. And we submitted that

1 in carbonate system in these locations we've looked at
2 that would not have some impact to the Garnet system
3 and water levels in the spring area. And as we've
4 shown there is that proportional effect to the
5 discharge.
6 So, I can't think of a well location that that
7 I would put a well thinking I'm just going to capture
8 outflow or a large percentage of it.
9 Q. Okay. Thank you.
10
11 EXAMINATION
12 BY HEARING OFFICER FAIRBANK:
13 Q. I have a question for Mr. Burns.
14 And I'm going to refer to page 39 of your slide
15 show, which is also Exhibit 7, page 7-5. 7.2. I
16 believe the original report was filed in July of this
17 year.
18 And I guess one of the questions I had was can
19 you explain how assigning a dollar value could be
20 analyzed depletion of the Muddy River ICS credits
21 relates to the specific questions that we're set forth
22 in Order 1303 listed by the State Engineer?
23 ANSWERS BY MR. BURNS:
24 A. I think these last two columns don't associate

1 evidence before you made that clear.
2 HEARING OFFICER FAIRBANK: The evidence was
3 presented today, Mr. Taggart. Thank you.
4 ANSWER BY MS. PELLEGRINO:
5 A. I'll answer the question.
6 We are one shareholder in the Muddy Valley
7 Irrigation Company and we cannot speak on behalf of
8 what is appropriate mitigation to the Muddy Valley
9 Irrigation Company.
10 There are many options which we think would be
11 amenable to us, the least favorable of which would be
12 financial mitigation. Because this is one of the most
13 valuable resources to Nevada and Southern Nevada,
14 considering that our water supply is there for seven
15 out of every ten Nevadans and about three-quarters of
16 the economic output of our state.
17 HEARING OFFICER FAIRBANK: Thank you.
18
19 EXAMINATION
20 BY ACTING STATE ENGINEER WILSON:
21 Q. Tim Wilson for the record.
22 I think my staff asked most of the questions as
23 usual, which is great. But I do want some
24 clarification on the Black Mountains area.

1 One of your recommendations is that you felt
2 the Nevada State Engineer's recommendation on the Lower
3 White River Flow System boundary was appropriate. Is
4 that still your testimony today?

5 ANSWER BY MR. BURNS:

6 A. It is. I think it is appropriate. But, what
7 I'm also saying or what we're also saying is that it's,
8 as Colby mentioned this morning, if there is prospects
9 of moving production from one part of an adjacent basin
10 to the boundary of Lower White River Flow System, and
11 particularly this boundary which I think a little
12 uncertain, we think those applications to change those
13 points of diversion in that regard should be
14 scrutinized. And by that I mean some sort of analysis,
15 or more definition about the boundary itself and what
16 the impacts of new points of diversion would be. I
17 suspect that's part of your process anyway.

18 But we think that circumstances like that are
19 concerning to us. And I think it should be to others
20 in the basin, in the flow system.

21 THE STATE ENGINEER: Thank you. I appreciate
22 that answer.

23 I think I'm going to let the rest of my
24 questions go, let you off the hook.

1 about alluvial pumping. And I wanted to ask about the
2 red line here, which shows the MR flow deficit. And
3 when I look at that line from 1993 through roughly
4 2003, it appears to me that that red line tracks the
5 total production in the Muddy River Springs area wells.
6 But then after Coyote Spring Valley pumping was
7 initiated 2005, and then on through 2018, the deficit
8 continues to track the non Coyote Spring Valley
9 pumping.

10 Would you agree?

11 ANSWERS BY MR. BURNS:

12 A. I'm sorry. Last tracking part I didn't catch.

13 Q. Red line is the Muddy River flow deficit?

14 A. Got that.

15 Q. Okay from 1993 to 2003. That line roughly
16 tracks the same way that the total red line alluvial
17 and carbonate pumping does. Then in 2005, Coyote
18 Springs production, Coyote Springs Valley production
19 begins in the carbonate. But that line to me, the red
20 line looks like it continues to track the non Coyote
21 Springs Valley production. Would you agree?

22 A. I agree.

23 Q. Doesn't this suggest that groundwater pumping
24 of Coyote Springs Valley is not tied to pumping from

1 MR. BURNS: Thank you. It's Friday.

2 HEARING OFFICER FAIRBANK: Okay. Let's go
3 ahead and take a ten-minute break. We'll get back on
4 the record at about five minutes to 3:00

5 So, let's take a ten-minute break we can get
6 back on the record.

7 Thank you.

8 (Recess.)

9 HEARING OFFICER FAIRBANK: Okay. So let's go
10 ahead and get back on the record.

11 Mr. Herrema, you asked how much time you would
12 have.

13 Six minutes. So we're going to go ahead and
14 open it up for the participants for additional
15 questions. Participants will have six minutes.

16
17 RE-CROSS-EXAMINATION

18 BY MR. HERREMA:

19 Q. Brad Herrema on behalf of CSI, for the record.

20 And Ms. Harrison was asking some questions
21 about slide 37. Would it be possible to bring that
22 back up? That is figure 54, from the Water Authority's
23 Exhibit Number 7. Thank you.

24 So Ms. Harrison was asking some questions,

1 the Muddy River Springs area, to the Muddy River
2 Springs area?

3 A. No. When I presented this slide earlier
4 mentioned when you create a stacked bar chart like
5 this, you have to pick an order. I picked it in four
6 areas that are closest in proximity and that sequence.
7 But really, this would infer that. But our MLR
8 analysis indicates that Coyote Spring pumping is indeed
9 cause and affects at least EH-f which in turn had a
10 proportional effect as I said to the spring discharge.

11 And that effect was measured during and after
12 the test.

13 Q. Okay.

14 A. Pederson Springs and Warm Springs West.

15 Q. If Coyote Springs Valley pumping affected the
16 flow deficit, wouldn't you have expected it to peak in
17 2012 and 2013? Wasn't there up to 5000 acre-feet per
18 year of pumping in Coyote Springs Valley at that time?

19 A. Right. I mean, yeah, if you reached steady
20 state in that quick a time, you would expect that.

21 But, Warda presented earlier, we have not captured all
22 of that, the equivalent volume of discharge from the
23 springs or ET in that area.

24 Q. Okay. So then doesn't that mean that there is

Page 1055

1 not a one-to-one relationship between pumping and
2 Coyote Springs Valley and spring flow into the Muddy
3 River?
4 A. It doesn't mean that. It means in the future,
5 so when we talk about one-to-one from the carbonate
6 system, we're talking about a long time from now. What
7 we've measured are influences at Pederson and Warm
8 Springs.
9 Q. Okay. But is there then a time lag between the
10 pumping and the impacts at the springs?
11 A. There is a response lag.
12 Q. Do you have an estimate of how long that is?
13 A. Well, it's how quickly the signal from a
14 pumping center affects EH-4. Well, affects the
15 groundwater conditions at the spring locations.
16 Q. Do have you an estimate of what that time is?
17 A. Well, Warda mention earlier --
18 MR. TAGGART: Object as to vagueness. In
19 carbonate or alluvial, lag of carbonate or alluvial or
20 a lag in any pumping.
21 HEARING OFFICER FAIRBANK: Your objection was
22 objection as to vagueness, as between carbonate and
23 alluvial or the combination there.
24 BY MR. Herrema:

Page 1056

1 Q. Carbonate.
2 ANSWERS BY MS. DRICI:
3 A. Okay. Well, what I can tell you is from the
4 Order 1169 pumping test --
5 Q. I'm sorry, ma'am. I don't have a lot of time.
6 Do you have estimate of what the time is, in
7 either days or months or years?
8 A. The response gets everywhere really quickly,
9 within a day, but not to the full extent of the effect
10 of pumping. That's what takes time. At first when you
11 are producing from a well, your mostly picking up water
12 from storage, and it takes a while for the cone of
13 depression to extend and grow, and get deeper, and
14 start capturing water from the springs, for example.
15 Q. So you are saying there's immediate impact but
16 not a one-to-one impact right away?
17 A. Yeah. The one-to-one then --
18 Q. Can I ask a question then, about if there is
19 this time lag if we look at -- or it's not yet a
20 one-to-one relationship if we look at slide 8, the
21 hydrograph of the EH-4 well.
22 When do you think the recovery starts on this
23 particular hydrograph?
24 ANSWERS BY MR. BURNS:

Page 1057

1 A. When does it start?
2 Q. Yes.
3 A. I can tell you when I think it ends, which is
4 about 2016. But it starts -- recovery starts when the
5 well stops, the well stops pumping, recovery starts.
6 Q. And you think that this hydrograph shows the
7 recovery starts at that red line?
8 MR. TAGGART: Objection to red line. Which
9 one.
10 BY MR. HERREMA:
11 Q. There is a red dashed line on EH-4 hydrograph,
12 somewhere right after 2013.
13 A. I think the recovery started, let's see.
14 What's complicated about 2013 record recovery started
15 when the seasonal decline starts. And so the seasonal
16 decline after, you know, the small -- here. You can
17 see that the magnitude of that decline is less than in
18 other years, so I think what's happened here, is that
19 the actual recovery has muted the seasonal decline.
20 And then on the way up to the seasonal high, you can
21 see it keeps going and it resumes this larger amplitude
22 in subsequent years to about 2016, first quarter is
23 what I estimate.
24 MR. HERREMA: Thank you.

Page 1058

1 HEARING OFFICER FAIRBANK: Fish and Wildlife
2 Service?
3 Seeing no questions.
4 National Park Service.
5 MS. GLASGOW: No questions.
6 HEARING OFFICER FAIRBANK: Seeing no questions.
7 Moapa Band? Seeing no questions.
8 Moapa Valley Water?
9 No questions.
10 Lincoln County/Vidler?
11 MS. PETERSON: Yes, sir.
12
13 RE-CROSS-EXAMINATION
14 BY MS. PETERSON:
15 Q. Thank you.
16 Karen Petersen again. This question is I
17 believe for the Ms. Pellegrino and/or Mr. Burns, since
18 both of you have talked about what your recommendation
19 is to the State Engineer, your request the State
20 Engineer. And I had heard Ms. Pellegrino state this
21 morning that there should be continuing management of
22 adjacent basins, and a jointly managed boundary, and
23 that that should be in the next phase.
24 And then I heard -- or on the slides we just

1 talk about applications on the adjoining basins should
2 be scrutinized. So i want to know what exactly SNWA's
3 position exactly, what the proposal is, because I don't
4 understand it.

5 ANSWERS BY MS. PELLEGRINO:

6 A. We're trying to be very respectful of the fact
7 that there is at least two phases of this process. The
8 first, which is technical fact-gathering phase,
9 specific to these four questions. And the next phase
10 which we're told is where all of the water management
11 decisions will be discussed.

12 The question of what the boundary should be,
13 the point I was trying to make is that from a
14 hydrologic connectivity standpoint, and the range of
15 effects and the degree of connectedness is very
16 technical in nature. But making a recommendation on
17 the boundary implicates a lot of water management
18 decisions and to put a finer point on it. Sort of the
19 rules for how water can move around within the jointly
20 managed basin, have a very real and immediate impact to
21 what that boundary should be.

22 Because there are areas where there is a degree
23 of connectivity. And if water is allowed to move
24 freely through the basin, you could potentially

1 impacts within the basin.

2 So I guess my point was, prudent management
3 would suggest that the boundary doesn't matter as much
4 as the way the five basin area and the adjacent basins
5 are managed.

6 Q. And would one the adjacent basins you're
7 talking about be Kane?

8 A. Yes.

9 Black Mountains.

10 Q. And I don't know exactly who this question goes
11 to. But, it relates to page 4.2 of Exhibit 7, SNWA
12 Exhibit 7.

13 And you're talking about precipitation data
14 from Winograd, 1998, on that page. Is that you,
15 Mr. Burns?

16 ANSWERS BY MR. BURNS:

17 A. I'll take it. Would you point me to that.

18 Q. Yes, it's page 4-2. And then like the second
19 paragraph, annual precipitation data, do you see that?

20 A. Yes.

21 Q. Okay. The next line down says winter
22 precipitation in the Lower White River flow System is
23 understood be dominant source of local recharge,
24 Winograd. Do see all that?

1 accelerate impacts by taking it from somewhere that's
2 less connected and putting it somewhere that's more
3 connected.

4 So, what we were saying is, for now, we've
5 presented the hydrologic evidence, and we think the
6 boundaries should stay the same pending the water
7 management decisions that will come in the next phase,
8 presumably about how water moves among and throughout
9 this jointly managed area.

10 Q. Is the jointly managed area, just the Lower
11 White River Flow System?

12 A. Area that the State Engineer has drawn --

13 Q. Yes?

14 A. -- a boundary around today.

15 Q. Okay. You are not saying like Kane should be
16 jointly manage with the Lower White River Flow System,
17 if for some reason Kane doesn't say in the Lower White
18 River Flow System?

19 A. Well, and that's where the scrutiny on the
20 boundary occurs that we talked about. The boundary of
21 the Lower White River Flow System doesn't necessarily
22 need to encompass anything that has any degree of
23 hydrologic connectivity. And wherever we choose to
24 draw that line, there is the potential to negative

1 A. I do.

2 Q. And then winter precipitation is defined as
3 October through June by Winograd for the Spring
4 Mountains in Southern Nevada, right?

5 A. Correct.

6 Q. Okay. And then later on, in the next
7 paragraph, on the next paragraph after that, when you
8 talk about the winter months, you've changed it to
9 October to March, October through March as the winter
10 season.

11 A. Okay.

12 Q. So decreased the winter precipitation, and
13 increased the summer precipitation. Do you see that?

14 A. The decrease -- I'm sorry. Say again.

15 Q. If you go to the next paragraph?

16 A. Right. I'm on Division for winter season
17 precip?

18 Q. Go down to the bottom, closer to the bottom?

19 A. Figure 42.

20 Q. And even above that you are defining winter
21 months as October through March?

22 A. Yes.

23 Q. Do you agree?

24 So you deviated from Winograd?

Page 1063

1 A. Correct.
2 Q. The source that you referenced?
3 A. Correct.
4 Q. What was the reason for doing that?
5 A. The reason is based on these temperatures, what
6 we -- let's see, April, it's basically what we've
7 observed here or at least recognize the high
8 temperatures in the previous sentence, for April
9 through September. And I think others have used
10 October through March. But I can't recollect who that
11 reference was.
12 Q. And --
13 A. Rick Waddell brought it up the other day. But
14 I don't have a reference here for it.
15 MS. PETERSON: Thank you.
16 Thank you, panel, too.
17 HEARING OFFICER FAIRBANK: City of North Las
18 Vegas.
19 MS. URE: We have no additional questions.
20 HEARING OFFICER FAIRBANK: Saying no further
21 questions. Center for Biological Diversity.
22 RE-CROSS-EXAMINATION
23 BY MR. DONNELLY:
24 Q. Thank you. Patrick Donnelly with the Center

Page 1064

1 For Biological Diversity.
2 Ms. Pellegrino, just to restate, would you say
3 ICS credits are an important component of SNWA's water?
4 ANSWERS BY MS. PELLEGRINO:
5 A. Yes.
6 Q. Does Lake Mead's storage help insure Colorado
7 River Compact define delivery of lower basin water?
8 A. I'm going to help you out because I don't want
9 to get into the law of the river.
10 Q. Indeed.
11 Nor do I.
12 A. But the compact does not define delivery in the
13 State of Nevada, the decree does.
14 Q. Thank you.
15 A. But having more water in Lake Mead keeps us out
16 of shortage, which makes more water available to all of
17 the lower basin water users.
18 Q. Thank you.
19 In a general sense are flows in the Colorado
20 River based on among other factors drought?
21 A. Yes.
22 Q. Mr. Burns, in a general sense are flows in the
23 Muddy River variable based on drought?
24 ANSWERS BY MR. BURNS:

Page 1065

1 A. Yes.
2 Q. Have we seen significant drought trends over
3 the past 20 years spring discharge in the Muddy River?
4 A. I don't think so. The drought -- I think
5 because it's a regional spring discharge, it's less
6 sensitive to immediate changes, because of drought.
7 Q. Thank you.
8 Ms. Pellegrino, you said the water for the dace
9 and the in water river are related, correct?
10 ANSWERS BY MS. PELLEGRINO:
11 A. Yes.
12 Q. Thus isn't it true the fate of the dace is tied
13 to your ability to store Muddy River ICS flows in Lake
14 Mead?
15 A. I think you've tried to ask this question
16 twice. Our activity related to ICS has no impact on
17 the dace.
18 Q. I guess I'm asking the reverse question.
19 Does the dace and its thriving in the Muddy
20 River Spring area have an impact on your ability to
21 store ICS?
22 A. Not tributary conservation ICS. Because that's
23 the surface flow of the Muddy River making it to Lake
24 Mead, which is unimpacted by the status of the dace.

Page 1066

1 It's impacted by the amount of water in the Muddy
2 River.
3 Q. Which is related to the dace?
4 A. Correct.
5 Q. Okay. We can leave it at that?
6 A. Okay.
7 Q. Mr. Burns, you stated that alluvial pumping has
8 a one-to-one relationship with river flows?
9 ANSWERS BY MR. BURNS:
10 A. That's my opinion, yes.
11 Q. And I believe you said carbonate is approaching
12 one-to-one or will approach one-to-one over a long
13 period of time?
14 A. I believe over a long period of time.
15 Q. In your questioning from City of North Las
16 Vegas earlier, is it true that you said over time as
17 waters levels in EH-4 carbonate system decline, I would
18 expect a proportional decline in spring flow?
19 A. Yes.
20 Q. And as you said in my questioning earlier,
21 declining spring flow results in a decline of river
22 flow, correct?
23 A. Yes.
24 Q. And you also said that we have to stay above

1 3.2 to maintain river flows, correct?
2 A. I guess by -- depends on what your datum is,
3 what your reference point is. We want to -- if it's
4 acceptable. If conflicts are acceptable, these impacts
5 are acceptable, then yes. Could you repeat the
6 question. You lost me.
7 Q. Yeah. I believe --
8 A. Lost myself.
9 Q. I believe earlier questioning, you stated we
10 need to keep flows Warm Springs West at 3.2 or higher
11 in order to maintain river flows and fulfill senior
12 water rights on the Muddy River?
13 A. What I mean to say is to make sure that the
14 senior rights are in full, we can't have depletions on
15 the river flow. Now, if the spring flows are reduced
16 by pumping, then by definition the river flows will be
17 too.
18 Q. Okay.
19 A. I don't know if that helps you --
20 Q. I think that's what I was trying to get at.
21 And then so given that we're at 3.2 now, or
22 close to I think we'll say, somewhere in the ballpark
23 of that. I understand the daily variations and so
24 forth. But and you say carbonate withdrawals will in

1 question?
2 Q. Are the actions or activities that you describe
3 which would be necessary in to order make 4- to 6000
4 the sustainable level, are those happening right now or
5 are those new things we would have to start doing?
6 A. I think that's the point of this hearing is to
7 figure out what those actions are. But I think there
8 is also an opportunity among stakeholders to
9 potentially solve a problem.
10 MR. DONNELLY: Thank you.
11 HEARING OFFICER FAIRBANK: Georgia Pacific?
12 MS. HARRISON: I'm thinking about it. But
13 Friday afternoon.
14 So no.
15 HEARING OFFICER FAIRBANK: Seeing no questions,
16 thank you.
17 Nevada Cogeneration?
18
19 RE-CROSS-EXAMINATION
20 BY MR. FLANGAS:
21 Q. Folks. I just to clarify of just one point.
22 Mr. Wilson asked whether the boundary of the Black
23 Mountains area should be changed. I think after
24 listening to Ms. Pellegrino, I'm very clear on your

1 the long term result in discharge capture. Don't we
2 needed to probably cease carbonate withdrawals in order
3 to insure long-term flows stay above 3.2?
4 A. No, I don't think we need to cease carbonate
5 production. I think we can manage the head levels at
6 EH-4 such that the 3.2 CFS flow can be realized over
7 the long term as we said. And that's the 4- to
8 6,000-acre-feet that we think is manageable.
9 Q. I'm sorry, go ahead?
10 A. We also caveat, that with if the impacts that
11 are existing potential future impacts that we expect, I
12 guess, if those are addressed, then we think the 4- to
13 6,000-acre-feet is a manageable amount of water.
14 Q. So it's a manageable amount of water contingent
15 on other actions and other activities?
16 A. That's correct.
17 Q. Have you all defined what those actions and
18 activities are?
19 A. Well, we have not. But they relate to the
20 depletions on the river.
21 Q. Are those actions or activities ongoing right
22 now, or are they new things that need to happen in
23 order to make 4- to 6000 a sustainable level?
24 A. I think these will be -- can you repeat the

1 position, boundaries shouldn't be changed. But if we
2 could clarify certainly we can understand,
3 hydrologically, you don't believe the production wells
4 are hydrologically connected to the Lower White River
5 flow system that we're talking about here, is that a
6 correct statement?
7 MR. TAGGART: Objection as to what production?
8 MR. FLANGAS: Well, I'm sorry.
9 BY MR. FLANGAS:
10 Q. The production wells in the Black Mountain area
11 that we talked about earlier that Nevada Cogeneration
12 owns?
13 A. We think that those -- I think what we're
14 saying is that boundary's uncertain. And more work is
15 needed to figure out if production -- we think if there
16 is connection --
17 Q. Connection. I'm sorry, I didn't hear that?
18 A. Limited. Based on the MLR analysis.
19 Q. Okay.
20 A. But we also recognize that the boundary there
21 is uncertain. And we don't -- we haven't investigated
22 the possible factors that would -- that cause that is a
23 structure, is it the completion of the well. Those are
24 things we haven't looked at in detail. That we think

Page 1071

1 when we talked earlier about scrutinizing points of
2 diversions and changes, those are the types of things
3 that we would -- I would expect to want better
4 understanding of.
5 Q. Okay. That's all. Thank you.
6 A. Thank you.
7 HEARING OFFICER FAIRBANK: Muddy Valley
8 Irrigation Company.
9 MR. KING: No questions.
10 HEARING OFFICER FAIRBANK: Seeing no questions.
11 Bedrock.
12 MR. TAGGART: No additional questions?
13 HEARING OFFICER FAIRBANK: No additional
14 questions.
15 Nevada Energy?
16 MS. CAVIGLIA: No additional questions.
17 HEARING OFFICER FAIRBANK: Seeing no additional
18 questions, I'll open up to Division of Water Resources
19 staff and State Engineer.
20
21 EXAMINATION
22 BY MS. COOPER:
23 Q. Christy Cooper for the record. All right.
24 Almost over. Hang in there.

Page 1072

1 I was going over this 4- to 6,000-acre-feet of
2 carbonate pumpage number in my head. And looking in
3 our order, and appendix B we put this table.
4 Groundwater pumping. Lower White River Flow System and
5 we haven't divvied out alluvial pumping in Coyote
6 Spring and Garnet Valley, but in 2017 there was just a
7 little between Lower White River Flow System Basin
8 pumping 9090 acre-feet total.
9 So, if you could give an estimate as from your
10 4- to 6,000 of carbonate, total, would you say the rest
11 could be alluvial, or do you agree that 9,000 may be a
12 little bit much? Give me your opinion on this total
13 pumpage value.
14 ANSWERS BY MS. PELLEGRINO:
15 A. I think the answer that we made is what is
16 pumped in the carbonate, because that was based on
17 protecting the dace. So, the total amount alluvial and
18 carbonate together that could be pumped is a conflict
19 question. We were trying to avoid the conflict
20 discussion. But, if the alluvium is conflicting
21 one-to-one, you pump whatever you want in alluvium as
22 long as you make the senior hold. Doesn't effect the
23 dace.
24 Q. Okay. So, in the testimony did you guys say

Page 1073

1 that the carbonate and the alluvium pumping, both, have
2 a one-to-one effect?
3 ANSWERS BY MR. BURNS:
4 A. The alluvial for certain. Within the year,
5 that year.
6 Q. On the river, right?
7 A. On the river.
8 The carbonate system, as Warda just said, it's
9 not one-to-one right now. But we think out in the
10 future it will be. Because that's the only discharge
11 in the system to capture. And we -- I guess we'll have
12 future debates on what the outflow that could be
13 captured but that's the other source. My opinion is
14 that there is not a lot of -- there is not significant
15 outflow from this system around these pumping centers.
16 Mainly. I think mainly thinking of Garnet
17 Valley, California Wash and across the Glendale thrust.
18 Dr. Waddell mentioned yesterday about what he feels
19 could be contributing to the discharge at Rogers and
20 Blue Point. But I don't think there is much more than
21 that, honestly.
22 MS. COOPER: Okay. Thank you. No more
23 questions.
24 HEARING OFFICER FAIRBANK: Thank you.

Page 1074

1 EXAMINATION
2 BY MR. BENEDICT:
3 Q. Jon Benedict for the record. I've got two
4 questions. First one, Page 20. Back on the
5 presentation. I apologize for having to go back to
6 that. Just want to make sure I got this.
7 So, residuals are equal to observed minus
8 calculated?
9 ANSWERS BY MS. DRICI:
10 A. Yes.
11 Q. So it's really the difference between the blue
12 and the orange curve, right?
13 A. Yes, it is.
14 Q. They don't look the same. I'm just curious
15 about that. It looks like the residuals are about half
16 of what that distance is. Is that -- am I misreading
17 that? If you look at like 2006, it looks like maybe
18 one foot of residual, but the difference between the
19 two curves looks like about two?
20 The relationship looks good. I'm just curious
21 about the -- I think it's reading residual is.
22 ANSWERS BY MR. BURNS:
23 A. I think it's a scale issue on the axis.
24 MS. DRICI: And --

Page 1075

1 A. So the elevation, on one hand, is two feet; the
2 other, on the residuals is four feet.
3 Q. Oh, okay. I see.
4 A. Probably different case.
5 Q. Okay. Thank you. That clarifies that. Okay.
6 Last question that I have is about these linear
7 relationships. I mean at some point it seems like
8 these relationships can't hold. You've said that, for
9 example, in Warm Springs West, when it flows zero you
10 wouldn't expect Muddy River to have a flow of zero?
11 A. Correct.
12 Q. I mean what's your opinion on how -- to what
13 extent you can apply that relationship to the spring
14 flow? Does it go down to .1 CFS or is it like in the
15 two and three range or what is that curve look like?
16 Is it really linear with a -- so it's like MX plus
17 B-type linear or is it just linear over segments or how
18 does that relationship work at different -- how do you
19 think it works I guess at different ranges or can you
20 apply it?
21 ANSWERS BY MS. DRICI:
22 Q. I think it's linear as long as all the springs
23 are flowing. And I didn't include that in the report
24 because I didn't think of it until later. But if you

Page 1076

1 plot, for example, Pederson Spring discharge versus
2 Warm Springs West, you will see that it is linear. And
3 that relationship between those two. Pederson Spring
4 and the gage is similar to the relationship between
5 Warm Springs West and the total discharge to the MRSA.
6 And the reason they behave that way is because
7 they are all connected to the carbonate aquifer, which
8 will, you know, give them the same, the same head, the
9 same water level. Potentiometric surface goes above
10 the springs orifices all over.
11 And spring discharge is proportional to the
12 head difference, right. And because the difference in
13 elevation in the big scheme of things, is not really
14 that different if you looking at like the total
15 discharge of the MRSA. You could approximate it like
16 one average elevation, to get an idea of how much might
17 be flowing into that area.
18 Q. Okay. So then I think what I'm hearing is your
19 answer would be is it would be linear up into the point
20 when the highest altitude spring went dry. At that
21 point any further losses on any springs it would not be
22 linear. Is that about right?
23 A. Yes, in general. But in this case, because I'm
24 doing the correlation between Warm Springs West and the

Page 1077

1 total, so I would put the elevation at the Warm Springs
2 West as long as we have flow there, the relationship
3 should hold.
4 Q. How about for the relationship between water
5 levels and pumping within the various basins. I mean
6 just -- do you feel like that linear relationship has a
7 limit with which you could apply it?
8 A. You mean the multiple linear regression?
9 Q. Yeah.
10 A. (Mr. Burns) A limit.
11 A. (Ms. Drici) I'm not sure I understand.
12 Q. Well, for example, one of the curves that was
13 looked at was California Wash, and it was shown that
14 400-acre-feet of pumpage caused X amount of drawdown.
15 Would 4000-acre-feet of pumpage there create 10 times
16 as much drawdown, that would be linear relationship?
17 Would that apply?
18 A. I think it should, because drawdown is
19 proportional to pumping, right. So the greater the
20 production from the well, the larger the drawdown.
21 Q. Okay. Thank you.
22 A. You're welcome.
23 ///
24 ///

Page 1078

1 EXAMINATION
2 BY MS. BARNES:
3 Q. Michelle Barnes for the record.
4 Maybe I missed it so if I did please let me
5 know. Were any aquifer parameters beyond connectedness
6 considered within the evaluation?
7 ANSWERS BY MR. BURNS:
8 A. I think they are implied by that analysis. So
9 by that I mean how they are connected is represented in
10 the water level record and response between this well
11 and that well. And so, whatever the properties are
12 between those wells were represented. I'm not sure if
13 you follow or not. But, I guess how a well responds to
14 a stress, implicit in that response are the high draw
15 properties. So if very tight material you have a lot
16 of drawdown. Big change. If it's -- if it's high
17 transmissivity, or lesser drawdown.
18 Q. I guess to further elaborate on that question.
19 I understand what you are saying about inferring the
20 properties based on the connectedness and the
21 relationships. Do you think there is anything to be
22 gained by considering the geology or the aquifer
23 properties in tandem with your analysis, going beyond
24 just your tighter empiricals maybe looking or at some

1 the other analyses we've seen this week combined
2 together?
3 A. Well, yes. I mean our conceptual model is
4 heavily based on what we understand about the
5 geological framework. What these data show is how that
6 framework influences groundwater response or one-level
7 responses to whatever the stress is. And, for example,
8 CSVM-5 banded about this week versus other wells in
9 the structural basin. So I forgot what your question
10 was. Sorry.
11 Q. I think you're getting there. It was more
12 focus is there anything to be gained by considering
13 your analysis and interpretation, and kind of over with
14 the geology and some those aquifer properties that were
15 talked about?
16 A. Yeah, that's, I guess, what I was going to say.
17 So, when we look at the framework in some of which has
18 been postulated in permeable boundaries, we receive
19 across those boundaries a response. And so, that
20 informs us on the character of those features in the
21 geologic framework of whether or not they are
22 influencing flows. So, when I looked at CSVM-1, that's
23 the pumping well at MX-5 and the response is CSVM-2,
24 which is across the structural block in Coyote Springs

1 Valley, which is across several faults we see these
2 identical responses to open endogenous stress or
3 natural stress. So for us the geologic framework is
4 very basic part and fundamental part of our assessment
5 of these conditions. But how to use that numerically,
6 I think you need like a groundwater flow model to
7 represent the framework in that regard. And then you
8 can test these features of that boundary. But frankly
9 I think the analytical data we have is pretty
10 informative already.
11 MS. BARNES: Thank you.
12 HEARING OFFICER FAIRBANK: Okay. So we have
13 about nine minutes left for the three and-a-half hours
14 for cross-examination. And there is time left that was
15 reserved by the Southern Nevada Water Authority out of
16 their time this morning. So, I can offer up three
17 minutes. Two to three participants who I think still
18 have questions if they want it take it. That would be
19 Coyote Spring Investments, Lincoln/Vidler and Center
20 for Biological Diversity. I see a shaking of the head
21 from Center for Biological Diversity.
22 Did we have any interest for an additional
23 three minutes? CSI shaking their head no.
24 Ms. Peterson.

1 MS. PETERSON: No.
2 HEARING OFFICER FAIRBANK: All right. Well,
3 then let's go ahead and turn it back over to
4 Mr. Taggart on behalf of Southern Nevada Water
5 Authority in Las Vegas Valley water district.
6
7 REDIRECT EXAMINATION
8 BY MR. TAGGART:
9 Q. Good afternoon. Let's get this over with. All
10 right.
11 Couple questions, Ms. Drici. You were asked by
12 Ms. Pederson about using statistics with the data
13 regarding water resource. Do you recall that?
14 ANSWERS BY MS. DRICI:
15 A. Yes, I do.
16 Q. And she asked you about what's been marked SNWA
17 Exhibit 13 and that's a USGS publication that's
18 entitled statistical methods in water resources?
19 A. Yes.
20 Q. Okay. And is it true that that document
21 contains a chapter on the obligation of multilinear
22 regression to water resource data?
23 A. Yes, it does.
24 Q. Okay. Does that publication also include a

1 discussion of using simple linear regression with
2 hydrologic data?
3 A. Yes, it does.
4 Q. Mr. Barker, would you mind bringing up slide 39
5 please.
6 I'm sorry. That wasn't the -- I have it wrong
7 there written down so let's just move on there.
8 And Mr. Burns, you were asked about the record
9 of water levels at CSVM-4 and the transducer in that
10 hole. Do you recall that?
11 ANSWERS BY MR. BURNS:
12 A. I recall questions on that, yes.
13 Q. Okay. Does the -- does the indication that --
14 of changing of the transducer in that hole, that
15 information that was provided to you, does it change
16 any of your opinions regarding the reliability of the
17 data you relied upon at CSVM-4?
18 A. No, it doesn't change my conclusion, which is
19 that that well has measured affects from the pumping at
20 MX-4 and the data fall all, the periodic measurement,
21 alone, can demonstrate that.
22 Q. Okay. A quick question about the big Muddy
23 Springs. Can you please explain the magnitude of flow
24 at that particular spring and whether the level of

1 change that you see at Warm Spring West, for instance,
2 could turn up in the flow record for Muddy, for big
3 Muddy Spring? You understand that my question?
4 A. Not really.
5 Q. Okay. I'm going to try again.
6 There's been a lot of questions about why isn't
7 the same hydrograph showing up at the big Muddy Spring
8 versus EH-4, right?
9 A. Yes.
10 Q. Okay. And is there anything about the -- well,
11 I'll just say it this way. Because of the magnitude of
12 flow at Big Muddy Spring, wouldn't it be hard to see
13 the kind of change that we're measuring at Warm Springs
14 West?
15 A. Yes, and for Pederson Springs as well. I
16 already spoke, I think at length, about how sensitive
17 those springs are, and how detectable responses can be
18 at those springs. They are higher elevation, they are
19 more sensitive. Big Muddy Spring is down on the basin
20 floor and it has much more -- the driving force on that
21 is much greater in proportion in relation to Pederson
22 Springs so you might have five or six feet at Pederson
23 Springs, you might have 80 feet or so at Big Muddy.
24 Those are just estimates, I wouldn't say those are the

1 numbers, but that's what I mean by that.
2 Q. Okay. And could we bring up on the screen
3 figure 5-4, please?
4 Okay. There's been a number of questions about
5 this, I think, from CSI as well as someone else, I
6 don't recall.
7 And the questions centered around this notion
8 of a visual correlation.
9 And so I wanted to nail this down. Obviously,
10 if you look at the red line on that bar chart and then
11 you look the dark blue or the darkly-shaded bars that
12 are the third set of bars up, I think that is the MRSA
13 pumping, it looks like, you know, the red line is
14 tracking along with those dark blue blocks. Is that
15 the proper way to interpret that?
16 A. It could be. But I would just caution based
17 on, as I said before, with the multilinear regression
18 analysis that Warda did, we see contributions of the
19 water level response from that pumping in the
20 decomposed water level at EH-4.
21 So, and I would add, what we've measured -- so
22 I guess this carbonate pumping could be -- let me
23 rephrase it.
24 Q. Let me ask first again. It's simple. Is this

1 visual correlation that I heard described, I mean if
2 you changed which pumping was just plotted on this
3 chart to be, you know, the Coyote Springs Valley
4 carbonate pumping was the block down at the bottom of
5 each bar and then it would change how things looked,
6 visually, to what's underneath the red line?
7 A. Yeah.
8 Q. And isn't that just an artifact of -- that's my
9 question. Should you draw anything from the fact that
10 the red line seems to track with the dark blue lines or
11 anything other than just that's the way it looks
12 because of how the bars are?
13 A. That's the way it was assembled. Now what I
14 would say, we're better off relying on this multilinear
15 regression because it forms of the total response
16 measured EH-4 what contribution to the other pumping
17 center throughout this basin, throughout the flow
18 system is. I would put emphasis on that rather than
19 depiction of this based on this chart.
20 Q. Okay.
21 Now, back to Ms. Drici. Could you bring up
22 figure A-3. Thanks.
23 I have a quick question for you here,
24 Ms. Drici. We've looked at this a number of times.

1 I just want to ask if although you've given the
2 testimony you have about Black Mountain pumping and the
3 decomposition of that stress at the EH-4 water level.
4 But isn't it true that on this particular figure A-3,
5 when pumping begins in 1996, there is a noticeable
6 change in the decomposed PH-4 water level. That's
7 caused by the Black Mountain pumping. It's small but
8 there is a change in the line there, yeah?
9 ANSWERS BY MS. DRICI:
10 A. Yeah, this looks like there is a small change.
11 But, I would same it's simply significant. It might be
12 within the level of error so that's why I couldn't say
13 yeah, this does not absolutely does not effect DH-4.
14 It is uncertain.
15 The Black Mountain production, can I add a
16 clarification?
17 Q. Yes.
18 A. So, earlier, I said that the production wells
19 there were EBM-6, RBM-5 and EBP-2. Before 2015, there
20 were two additional wells that have since been promoted
21 to monitoring wells and those are EBM-4 and ETV-4.
22 Q. Okay. I have just two more questions.
23 One is you were asked about the table with the
24 proportional flow analysis, and -- and I -- and the

Page 1087

1 question that came from State Engineer staff about
2 whether the linear relationship between the Warm
3 Springs West flow and Muddy River flow might break down
4 at some point, right?
5 I guess my question is through the flows rates
6 that are analyzed in your analysis particularly like
7 2.6 CFS in Warm Springs up to 3.4, do you agree that
8 the linear relationship survives in that range?
9 A. Yes, it's 2.7, the lower range.
10 Q. Okay.
11 A. I think so.
12 Q. Okay.
13 A. Yes.
14 Q. Now, Mr. Burns, there's been some presentations
15 regarding what I might call compartments that some
16 parties believe they can pump from without causing
17 impacts to others or to the Muddy River or to the Muddy
18 River Springs.
19 And so my question to you is, first of all, do
20 you think such compartments exist?
21 ANSWERS BY MR. BURNS:
22 A. They can, yes.
23 Q. Okay. And what would be necessary, in your
24 opinion, for someone to prove that they can pump from

Page 1088

1 one of these compartments, if they exist, without
2 causing harm to others or to the river or to the Moapa
3 dace?
4 A. I think pumping tests on something like Order
5 1169, that can demonstrate that that possibility
6 exists.
7 Q. And so, it would have to be at same magnitude
8 and extent as 1169?
9 A. Or someone looking at the data, that would be
10 preferable.
11 Q. And just for folks to remember, how large was
12 that pumping stress from Order of 1169? And I ask you
13 that because I would like you put in contrast to
14 aquifer test that might be done at a well, a 72-hour
15 aquifer test. How much bigger was this than just a
16 simple 72-hour aquifer test?
17 A. Well, it depends on how you view the test,
18 itself. If you view it as a total production from the
19 flow system then it's on the order of ten, over
20 10,000-acre-feet for couple of years almost. If you
21 are looking at a single well as part of that pumping,
22 like MX-5, then it was about 3,000 or so acre-feet --
23 3,000 or so acre-feet over those two years of the
24 pumping test.

Page 1089

1 MR. TAGGART: All right. No further questions.
2 HEARING OFFICER FAIRBANK: All right. Well,
3 thank you very much.
4 We will go ahead and complete today's meeting.
5 But before we do that, actually, let's go ahead and go
6 over a little bit for -- get ready for next week.
7 So, Monday morning Southern Nevada Water
8 Authority's going to continue their presentation of
9 biological panel then we'll do cross-examination. Then
10 once they're completed we will go ahead and follow with
11 the Moapa Valley Water District. And then basically
12 our plan is within the dace where there is multiple
13 parties scheduled in a day then we'll just go ahead and
14 tail one another right after one another other than the
15 one exception of the Muddy Valley Irrigation Company,
16 who's agreed to go ahead and switch to December 3rd to
17 go earlier or, excuse me, what year is it, what day is
18 it? October 3rd.
19 We will not be moving parties between dace.
20 So basically, if we get done early because
21 everybody's super efficient as we have seen as a common
22 thread this week. Which we encourage for the following
23 week. Then we'll just end early and we'll start with
24 the party that's scheduled for the following day.

Page 1090

1 So, my -- I guess the long and short of it is,
2 if you're somebody who's scheduled after an earlier
3 party in those dace, be prepared to go before the
4 little time slot in the matrix that was intended to
5 kind of be a rough idea.
6 Otherwise, have a great weekend. We'll see
7 everyone 8:30 on Monday morning.
8
9
10 (End of Proceedings.)
11
12 * * * * *
13
14
15
16
17
18
19
20
21
22
23
24

1 CERTIFICATE
2
3 STATE OF NEVADA)
4)SS.
5 CARSON CITY)
6

7 I, Kathy Terhune, CCR 209, do hereby certify
8 that I reported the foregoing proceedings; that the
9 same is true and correct rough draft transcript as
10 reflected by my original machine shorthand notes taken
11 at said time and place.
12

13 Dated at Carson City, Nevada, this
14 28th day of September, 2019.
15
16

17 _____
18 CCR #209
19
20
21
22
23
24

#	988:4;1050:20 actions (6) 999:13;1068:15,17, 21;1069:2,7	1015:3,20,24; 1026:20;1028:6,12; 1040:18;1053:10,21, 22;1062:23;1072:11; 1087:7	1066:1;1068:13,14; 1072:17;1077:14 amplitude (1) 1057:21	1066:12 approaching (1) 1066:11
#209 (1) 1091:18	activities (4) 1068:15,18,21; 1069:2	agreed (1) 1089:16	analyses (4) 992:10;1025:12; 1036:1;1079:1	appropriate (3) 1050:8;1051:3,6 appropriated (1) 997:20
/	activity (1) 1065:16	ahead (13) 991:4;1017:11; 1030:20;1052:3,10,13; 1068:9;1081:3;1089:4, 5,10,13,16	analysis (33) 992:19;1004:18; 1011:16,16;1015:8,19; 1018:24;1019:2,22; 1020:3,14,17;1023:19, 23;1030:11,17;1033:3, 5,20;1036:5;1038:18; 1039:15;1045:17; 1049:12;1051:14; 1054:8;1070:18; 1078:8,23;1079:13; 1084:18;1086:24; 1087:6	approximate (2) 1028:2;1076:15 approximately (6) 992:5;1026:1,2,3; 1027:4;1030:4; 1036:18
/// (2) 1077:23,24	actual (3) 1013:5;1038:5; 1057:19	albeit (1) 1004:4	analytical (1) 1080:9	approximation (1) 1035:5
A	actually (8) 1001:12;1010:11; 1013:3;1032:19; 1042:15;1049:4,8; 1089:5	alex (2) 989:8;1017:17	analyzed (2) 1048:20;1087:6	April (2) 1063:6,8
A-1 (2) 1021:6,7	Adam (1) 988:5	Allison (1) 989:5	and/or (2) 1038:10;1058:17	aquifer (18) 1007:15,17;1008:18, 23;1009:5,16;1010:3; 1019:14,18;1024:21; 1033:8;1076:7;1078:5, 22;1079:14;1088:14, 15,16
A-3 (3) 1021:14;1085:22; 1086:4	add (4) 1033:11;1042:7; 1084:21;1086:15	allow (2) 998:2,5	and-a-half (1) 1080:13	AREA (51) 987:12;991:20; 992:20,21,23;994:9,14; 995:7,14;999:16; 1005:7,23;1009:1; 1014:13;1015:1,6; 1017:24;1019:2; 1020:23;1022:9,20; 1023:3;1025:2;1030:1; 1031:12;1034:3,5,11; 1038:21;1042:14,14; 1043:24;1046:4,14; 1047:2,8,22;1048:3; 1050:24;1053:5; 1054:1,2,23;1060:9,10, 12;1061:4;1065:20; 1069:23;1070:10; 1076:17
abandoned (1) 1047:21	added (1) 1033:23	allied (4) 998:4,9,12;1059:23	Andrew (1) 1000:10	areas (10) 992:23,24;1024:24; 1025:1;1042:22; 1044:22;1045:3; 1046:5;1054:6; 1059:22
ability (3) 1000:1;1065:13,20	additional (10) 998:6;1019:6; 1052:14;1063:19; 1071:12,13,16,17; 1080:22;1086:20	alluvial (29) 994:19;1004:1,5,17, 19,20;1005:4;1007:14, 21;1008:22;1009:5,8; 1010:21;1015:21; 1016:1,6,8,18;1034:1; 1053:1,16;1055:19,19, 23;1066:7;1072:5,11, 17;1073:4	Angeles (1) 988:23	around (6) 992:20;1002:14; 1059:19;1060:14; 1073:15;1084:7
able (1) 1044:24	addressed (1) 1068:12	alluvium (7) 995:6,6;1007:17; 1024:21;1072:20,21; 1073:1	angles (1) 1020:2	artifact (1) 1085:8
above (7) 1004:15;1031:10; 1033:23;1062:20; 1066:24;1068:3; 1076:9	adds (1) 994:20	almost (5) 1004:7;1037:18; 1040:12;1071:24; 1088:20	annual (1) 1061:19	assembled (1) 1085:13
absolutely (1) 1086:13	adjoining (1) 1059:1	alone (1) 1082:21	apex (1) 993:18	assess (1) 995:15
abut (1) 1079:15	adjust (1) 1037:8	along (7) 1009:7,8;1010:18; 1033:24;1035:6; 1045:21;1084:14	apologize (2) 1002:3;1074:5	assessment (3) 1000:4,6;1080:4
accelerate (1) 1060:1	adjusted (1) 1018:2	although (1) 1086:1	apparently (2) 1006:14,14	assigning (1) 1048:19
acceptable (3) 1067:4,4,5	ADMINISTRATION (1) 987:7	altitude (1) 1076:20	appear (2) 992:16;1013:2	associate (1)
according (3) 1019:2;1029:12; 1030:11	adversely (1) 1000:16	always (1) 1006:4	APPEARANCES (2) 988:1;989:1	
account (4) 998:13;1004:18; 1037:7,8	affected (2) 1012:16;1054:15	amenable (2) 1049:17;1050:11	appears (5) 1001:9;1019:2; 1021:14,15;1053:4	
Accumulative (2) 1001:12,14	affects (5) 1015:9;1054:9; 1055:14,14;1082:19	amended (1) 1014:5	appendix (5) 1021:7;1022:17,22; 1046:21;1072:3	
accurate (6) 1014:7;1018:22; 1025:19;1036:12,12,15	afternoon (5) 991:10;1007:11; 1017:17;1069:13; 1081:9	among (4) 1006:3;1060:8; 1064:20;1069:8	applications (2) 1051:12;1059:1	
achieve (1) 992:18	again (9) 1023:8;1024:17; 1028:3,22;1029:9; 1058:16;1062:14; 1083:5;1084:24	amount (17) 994:24;997:17; 1000:8,11,15;1006:22; 1010:11;1016:2,10; 1017:2;1041:5,7;	apply (7) 1027:18;1029:17; 1030:2;1075:13,20; 1077:7,17	
achieved (1) 992:14	ago (2) 1046:13;1047:14		applying (1) 1039:21	
acknowledge (1) 994:1	agree (13)		appreciate (2) 1017:19;1051:21	
acre-feet (8) 1026:3;1030:10; 1042:16;1046:14; 1054:17;1072:8; 1088:22,23			approach (1)	
across (4) 1073:17;1079:19,24; 1080:1				
Acting (2)				

1048:24 Associates (1) 1022:1 Associates' (1) 1022:7 assume (5) 1009:20,21;1014:24; 1015:4;1034:14 assumed (1) 1007:16 assuming (4) 994:5;1000:14; 1017:1,5 assurities (1) 1014:10 attached (1) 996:24 attending (1) 1018:14 attenuated (1) 1038:7 attenuation (1) 1039:10 Authority (7) 996:22;997:5; 998:16;999:8;1023:24; 1080:15;1081:5 Authority's (4) 996:19;999:6; 1052:22;1089:8 available (2) 1008:20;1064:16 average (3) 1027:14;1034:14; 1076:16 averaged (1) 1036:8 avoid (1) 1072:19 aware (6) 991:24;992:4; 1001:19,23;1012:17; 1025:2 awareness (1) 997:4 away (2) 1043:24;1056:16 axis (4) 1032:3;1035:1,1; 1074:23	backwards (1) 1015:10 Baldwin (1) 989:7 ballpark (1) 1067:22 Band (2) 989:7;1058:7 bandied (1) 1079:8 bar (3) 1054:4;1084:10; 1085:5 Barker (1) 1082:4 Barnes (5) 988:8;990:23; 1078:2,3;1080:11 bars (4) 1017:3;1084:11,12; 1085:12 base (1) 1041:23 Based (23) 992:19;1001:7; 1002:17;1014:19; 1026:4;1027:1; 1036:12;1038:8,14; 1040:15;1044:11; 1045:2;1046:15; 1049:15;1063:5; 1064:20,23;1070:18; 1072:16;1078:20; 1079:4;1084:16; 1085:19 basic (1) 1080:4 basically (5) 1021:2;1040:11; 1063:6;1089:11,20 BASIN (31) 987:9,10,11,13; 993:24;1008:2; 1009:14,16,17,20,22; 1010:4,6;1016:24; 1032:10;1045:6,12; 1047:3,23;1051:9,20; 1059:20,24;1061:1,4; 1064:7,17;1072:7; 1079:9;1083:19; 1085:17 basins (6) 1041:14;1058:22; 1059:1;1061:4,6; 1077:5 basis (1) 1003:7 Bedrock (4) 1024:13,18;1025:3; 1071:11 begins (2) 1053:19;1086:5 behalf (4)	1025:15;1050:7; 1052:19;1081:4 behave (1) 1076:6 behaves (1) 1033:9 behaviors (1) 1033:10 Belaustegui (1) 988:19 below (1) 1034:3 Benedict (8) 988:11;990:12,22; 1035:11,12;1046:8; 1074:2,3 benefit (1) 998:8 besides (1) 1020:19 Beth (1) 989:7 better (4) 1006:20;1036:16; 1071:3;1085:14 beyond (2) 1078:5,23 big (8) 1076:13;1078:16; 1082:22;1083:2,7,12, 19,23 bigger (2) 1042:5;1088:15 Biological (9) 996:8,13,23;997:5; 1063:21;1064:1; 1080:20,21;1089:9 bit (7) 1014:23;1015:4; 1020:7,8;1031:24; 1072:12;1089:6 BLACK (14) 987:9;992:24; 1017:24;1019:1; 1022:9,20;1023:2; 1050:24;1061:9; 1069:22;1070:10; 1086:2,7,15 Bliss (1) 988:14 block (2) 1079:24;1085:4 blocks (1) 1084:14 blow (1) 1002:6 blue (9) 1017:3;1031:20,21; 1035:20;1073:20; 1074:11;1084:11,14; 1085:10 BMDL-2 (2) 1020:7;1022:2	BM-DL2 (1) 1019:13 body (2) 1042:21,21 both (6) 1000:10;1009:3; 1018:5;1036:6; 1058:18;1073:1 bottom (3) 1062:18,18;1085:4 boundaries (6) 1018:2,17;1060:6; 1070:1;1079:18,19 boundary (32) 994:4;995:24; 1009:7;1014:14; 1018:22;1022:11; 1024:22;1043:9,14,21; 1044:2,5,10,16,17,18; 1046:23;1051:3,10,11, 15;1058:22;1059:12, 17,21;1060:14,20,20; 1061:3;1069:22; 1070:20;1080:8 boundary's (1) 1070:14 Brad (1) 1052:19 break (5) 1033:7,14;1052:3,5; 1087:3 Bridget (1) 988:14 bring (3) 1052:21;1084:2; 1085:21 bringing (1) 1082:4 broke (1) 1011:7 brother (1) 1002:1 brought (2) 1032:15;1063:13 B-type (1) 1075:17 Bureau (1) 998:1 BURNS (49) 991:17;1000:20; 1001:19,22;1002:1,1,2, 3;1003:18;1005:12; 1007:15,19;1018:5; 1020:13,15;1022:13, 15,21,23;1023:5,10,21; 1031:7;1035:23; 1042:7;1043:16; 1046:12,18;1048:13, 23;1051:5;1052:1; 1053:11;1056:24; 1058:17;1061:15,16; 1064:22,24;1066:7,9; 1073:3;1074:22;	1077:10;1078:7; 1082:8,11;1087:14,21 bypassing (1) 1046:14
B		C		
B-1 (3) 1031:6,10,14 back (19) 1001:19;1007:4; 1020:13;1026:19; 1028:1;1029:11; 1033:23;1035:3,15; 1038:1;1047:14; 1052:3,6,10,22;1074:4, 5;1081:3;1085:21				C-3 (1) 1031:9 CA (1) 989:18 cable (2) 1037:8,22 calculate (4) 1027:6;1033:11; 1039:2;1047:10 calculated (1) 1074:8 calculation (3) 1034:16;1046:24; 1047:11 calculations (1) 1004:24 calculator (3) 1027:7,10;1028:21 calibrated (1) 1037:20 calibration (1) 1037:18 California (7) 988:23;1025:23; 1027:21;1030:12; 1047:2;1073:17; 1077:13 call (2) 1038:2;1087:15 came (3) 1020:20;1033:17; 1087:1 can (62) 992:23;997:17; 1000:12,16;1002:11; 1005:1;1006:7;1008:7, 12;1009:7;1010:8,14, 19;1011:1,9,14,15; 1014:15;1015:13; 1017:11;1018:13; 1021:13;1023:7; 1029:9;1033:10; 1036:20;1037:7,7,14, 20;1042:6,13;1043:21; 1045:4,17,23;1048:18; 1049:4;1052:5;1056:3, 18;1057:3,16,20; 1059:19;1066:5; 1068:5,6,24;1070:2; 1075:13,19;1080:8,16; 1082:21,23;1083:17; 1086:15;1087:16,22, 24;1088:5 capture (26) 992:14,18;994:7,9, 10,14;995:11,13,16,20,

20;997:19;1001:8; 1043:4,14;1044:24; 1045:4,18;1046:1; 1047:18;1048:7; 1049:5,9,13;1068:1; 1073:11 captured (5) 995:20,23;996:1; 1054:21;1073:13 capturing (6) 1000:13;1001:13; 1016:24;1045:14; 1047:13;1056:14 carbon (1) 1019:18 carbonate (52) 993:18;994:23; 995:2,14;1000:21; 1001:4;1004:19; 1005:1,3;1007:15,17, 22;1008:8,11,14,18,23; 1009:5,14,16,20,22; 1010:3;1016:2;1017:2; 1019:14;1025:5; 1032:12;1033:8; 1034:1;1048:1; 1053:17,19;1055:5,19, 19,22;1056:1;1066:11, 17;1067:24;1068:2,4; 1072:2,10,16,18; 1073:1,8;1076:7; 1084:22;1085:4 carbonated (1) 1016:10 carbonates (1) 1017:2 Carson (5) 988:17;989:6;991:1; 1091:5,13 case (4) 1033:12;1049:20; 1075:4;1076:23 catastrophic (1) 1006:2 catch (2) 1015:2;1053:12 cause (3) 994:8;1054:9; 1070:22 caused (3) 1030:13;1077:14; 1086:7 causes (1) 1021:16 causing (5) 1024:22;1041:10,20; 1087:16;1088:2 caution (3) 993:14;1042:18; 1084:16 Cavaglia (1) 1025:15 caveat (1)	1068:10 Caviglia (8) 989:2;990:10; 1025:11;1026:18; 1028:8,9;1030:18; 1071:16 CBD (1) 1007:13 CCR (2) 1091:7,18 cease (2) 1068:2,4 cemented (1) 1010:6 Center (10) 996:7,12,22;997:5; 1055:14;1063:21,24; 1080:19,21;1085:17 centered (1) 1084:7 centers (1) 1073:15 certain (6) 1002:8;1006:1; 1021:18;1024:24; 1041:5;1073:4 Certainly (3) 994:19;1016:17; 1070:2 certainty (2) 1019:24;1021:17 CERTIFICATE (1) 1091:1 certificated (1) 992:6 certify (1) 1091:7 CFS (16) 996:17;1001:21; 1002:24;1026:10; 1027:4,19,21;1028:2, 13;1029:19;1030:2,4, 10;1068:6;1075:14; 1087:7 change (15) 993:2;1018:17; 1034:17;1040:6,8; 1051:12;1078:16; 1082:15,18;1083:1,13; 1085:5;1086:6,8,10 changed (4) 1062:8;1069:23; 1070:1;1085:2 changes (2) 1065:6;1071:2 changing (1) 1082:14 chapter (1) 1081:21 character (2) 1044:20;1079:20 chart (9) 1003:4,6,6;1004:24;	1031:21;1054:4; 1084:10;1085:3,19 charts (1) 1028:14 Chief (2) 988:7,10 choose (1) 1060:23 Christy (2) 1030:24;1071:23 circumstances (1) 1051:18 City (10) 988:17;989:6,13; 991:1,5,11;1063:17; 1066:15;1091:5,13 clarification (3) 1031:3;1050:24; 1086:16 clarifies (1) 1075:5 clarify (5) 1001:24;1007:20; 1022:18;1069:21; 1070:2 clarifying (2) 1002:4;1032:9 clarity (1) 1026:12 cleanest (1) 1035:5 clear (9) 997:8;1018:13; 1019:8;1021:20; 1026:13;1028:3; 1046:19;1050:1; 1069:24 close (6) 1002:11,12;1013:12; 1030:6;1043:21; 1067:22 closer (1) 1062:18 closest (2) 1039:12;1054:6 Co (1) 1023:18 coefficient (1) 1039:19 Cogen (1) 1024:4 Cogeneration (5) 1017:13;1022:1,6; 1069:17;1070:11 coin (1) 1000:11 Colby (1) 1051:8 collected (1) 1036:24 Colorado (4) 998:13;999:2; 1064:6,19	columns (1) 1048:24 combination (1) 1055:23 combined (2) 1041:19;1079:1 coming (8) 993:22;1000:4; 1034:3,5;1038:12; 1039:7;1045:9,20 commentary (1) 1044:23 commitment (1) 1045:11 common (2) 1040:8;1089:21 community (1) 1008:22 Compact (2) 1064:7,12 Company (8) 989:5;1024:10; 1047:14;1049:3; 1050:7,9;1071:8; 1089:15 compare (4) 1026:9;1028:10,14; 1037:20 compared (4) 999:2;1021:13; 1039:15;1044:7 compartments (3) 1087:15,20;1088:1 complete (2) 995:21;1089:4 completed (1) 1089:10 completion (2) 1020:6;1070:23 complex (1) 1005:22 complicated (1) 1057:14 component (1) 1064:3 composite (1) 1033:12 concept (3) 1040:22;1041:3; 1045:14 conceptual (5) 1004:21,23;1007:16; 1014:20;1079:3 conceptually (1) 1008:7 concerning (1) 1051:19 conclusion (6) 1007:24;1018:6; 1020:20;1021:4,11; 1082:18 conclusions (2) 1014:6;1049:9	conclusively (1) 1008:17 concur (1) 1020:14 condition (4) 998:24;1043:21; 1044:3,5 conditions (6) 1005:23;1034:7; 1044:10;1046:6; 1055:15;1080:5 conduct (1) 1013:14 cone (2) 996:5;1056:12 confident (1) 1014:18 confined (1) 1033:9 confirm (1) 1020:5 conflict (2) 1072:18,19 conflicting (2) 1000:12;1072:20 conflicts (4) 1000:14;1049:17,24; 1067:4 connected (5) 1060:2,3;1070:4; 1076:7;1078:9 connectedness (3) 1059:15;1078:5,20 connection (9) 1011:14;1038:11,24; 1045:3;1046:3,4; 1047:24;1070:16,17 connectivity (3) 1059:14,23;1060:23 CONSERVATION (2) 987:2;1065:22 conservative (1) 1041:1 consider (1) 1014:2 consideration (1) 1008:5 considered (1) 1078:6 considering (3) 1050:14;1078:22; 1079:12 constant (1) 1041:7 constraint (2) 997:17,20 construct (2) 998:11;1047:24 consultants (1) 1024:4 contact (4) 1009:13,19,24; 1010:7
--	--	---	--	--

contains (1) 1081:21	count (2) 1032:2;1037:11	1075:15	995:3,3;1001:9;	density (1) 1012:24
contingent (1) 1068:14	County/Vidler (1) 1058:10	curves (2) 1074:19;1077:12	1002:18,23;1004:7;	DEPARTMENT (1) 987:2
continue (2) 1041:4;1089:8	couple (4) 1017:18,23;1081:11;	D	1016:3;1021:16;	depends (2) 1067:2;1088:17
continued (2) 1002:8,23	1088:20	dace (21) 996:17;999:7,15,18,	1026:21;1027:4,12;	depiction (1) 1085:19
continues (2) 1053:8,20	course (1) 1039:21	21,24;1000:8,17;	1028:11,13;1032:11,	depleted (2) 1049:2,18
continuing (2) 1002:18;1058:21	Coyote (16) 1025:3;1032:11;	1003:16;1065:8,12,17,	16,18;1041:10;	depletion (5) 994:22;1004:4;
continuous (1) 1038:1	1053:6,8,17,18,20,24;	19,24;1066:3;1072:17,	1057:15,16,17,19;	1030:13;1048:20;
contractual (1) 1024:2	1054:8,15,18;1055:2;	23;1088:3;1089:12,19;	1066:17,18,21	1049:13
contrast (2) 1012:24;1088:13	1072:5;1079:24;	1090:3	declined (2) 1042:15;1047:20	depletions (3) 1004:2;1067:14;
contribute (2) 1008:2,12	1080:19;1085:3	daily (3) 1036:7;1042:3;	declining (5) 1000:21,24;1006:16;	1068:20
contributing (1) 1073:19	create (2) 1054:4;1077:15	1067:23	1042:9;1066:21	depression (1) 1056:13
contribution (3) 1004:4;1027:12;	created (1) 998:1	Darcy (1) 1046:23	decomposed (2) 1084:20;1086:6	depth (1) 1037:5
1085:16	creates (1) 1013:11	dark (3) 1084:11,14;1085:10	decomposition (1) 1086:3	derive (1) 1044:11
contributions (1) 1084:18	credit (1) 998:7	darkly-shaded (1) 1084:11	decrease (3) 993:3;1028:13;	derived (2) 997:22;1047:5
controlling (1) 1013:11	credits (6) 997:16,21,23;	dash (1) 1015:13	1062:14	describe (2) 1036:3;1069:2
conversation (1) 1045:16	998:18;1048:20;	dashed (1) 1057:11	decreased (2) 1047:21;1062:12	described (2) 1036:13;1085:1
Conversion (1) 1030:10	1064:3	data (37) 991:15,18;992:8,8,	decree (2) 997:20;1064:13	describing (1) 1040:11
Cooper (8) 990:11,21;1030:23,	Creek (2) 1047:6,17	12;1000:21;1002:14;	decreed (1) 1049:18	description (1) 1046:15
24;1035:7;1071:22,23;	criteria (1) 997:9	1003:6;1004:18;	deeper (2) 1020:8;1056:13	design (4) 1011:11;1014:10,19;
1073:22	CROSS-EXAMINATION (7) 991:8;996:10;	1005:24;1006:18;	deficit (10) 994:22;1015:22;	1045:24
coordinate (1) 996:23	1007:9;1017:15;	1007:1;1008:15,16,16,	1016:3,5,10,22;1053:2,	designing (1) 1044:15
coordinated (1) 997:6	1025:10;1080:14;	20;1014:17;1035:5,16,	7,13;1054:16	despite (3) 1000:24;1001:1;
correctly (1) 1026:11	1089:9	19;1036:3,21,24;	define (2) 1064:7,12	1021:14
correlated (4) 992:24;1036:9;	CSCM-4 (1) 1038:19	1038:5;1042:22;	defined (2) 1062:2;1068:17	detail (2) 1020:12;1070:24
1038:23;1039:15	CSI (4) 988:19;1052:19;	1044:9,11;1061:13,19;	defining (1) 1062:20	detect (1) 1013:22
correlation (13) 992:19;1011:16;	1080:23;1084:5	1079:5;1080:9;	definition (3) 1022:11;1051:15;	detectable (1) 1083:17
1015:21;1016:11;	CSV-3 (1) 1032:15	1081:12,22;1082:2,17,	1067:16	determination (2) 1003:7;1019:4
1028:16,18;1036:5;	CSV-1 (1) 1079:22	20;1088:9	definitive (2) 1044:19,20	determine (3) 997:12;1007:1;
1039:1,17,19;1076:24;	CSV-2 (1) 1079:23	date (1) 998:21	defuse (3) 1008:8;1009:4,21	1047:11
1084:8;1085:1	CSV-4 (6) 1035:15,20;1038:6;	Dated (1) 1091:13	degree (5) 1001:2,3;1059:15,	developed (2) 1000:12,16
correlations (3) 1036:1;1040:4;	1039:16;1082:9,17	datum (1) 1067:2	22;1060:22	developing (1) 999:10
1045:2	CSV-5 (1) 1079:8	day (6) 1056:9;1063:13;	Delamar (1) 1039:13	deviated (1) 1062:24
correlationship (1) 1040:11	cumulative (1) 1031:14	1089:13,17,24;1091:14	deliver (1) 998:11	DH-4 (1) 1086:13
correlationships (1) 1041:5	curious (3) 1039:5;1074:14,20	days (1) 1056:7	demonstrate (4) 1008:17;1020:1;	difference (6) 1012:12;1013:15;
cost (1) 1049:11	current (4) 1001:4;1002:5;	debate (1) 1006:14	1082:21;1088:5	1074:11,18;1076:12,12
costs (1) 1049:11	1017:23;1019:15	debates (1) 1073:12	demonstrated (1) 1046:3	
	currently (1) 1044:11	December (1) 1089:16	demonstrating (1) 1049:1	
	curve (3) 1027:2;1074:12;	decides (1) 1006:22	demonstration (1) 1003:24	
		decision (1) 1006:9		
		decisions (3) 1059:11,18;1060:7		
		decline (24)		

different (11) 1005:15;1008:3,4; 1010:8;1020:2; 1033:10,15;1075:4,18, 19;1076:14	document (1) 1081:20	driving (1) 1083:20	1026:6;1033:11; 1041:13,19;1059:15	989:2;1025:7,8,15; 1031:15;1071:15
dollar (1) 1048:19	dollar (1) 1048:19	drop (1) 1027:3	efficient (1) 1089:21	Engineer (14) 988:4;990:15; 1006:22;1021:21; 1022:12;1030:20; 1048:22;1050:20; 1051:21;1058:19,20; 1060:12;1071:19; 1087:1
Difficult (2) 1023:8;1028:7	dominant (1) 1061:23	drought (5) 1064:20,23;1065:2, 4,6	EGB-3 (1) 1023:10	engineers (1) 1024:3
diffuse (1) 1008:24	done (7) 1005:13;1036:2; 1038:8;1043:7; 1046:13;1088:14; 1089:20	dry (1) 1076:20	EH4 (1) 993:1	Engineer's (1) 1051:2
direct (2) 996:14;1007:23	Donnelly (10) 989:16;990:6,19; 996:11,12;999:4,5; 1063:23,24;1069:10	due (1) 1005:18	EH-4 (30) 993:2;995:2;1011:6, 14;1012:3,5;1013:18; 1015:9;1019:3; 1021:16;1025:18; 1026:7;1028:16; 1029:14;1033:13; 1036:10;1038:19,20; 1041:20;1042:8,17; 1055:14;1056:21; 1057:11;1066:17; 1068:6;1083:8; 1084:20;1085:16; 1086:3	enough (2) 1030:6;1039:23
directly (2) 998:12;1008:10	dots (1) 1035:20	duly (1) 1029:7	EH-f (1) 1054:9	entering (1) 998:13
discernible (2) 1004:10;1011:22	doubt (1) 1016:17	duration (3) 996:4;1011:10,22	either (4) 1036:9;1040:24; 1041:1;1056:7	entire (1) 997:21
discharge (32) 992:21;993:2; 994:23;1001:8;1003:5; 1004:3;1005:20; 1026:7;1027:16,21,23, 24;1030:14;1034:5,10, 21,21,23;1045:1; 1046:7;1048:5; 1054:10,22;1065:3,5; 1068:1;1073:10,19; 1076:1,5,11,15	down (18) 1016:5;1032:20; 1033:7,14;1041:4,17, 20;1042:4;1043:7; 1044:5;1061:21; 1062:18;1075:14; 1082:7;1083:19; 1084:9;1085:4;1087:3	during (3) 1001:1;1004:6; 1054:11	elaborate (2) 1003:21;1078:18	entirely (1) 1023:23
discharged (1) 995:17	Dr (4) 1000:20;1001:19; 1002:1;1073:18	E	elevation (12) 993:19;1010:3; 1012:2,3,7,15;1013:2; 1075:1;1076:13,16; 1077:1;1083:18	entities (1) 996:20
discharging (2) 1045:11,23	draft (1) 1091:9	Eakin (1) 1035:4	else (3) 1011:1;1038:12; 1084:5	entitled (1) 1081:18
discrete (2) 1008:9;1009:1	draw (4) 1014:6;1060:24; 1078:14;1085:9	earlier (16) 1018:21;1021:5; 1042:3,15;1046:12; 1054:3,21;1055:17; 1066:16,20;1067:9; 1070:11;1071:1; 1086:18;1089:17; 1090:2	elsewhere (3) 1038:21;1042:10; 1047:23	entity (1) 1006:8
discussed (1) 1059:11	drawdown (11) 996:5;1025:17,24; 1041:1;1043:12; 1077:14,16,18,20; 1078:16,17	early (3) 1047:14;1089:20,23	emerge (1) 998:22	environment (1) 999:10
discussion (5) 1035:16;1040:2; 1044:24;1072:20; 1082:1	DRICI (38) 1001:11;1003:10; 1005:5;1017:23; 1018:3,5,8,20,21,23; 1019:20;1020:19; 1021:4,8;1022:17,22; 1023:2,12,17;1025:14, 20;1026:17,22;1029:5, 8;1032:23,24;1040:20; 1056:2;1074:9,24; 1075:21;1077:11; 1081:11,14;1085:21, 24;1086:9	easier (1) 1034:8	emphasis (1) 1085:18	Environmental (1) 1007:12
discussions (1) 1045:13	drawing (1) 1044:1	east (1) 1047:16	empirical (1) 1040:9	envision (1) 1040:14
distance (1) 1074:16	drawn (1) 1060:12	EB-2 (2) 1021:22;1022:14	empiricals (1) 1078:24	equal (2) 1034:11;1074:7
distribution (1) 1036:24	DRICI (38) 1001:11;1003:10; 1005:5;1017:23; 1018:3,5,8,20,21,23; 1019:20;1020:19; 1021:4,8;1022:17,22; 1023:2,12,17;1025:14, 20;1026:17,22;1029:5, 8;1032:23,24;1040:20; 1056:2;1074:9,24; 1075:21;1077:11; 1081:11,14;1085:21, 24;1086:9	EB-5 (1) 1022:14	employing (1) 1036:22	equilibrated (2) 992:14,17
District (5) 989:4,10;1031:15; 1081:5;1089:11	drift (2) 1037:7,15	EBM-4 (2) 1023:14;1086:21	emergency (1) 998:22	equilibrium (4) 1040:3,23;1041:23; 1042:20
diversion (2) 1051:13,16	drilled (1) 993:16	EBM-5 (2) 1023:11,15	empirical (1) 1040:9	equipped (1) 1037:3
diversions (6) 1031:5,10,15,16; 1034:1;1071:2	drinking (1) 999:21	EBM-6 (3) 1023:10,15;1086:19	empiricals (1) 1040:9	equivalent (3) 1009:2;1030:7; 1054:22
Diversity (9) 989:16;996:8,13,23; 997:5;1063:21;1064:1; 1080:20,21		EBP-2 (3) 1023:10,15;1086:19	empiricals (1) 1078:24	error (2) 1037:15;1086:12
DIVISION (4) 987:3;1030:21; 1062:16;1071:18		economic (1) 1050:16	employing (1) 1036:22	Esq (9) 988:18,20;989:2,7,8, 10,12,16,17
divvied (1) 1072:5		effect (20) 993:2;1011:22; 1012:19,21,22;1013:1, 5,18,22;1015:1,5; 1019:3;1046:7;1048:4; 1054:10,11;1056:9; 1072:22;1073:2; 1086:13	encompass (1) 1060:22	essence (1) 1010:6
Doctor (1) 1002:1		effective (3) 1007:1;1011:10,11	encourage (1) 1089:22	essentially (1) 998:2
		effects (7) 1005:14;1011:5;	end (2) 1089:23;1090:10	established (1) 1011:13
			endangered (2) 999:12;1006:3	estimate (12) 1002:11;1034:23; 1046:12,16,20;1047:8, 11;1055:12,16;1056:6; 1057:23;1072:9
			endogenous (1) 1080:2	estimates (3)
			ends (1) 1057:3	
			Energy (6)	

<p>1033:22;1047:7; 1083:24 ET (6) 1033:22,22;1034:9, 10,14;1054:23 ETV-4 (1) 1086:21 evaluate (1) 1011:5 evaluation (2) 997:10;1078:6 even (3) 1013:16,20;1062:20 event (1) 1002:20 events (1) 1005:18 everybody's (1) 1089:21 everyone (1) 1090:7 everywhere (1) 1056:8 evidence (8) 1007:23;1018:8; 1019:6;1042:21; 1049:22;1050:1,2; 1060:5 EVM (1) 1023:4 EVM-4 (1) 1022:24 exact (3) 1019:7,8;1039:11 exactly (5) 1001:18;1035:3; 1059:2,3;1061:10 EXAMINATION (9) 1030:22;1035:10; 1046:10;1048:11; 1050:19;1071:21; 1074:1;1078:1;1081:7 example (17) 1006:10;1008:10; 1009:2,9;1013:8,14; 1038:18;1040:15; 1042:11;1043:23; 1044:4;1047:5; 1056:14;1075:9; 1076:1;1077:12; 1079:7 except (2) 1034:5,9 excepting (1) 994:24 exception (1) 1089:15 Excuse (3) 996:14;1004:12; 1089:17 Exhibit (7) 1017:21;1021:6; 1048:15;1052:23;</p>	<p>1061:11,12;1081:17 exist (3) 1044:10;1087:20; 1088:1 existing (2) 998:14;1068:11 exists (1) 1088:6 expect (12) 993:2;995:3; 1005:16,19,20; 1036:17;1043:12; 1054:20;1066:18; 1068:11;1071:3; 1075:10 expected (1) 1054:16 expensive (1) 998:11 explain (3) 1004:22;1048:19; 1082:23 explains (1) 1042:22 explanation (3) 1020:9;1045:8,20 extend (1) 1056:13 extent (8) 993:1;1014:12; 1038:22;1045:16,16; 1056:9;1075:13; 1088:8 external (1) 1020:22 extraordinary (1) 998:5</p>	<p>1048:12;1049:21; 1050:2,17;1052:2,9; 1055:21;1058:1,6; 1063:17,20;1069:11, 15;1071:7,10,13,17; 1073:24;1080:12; 1081:2;1089:2 fall (2) 1002:6;1082:20 fancy (1) 1015:19 far (4) 1002:10;1024:3; 1029:5;1045:17 fate (3) 999:21,24;1065:12 fault (3) 1009:6,8,12 faults (1) 1080:1 favorable (1) 1050:11 feature (2) 1009:10,12 features (2) 1079:20;1080:8 feed (1) 1010:22 feel (2) 1046:5;1077:6 feeling (1) 1046:16 feels (1) 1073:18 feet (4) 1075:1,2;1083:22,23 felt (1) 1051:1 few (3) 991:12;996:14; 1024:18 field (2) 1047:15,21 figure (22) 993:21;1001:7; 1012:8,10,11;1015:13, 15,23;1019:15; 1021:14;1025:21; 1027:24;1035:2; 1042:1,13;1052:22; 1062:19;1069:7; 1070:15;1084:3; 1085:22;1086:4 figures (1) 992:22 filed (1) 1048:16 fill (11) 993:24;1009:14,16, 17,20,22;1010:4,6; 1016:24;1032:10; 1047:3 final (1)</p>	<p>1002:16 financial (2) 1049:17;1050:12 find (7) 993:16;1037:22; 1038:22,23;1047:6,23, 24 fine (1) 1029:1 finer (1) 1059:18 finite (1) 1000:15 First (16) 994:19;995:17; 996:14;1011:13; 1018:4;1019:10,10; 1020:13;1023:2; 1045:1;1056:10; 1057:22;1059:8; 1074:4;1084:24; 1087:19 Fish (2) 989:17;1058:1 fits (1) 1040:22 five (4) 1015:14;1052:4; 1061:4;1083:22 five- (1) 1015:14 five-foot (2) 1012:12;1013:15 fixed (1) 1044:1 Flangas (11) 989:8;990:8,20; 1017:16,17;1018:9,19; 1024:7;1069:20; 1070:8,9 flat (2) 1005:24;1031:16 flatten (2) 1005:17,19 floor (1) 1083:20 FLOW (78) 987:8;993:7;994:6,7, 15,21;995:4,11,13,23, 24;997:14,18,19,21; 998:6;999:18;1000:13; 1004:19;1005:4,4; 1008:8,11,24;1009:4, 21;1010:12,15;1014:3, 12;1019:5;1022:10; 1024:22;1027:15; 1034:19;1042:20; 1043:22;1044:3,6,11, 22,24;1045:5,6,15; 1051:3,10,20;1053:2, 13;1054:16;1055:2; 1060:11,16,18,21; 1061:22;1065:23;</p>	<p>1066:18,21,22; 1067:15;1068:6; 1070:5;1072:4,7; 1075:10,14;1077:2; 1080:6;1082:23; 1083:2,12;1085:17; 1086:24;1087:3,3; 1088:19 flowing (5) 998:24;1009:15; 1045:10;1075:23; 1076:17 flows (21) 1000:7;1003:5; 1004:1;1049:2,6,6,10, 14;1064:19,22; 1065:13;1066:8; 1067:1,10,11,15,16; 1068:3;1075:9; 1079:22;1087:5 flux (4) 1046:23;1047:3,10, 11 focus (2) 1018:3;1079:12 focused (2) 1000:6;1025:16 focussed (1) 1017:20 folks (3) 1045:14;1069:21; 1088:11 follow (6) 1014:23;1031:13; 1032:4;1049:15; 1078:13;1089:10 following (4) 1028:7;1043:17; 1089:22,24 foot (2) 1037:10;1074:18 force (1) 1083:20 foregoing (1) 1091:8 forgot (1) 1079:9 formation (2) 1047:6,17 forms (1) 1085:15 forth (3) 1003:16;1048:21; 1067:24 forum (1) 1025:18 found (2) 993:15;1039:16 four (5) 1001:3;1006:11; 1054:5;1059:9;1075:2 frame (1) 1002:8</p>
	F			
	<p>facilities (2) 991:24;998:15 fact (4) 996:15;1038:11; 1059:6;1085:9 fact-gathering (1) 1059:8 factor (3) 1005:2,3;1039:1 factors (3) 1014:11;1064:20; 1070:22 facts (2) 996:16;1049:20 Fair (1) 1039:23 FAIRBANK (38) 987:4;988:2;991:4; 996:7;1007:5;1017:8, 11;1018:12;1023:7; 1024:9,12;1025:7; 1026:14;1028:6; 1029:3,6;1030:19;</p>			

<p>framework (7) 992:20;1079:5,6,17, 21;1080:3,7</p> <p>frankly (1) 1080:8</p> <p>freely (1) 1059:24</p> <p>frequent (1) 1037:24</p> <p>FRIDAY (3) 987:21;1052:1; 1069:13</p> <p>fulfill (1) 1067:11</p> <p>fulfilling (1) 1004:13</p> <p>full (2) 1056:9;1067:14</p> <p>fundamental (1) 1080:4</p> <p>further (6) 1024:7;1030:18; 1063:20;1076:21; 1078:18;1089:1</p> <p>fusion (1) 1036:3</p> <p>future (4) 1055:4;1068:11; 1073:10,12</p>	<p>geological (1) 1079:5</p> <p>Geologist (1) 988:13</p> <p>geology (2) 1078:22;1079:14</p> <p>George (1) 1007:12</p> <p>Georgia (2) 1007:7;1069:11</p> <p>gets (1) 1056:8</p> <p>given (8) 992:20;996:15; 1003:15;1006:1; 1036:6;1043:9; 1067:21;1086:1</p> <p>GLASGOW (1) 1058:5</p> <p>glasses (1) 1015:14</p> <p>Glendale (1) 1073:17</p> <p>goes (2) 1061:10;1076:9</p> <p>Good (10) 991:10;999:9; 1006:12;1007:11; 1017:17;1037:9; 1039:19;1040:1; 1074:20;1081:9</p> <p>gradient (5) 993:21;994:2; 1013:11,15;1045:22</p> <p>gradients (1) 1013:6</p> <p>graph (3) 1021:13;1027:5; 1040:15</p> <p>graphs (1) 1040:6</p> <p>great (2) 1050:23;1090:6</p> <p>greater (2) 1077:19;1083:21</p> <p>green (1) 1035:21</p> <p>Greg (1) 989:10</p> <p>ground (1) 1008:11</p> <p>groundwater (14) 997:13;1000:22; 1001:5,13;1014:12; 1044:22,24;1045:5; 1049:9;1053:23; 1055:15;1072:4; 1079:6;1080:6</p> <p>grow (1) 1056:13</p> <p>guess (28) 993:14;994:17; 995:10;999:8;1007:13;</p>	<p>1008:6;1010:21; 1026:15;1039:4,8; 1043:1,19;1047:7,16; 1048:18;1049:15; 1061:2;1065:18; 1067:2;1068:12; 1073:11;1075:19; 1078:13,18;1079:16; 1084:22;1087:5; 1090:1</p> <p>guidelines (1) 998:4</p> <p>guys (1) 1072:24</p> <p>GV-1 (2) 1012:7;1013:14</p>	<p style="text-align: center;">H</p> <p>half (1) 1074:15</p> <p>hand (1) 1075:1</p> <p>Hang (1) 1071:24</p> <p>happen (1) 1068:22</p> <p>happened (2) 1011:19;1057:18</p> <p>happening (2) 1042:22;1069:4</p> <p>hard (3) 1032:7;1047:24; 1083:12</p> <p>harm (1) 1088:2</p> <p>Harrison (8) 990:7;1007:10,11; 1017:9,10;1052:20,24; 1069:12</p> <p>head (8) 1027:6;1037:2; 1068:5;1072:2;1076:8, 12;1080:20,23</p> <p>hear (3) 1015:16;1023:8; 1070:17</p> <p>heard (3) 1058:20,24;1085:1</p> <p>HEARING (50) 987:4,17,18;988:7; 990:14;991:4,5;996:7, 24;1004:14;1007:5; 1017:8,11;1018:12,14; 1023:7;1024:9,12; 1025:7;1026:14; 1028:6;1029:3,6; 1030:19;1038:14; 1046:22;1048:12; 1049:21,24;1050:2,17; 1052:2,9;1055:21; 1058:1,6;1063:17,20; 1069:6,11,15;1071:7,</p>	<p>10,13,17;1073:24; 1076:18;1080:12; 1081:2;1089:2</p> <p>heavily (1) 1079:4</p> <p>Hello (1) 1024:17</p> <p>help (4) 1010:1;1036:20; 1064:6,8</p> <p>helps (2) 1012:8;1067:19</p> <p>hereby (1) 1091:7</p> <p>Herrema (7) 990:17;1052:11,18, 19;1055:24;1057:10, 24</p> <p>Hi (1) 1030:24</p> <p>high (4) 1057:20;1063:7; 1078:14,16</p> <p>higher (7) 993:19;1002:22; 1010:3;1013:3; 1042:17;1067:10; 1083:18</p> <p>highest (2) 1002:20;1076:20</p> <p>highly (1) 992:24</p> <p>hold (4) 1002:15;1072:22; 1075:8;1077:3</p> <p>hole (2) 1082:10,14</p> <p>Honestly (3) 1017:7;1020:5; 1073:21</p> <p>hook (1) 1051:24</p> <p>hope (2) 1004:12,13</p> <p>hours (1) 1080:13</p> <p>hundred (2) 1002:10;1019:24</p> <p>hundredth (1) 1037:10</p> <p>hydraulic (3) 1013:5;1046:3,4</p> <p>hydrograph (6) 1038:6;1056:21,23; 1057:6,11;1083:7</p> <p>HYDROGRAPHIC (1) 987:11</p> <p>hydrographs (1) 1011:15</p> <p>hydrologic (5) 1000:19;1059:14; 1060:5,23;1082:2</p> <p>hydrologically (2)</p>	<p>1070:3,4</p> <p>hydrologists (2) 1020:18,24</p> <p>Hydrology (1) 988:10</p> <p>hypothetical (1) 1016:13</p> <p>hypothetically (1) 1034:13</p> <hr/> <p style="text-align: center;">I</p> <p>ICS (11) 997:16,21,23;998:1, 18;1048:20;1064:3; 1065:13,16,21,22</p> <p>idea (6) 1011:9;1028:23; 1029:1;1044:17; 1076:16;1090:5</p> <p>identical (1) 1080:2</p> <p>illustrated (2) 1013:17;1015:22</p> <p>illustrates (1) 1049:12</p> <p>immediate (3) 1056:15;1059:20; 1065:6</p> <p>impact (10) 1024:23;1025:4; 1046:5;1048:2;1049:2; 1056:15,16;1059:20; 1065:16,20</p> <p>impacted (1) 1066:1</p> <p>impacting (2) 999:12;1000:16</p> <p>impacts (13) 994:20,20;1003:24; 1006:3;1049:11; 1051:16;1055:10; 1060:1;1061:1;1067:4; 1068:10,11;1087:17</p> <p>impermeable (1) 1044:21</p> <p>implicates (1) 1059:17</p> <p>implicit (1) 1078:14</p> <p>implied (1) 1078:8</p> <p>implies (1) 993:20</p> <p>imply (2) 1001:4,17</p> <p>important (2) 1049:3;1064:3</p> <p>include (2) 1075:23;1081:24</p> <p>included (2) 992:9;1022:10</p> <p>incorrect (2)</p>
--	--	--	---	---	---

1014:6,6 increased (2) 1001:1;1062:13 increasing (2) 1001:12,14 indeed (2) 1054:8;1064:10 independent (2) 1023:19;1040:10 indicates (5) 1019:1,13,23; 1020:3;1054:8 indication (6) 1005:11,13;1006:12, 20;1023:12;1082:13 indicator (2) 1006:17;1042:19 indicators (1) 1005:23 induce (5) 995:23;1014:12; 1043:22;1044:3,6 infer (1) 1054:7 inference (1) 1049:16 inferring (1) 1078:19 inflow (1) 1014:3 influence (2) 996:5;1032:17 influences (2) 1055:7;1079:6 influencing (1) 1079:22 information (3) 1014:18;1026:4; 1082:15 informative (1) 1080:10 informs (1) 1079:20 initially (1) 1045:19 initiated (1) 1053:7 input (1) 997:12 install (1) 1037:12 instance (1) 1083:1 instances (2) 1037:23,24 instead (1) 998:10 instream (1) 1000:7 insure (2) 1064:6;1068:3 intended (2) 998:22;1090:4	interaction (2) 996:19;1007:14 interest (2) 999:7;1080:22 interpret (1) 1084:15 interpretation (1) 1079:13 into (26) 993:8,12;994:6; 995:10;996:2;998:6, 13;1004:19;1007:17; 1008:5,8,11,18;1009:5, 8,22;1010:6,9; 1020:11;1033:14,24; 1034:5;1055:2;1064:9; 1076:17,19 introduced (1) 1008:18 inventories (1) 991:19 inventory (1) 991:22 investigated (1) 1070:21 Investments (1) 1080:19 Irrigation (7) 989:19;1024:10; 1049:2;1050:7,9; 1071:8;1089:15 isotope (1) 1008:16 issue (1) 1074:23 issued (1) 1046:22 issues (1) 1036:12	1060:15,17;1061:7 Karen (1) 1058:16 Kathy (2) 987:24;1091:7 keep (2) 1041:11;1067:10 keeps (2) 1057:21;1064:15 Kent (1) 988:20 kilometers (1) 993:24 kind (8) 1013:18;1015:12; 1032:3;1040:13; 1041:2;1079:13; 1083:13;1090:5 KING (2) 1024:11;1071:9	1045:19;1050:11; 1054:9;1059:7;1063:7 leave (1) 1066:5 leaving (1) 1045:12 led (2) 1004:23;1021:10 left (3) 1007:13;1080:13,14 length (1) 1083:16 less (5) 1003:1;1036:12; 1057:17;1060:2; 1065:5 lesser (2) 1039:16;1078:17 lets (1) 1052:5 letter (2) 1015:7;1049:4 letters (1) 1049:5 level (24) 996:18;1002:22; 1012:2,19,21,22; 1021:16,18;1026:7; 1036:23;1041:10,11, 20;1043:24;1068:23; 1069:4;1076:9; 1078:10;1082:24; 1084:19,20;1086:3,6, 12 levels (24) 993:1,1;995:2; 1000:22;1001:1,5; 1002:18;1005:2,17; 1006:16;1019:3; 1033:14;1040:7,16; 1041:4,6;1043:22; 1044:6;1047:19; 1048:3;1066:17; 1068:5;1077:5;1082:9 likely (2) 1002:5;1036:11 limit (3) 1006:22;1077:7,10 Limited (1) 1070:18 Lincoln (1) 1058:10 Lincoln/Vidler (1) 1080:19 line (24) 1027:2;1029:17; 1031:16,19;1034:22; 1035:6;1053:2,3,4,13, 15,16,19,20;1057:7,8, 11;1060:24;1061:21; 1084:10,13;1085:6,10; 1086:8 linear (18)	1029:12;1033:9; 1034:20;1035:1; 1075:6,16,17,17,22; 1076:2,19,22;1077:6,8, 16;1082:1;1087:2,8 lines (3) 1019:6;1035:21; 1085:10 listed (1) 1048:22 listening (1) 1069:24 little (9) 1012:6;1020:8; 1023:8;1031:19; 1051:11;1072:7,12; 1089:6;1090:4 local (1) 1061:23 location (5) 994:2;996:4; 1039:11;1047:12; 1048:6 locations (3) 1042:12;1048:1; 1055:15 long (16) 995:1,18,19;999:12; 1000:12;1034:18; 1055:6,12;1066:12,14; 1068:1,7;1072:22; 1075:22;1077:2; 1090:1 longer (3) 1006:5;1042:1,1 long-term (3) 997:12;1000:6; 1068:3 look (38) 992:22;995:11,15; 1010:2;1012:5; 1015:13;1016:2,8; 1020:2,4,11;1021:13; 1022:21;1025:13,16; 1027:18;1032:17,21; 1038:17;1040:14; 1041:13,14,16,21; 1042:5,9,12,21;1047:3; 1053:3;1056:19,20; 1074:14,17;1075:15; 1079:17;1084:10,11 looked (10) 1002:13;1020:6; 1032:14;1036:21; 1048:1;1070:24; 1077:13;1079:22; 1085:5,24 looking (17) 1012:8;1025:12; 1026:6,6;1027:11,11, 13;1028:1;1029:23,24; 1040:3;1042:2;1072:2; 1076:14;1078:24;	
	J	L			
	January (1) 1034:9 Jim (1) 1021:2 John (1) 988:11 jointly (5) 1058:22;1059:19; 1060:9,10,16 Jon (2) 1035:12;1074:3 July (1) 1048:16 June (1) 1062:3 Justina (2) 989:2;1025:15	lag (9) 1038:15,15;1039:4, 22;1055:9,11,19,20; 1056:19 lags (2) 1038:7;1039:5 Lake (10) 998:3,6,14,17;999:1; 1000:2;1064:6,15; 1065:13,23 large (5) 998:8;1044:7; 1045:4;1048:8; 1088:11 larger (5) 1013:16;1017:3; 1021:12;1057:21; 1077:20 Las (15) 989:13;991:6,11; 993:8,11,16,18,22; 994:6;998:12;999:21; 1000:1;1063:17; 1066:15;1081:5 last (9) 1002:13;1005:14; 1006:11;1015:2; 1019:9,10;1048:24; 1053:12;1075:6 late (2) 992:1;1047:15 later (2) 1062:6;1075:24 Laura (1) 989:12 Law (2) 989:13;1064:9 least (10) 1004:6;1008:19; 1015:20;1040:14,18;			
	K				
	Kane (3)				

1088:9,21 looks (17) 1002:7;1022:24; 1025:17,23;1026:2,8; 1027:13;1029:11; 1031:18;1053:20; 1074:15,17,19,20; 1084:13;1085:11; 1086:10 Los (1) 988:23 loss (2) 1005:3;1033:23 losses (2) 1034:8;1076:21 lost (2) 1067:6,8 lot (9) 999:13;1008:1; 1040:5;1043:20; 1056:5;1059:17; 1073:14;1078:15; 1083:6 Loud (1) 997:8 loudly (1) 1023:8 low (1) 1034:10 Lower (23) 994:15;997:14; 1010:12,12;1018:1; 1019:5;1022:10; 1024:21;1025:22,22; 1051:2,10;1060:10,16, 17,21;1061:22;1064:7, 17;1070:4;1072:4,7; 1087:9 lowering (1) 1001:5 Ltd (1) 988:16 Luke (1) 989:17 lumped (1) 1022:8 LWRFS (2) 1019:14,18	main (2) 995:9;1010:19 Mainly (2) 1073:16,16 maintain (2) 1067:1,11 maintaining (1) 1005:1 makes (1) 1064:16 making (3) 1041:20;1059:16; 1065:23 manage (2) 1060:16;1068:5 manageable (3) 1068:8,13,14 managed (5) 1058:22;1059:20; 1060:9,10;1061:5 management (7) 1006:8;1049:20; 1058:21;1059:10,17; 1060:7;1061:2 manual (5) 1035:21;1037:5,9, 14,19 many (3) 1005:24;1014:10; 1050:10 March (4) 1062:9,9,21;1063:10 marked (1) 1081:16 material (2) 1047:12;1078:15 math (3) 1026:11;1028:1; 1029:18 matrix (1) 1090:4 MATTER (2) 987:7;1061:3 max (1) 1002:14 maximum (1) 992:14 may (13) 997:13;1001:19; 1009:1;1012:19; 1013:1;1018:24; 1019:23;1031:18; 1038:12;1043:3; 1044:3;1049:16; 1072:11 Maybe (30) 1004:21;1007:20; 1010:1,5;1020:3,10; 1022:16;1031:1,19; 1034:13;1035:8; 1036:7,20;1037:22,22; 1038:7;1039:1,4,8; 1040:1,8;1041:1,22;	1043:1;1044:6,17; 1047:15;1074:17; 1078:4,24 Mead (9) 998:3,6,14,17;999:2; 1000:2;1064:15; 1065:14,24 Mead's (1) 1064:6 mean (27) 1002:7;1006:8; 1009:15,16,23; 1010:16;1012:1; 1014:11;1017:18; 1020:1,23;1022:8; 1034:1;1036:7; 1051:14;1054:19,24; 1055:4;1067:13; 1075:7,12;1077:5,8; 1078:9;1079:3;1084:1; 1085:1 meaning (1) 1019:22 means (5) 1019:17,19,22; 1033:9;1055:4 measurable (1) 1004:5 measure (1) 1034:4 measured (9) 993:20;994:21; 1010:19;1015:9; 1054:11;1055:7; 1082:19;1084:21; 1085:16 measurement (8) 1034:9;1036:8,14; 1037:6,19,21;1038:3; 1082:20 measurements (8) 1005:6;1010:15; 1034:11;1035:4,21; 1036:23;1037:9,14 measures (1) 998:5 measuring (1) 1083:13 mechanism (2) 1009:4;1013:11 mechanisms (1) 1010:8 meet (1) 1003:17 meeting (1) 1089:4 mention (2) 1012:5;1055:17 mentioned (9) 994:22;1000:9; 1011:6;1042:15; 1043:6;1046:12; 1051:8;1054:4;	1073:18 methods (1) 1081:18 MICHELINE (2) 987:4;988:2 Michelle (2) 988:8;1078:3 mid (1) 992:4 might (17) 1005:17;1013:16; 1028:24;1031:19; 1038:1;1039:10; 1041:21;1042:7,9; 1044:6;1076:16; 1083:22,23;1086:11; 1087:3,15;1088:14 miles (1) 1042:19 Miller (1) 989:17 mind (1) 1082:4 minus (1) 1074:7 minutes (7) 1007:3;1052:4,13, 15;1080:13,17,23 miscalculation (1) 1006:2 mischaracterized (1) 1018:10 mischaracterizes (2) 1018:7,15 misreading (1) 1074:16 missed (2) 1031:2;1078:4 misunderstood (1) 993:11 mitigable (1) 1000:15 mitigation (3) 1049:17;1050:8,12 MLR (4) 1033:3,4;1054:7; 1070:18 MOA (1) 1003:15 Moapa (20) 989:7;996:17;999:7, 15,17,21,24;1000:8,17; 1026:7;1031:10,11,15; 1033:24;1034:6,12; 1058:7,8;1088:2; 1089:11 model (7) 1004:21,23;1007:16; 1014:20;1029:13; 1079:3;1080:6 moment (1) 1017:21 Monday (3)	999:14;1089:7; 1090:7 monitor (5) 1005:14;1014:14; 1032:10;1037:3; 1043:18 monitored (2) 1014:11;1015:8 monitoring (6) 1002:9;1043:8,11, 19,21;1086:21 month (2) 1036:6,9 months (4) 1039:22;1056:7; 1062:8,21 more (25) 999:14;1000:19; 1006:18,19;1007:3; 1014:17;1016:23; 1020:11;1023:8; 1031:24;1036:12,15; 1044:19,19;1051:15; 1060:2;1064:15,16; 1070:14;1073:20,22; 1079:11;1083:19,20; 1086:22 morning (5) 1051:8;1058:21; 1080:16;1089:7; 1090:7 Morrison (1) 989:10 most (3) 1012:6;1050:12,22 mostly (1) 1056:11 Mountain (8) 992:24;1019:1; 1022:9;1023:3; 1070:10;1086:2,7,15 Mountains (7) 1017:24;1022:20; 1039:13;1050:24; 1061:9;1062:4; 1069:23 move (4) 1017:12;1059:19,23; 1082:7 moves (1) 1060:8 moving (2) 1051:9;1089:19 MRSA (9) 1011:6;1015:1,5; 1034:5,11;1041:10; 1076:5,15;1084:12 much (18) 999:14;1004:4; 1005:1;1006:19; 1034:4;1036:16; 1039:9;1040:17; 1052:11;1061:3;
M				
ma'am (2) 991:23;1056:5 machine (1) 1091:10 MacKenzie (1) 989:5 magnitude (11) 996:2,4;1002:10; 1004:9;1011:21; 1013:21;1016:21; 1057:17;1082:23; 1083:11;1088:7				

1072:12;1073:20; 1076:16;1077:16; 1083:20,21;1088:15; 1089:3 MUDDY (70) 987:12;989:19; 992:21;994:9,14,21; 995:6,14;997:19,21; 998:10;999:1,18; 1000:13;1004:10; 1008:4;1010:16; 1015:5,22;1016:9; 1024:9,23;1027:16,24; 1030:1,4,8,13;1031:5, 11,11;1042:14;1045:1, 15;1046:14;1047:6,17; 1048:20;1049:2,5,10, 13,18;1050:6,8;1053:5, 13;1054:1,1;1055:2; 1064:23;1065:3,13,19, 23;1066:1;1067:12; 1071:7;1075:10; 1082:22;1083:2,3,7,12, 19,23;1087:3,17,17; 1089:15 multi (1) 1015:7 multilinear (4) 992:11;1081:21; 1084:17;1085:14 multiple (4) 1010:22;1029:12; 1077:8;1089:12 multiply (1) 1026:9 muted (2) 1043:22;1057:19 MX (1) 1075:16 MX-4 (4) 1036:10;1039:15,16; 1082:20 MX-5 (2) 1079:23;1088:22 myriad (1) 999:13 myself (2) 1021:2;1067:8	989:8 near (1) 1002:24 nearby (2) 1012:14;1043:14 necessarily (4) 1009:13,15,21; 1060:21 necessary (4) 1004:15;1011:10; 1069:3;1087:23 need (13) 1006:19;1011:20; 1013:16;1019:6; 1020:2,4;1042:21; 1045:19;1060:22; 1067:10;1068:4,22; 1080:6 needed (3) 1011:8;1068:2; 1070:15 needs (2) 1033:23;1037:16 negative (1) 1060:24 negligible (1) 1034:10 NEVADA (34) 987:1;988:17;989:6; 991:1;996:18,22; 997:4;998:8,16;999:6, 8;1017:13;1021:24; 1022:6;1023:18,24; 1024:4;1025:7,8; 1031:14;1047:14; 1050:13,13;1051:2; 1062:4;1064:13; 1069:17;1070:11; 1071:15;1080:15; 1081:4;1089:7;1091:3, 13 Nevadans (1) 1050:15 new (7) 993:15,16;1002:19; 1037:23;1051:16; 1068:22;1069:5 next (15) 991:5;1003:1; 1006:11;1038:19; 1041:14,15;1043:23; 1058:23;1059:9; 1060:7;1061:21; 1062:6,7,15;1089:6 nine (1) 1080:13 non (2) 1053:8,20 none (3) 1021:17;1031:17; 1047:7 Nor (1) 1064:11	North (7) 989:13;991:6,11; 1025:2;1039:13; 1063:17;1066:15 note (1) 1040:5 noted (1) 1029:7 notes (1) 1091:10 noticeable (1) 1086:5 notion (1) 1084:7 number (6) 1002:16;1027:1; 1052:23;1072:2; 1084:4;1085:24 numbers (8) 1005:3;1021:19; 1027:5;1028:11,13; 1029:12;1033:18; 1084:1 numerically (1) 1080:5 NV (2) 989:2;1025:15 NVWR (1) 991:18	988:18 October (6) 1062:3,9,9,21; 1063:10;1089:18 off (6) 992:9;1007:13; 1037:2;1045:2; 1051:24;1085:14 offer (2) 997:12;1080:16 offered (1) 1045:14 OFFICER (39) 987:4;988:7;990:14; 991:4;996:7;1007:5; 1017:8,11;1018:12; 1023:7;1024:9,12; 1025:7;1026:14; 1028:6;1029:3,6; 1030:19;1048:12; 1049:21;1050:2,17; 1052:2,9;1055:21; 1058:1,6;1063:17,20; 1069:11,15;1071:7,10, 13,17;1073:24; 1080:12;1081:2; 1089:2 old (1) 1023:14 once (2) 1002:16;1089:10 one (37) 995:10,17;1002:18; 1005:13;1008:1; 1010:17;1025:22,23; 1028:18,19;1032:4,9; 1035:1;1036:17; 1040:1;1043:4;1044:4; 1048:18;1049:3,5; 1050:6,12;1051:1,9; 1057:9;1061:6; 1069:21;1074:4,18; 1075:1;1076:16; 1077:12;1086:23; 1088:1;1089:14,14,15 one-for-one (2) 994:12,20 one-level (1) 1079:6 ones (1) 1023:13 one-to-one (18) 992:18;994:9,13; 995:11,13,16;1024:22; 1055:1,5;1056:16,17, 20;1066:8,12,12; 1072:21;1073:2,9 ongoing (3) 1001:9;1011:23; 1068:21 only (10) 994:23;996:18; 1020:5;1025:2;	1030:14,16;1033:19, 21;1036:23;1073:10 open (4) 1030:20;1052:14; 1071:18;1080:2 open-ended (2) 1015:12;1016:16 opening (1) 1031:24 operated (1) 1021:24 operating (2) 992:1;999:9 operation (1) 998:4 opine (1) 995:12 opinion (7) 1011:20;1038:9; 1066:10;1072:12; 1073:13;1075:12; 1087:24 opinions (1) 1082:16 opportunities (1) 1010:5 opportunity (1) 1069:8 opposed (1) 1045:15 options (1) 1050:10 orange (1) 1074:12 ORDER (20) 987:18;997:10,11; 1000:5;1002:10; 1011:19,21;1013:13, 14;1048:22;1054:5; 1056:4;1067:11; 1068:2,23;1069:3; 1072:3;1088:4,12,19 orifices (1) 1076:10 original (2) 1048:16;1091:10 others (6) 1005:21;1021:14; 1051:19;1063:9; 1087:17;1088:2 otherwise (2) 1014:8;1090:6 out (19) 993:21;997:18; 1005:1,19;1008:11; 1017:9;1035:3; 1038:22;1039:10; 1042:1;1044:10; 1050:15;1064:8,15; 1069:7;1070:15; 1072:5;1073:9; 1080:15 outflow (7)
N		O		
nail (1) 1084:9 name (3) 991:10;1017:17; 1018:8 National (1) 1058:4 NATURAL (2) 987:2;1080:3 nature (1) 1059:16 NCA (1)	o0o- (1) 991:3 object (3) 1028:22;1049:19; 1055:18 Objection (11) 999:3;1018:7,12,15; 1026:12;1028:3; 1029:7;1055:21,22; 1057:8;1070:7 obligation (1) 1081:21 observation (3) 1001:6;1020:7; 1022:2 observe (5) 1006:16;1011:19; 1029:6;1032:18; 1042:10 observed (5) 1032:12;1038:2,2; 1063:7;1074:7 obtain (2) 991:15,21 obtained (1) 991:18 Obviously (1) 1084:9 occurs (2) 1010:12;1060:20 O'Connor (1)			

995:1,23;1045:15; 1046:1;1048:8; 1073:12,15 output (1) 1050:16 outside (4) 995:24;1020:23; 1024:4;1045:6 over (23) 995:1,1,18;1005:18; 1011:18;1022:17; 1040:6;1047:20; 1065:2;1066:12,14,16; 1068:6;1071:24; 1072:1;1075:17; 1076:10;1079:13; 1081:3,9;1088:19,23; 1089:6 overall (1) 1006:23 overcomes (1) 1013:15 overestimate (1) 1041:1 owed (1) 1045:7 owns (1) 1070:12	1088:21 participants (3) 1052:14,15;1080:17 particular (5) 1041:8,9;1056:23; 1082:24;1086:4 particularly (2) 1051:11;1087:6 parties (3) 1087:16;1089:13,19 party (2) 1089:24;1090:3 past (1) 1065:3 Patrick (3) 989:16;996:12; 1063:24 peak (1) 1054:16 Pederson (11) 1004:6;1005:21; 1008:10;1054:14; 1055:7;1076:1,3; 1081:12;1083:15,21,22 Pellegrino (12) 996:15;997:1; 1050:4;1058:17,20; 1059:5;1064:2,4; 1065:8,10;1069:24; 1072:14 pending (1) 1060:6 per (1) 1054:17 percent (3) 1004:7,8;1019:24 percentage (2) 1045:5;1048:8 performed (1) 1018:24 perhaps (2) 999:2;1013:4 period (8) 995:18;1002:21; 1006:4;1011:19; 1040:7;1047:20; 1066:13,14 periodic (4) 1036:7,14;1038:2; 1082:20 periods (1) 1042:1 permeable (2) 1044:21;1079:18 pertinent (1) 1049:14 Petersen (1) 1058:16 Peterson (7) 990:18;1011:4; 1058:11,14;1063:15; 1080:24;1081:1 PH-4 (1)	1086:6 phase (4) 1058:23;1059:8,9; 1060:7 phases (1) 1059:7 pick (3) 1007:13;1011:3; 1054:5 picked (1) 1054:5 picking (1) 1056:11 piece (1) 1040:4 pipe (1) 1010:6 pipeline (1) 998:11 place (1) 1091:11 places (1) 1044:7 plan (1) 1089:12 play (1) 996:2 please (8) 1025:14;1028:8; 1031:1;1035:13; 1078:4;1082:5,23; 1084:3 plot (8) 1034:24,24;1035:20; 1036:15,16;1040:19, 21;1076:1 plotted (1) 1085:2 plus (1) 1075:16 PM (1) 991:1 point (29) 992:15,18,22; 995:20;1008:19; 1010:10;1013:7; 1014:20;1015:13; 1017:5;1028:1;1035:6; 1037:6;1042:8,19; 1045:10,22;1059:13, 18;1061:2,17;1067:3; 1069:6,21;1073:20; 1075:7;1076:19,21; 1087:4 pointed (1) 1043:5 points (4) 997:10;1051:13,16; 1071:1 PORTION (4) 987:9;1019:11; 1022:9;1025:3 position (3)	994:13;1059:3; 1070:1 possibility (3) 994:5;1014:2;1088:5 possible (9) 993:7,14;995:22; 1024:20;1030:15,17; 1035:19;1052:21; 1070:22 postulate (1) 1045:17 postulated (1) 1079:18 potential (3) 1011:4;1060:24; 1068:11 potentially (4) 1014:17;1039:8; 1059:24;1069:9 Potentiometric (1) 1076:9 Power (1) 1047:14 practice (1) 1037:12 precip (1) 1062:17 precipitation (8) 1001:1;1002:20; 1061:13,19,22;1062:2, 12,13 predictable (1) 1034:7 predictive (1) 1041:6 preferable (1) 1088:10 prepared (2) 1032:21;1090:3 present (1) 1032:13 presentation (5) 991:13;1032:5; 1035:14;1074:5; 1089:8 presentations (1) 1087:14 presented (6) 1000:10;1049:21; 1050:3;1054:3,21; 1060:5 presumably (1) 1060:8 pretend (1) 1016:18 pretty (5) 1006:12;1036:16; 1040:16;1047:8; 1080:9 previous (2) 996:19;1063:8 prior (1) 996:24	probably (12) 1002:15;1014:13; 1018:1,2;1019:15,17, 21;1020:4;1026:3; 1039:12;1068:2; 1075:4 problem (1) 1069:9 PROCEEDINGS (3) 987:16;1090:10; 1091:8 process (4) 1020:22;1021:1; 1051:17;1059:7 producing (1) 1056:11 production (34) 1017:24;1019:1,4, 15;1020:8;1021:15,15, 21;1022:4,5,9,19,20; 1034:2;1041:9,12; 1042:14;1043:18; 1047:22;1049:9; 1051:9;1053:5,18,18, 21;1068:5;1070:3,7,10, 15;1077:20;1086:15, 18;1088:18 professional (1) 1006:9 program (2) 998:1,20 promising (1) 1047:22 promoted (1) 1086:20 propagate (1) 1005:15 propagates (1) 996:5 proper (1) 1084:15 properties (6) 1047:4;1078:11,15, 20,23;1079:14 proportion (1) 1083:21 proportional (9) 993:3;995:3;1046:7; 1048:4;1054:10; 1066:18;1076:11; 1077:19;1086:24 proposal (1) 1059:3 proposed (1) 1024:21 prospect (1) 1002:19 prospects (1) 1051:8 protect (1) 999:15 protecting (1) 1072:17
P				
Pacific (2) 1007:12;1069:11 Pacific/Republic (1) 1007:7 page (21) 1012:9;1017:21; 1019:10,11;1026:2,6; 1027:2,13;1028:10; 1029:11,17,23; 1033:16;1041:18; 1042:13;1048:14,15; 1061:11,14,18;1074:4 Paiutes (1) 989:7 panel (4) 999:14;1007:11; 1063:16;1089:9 paragraph (7) 1019:10,10,11; 1061:19;1062:7,7,15 parameters (1) 1078:5 paraphrased (1) 1049:8 Park (1) 1058:4 part (16) 992:21;994:7,10,11; 999:9;1003:9;1004:21; 1015:2;1021:4; 1039:14;1051:9,17; 1053:12;1080:4,4;				

prove (1) 1087:24	1088:13	reading (5) 1019:9;1033:24; 1034:6;1037:21; 1074:21	recompose (1) 1034:2	994:24;1065:5
provide (1) 1038:9	putting (1) 1060:2		recompute (1) 1016:22	regression (11) 992:10,11;1011:16; 1015:7;1029:13; 1038:18;1077:8; 1081:22;1082:1; 1084:17;1085:15
provided (3) 1026:4;1029:17; 1082:15	Q	ready (1) 1089:6	reconcile (1) 1041:2	relate (2) 1049:12;1068:19
provisional (1) 1002:15	qualified (1) 999:14	real (1) 1059:20	reconvene (1) 991:5	related (3) 1065:9,16;1066:3
proximity (1) 1054:6	quality (3) 1012:16;1035:16; 1047:20	reality (1) 1030:15	record (23) 996:21;997:3; 1001:24;1002:21; 1004:10;1006:5; 1030:24;1035:12; 1037:9;1038:1,20; 1050:21;1052:4,6,10, 19;1057:14;1071:23; 1074:3;1078:3,10; 1082:8;1083:2	relates (3) 1048:21;1049:6; 1061:11
prudent (1) 1061:2	quantification (1) 1010:11	realized (1) 1068:6	recovery (7) 1056:22;1057:4,5,7, 13,14,19	relating (1) 1003:4
PUBLIC (1) 987:17	quantify (1) 1010:14	really (15) 1006:2,13;1011:16; 1017:18;1032:4; 1036:15;1037:18; 1040:9;1045:23; 1054:7;1056:8; 1074:11;1075:16; 1076:13;1083:4	RECROSS (1) 990:16	relation (1) 1083:21
publication (2) 1081:17,24	quantity (1) 997:13	rears (1) 1033:14	RECORDS-EXAMINATION (5) 1024:15;1052:17; 1058:13;1063:22; 1069:19	relationship (19) 1001:8;1016:9; 1024:2;1034:20; 1040:9;1055:1; 1056:20;1066:8; 1074:20;1075:13,18; 1076:3,4;1077:2,4,6, 16;1087:2,8
pump (13) 1011:5,11,11; 1013:14,20;1014:5,19; 1024:20;1043:24; 1046:5;1072:21; 1087:16,24	quarter (1) 1057:22	reason (6) 1033:19,21;1060:17; 1063:4,5;1076:6	red (12) 1053:2,4,13,16,19; 1057:7,8,11;1084:10, 13;1085:6,10	relationships (3) 1075:7,8;1078:21
pumpage (10) 991:22;992:14; 1000:6;1034:16; 1040:6;1041:7;1072:2, 13;1077:14,15	question's (1) 1026:13	recall (5) 1046:21;1081:13; 1082:10,12;1084:6	REDIRECT (1) 1081:7	relatively (1) 1044:1
pumped (4) 997:13,17;1072:16, 18	quick (5) 1024:18;1049:15; 1054:20;1082:22; 1085:23	receive (1) 1079:18	reduced (2) 1004:3;1067:15	reliability (1) 1082:16
Pumping (93) 991:14,19;992:2,17; 994:11,15,19,23; 995:13;996:2;1001:4; 1002:5;1004:1,5,18,20; 1005:10,15;1006:23; 1011:6,18;1013:8,10, 22;1014:7,14,24; 1015:4,21;1016:1,2,6, 8,10,19;1022:24; 1023:13;1025:4,18,23; 1026:3;1029:14; 1030:12;1038:11,13, 15,21;1039:6,14; 1040:15;1041:5,11; 1043:8;1053:1,6,9,17, 23,24;1054:8,15,18; 1055:1,10,14,20; 1056:4,10;1057:5; 1066:7;1067:16; 1072:4,5,8;1073:1,15; 1077:5,19;1079:23; 1082:19;1084:13,19, 22;1085:2,4,16;1086:2, 5,7;1088:4,12,21,24	quicker (2) 1055:13;1056:8	recently (4) 1012:6;1032:14; 1036:21;1040:23	referred (1) 1022:4	reliable (4) 992:12;999:1,3; 1014:19
put (15) 998:12,19;1006:22; 1014:13;1036:16; 1041:15,19;1044:17; 1047:16;1048:7; 1059:18;1072:3; 1077:1;1085:18;	quite (2) 1020:7;1042:6	receptor (1) 1013:9	reduction (5) 1029:13,16,21; 1030:5,8	relied (1) 1082:17
	R	recess (2) 1005:16;1052:8	refer (3) 996:17;1022:18; 1048:14	rely (1) 999:11
	range (4) 1059:14;1075:15; 1087:8,9	recharge (12) 1002:20,21;1005:18; 1007:17;1008:2; 1027:24;1038:10,12, 15,20;1039:12; 1061:23	reference (4) 996:18;1063:11,14; 1067:3	relying (1) 1085:14
	ranges (1) 1075:19	recharging (1) 1039:6	referred (1) 1022:4	remain (2) 1040:16;1041:6
	rates (1) 1087:5	Reclamation (1) 998:2	Referring (3) 1003:4;1022:6,19	remember (3) 1032:15;1049:3; 1088:11
	rather (3) 1038:12;1045:1; 1085:18	recognize (2) 1063:7;1070:20	reflected (1) 1091:10	remotely (1) 1018:14
	ratio (7) 1027:18;1029:24; 1030:2;1033:18; 1034:17,18;1035:4	recognized (1) 1008:21	regard (3) 1004:17;1051:13; 1080:7	remove (1) 1016:1
	ratios (2) 1027:14,15	recollect (1) 1063:10	regarding (3) 1081:13;1082:16; 1087:15	removed (1) 1016:8
	RBM-5 (1) 1086:19	recollection (4) 1032:16,17;1047:1, 19	regime (1) 999:9	repeat (3) 1009:18;1067:5; 1068:24
	reach (1) 1018:5	recommendation (4) 1003:8;1051:2; 1058:18;1059:16	regimes (1) 1005:15	rephrase (1) 1084:23
	reached (6) 1003:1;1005:9,11; 1006:1;1040:23; 1054:19	recommendations (1) 1051:1	regional (2)	report (15) 992:9;1001:7; 1002:13;1008:20; 1017:20;1018:4; 1019:9,12;1020:19; 1021:6;1036:10;

1046:21,24;1048:16; 1075:23 Reported (3) 987:24;1001:20; 1091:8 reports (1) 1045:13 represent (2) 1043:10;1080:7 represented (2) 1078:9,12 representing (2) 991:11;1024:17 represents (2) 1038:20,21 Republic (1) 1007:12 request (1) 1058:19 require (1) 1033:4 reserved (1) 1080:15 reservoir (6) 1007:21;1008:3,9, 13;1009:8;1010:9 reset (1) 1002:22 residual (2) 1074:18,21 residuals (3) 1074:7,15;1075:2 resource (2) 1081:13,22 RESOURCES (11) 987:2,3;999:11,11, 16;1006:3;1030:21,21; 1050:13;1071:18; 1081:18 respect (9) 994:22;1006:21; 1011:18;1035:16; 1037:11;1038:11; 1039:14;1041:12; 1047:13 respectful (1) 1059:6 respects (1) 1037:19 responds (1) 1078:13 response (13) 1033:7,12;1038:6; 1042:16;1055:11; 1056:8;1078:10,14; 1079:6,19,23;1084:19; 1085:15 responses (4) 1033:15;1079:7; 1080:2;1083:17 rest (2) 1051:23;1072:10 restate (2)	1028:8;1064:2 result (4) 1006:2;1029:18; 1049:13;1068:1 results (3) 1040:24;1043:5; 1066:21 resumes (1) 1057:21 reverse (2) 1033:13;1065:18 review (1) 1020:22 reviewed (2) 1020:19,21 Rick (2) 1032:15;1063:13 right (29) 997:14;998:17; 1010:4,6;1016:15; 1017:8;1023:3,11; 1054:19;1056:16; 1057:12;1062:4,16; 1068:21;1069:4; 1071:23;1073:6,9; 1074:12;1076:12,22; 1077:19;1081:2,10; 1083:8;1087:4;1089:1, 2,14 rights (9) 992:6;1000:7,13,15; 1003:17;1004:14; 1049:18;1067:12,14 RIVER (96) 987:8,12;992:21; 994:9,14,15,20,21; 995:6,14,24;997:14,19, 21;998:13;999:1,2,18; 1000:13;1003:17; 1004:1,10,11,14; 1010:12,18,19; 1015:22;1016:9,23; 1018:1;1019:5; 1022:10;1024:22,23; 1030:1,4,8,14;1031:5, 11,11;1034:6;1042:14; 1043:23;1044:2; 1045:1,15;1046:14; 1048:20;1049:6,10,10, 13,14,18;1051:3,10; 1053:5,13;1054:1,1; 1055:3;1060:11,16,18, 21;1061:22;1064:7,9, 20,23;1065:3,9,13,20, 23;1066:2,8,21;1067:1, 11,12,15,16;1068:20; 1070:4;1072:4,7; 1073:6,7;1075:10; 1087:3,17,18;1088:2 Robison (2) 988:19,20 rocks (2) 1045:10,21	Rogers (2) 1021:3;1073:19 root (1) 1039:18 rough (2) 1090:5;1091:9 Roughly (5) 998:19;1026:10,11; 1053:3,15 RPR (1) 987:24 rules (1) 1059:19 run (1) 999:12 runs (1) 1009:6	1051:14;1059:2 scrutinizing (1) 1071:1 scrutiny (1) 1060:19 season (2) 1062:10,16 seasonal (4) 1057:15,15,19,20 second (1) 1061:18 secondary (1) 1032:3 seconds (1) 1007:6 Section (3) 988:7,10;997:11 Seeing (7) 1024:12;1058:3,6,7; 1069:15;1071:10,17 seems (2) 1075:7;1085:10 segments (1) 1075:17 senior (8) 1000:7,13,14; 1003:17;1004:13; 1067:11,14;1072:22 sense (8) 1011:24;1034:12; 1036:11;1039:10; 1040:8;1045:23; 1064:19,22 sensitive (3) 1065:6;1083:16,19 sentence (1) 1063:8 separate (1) 1040:3 separates (1) 1011:22 SEPTEMBER (4) 987:21;991:1; 1063:9;1091:14 sequence (1) 1054:6 series (1) 1033:14 Service (2) 1058:2,4 set (6) 997:3;1037:4,5; 1040:9;1048:21; 1084:12 sets (1) 1003:16 seven (1) 1050:14 several (4) 1006:24;1033:8; 1046:13;1080:1 shaking (2) 1080:20,23	shareholder (1) 1050:6 Sharp (1) 988:19 shear (1) 993:23 short (1) 1090:1 shortage (1) 1064:16 shorthand (1) 1091:10 show (5) 1040:7;1041:6; 1043:13;1048:15; 1079:5 showing (2) 1001:7;1083:7 shown (4) 1021:6;1046:2; 1048:4;1077:13 shows (4) 1015:8;1029:18; 1053:2;1057:6 side (2) 993:18;1044:18 sides (1) 1000:10 signal (2) 1014:1;1055:13 signed (1) 1018:4 significant (11) 1011:7;1012:17,18, 20;1035:2;1039:3,17, 20;1065:2;1073:14; 1086:11 similar (9) 1016:3,19;1034:14; 1038:15,17;1039:6,7; 1040:16;1076:4 Similarly (1) 1044:2 simple (3) 1082:1;1084:24; 1088:16 simplify (1) 1007:20 simplifying (1) 1039:9 simply (5) 1009:19;1016:2,7,9; 1086:11 single (3) 1042:8,18;1088:21 site (1) 1043:21 Six (3) 1052:13,15;1083:22 slide (18) 991:14;1003:4; 1025:14,16;1027:13; 1031:1;1035:13;
		S		
		Sacramento (1) 989:18 Sadly (1) 1047:7 salinity (3) 1012:17,18,20 same (19) 1005:20;1008:13; 1018:6;1020:20; 1028:15;1034:18; 1036:18;1039:15; 1040:17;1053:16; 1060:6;1074:14; 1076:8,8,9;1083:7; 1086:11;1088:7; 1091:9 saw (2) 1004:6;1032:16 saying (17) 1004:14;1010:22; 1016:7;1017:4; 1031:17,20;1032:5; 1038:14;1042:3; 1051:7,7;1056:15; 1060:4,15;1063:20; 1070:14;1078:19 scale (2) 1032:6;1074:23 scatter (1) 1035:2 scheduled (3) 1089:13,24;1090:2 scheme (1) 1076:13 Schreck (1) 988:22 Schroeder (2) 989:12,13 scientific (1) 1008:21 screen (1) 1084:2 scrutinized (2)		

<p>1038:19;1039:24; 1040:1;1041:8,15,17; 1048:14;1052:21; 1054:3;1056:20; 1082:4 slides (1) 1058:24 Slight (1) 1041:18 slipped (1) 1037:22 sliver (1) 1031:19 slope (3) 1027:3;1034:22; 1035:3 slot (1) 1090:4 small (8) 1004:9;1008:2; 1010:18;1021:17; 1031:22;1057:16; 1086:7,10 smaller (1) 1004:4 SNWA (7) 988:16;1017:21; 1046:13;1049:16,17; 1061:11;1081:16 SNWA's (2) 1059:2;1064:3 sole (1) 992:20 solve (1) 1069:9 somebody (1) 1090:2 somehow (2) 1017:2;1020:11 someone (3) 1084:5;1087:24; 1088:9 somewhere (8) 1006:23;1038:12; 1044:5;1045:6; 1057:12;1060:1,2; 1067:22 sorry (19) 993:11;1015:15,17; 1018:9;1023:11,14; 1025:22;1028:1; 1032:7;1041:18; 1042:13;1053:12; 1056:5;1062:14; 1068:9;1070:8,17; 1079:10;1082:6 sort (5) 1002:22;1008:13; 1012:1;1051:14; 1059:18 sound (1) 997:14 source (14)</p>	<p>999:1;1007:21; 1008:3,4,14,22; 1010:20;1013:9,10; 1039:12;1043:4; 1061:23;1063:2; 1073:13 sources (4) 1010:22;1014:3,4; 1039:7 south (6) 992:23;1020:8; 1022:2;1047:1,16,16 Southern (13) 996:18,22;997:4; 998:8,16;999:6,8; 1023:23;1050:13; 1062:4;1080:15; 1081:4;1089:7 speak (1) 1050:7 speaking (3) 998:19;1004:22,23 species (2) 999:12;1006:3 Specific (3) 1032:10;1048:21; 1059:9 Specifically (2) 997:11;1049:23 spectacles (1) 1036:16 speculative (2) 1014:23;1015:4 spoke (1) 1083:16 spring (47) 993:2;995:4,11,13; 1003:5,5;1005:2,22; 1010:15;1015:5; 1028:16;1030:1,14; 1032:11;1034:21; 1042:14;1047:1,2; 1048:3;1049:6,14; 1053:6,8;1054:8,10; 1055:2,15;1062:3; 1065:3,5,20;1066:18, 21;1067:15;1072:6; 1075:13;1076:1,3,11, 20;1080:19;1082:24; 1083:1,3,7,12,19 SPRINGS (77) 987:12;991:14; 992:21;994:9,14; 995:2,6,14;1001:20; 1003:16;1004:3,6,8; 1005:20,22,23;1008:5, 9,10;1009:2;1010:16; 1025:3;1026:10; 1027:12,15,16,24; 1028:14;1030:1; 1031:11;1034:3,19; 1042:4;1045:1,3,15; 1046:6,14;1047:17;</p>	<p>1049:10;1053:5,18,18, 21,24;1054:1,2,14,14, 15,18,23;1055:2,8,10; 1056:14;1067:10; 1075:9,22;1076:2,5,10, 21,24;1077:1;1079:24; 1082:23;1083:13,15, 17,18,22,23;1085:3; 1087:3,7,18 square (2) 1039:18;1042:19 Squared (2) 1039:2,18 SS (1) 1091:4 stabilized (1) 1042:6 stabilizing (3) 1041:11,16,22 stable (2) 1041:6;1042:10 stacked (1) 1054:4 staff (6) 1020:21,24;1030:21; 1050:22;1071:19; 1087:1 stakeholder (1) 1045:13 stakeholders (1) 1069:8 Standby (1) 1012:4 standpoint (1) 1059:14 stands (1) 1002:12 start (6) 996:21;1033:13; 1056:14;1057:1; 1069:5;1089:23 started (4) 998:20;1025:12; 1057:13,14 Starting (1) 1025:13 starts (6) 1056:22;1057:4,4,5, 7,15 STATE (31) 987:1;988:4;990:15; 1001:17;1005:9,11,16; 1006:1,15,21,21; 1021:21;1022:12; 1030:20;1040:3,12; 1041:3;1048:22; 1050:16,20;1051:2,21; 1054:20;1058:19,19, 20;1060:12;1064:13; 1071:19;1087:1; 1091:3 stated (2) 1066:7;1067:9</p>	<p>statement (5) 1017:22;1019:7,8; 1028:4;1070:6 statements (1) 996:19 statistical (2) 1015:19;1081:18 statistics (2) 1038:14;1081:12 status (1) 1065:24 stay (4) 1004:15;1060:6; 1066:24;1068:3 stays (1) 1034:18 steady (11) 1001:17;1005:9,11, 16;1006:1,15,21; 1040:3,12;1041:3; 1054:19 stem (1) 1010:19 steward (1) 999:9 still (9) 1001:9,13;1006:14; 1015:3;1039:17,19; 1041:17;1051:4; 1080:17 stops (2) 1057:5,5 storage (9) 995:20;1001:8,10, 12,13,14;1008:12; 1056:12;1064:6 store (4) 998:3;1000:1; 1065:13,21 stored (1) 998:17 stratographic (1) 1009:24 streams (4) 1010:18,20,21,23 stress (10) 1011:7,21;1013:17, 24;1078:14;1079:7; 1080:2,3;1086:3; 1088:12 stresses (2) 1011:23;1033:15 stressor (1) 1013:22 stressors (2) 1033:8,10 stretch (1) 1037:8 stretched (1) 1037:23 strong (3) 1015:21;1016:11; 1046:4</p>	<p>strongly (1) 1000:21 structural (4) 1009:10,12;1079:9, 24 structure (2) 1020:10;1070:23 submitted (1) 1049:24 subsequent (2) 1004:19;1057:22 subsequently (1) 1031:22 substance (1) 996:23 substantial (1) 998:17 sufficient (2) 1003:16;1013:21 suggest (5) 1010:7;1013:16; 1014:5;1053:23; 1061:3 suggested (3) 1008:24;1038:7; 1043:3 suggests (5) 1000:21;1039:6; 1040:8,24;1044:9 Sullivan (3) 988:5;990:13; 1046:11 summarized (1) 1017:22 summer (1) 1062:13 super (1) 1089:21 supply (4) 998:17,22;999:22; 1050:14 suppose (4) 1005:18;1008:12; 1010:14;1012:24 sure (20) 1003:14,22;1006:6, 7;1011:1;1013:20; 1016:12;1017:5; 1019:22;1020:10; 1032:19;1035:18; 1039:2;1044:13,22; 1046:19;1067:13; 1074:6;1077:11; 1078:12 surface (5) 1010:2;1031:10; 1049:18;1065:23; 1076:9 surprise (1) 1002:24 survives (1) 1087:8 suspect (1)</p>
---	---	---	--	---

1051:17 sustainable (4) 1000:5,8;1068:23; 1069:4 switch (1) 1089:16 Sylvia (1) 1007:11 SYSTEM (44) 987:8;994:16,24; 995:2,24;997:18; 1006:13,15;1007:22; 1008:8,11,14,18,23; 1010:21;1018:1; 1019:5;1022:11; 1024:22;1025:5; 1042:8,10,19,20; 1048:1,2;1051:3,10,20; 1055:6;1060:11,16,18, 21;1061:22;1066:17; 1070:5;1072:4,7; 1073:8,11,15;1085:18; 1088:19	1039:10;1041:8 tells (1) 1038:10 temperature (1) 1008:15 temperatures (2) 1063:5,8 ten (5) 1003:1;1004:8; 1006:18;1050:15; 1088:19 tends (1) 1043:22 ten-minute (2) 1052:3,5 tension-metric (1) 1010:2 Terhune (2) 987:24;1091:7 term (4) 1000:12;1042:1; 1068:1,7 terms (3) 1004:9;1042:5; 1049:11 test (25) 1004:6;1011:5,11, 11,18,20;1013:14,17, 21;1014:7,10,19; 1043:6,7,11;1044:16; 1045:24;1054:12; 1056:4;1080:8; 1088:14,15,16,17,24 testifying (1) 993:5 testimony (8) 1003:24;1018:11,15, 17,18;1051:4;1072:24; 1086:2 tests (1) 1088:4 Thanks (1) 1085:22 That' (1) 1066:10 therefore (2) 1041:4;1046:6 thinking (5) 1043:5,20;1048:7; 1069:12;1073:16 third (1) 1084:12 thought (5) 1014:21,21;1032:16; 1044:16;1049:19 thoughts (1) 1045:7 thread (1) 1089:22 three (13) 993:24;1006:11,18; 1023:3,13;1028:1; 1039:21,22;1075:15;	1080:13,16,17,23 three-quarters (1) 1050:15 thriving (1) 1065:19 throughout (5) 1014:1;1046:4; 1060:8;1085:17,17 throw (1) 992:9 thrust (1) 1073:17 Thus (1) 1065:12 tied (5) 999:18,21;1000:1; 1053:24;1065:12 tight (1) 1078:15 tighter (1) 1078:24 Tim (2) 988:18;1050:21 times (6) 1001:2;1017:23; 1027:3;1043:20; 1077:15;1085:24 today (7) 1000:9;1017:23; 1018:21;1046:2; 1050:3;1051:4; 1060:14 today's (1) 1089:4 together (7) 999:18;1025:13; 1040:5;1041:16,19; 1072:18;1079:2 told (2) 1049:23;1059:10 took (1) 1034:9 tool (1) 1033:7 top (3) 1031:19;1036:17; 1037:2 total (23) 1005:6;1006:22; 1027:12,16,23,23; 1030:13;1034:2,5,10, 21,23;1053:5,16; 1072:8,10,12,17; 1076:5,14;1077:1; 1085:15;1088:18 track (3) 1053:8,20;1085:10 tracking (2) 1053:12;1084:14 tracks (2) 1053:4,16 Tracy (2) 991:10;1024:17	TRANSCRIPT (2) 987:16;1091:9 transducer (7) 1035:17,22;1037:5, 7,21;1082:9,14 transducers (3) 1036:22;1037:4,12 transmissivity (4) 1033:2,4;1047:5; 1078:17 trend (3) 1027:2;1029:17; 1035:1 trends (3) 1002:22,23;1065:2 tributaries (1) 998:10 tributary (1) 1065:22 tried (3) 1025:13;1047:15; 1065:15 true (6) 1020:1;1065:12; 1066:16;1081:20; 1086:4;1091:9 trust (2) 992:12;1027:6 try (1) 1083:5 trying (13) 997:12;1008:6; 1022:18;1032:2; 1039:9;1040:4;1041:2; 1047:3,17;1059:6,13; 1067:20;1072:19 turn (3) 1054:9;1081:3; 1083:2 twice (1) 1065:16 two (25) 993:23;994:17,17; 1001:3;1002:17; 1005:19;1006:12,18; 1026:9;1028:14; 1039:16;1040:4; 1041:24;1048:24; 1059:7;1074:3,19,19; 1075:1,15;1076:3; 1080:17;1086:20,22; 1088:23 two-part (1) 1000:9 types (1) 1071:2 typographical (1) 1031:18	Ultimately (2) 995:18;1004:24 uncertain (5) 1047:9;1051:12; 1070:14,21;1086:14 uncertainty (1) 1021:18 under (4) 998:4;1005:15; 1012:6;1034:7 underflow (1) 1045:5 underground (1) 1009:2 underlying (1) 1046:6 underneath (1) 1085:6 understands (2) 1028:24;1029:4 Understood (2) 997:23;1061:23 undoubtedly (1) 1019:14 Unfortunately (1) 1034:22 uniform (1) 1040:6 unimpacted (1) 1065:24 unimpaired (1) 998:24 unless (1) 1043:23 up (35) 991:5;994:11; 1000:4;1007:13; 1009:7;1011:3;1014:4; 1030:20;1031:13,23, 24;1032:15;1033:11, 17;1034:3;1035:15; 1040:9;1041:22; 1049:15;1052:14,22; 1054:17;1056:11; 1057:20;1063:13; 1071:18;1076:19; 1080:16;1082:4; 1083:2,7;1084:2,12; 1085:21;1087:7 upon (5) 999:11;1014:20; 1027:1;1049:16; 1082:17 upstream (1) 1034:2 upward (2) 1004:18;1005:4 Ure (7) 990:5,9;991:9,10; 1024:16,17;1063:19 use (10) 998:22;1005:21; 1027:1;1028:11,20;
T				
table (5) 1031:6,6;1033:16; 1072:3;1086:23 Taggart (20) 988:16,16;990:24; 999:3;1018:7,10,16; 1026:12;1028:3,22; 1049:19,22,23;1050:3; 1055:18;1057:8; 1070:7;1071:12; 1081:8;1089:1 Taggart (1) 1081:4 tail (1) 1089:14 talk (5) 999:14;1007:14; 1055:5;1059:1;1062:8 talked (7) 1021:5;1042:12; 1058:18;1060:20; 1070:11;1071:1; 1079:15 talking (10) 995:5,10;1002:14; 1020:23;1021:21; 1022:14;1055:6; 1061:7,13;1070:5 tandem (1) 1078:23 tape (1) 1037:20 technical (2) 1059:8,16 Technologies (1) 1007:12 telling (2)				
			U	
			Uh-hum (1) 1034:13	

1033:2;1037:14; 1041:24;1042:18; 1080:5 used (14) 997:23;1027:4,5,7, 10;1028:12;1035:4,19; 1036:2,3,6;1037:18; 1047:4;1063:9 users (3) 998:2,5;1064:17 USGS (2) 1001:20;1081:17 using (2) 1081:12;1082:1 usual (1) 1050:23	Vegas (13) 989:13;991:6,11; 993:8,11,16,18,22; 994:6;998:12;1063:18; 1066:16;1081:5 Vegas's (2) 999:21;1000:1 versus (3) 1076:1;1079:8; 1083:8 vertically (1) 1026:24 Vidler (1) 989:5 view (3) 1008:13;1088:17,18 viewing (1) 1018:14 Virgin (1) 998:10 visual (3) 1015:21;1084:8; 1085:1 visually (1) 1085:6 VOLUME (4) 987:19;1014:4; 1034:2;1054:22	1005:1,3,16;1006:16; 1007:21;1008:3,14,17, 22;1009:7,15;1010:8, 20;1012:2,15,16,19,21, 22;1016:23;1019:3; 1021:16;1023:24; 1030:21,21;1031:10, 15;1033:13;1034:2,4; 1036:23;1040:7,16; 1041:4,6,20;1043:15, 22,24;1044:1,6;1045:8, 10,11;1047:13,18,19, 20;1048:3;1049:18; 1050:14;1052:22; 1056:11,14;1058:8; 1059:10,17,19,23; 1060:6,8;1064:3,7,15, 16,17;1065:8,9; 1066:1;1067:12; 1068:13,14;1071:18; 1076:9;1077:4; 1078:10;1080:15; 1081:4,5,13,18,22; 1082:9;1084:19,20; 1086:3,6;1089:7,11 waters (1) 1066:17 water's (1) 1045:20 way (14) 1002:7;1010:1; 1030:16;1034:4; 1040:13;1041:2; 1053:16;1057:20; 1061:4;1076:6; 1083:11;1084:15; 1085:11,13 ways (4) 999:17,20;1000:1; 1018:3 wear (2) 992:3;1012:20 website (1) 991:18 week (5) 1079:1,8;1089:6,22, 23 weekend (1) 1090:6 welcome (3) 1003:13;1023:17; 1077:22 wellhead (1) 1013:8 wells (36) 993:19;1006:17; 1012:14,16,19,21; 1017:24;1019:15; 1020:6,8;1021:15,21, 24;1022:4,5,7,19,20; 1023:13;1025:4; 1032:10,12,18; 1036:22;1037:3,11;	1043:8;1045:18; 1053:5;1070:3,10; 1078:12;1079:8; 1086:18,20,21 west (20) 993:17,23;1005:2, 22;1026:10;1027:15; 1028:14;1030:1; 1034:19;1042:4; 1054:14;1067:10; 1075:9;1076:2,5,24; 1077:2;1083:1,14; 1087:3 what's (10) 1012:7;1014:15; 1015:14;1023:4; 1042:22;1057:14,18; 1075:12;1081:16; 1085:6 whereas (1) 1042:9 wherein (1) 1040:15 wherever (1) 1060:23 WHITE (18) 987:8;994:15; 995:24;997:14; 1010:12;1018:1; 1019:5;1022:10; 1051:3,10;1060:11,16, 17,21;1061:22;1070:4; 1072:4,7 Whites (1) 1024:21 whole (1) 1041:13 who's (4) 1002:1;1003:14; 1089:16;1090:2 widely (1) 1008:21 Wildlife (2) 989:17;1058:1 WILSON (3) 1050:20,21;1069:22 Winograd (4) 1061:14,24;1062:3, 24 winter (7) 1061:21;1062:2,8,9, 12,16,20 withdraw (1) 998:14 withdrawals (2) 1067:24;1068:2 withdrawn (2) 998:21;999:4 WITHIN (15) 987:8;1003:1; 1010:12;1018:1; 1019:14,17;1024:21; 1056:9;1059:19;	1061:1;1073:4;1077:5; 1078:6;1086:12; 1089:12 without (6) 1000:12,16;1014:17; 1024:22;1087:16; 1088:1 witness (3) 996:16;1028:24; 1029:4 witness's (1) 1018:8 wonder (2) 1038:9;1040:22 wondering (1) 1044:8 word (2) 1016:17;1019:21 words (3) 1012:17;1014:3; 1040:10 work (5) 1023:18;1025:13; 1038:8;1070:14; 1075:18 worked (1) 1020:24 working (2) 1024:3,4 works (1) 1075:19 written (1) 1082:7 wrong (4) 1023:11;1038:16; 1040:13;1082:6
V	W			Y
vague (1) 999:3 vagueness (2) 1055:18,22 VALLEY (57) 987:10,11;989:19; 991:21;992:1,2,6,13, 18;993:8,8,12,12,17, 18,20;994:6,7,8; 1011:5,12,14;1012:14; 1013:23;1014:1,19,24; 1015:5;1024:9;1025:3; 1031:15;1032:11; 1042:11;1043:2,10,13; 1044:4;1049:2;1050:6, 8;1053:6,8,18,21,24; 1054:15,18;1055:2; 1058:8;1071:7;1072:6; 1073:17;1080:1; 1081:5;1085:3; 1089:11,15 valuable (1) 1050:13 value (9) 1002:13;1003:2; 1021:12;1033:2; 1036:7,8;1042:17; 1048:19;1072:13 values (6) 991:13,21;1011:9; 1021:5;1031:4; 1034:24 variable (2) 1012:5;1064:23 variables (3) 995:9,15;1039:16 variation (1) 1005:18 variations (1) 1067:23 various (2) 1036:1;1077:5 vector (1) 1039:7	Waddell (4) 993:4;1032:15; 1063:13;1073:18 Ward (1) 1000:10 Warda (5) 1021:2;1054:21; 1055:17;1073:8; 1084:18 Warm (26) 1001:20;1003:5,5, 16;1004:8;1005:2,22; 1026:10;1027:12,15; 1028:14;1029:24; 1034:19;1042:4; 1054:14;1055:7; 1067:10;1075:9; 1076:2,5,24;1077:1; 1083:1,13;1087:2,7 Wash (6) 1025:23;1027:22; 1030:12;1047:2; 1073:17;1077:13 WATER (128) 987:3;989:4,5,10; 992:6;993:1,1,22; 995:1,17,19,22;996:18, 22;997:5,17;998:2,3,5, 6,9,12,14,16,21;999:1, 6,8,10,16,22;1000:2,7, 11,13,15;1002:18; 1003:17;1004:13;			year (12) 998:20;1002:14; 1005:19;1025:18; 1026:3;1030:14; 1041:24;1048:17; 1054:18;1073:4,5; 1089:17 years (21) 1001:3;1002:11; 1003:1;1005:14,24; 1006:11,11,12,18,24; 1033:22;1040:14; 1046:13;1047:14,20; 1056:7;1057:18,22; 1065:3;1088:20,23 year-to-year (1) 998:3 yesterday (4) 1001:20;1032:15; 1042:4;1073:18
				Z
				zero (3)

1000:14;1075:9,10 zone (1) 993:23	990:22 1081 (1) 990:24		2450-acre-feet (1) 1030:8	1026:3 4000-acre-feet (1) 1077:15
0	110 (1) 1002:10	2	25 (1) 1003:4	400-acre-feet (2) 1030:12;1077:14
0.05 (1) 1021:12	1100 (1) 1042:19	2.5 (2) 1030:6,10	267 (5) 1026:10;1027:4,19; 1028:13;1030:2	42 (1) 1062:19
0.267 (1) 1029:18	1100-acre-feet (1) 992:5	2.6 (1) 1087:7	27 (2) 987:21;991:1	4-2 (1) 1061:18
0.76 (1) 1029:24	1169 (9) 1011:20;1013:17,21; 1043:6,11;1056:4; 1088:5,8,12	2.7 (1) 1087:9	28 (2) 991:15;1026:2	5
1	126 (1) 1031:16	20 (4) 1005:14;1041:17; 1065:3;1074:4	2-8 (1) 1019:15	5 (3) 1015:13,13;1021:22
1 (1) 1075:14	126,000 (1) 1032:7	2003 (2) 1053:4,15	28th (1) 1091:14	5000 (1) 1054:17
1.57 (3) 1026:8,9;1027:3	126-acre-feet (1) 1032:7	2005 (4) 1002:19;1040:15; 1053:7,17	3	54 (1) 1052:22
1.7 (3) 1026:9;1028:20; 1029:10	13 (1) 1081:17	2006 (1) 1074:17	3 (2) 1012:10;1023:5	5-4 (3) 1015:15,17;1084:3
1.7-foot (7) 1025:17,24;1026:20; 1027:3;1028:11; 1029:13,16	1303 (5) 987:18;997:10,11; 1000:5;1048:22	2007 (1) 998:4	3,000 (2) 1088:22,23	6
1:12 (1) 991:1	14 (1) 1007:3	2011 (1) 1046:22	3.2 (12) 996:17;1002:6,24; 1003:15,16;1004:15; 1042:4;1067:1,10,21; 1068:3,6	6 (2) 1021:22;1022:14
10 (2) 1035:13;1077:15	15,000-acre-feet (1) 1032:6	2012 (3) 1033:20;1034:15; 1054:17	3.23 (1) 1001:20	6,000 (1) 1072:10
10,000 (1) 1046:13	16 (7) 1007:5;1017:21; 1019:10;1026:6; 1027:2;1028:10; 1029:18	2013 (4) 1034:16;1054:17; 1057:12,14	3.4 (2) 1002:13;1087:7	6,000-acre-feet (6) 1000:17;1005:10; 1006:24;1068:8,13; 1072:1
10,000-acre-feet (1) 1088:20	17 (9) 1007:5;1017:21; 1019:11;1025:14,16; 1026:19;1028:10,18; 1029:11	2015 (5) 1025:17,24;1029:14; 1030:12;1086:19	3.42 (3) 1027:21;1028:1; 1030:4	6,000-acre-foot (1) 1003:8
1017 (1) 990:8	18 (2) 1007:5;1012:4	2016 (4) 1000:22;1032:13; 1057:4,22	3.6 (1) 1012:8	60 (1) 1004:7
1024 (1) 990:9	1808 (1) 1012:11	2017 (5) 1031:14,21;1041:21; 1042:17;1072:6	3:00 (1) 1052:4	6000 (2) 1068:23;1069:3
1025 (1) 990:10	1812 (1) 1012:6	2018 (6) 1016:4,5;1031:23; 1034:16;1041:21; 1053:7	30,000-acre-feet (1) 998:20	6-1 (1) 1033:16
1030 (1) 990:11	19 (4) 1040:1;1041:18; 1042:13,13	2019 (3) 987:21;991:1; 1091:14	3000-acre-feet (1) 1013:24	62 (1) 1023:5
1035 (1) 990:12	1980s (2) 992:1,2	209 (1) 1091:7	35 (1) 1031:1	6-2c (1) 1000:5
1046 (1) 990:13	1990s (2) 992:2,5	210 (1) 987:9	3-6 (1) 1012:10	6-2-C (1) 997:11
1048 (1) 990:14	1992 (1) 991:20	215 (1) 987:10	37 (1) 1052:21	6-3 (1) 1001:7
1050 (1) 990:15	1993 (2) 1053:3,15	217 (1) 987:11	39 (2) 1048:14;1082:4	7
1052 (1) 990:17	1995 (1) 991:20	218 (1) 987:12	3rd (2) 1089:16,18	7 (4) 1048:15;1052:23; 1061:11,12
1058 (1) 990:18	1996 (1) 1086:5	219 (1) 987:13	4	7.2 (1) 1048:15
1063 (1) 990:19	1998 (1) 1061:14	22 (3) 1027:13,13;1029:23	4- (10) 1000:17;1003:7; 1005:10;1006:23; 1068:7,12,23;1069:3; 1072:1,10	72-hour (2) 1088:14,16
1069 (1) 990:20	1999 (1) 1040:14	24 (1) 1029:24	4.2 (1) 1061:11	7-5 (1) 1048:15
1071 (1) 990:21		2400-acre-feet (1) 1030:13	400 (1)	78 (2) 1027:14;1039:18
1073 (1) 990:23				
1074 (1)				

8				
8 (1) 1056:20				
8:30 (1) 1090:7				
80 (1) 1083:23				
802 (1) 1031:23				
80s (1) 1047:15				
85 (1) 1039:1				
850 (1) 1042:16				
9				
9 (1) 1017:21				
9,000 (1) 1072:11				
9090 (1) 1072:8				
90s (1) 1047:14				
957 (1) 990:7				
991 (1) 990:5				
996 (1) 990:6				

In The Matter Of:

*DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER*

*Vol. VI
September 30, 2019*

*Capitol Reporters
123 W. Nye Lane, Ste 107

Carson City, Nevada 89706*

Original File 9-30-19A.M.VolumeVIFINALFINALSE_1.txt

Min-U-Script® with Word Index

SE ROA 53430

JA_17827

1 STATE OF NEVADA
 2 DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
 3 DIVISION OF WATER RESOURCES
 4 BEFORE MICHELINE N. FAIRBANK, HEARING OFFICER
 5
 6
 7 IN THE MATTER OF THE ADMINISTRATION
 8 AND MANAGEMENT OF THE LOWER
 9 WHITE RIVER FLOW SYSTEM WITHIN
 10 COYOTE SPRING VALLEY HYDROGRAPHIC
 11 BASIN (210), A PORTION OF BLACK
 12 MOUNTAIN'S AREA HYDROGRAPHIC
 13 BASIN (215), GARNET VALLEY
 14 HYDROGRAPHIC BASIN (216), HIDDEN
 15 VALLEY HYDROGRAPHIC BASIN (217),
 16 CALIFORNIA WASH HYDROGRAPHIC BASIN
 17 (218), AND MUDDY RIVER SPRINGS AREA
 18 (AKA UPPER MOAPA VALLEY HYDROGRAPHIC
 19 BASIN (219)).
 20
 21
 22
 23
 24

14
 15 TRANSCRIPT OF PROCEEDINGS
 16 PUBLIC HEARING
 17 HEARING ON ORDER 1303
 18 VOLUME VI, A.M. SESSION
 19 (Pages 1092-1230)
 20 MONDAY, SEPTEMBER 30, 2019
 21
 22
 23
 24 Reported by: Michel Loomis, RPR

1 APPEARANCES:
 2 For Lincoln County
 3 Water District
 4 -and-
 5 Vidler Water Company: Allison MacKenzie
 6 By: Karen Peterson, Esq.
 7 Carson City, Nevada
 8
 9 For Moapa Band of Paiutes: Richard Berley, Esq.
 10
 11 For Moapa Valley
 12 Water District: Greg Morrison, Esq.
 13
 14 For Bedroc:
 15 -and-
 16 For City of North Las Vegas: Schroeder Law
 17 By: Therese Ure, Esq.
 18
 19 For National Park Service: Karen Glasgow
 20
 21 For Center for Biologic
 22 Diversity: Patrick Donnelly
 23
 24

1 APPEARANCES:
 2 Micheline N. Fairbank,
 3 Hearing Officer
 4
 5 Tim Wilson,
 6 Acting State Engineer
 7 Adam Sullivan,
 8 Deputy State Engineer
 9
 10 Melissa Flatley,
 11 Chief of the Hearing Officer Section
 12 Michelle Barnes,
 13 Supervising Professional Engineer
 14
 15 Levi Kryder,
 16 Chief of the Hydrology Section
 17 Jon Benedict,
 18 Hydrologist
 19
 20 John Guillory,
 21 PE Supervisor
 22 Bridget Bliss,
 23 Basin Engineer
 24
 25 For SNWA: Taggart & Taggart, Ltd.
 26 By: Paul G. Taggart, Esq.
 27 Carson City, Nevada
 28 -and-
 29 Tim O'Connor, Esq.
 30 For CSI: Robison, Belaustegui, Sharp
 31 & Low
 32 By: Kent R. Robison, Esq.
 33 Reno, Nevada
 34
 35 For CSI: Brownstein Hyatt Farber Schreck
 36 By: Brad Herrema, Esq.
 37 Los Angeles, California
 38 For NV Energy: Justina Caviglia, Esq.

1 INDEX
 2 THE PANELS: DIRECT CROSS REDIRECT RECROSS
 3 By Mr. Taggart: 1098 1217 1158
 4 By Mr. Herrema: 1130,1207 1148
 5 By Mr. Burley: 1133, 1213 1150
 6 By Mr. Morrison: 1167 1137
 7 By Ms. Peterson: 1138
 8 By Mr. Frehner: 1222
 9 By Mr. Donnelly: 1142 1152,1155
 10 By Ms. Caviglia: 1146
 11 By Ms. Ure: 1228
 12
 13 EXAMINATION
 14
 15 By Mr. Wilson: 1155
 16
 17
 18
 19
 20
 21
 22
 23
 24

1 CARSON CITY, NEVADA, MONDAY, SEPTEMBER 30, 2019, A.M. SESSION
2 -o0o-
3
4 HEARING OFFICER FAIRBANK: Good morning. Welcome
5 back.
6 This is the time and place set for the --
7 regarding the Lower White River Flow System and Order 1303
8 hearing in the proceedings arising out of that particular
9 order.
10 And so this morning we want to go ahead and
11 just -- we're going to have a continuation of the Southern
12 Nevada Water Authority's presentation, and then we're going to
13 go ahead and proceed with our next -- with the Moapa Valley
14 Water District, and then this afternoon Lincoln County and
15 Vidler Water Company.
16 Just as a quick reminder, these proceedings,
17 again, are with respect to those four questions, and kind of
18 that fits with regards to the solicitations of information
19 from the State Engineer in Order 1303.
20 And so how I'm going to go ahead and do these
21 this morning is Southern Nevada Water Authority has been
22 allocated time for two hours this morning, and so they'll be
23 given an hour for the presentation of their biologic panel,
24 and then there will be one hour for questions of the

1 just wanted to go ahead and also introduce. So today we have
2 a different member of our staff with us from our Las Vegas
3 office, John Guillory, and Christi Cooper will be observing
4 from afar this week.
5 And so go ahead and swear in the witnesses.
6 Thank you.
7 (Panel sworn.)
8 MR. TAGGART: And also for the record, both
9 witnesses have been qualified in this proceeding through our
10 prequalification procedure that we developed.
11 Mr. Marshall in the area of biological resources,
12 including conservation biology, environmental compliance, and
13 environmental monitoring.
14 Mr. Williams with respect to environmental
15 resources in the Lower White River Flow System conservation
16 efforts to protect the Moapa Dace and ongoing compliance with
17 the MOA and Endangered Species Act; and also both will testify
18 about the report that they prepared.
19 So, I'm going to start with you, Mr. Williams.
20 Good morning.
21 DIRECT EXAMINATION
22 ANSWERS BY MR. WILLIAMS:
23 A. Good morning.
24 Q. Could you -- could you just briefly describe for

1 participants and the State Engineer's office, then we'll go
2 ahead and move right into the Moapa Valley Water District.
3 And so this week is going to be a little bit more
4 fast pace with respect that we're going to have multiple
5 parties on any given day, and on that particular day when
6 we're completed with the party, then we're going to move right
7 next into the next participant.
8 And so with that, we will go ahead and get
9 started with the Southern Nevada Water Authority.
10 Mr. Taggart?
11 MR. TAGGART: Thank you.
12 Good morning. Paul Taggart for the Southern
13 Nevada Water Authority and the Las Vegas Water District.
14 For the record, on Friday we did an errata to our
15 Exhibit 7, and we provided a copy of that over on the stand
16 over there. And that's Figure 6-2, page 6-7 of that document.
17 And so we -- we presented our hydrology experts
18 on Friday. This morning we'll be talking to our biological
19 resource experts.
20 So with that, I'm going to call our witnesses,
21 Mr. Bob Williams and Mr. Zane Marshall and -- and ask them to
22 be sworn.
23 HEARING OFFICER FAIRBANK: All right. Thank you.
24 And real quick before we swear the witnesses, I

1 the State your background and experience with respect to the
2 Endangered Species Act, compliance with that act, and also
3 with the Moapa Dace in the Lower White River Flow System?
4 A. Yes. Thank you. I'd like to begin telling you
5 about my career as it unfolded over the last four years. I
6 started in 1979 after graduating from Brigham Young University
7 with a degree in fisheries and aquatic ecology.
8 I was hired that same year by the U.S. Fish and
9 Wildlife Service in the Salt Lake City endangered species
10 office as their Section 7 biologist -- Section 7 fishing
11 biologist.
12 I worked there for a couple of years specifically
13 working on Section 7 consultation with the Bureau of
14 Reclamation. I was in the process of completing the Central
15 Utah Project, as well as operation of main stem Colorado River
16 Project, such as Flaming Gorge, Glen Canyon Dam, and the way
17 and Aspen and all that.
18 The requirements of Section 7 and the regulations
19 that accompanied Section 7 that were finalized in 1978
20 required the federal agencies to fund research and to conduct
21 or basically go through the consultation process to ensure
22 that their actions and their funding of actions did not
23 jeopardize the species that were occurring in the Colorado
24 River and Duchesne River; that being the pikeminnow, humpback

1 chub, bonytail chub, and razorback sucker.
2 I worked for the Fish and Wildlife Service in
3 that capacity, and then transferred to the Bureau of
4 Reclamation and was the point of -- working for the Bureau of
5 Reclamation I became the point person in developing the Upper
6 Colorado Recovery Implementation Program, which is a
7 three-state and multi-federal agency program to basically
8 continue research on the Colorado River system to better
9 understand the needs of the species, come up with in-stream
10 flow requirements for the species, and formalize the
11 consultation process.

12 In 1992, I moved through the bureau and became
13 the State supervisor for the Fish and Wildlife Service in
14 Utah.

15 In that capacity, I continued to work on
16 implementing the Endangered Species Act in Utah, completing
17 the Washington County HCP for dessert tortoise, initiated the
18 development of Upper Virgin River Implementation Program, and
19 working with the State of Utah on developing conservations --
20 species conservation agreements under Section 6 of the act for
21 species such as Bonneville cutthroat and leagues chub.

22 In 1997, I moved from Utah, became the State
23 supervisor here in Nevada, and I supervised an office in Reno.
24 I supervised the National Fish Hatchery in Gardnerville --

1 I continued to work on endangered species implementation and
2 compliance. I went to work for a consulting company in
3 California, ICF International, and have my own individual
4 company, Conservation Solutions LLC. And I have a -- I work
5 with National Wildlife Refuge Association in that capacity, as
6 well as a contract with Texas A&M National Resource Institute
7 working on compliance for EOD on desert tortoise issues in
8 Southern California.

9 Q. Thank you, Mr. Williams.

10 So, just quickly from '97 -- 1997 to 2011, you
11 were the head of the Fish and Wildlife Service office for
12 Nevada, and you worked and oversaw environmental compliance,
13 and specifically with the Endangered Species Act?

14 A. That's correct.

15 Q. Okay. Mr. Williams, could you -- I mean, Mr.
16 Marshall, could you also describe a brief background of your
17 experience with respect to the Moapa Dace in the Lower White
18 River Flow System?

19 ANSWERS BY MR. MARSHALL:

20 A. Yes. Thank you, and good morning.

21 I have a master's of arts and science in biology
22 and statistics from UNLV, which I received in 2006.

23 I have 27 years of experience in my field working
24 for the Southern Nevada Water Authority and Las Vegas Valley

1 Lahontan National Fish Hatchery in Gardnerville. That was
2 responsible, and still is, for the recovery of Lahontan
3 cutthroat trout.

4 I had an office also in Las Vegas, and I quickly
5 became acquainted with the issue of Moapa Dace and groundwater
6 pumping.

7 Again, as I said, I moved here in 1997. I was
8 here in 1998 when Fish and Wildlife Service filed protests for
9 pumping in Arrow Canyon wells, and was the supervisor in
10 charge during the period of time from '97 to 2011, when I
11 retired.

12 During that process, I -- or during that time, I
13 was very much engaged with the issues of the Moapa Dace Fish
14 and Wildlife Service filing protests for Coyote Springs
15 pumping and then working on stipulated agreements to work with
16 parties to come up with ways to mitigate those programs and
17 those processes.

18 I was in charge when the MOA was developed. I
19 signed the MOA for the regional manager in Sacramento, and I
20 was responsible for developing the biological opinion. By
21 working with staff, we completed the programmatic opinion, as
22 well as the tiered consultations for Coyote Springs Investment
23 and Southern Nevada Water Authority.

24 Again, as I said, I retired in January of 2011.

1 Water District for the past 24 years.

2 In my capacity there, I have worked as a
3 biologist, supervising biologist, environmental manager, and
4 department director.

5 I have participated in field surveys for
6 threatened endangered species, worked in the development of
7 Endangered Species Act compliance programs, like the Lower
8 Colorado River Multispecies Conservation Plan and the Clark
9 County Multispecies Habitat Conservation Plan.

10 I participated in the development of Section 7
11 consultation documents, which included the biological
12 assessment and working with the Fish and Wildlife Service on
13 the BO for the memorandum agreement and the tiered Section 7
14 consultation.

15 I sat on the technical team that worked and
16 developed the triggers and mitigation measures that are
17 embedded within the memorandum of agreement and the biological
18 opinion.

19 I've also worked in a team to acquire the Warm
20 Springs Natural Area. And since 2010, as the department
21 director, I've overseen the staff that had worked on the
22 biological advisory committee, which is the biological team
23 that's embedded within MOA and BO.

24 I've worked on the management of the Warm Springs

1 Natural Area, which my team oversees, and the overall
2 implementation of the conservation measures that are included
3 in the memorandum of agreement and the biological payment.
4 Q. Thank you. Thank you.
5 Did each of you also work on a report that was
6 submitted to the State Engineer involving the Moapa Dace?
7 MR. WILLIAMS: Yes.
8 MR. MARSHALL: Yes.
9 BY MR. TAGGART:
10 Q. And did you each also work on a revolved report
11 that was provided to the State Engineer involving that same
12 topic.
13 MR. WILLIAMS: Yes.
14 MR. MARSHALL: Yes.
15 BY MR. TAGGART:
16 Q. Okay. And through the hearing, officer, we
17 offered Exhibit 7, 8 and 9 into evidence. We've now presented
18 all of our witnesses who are available for cross-examination,
19 and those are the three reports that we submitted.
20 HEARING OFFICER FAIRBANK: And those reports will
21 be admitted. And also just for purposes of clarification, Mr.
22 Williams was proffered as an expert and without objection.
23 He's not previously been qualified by the State Engineer, and
24 so for the purposes of these proceedings and limited to these

1 proceedings he will be admitted as an expert.
2 MR. TAGGART: Great. Thank you.
3 BY MR. TAGGART:
4 Q. And have you also -- the two of you also provided
5 documents as part of the record for the State Engineer to
6 consider that support your reports?
7 MR. MARSHALL: Yes.
8 MR. WILLIAMS: Yes.
9 MR. TAGGART: Okay. And for the record, those
10 documents have been identified as SNWA's Exhibit 38
11 through 57.
12 BY MR. TAGGART:
13 Q. Okay. Now, Mr. -- Mr. Williams, I'd like to ask
14 you, what is the, in your view, relevance of the Moapa Dace to
15 the State Engineer's question about the long-term annual
16 quantity of groundwater that can be pumped in the Lower White
17 River Flow System?
18 ANSWERS BY MR. WILLIAMS:
19 A. I think the relevance of the Moapa Dace has --
20 with respect to the question of the long-term annual pumping
21 that's available, has been around a long time, as we all know,
22 and it -- because it's a listed -- federally listed species.
23 And -- and actions that would cause jeopardy to
24 the species being something considered, I think, you know,

1 from the beginning -- in my beginning working on the species
2 at issue back in 1998 to today, the issue has been the same:
3 What can we develop in the carbonate aquifer that doesn't
4 jeopardize, you know, the continued existence of Moapa Dace.
5 And I have to say that I think the State
6 Engineer's office has taken a very good and cautious approach
7 towards that issue. You know, the Order 1169 came out of the
8 conflict between, you know, the parties trying to say how much
9 was available. The State Engineer at that time said, well,
10 let's have a pump test. Let's see what's available.
11 You know, in 2013 after the pump test, reports
12 were developed and, again, you know, trying to -- each party
13 trying to express what they thought is available.
14 The question still stands, and it's all about
15 protecting the endangered species while coming up with a
16 volume.
17 Q. And, Mr. Williams, could you also describe in
18 your view what the role of the Endangered Species Act is with
19 respect to the groundwater pumping in the Lower White River
20 Flow System?
21 A. Well, the Endangered Species Act being very broad
22 in its scope and requiring, you know, federal agencies, and
23 pretty much everybody -- I mean, the Endangered Species Act,
24 as it was crafted, involved states, involved private

1 individuals, federal agencies to basically preserve sensitive
2 endangered species.
3 Nobody has allowed the opportunity to take a
4 species, that be killing it or harming it or harassing it, and
5 "harassing" being defined as, you know, limiting habitat, if
6 you will, you can't do that. You have to be prudent. You
7 can't just go out and take it, take a species.
8 So, the Endangered Species Act, I think, has
9 driven the processes that we're in to try to understand, you
10 know, what can be developed in the carbonate aquifer without
11 endangering a species, so -- without impacting the Moapa Dace
12 and its habitat. So I think it's played, you know, a pivotal
13 role where we are today.
14 Q. Now, in your experience with the Fish and
15 Wildlife Service, were there examples of when the State
16 Engineer of Nevada took the Endangered Species Act into
17 account or when the Endangered Species Act affected decisions
18 of the Nevada State Engineer?
19 A. Yes, and three in particular come to mind. The
20 first was -- that I recall was in 1991 when the State Engineer
21 protected in-stream flow rights on Summit Lake on Mahogany
22 Creek for spawning and recreational purposes for Lahontan
23 Cutthroat trout recovery and protection.
24 Another was in 1998 when the State Engineer

1 appropriated -- or basically granted the unappropriated rights
2 on the Truckee River to the Pyramid Lake tribe for the
3 protection of Lahontan cutthroat trout and cui-ui, a sucker
4 that only -- a species -- fish species sucker that only occurs
5 in Pyramid Lake.

6 The State Engineer said to do otherwise would
7 have jeopardized -- or would have violated the Endangered
8 Species Act.

9 And the third one, of course, is the Devil's Hole
10 pupfish case, where, you know, a quantity of water has to be
11 protected over the shelf of Devil's Hole pupfish, and that was
12 the first Keeper versus in the United States. And it -- you
13 know, it basically has caused groundwater irrigation
14 development to be curtailed in the years when there's drought
15 to maintain the Devil's Hole spawning and feeding areas for
16 Devil's pupfish.

17 Q. Thank you.

18 Mr. Marshall, do you have anything to add to Mr.
19 Williams' testimony regarding the relevance of the Moapa Dace
20 to the question of the long-term annual quantity of
21 groundwater that could be pumped in the Lower White River Flow
22 System?

23 ANSWERS BY MR. MARSHALL:

24 A. Yes. I think it's important to understand that

1 describing the biological requirements of the Moapa Dace.
2 Q. Okay. I want to ask you a couple specific
3 questions, but I'm going to put up on the screen a picture of
4 a Moapa Dace.

5 Is that -- is that what we're looking at right
6 now?

7 A. Yes, it is.

8 Q. Okay. And could you briefly, in your view,
9 describe the Dace, and specifically the thermal or temperature
10 requirements in water at the spring heads for this fish?

11 A. Right. So just physically, Dr. Schwemm mentioned
12 that this fish gets up to approximately 120 millimeters.
13 We're finding smaller fish in the system in recent years.

14 It's readily identifiable so that the data that
15 we collect in the field through similar surveys is through
16 visual observation of these animals. And like I said, they're
17 distinct and easily to identify in the stream.

18 They are thermophilics, and they're unique, like
19 Dr. Schwemm mentioned. They require warm water to reproduce,
20 and that range of temperature is between 30 and 32 degrees
21 Celsius. And so they reproduce in the upper portions of the
22 Muddy River tributaries.

23 But the later life stages may use a broader range
24 of habitat. The larger adults, they are more -- they have

1 the Moapa Dace depends on flows in the upper portion of the
2 Muddy River, particularly the Pederson Unit.

3 And to the extent that groundwater pumping in the
4 Lower White River Flow System has the potential to impact
5 those flows, the State Engineer should be concerned and should
6 take that into consideration.

7 I think it's also important to know that the
8 State has been involved in the conservation and recovery
9 actions of Moapa Dace for a very long time.

10 And in recent years, since we entered into the
11 memorandum agreement, Nevada Department of Wildlife has been a
12 key player in the actions that we implemented and sets a
13 precedence for -- for I think the State Engineer to consider
14 potential impacts of groundwater pumping on the Moapa Dace and
15 its habitat.

16 Q. Mr. Marshall, were you present or did you hear
17 Dr. Schwemm's testimony last week?

18 A. Yes, I did.

19 Q. And I'm going to ask you some questions briefly
20 about the Dace itself.

21 Do you agree generally with his testimony
22 regarding the Dace and the -- the biological requirements of
23 the Dace?

24 A. Yes, I do. I think Dr. Schwemm did a good job in

1 more reproductive potential and will use cooler water down
2 into the main stem.

3 They are restricted to habitats above the Warm
4 Springs -- I'm sorry -- yes, the Moapa Gage. And I'll show a
5 map in a little bit in terms of where most of the species are.

6 Q. All right. Let's go to that right now. I think
7 that's Figure 3-1 in your report; is that right?

8 A. Yes, it is.

9 Q. Okay. Can you describe what is shown on that
10 particular figure? I think Dr. Schwemm used this as well, but
11 can you describe this figure in your view?

12 A. So this figure comes from the Warm Springs
13 Natural Area's stewardship plan. And there is an error on
14 this figure that I would like to correct.

15 On the scale to the left, there are temperatures
16 that are correlating with the colors of the map. The last two
17 temperatures should be 28 degrees Celsius and 27 degrees
18 Celsius. So that's the scale on the far left.

19 And --

20 Q. So just to be clear, where it says 27 degrees, it
21 should be 28 degrees, and where it says 22 degrees, it should
22 say 27 degrees?

23 A. Yes, that's correct.

24 Q. All right.

1 A. We've also drawn a box around the Aparcar,
2 Pederson, Plummer and Refuge streams to indicate that this is
3 where 95 percent of the Moapa Dace population occurs.
4 This is approximately one-third of the historical
5 habitat. So it's about two miles of stream length, and the
6 historical habitat was approximately six months.
7 We've also added the Moapa Gage, which you can
8 see on the lower right-hand corner of the figure, and the Warm
9 Springs West Gage, which is about center and lower third of
10 the figure, which shows where that Gage is located, and it
11 measures the combined flow of the Pederson Unit Springs.
12 And then the colors represent the different
13 temperatures.
14 And, again, Moapa Dace breed in temperatures
15 32 degrees C to 32 degrees C.
16 Q. Can you describe the recovery goals for the Dace
17 and the progress that's been made towards those goals?
18 A. So the recovery goal -- so there's a recovery
19 plan for the aquatic species of the Muddy River. In that plan
20 it lays out what the goals are for -- for recovery of the
21 species.
22 The primary goals are to get the population of
23 adult fish to 6,000 animals for five consecutive years
24 to protect, maintain 75 percent of the historical habitat, and

1 report and describe what is shown there.
2 A. So this figure shows a history of the Moapa Dace
3 population and the occurrence of tilapia. So tilapia were
4 originally introduced in the system. I can't see this number.
5 I can show it here.
6 So the blue line is -- is pre-tilapia, and I
7 think that number is in the 1995-'96 time frame when tilapia
8 were introduced. And you can see that once tilapia were
9 introduced, the Moapa Dace population fell precipitously.
10 And Gary Scapatoni produced -- or published a
11 paper in the mid-1990s found that tilapia not only competed
12 with Moapa Dace for habitat, but they also predate Moapa Dace,
13 or they eat them. So this is pretty obvious impact here from
14 tilapia regarding Moapa Dace population.
15 They sort of stabilized and bounced around into
16 the 2000's. And then by about 2012 through major efforts
17 regarding the MOA and efforts of Nevada Department of Wildlife
18 and Fish and Wildlife Service, the tilapia were removed by
19 building fish barriers in the system, poisoning sections of
20 the stream with -- with a pesticide called Rotenone, and then
21 deconstructing those fish barriers to allow fish passage to
22 occur later.
23 And so the effect of that was a significant
24 increase in Moapa Dace population after 2012.

1 to have five spring complexes that are providing habitat for
2 the species, and to also remove non-native species and
3 parasites from the system to the extent that the conservation
4 recovery of the species are not impeded.
5 To date, through efforts of the Fish and Wildlife
6 Service, Nevada Department of Wildlife, and the activities of
7 the signatories of the memorandum of agreement, we have
8 tripled the population from 2008 from 500 fish to 1,500 fish.
9 And that's a total count, not an adult count. But we're on a
10 trajectory to move towards recovery.
11 We have -- approximately 87 percent of the
12 historical habitat is now in ownership by either the Fish and
13 Wildlife Service, the Southern Nevada Water Authority, the
14 Warm Springs Natural Area acquisition. We've done significant
15 habitat restoration in the Plummer, Pederson, Aparcar Refuge
16 streams. And we also have dedicated flows as part of the MOA
17 and water development and water district dedicated one CFS in
18 the Jones Springs, which provides flow to the Aparcar system.
19 And, finally, and probably one of the most
20 important things that's been accomplished is the removal of
21 the non-native species tilapia from the system, which has had
22 a significant positive impact on the population of the Moapa
23 Dace.
24 Q. Mr. Marshall, let's look at Figure 3-2 of your

1 Q. And what -- in your opinion, Mr. Marshall, what
2 is the biggest threat to the Dace now?
3 A. Well, over time there have been a number of
4 significant threats to the Moapa Dace. But after the removal
5 of tilapia from the system, the restoration of habitat today,
6 I think, impacts to the flows in the upper streams are the
7 major, primary threat to the existence of Moapa Dace.
8 Q. Again, I want to show you a picture up on the
9 screen that's entitled "Pederson Spring." What is this
10 showing?
11 A. So this is one of the five springs in the
12 Pederson complex, and it's one of the smaller ones.
13 But the point of this picture is just to
14 demonstrate that these systems are small, and that small,
15 incremental impacts to flows and Moapa Dace habitat can have a
16 significant long-term impact to its ability to reproduce and
17 maintain itself in the system.
18 Q. Okay. And on the next page, what's there?
19 What's that a photograph of?
20 A. This is one of the Plummer spring heads in the
21 Plummer system, which is on the Refuge, and just -- just east
22 of the Pederson system. And, again, it's to demonstrate the
23 small size of -- of habitat that this species depends on.
24 Q. Okay. Now, I'm also going to show you what's

1 been marked as Figure 5-7 in SNWA Exhibit 7.
2 Do you see that document? Specifically the
3 hydrograph for the Warm Springs West near Moapa, Nevada
4 hydrograph?
5 A. Yes. And I understand that Warm Springs West is
6 the second table from the top, the second graph from the top,
7 and this demonstrates the flows at Warm Springs West prior to,
8 during, and after the Order 1169 pump test.
9 And I think what's important here is that soon
10 after the pump test was completed, that the flows in Warm
11 Springs West got down to a point just above 3.2 CFS, which is
12 one of the triggers in the memorandum of agreement. So just
13 above that.
14 And then in the last few years, the flows have
15 been bouncing around 3.3 to 3.4 CFS. So, we're close to that
16 first trigger in the memorandum of agreement.
17 Q. And are you -- are you familiar with the expert
18 reports that were submitted by CSI?
19 A. Yes, I am.
20 Q. And to the extent those reports refer to
21 conditions for the Dace in the Muddy River at the Moapa Gage,
22 what is your view regarding focusing on that location for
23 addressing the condition of the fish?
24 A. So, the Moapa Gage, as I showed earlier, is at

1 far left column, and -- and then there are the associated
2 actions or pumping restrictions that are tied to those
3 triggers.
4 Q. Now, how would you characterize the pumping
5 restrictions? Are they voluntary, or are they mandatory?
6 A. These triggers and pumping restrictions were
7 included in the programmatic biological opinion and the tiered
8 biological opinions for SNWA, the water district, and the
9 Moapa band of Paiutes. And because the compliance documents
10 depend on these triggers and the protection of in-stream flows
11 for Moapa Dace, they are mandatory.
12 If we didn't follow these triggers, we would be
13 out of compliance with the Endangered Species Act.
14 ANSWERS BY MR. WILLIAMS:
15 Q. And to you, Mr. Williams, could you describe in
16 your view what the purpose of the MOA was and who the parties
17 to that MOA are?
18 A. Yes. The purpose of the memorandum of agreement
19 that was signed by the Moapa Valley Water District, Coyote
20 Springs Investment, Southern Nevada Water Authority, Moapa
21 Band of Tribe as Fish and Wildlife Service was to provide a
22 mechanism for the pump test, the 1169 Order, 1169 pump test.
23 The MOA was basically again the vehicle or the
24 mechanism by which Fish and Wildlife Service could enter into

1 the bottom end of the historical range in occurrence of Moapa
2 Dace. It measures the combined flows of the North Fork, South
3 Fork, Big Muddy, Apcar, Pederson, Plummer Refuge streams. And
4 in my opinion it does not provide sufficient resolution to
5 understand how impacts to those higher elevation springs might
6 have on Moapa Dace population.
7 That's why the MOA focuses on the Warm Springs
8 West Gage, which measures the flows of the Pederson complex
9 where those numbers matter to Moapa Dace and its ability to
10 reproduce in the system.
11 Q. Now, Mr. Marshall, I want to ask you about
12 Table 5-1, and I've heard you talk about the Warm Springs West
13 Gage. Can you describe how that Gage is included in this
14 table and also what this table is showing generally?
15 A. Right. So there are two main components of the
16 memorandum of agreement. One is a set of triggers that are
17 intended to protect and maintain in-stream flows in Moapa Dace
18 habitat, and that is this table here.
19 But the other component, or the conservation
20 measures or conservation package, we'll talk about a little
21 later.
22 So, as you can see here, this table shows the
23 signatories to the memorandum of agreement. That is the
24 parties that have water rights. And the triggers are on the

1 an agreement under Section 7A-1. It'd be more voluntary, but
2 it's supposed to be contributing toward conservation of
3 species.
4 So the MOA basically was a way for us to design a
5 pump test with triggers that allow temporary take, if you
6 will, of the Moapa Dace and habitat.
7 Q. And what are the key components to that
8 memorandum of agreement?
9 A. Well, the key components for the MOA is really
10 the conservation measures. And then the triggers and the
11 pumping restrictions are actually after we identified all the
12 conservation measures that would basically offset any impacts
13 to the Dace.
14 The key to the -- one of the key conservation
15 measures was the dedication of Jones Springs for the Apcar
16 unit on the Refuge. It was, you know, a big part of the
17 recovery effort for the species at that time.
18 There were restoration as part of the
19 conservation measures. I know removal of, you know,
20 non-natives' funding for recovery implementation program, that
21 was supposed to be designed for continuing the conservation
22 action after the pump test, with the parties, you know,
23 working together for long-term species recovery and management
24 of the system.

1 Q. And was a biological opinion completed by the
 2 Fish and Wildlife Service as part of the approval of the MOA?
 3 A. Yes. It was primarily crafted in the Las Vegas
 4 office by staff, and I oversaw it and signed it. It was
 5 programmatic in nature; that meaning that we analyzed in the
 6 programmatic opinion the full impact of pumping
 7 16,100 acre-feet as ordered or the existing rights.
 8 So the programmatic nature of it allowed us to do
 9 a full analysis, look at the impacts of what the triggers
 10 would have on the species and its habitat.
 11 From there we were able to then do what they
 12 called tiered biological opinions for Southern Nevada Water
 13 Authority. Their tiered opinion was about 9,000 acre-feet at
 14 that part of the sixteen one, and then they were able to
 15 initiate construction of the pipeline from the Coyote Springs
 16 Valley down to the Muddy River area.
 17 The other programmatic that was done during my
 18 time as supervisor was the tiered consultation for Coyote
 19 Springs Investment that allowed them to develop their
 20 4,100 acre-feet.
 21 Q. So, does the MOA provide Endangered Species Act
 22 compliance for the parties to that agreement?
 23 A. Yes.
 24 Q. What about parties who are not -- who did not

1 ANSWERS BY MR. MARSHALL:
 2 A. Yes, there was.
 3 I think it's important, though, to recognize the
 4 two modeling efforts that were done during the consultation
 5 period and then the two that were done afterwards.
 6 So Fish and Wildlife Service contracted Otis Bay
 7 to do a head grass modeling effort to model changes in flow --
 8 how changes in flow impact the habitat quantity. Desert
 9 Research Institute was also contracted to do a thermal load
 10 model, and so they evaluated how changes in flow impact
 11 temperatures in the system.
 12 And then after the biological opinion was
 13 completed and as part of the funding commitments in the
 14 memorandum of agreement, the USGS was contracted to do an
 15 ecohydrologic model by Dr. Hatten, and that's the model that
 16 Dr. Schwemm mentioned.
 17 And there was also a stochastic population model
 18 that was completed as part of that effort and done by USGS.
 19 Those four models together create the evidence
 20 that shows that changes to flow impact habitat quantity and
 21 quality, which impacts the biological success in Moapa Dace,
 22 and it also impacts the carrying capacity of the stream.
 23 So we have a full connection of flows to carrying
 24 capacity of the system with those four studies.

1 sign the agreement? Is there ESA compliance for those parties
 2 if they affect the Dace?
 3 A. No. Not as part of the MOA or the biological
 4 opinions that have been issued to date.
 5 Q. Did the analysis in the biological opinion
 6 evaluate the triggers themselves?
 7 A. Yes. From 3.2 down to 2.7.
 8 Q. In the MOA, are the triggers flexible or are they
 9 fixed in terms of how the MOA is intended to be implemented?
 10 A. Well, the MOA structure has fixed the triggers,
 11 but the pumping restrictions can be modified. That was the
 12 purpose of the technical review team, is to look at what was
 13 going on hydrologically, maybe even after the pump test, and
 14 then adjust the restrictions appropriately based on new
 15 information.
 16 Q. And did the analysis in the biological opinion
 17 evaluate the 3.2 CFS flow at Warm Springs West Gage and
 18 whether that is a requirement for the Dace?
 19 A. Yes.
 20 BY MR. TAGGART:
 21 Q. And to you, Mr. Marshall, was there additional
 22 modeling done after the MOA was executed to evaluate the
 23 requirement of 3.2 CFS for the Dace?
 24

1 Q. And, Mr. Marshall, I'm going to read you a
 2 statement out of an Exhibit that's been provided by CSI and
 3 was drafted by Stetson Engineers, which states, "Although the
 4 interim order aims to protect existing senior rights in the
 5 public interest in endangered species, objected data linking
 6 the survival of the Moapa Dace to the flow in Pederson spring
 7 has not been provided."
 8 Do you agree with that statement?
 9 A. No, I don't, and because of what I just
 10 mentioned. Those four studies build that linkage from the
 11 quality -- or the quantity of flows to the success of Moapa
 12 Dace in the system.
 13 There's also a couple decades of research that
 14 has been done by Gary Scapaton and other researchers which
 15 have found what -- what Moapa Dace need in terms of resources,
 16 temperature of water and those type of things to support
 17 the -- and end up resulting in the recovery of Moapa Dace in
 18 the system.
 19 Q. Mr. Marshall, in your view, was the MOA and the
 20 biological opinion that -- that was analyzed -- analyzed the
 21 MOA, was it structured to allow for a temporary reduction in
 22 flow below 3.2 or for a permit reduction of flow below 3.2?
 23 A. So the MOA does two things. It allows for the
 24 development of 16,100 acre-feet of water rights in Coyote

1 Springs Valley and California Wash. It provides for the Order
2 1169 pump test.
3 And there are a couple provisions in there that
4 are temporary, particularly to the Arrow Canyon well within
5 its operation. And then the MOA provides for the long-term
6 development of that 16,100 acre-feet in the associated
7 biological opinion.
8 The way that the triggers are set up and the
9 actions under those triggers, I believe that the intent of the
10 MOA was to maintain 3.2 CFS in the system. It allows for
11 flows to drop down to 2.7, and the tiered biological opinions
12 allow the flows to drop to 2.78, but the intent was to get the
13 system back to 3. 2.
14 Q. And, Mr. Williams, from the services perspective,
15 do you agree with that statement?
16 ANSWERS BY MR. WILLIAMS:
17 A. Yes, I do. At the time, the MOA and the writing
18 of the MOA and the biological opinion that facilitated the
19 pump test was critical to the Fish and Wildlife Service at
20 that time.
21 And I think that the -- the conditions below 3.2
22 to allow the pump test to fully -- for the parties to
23 basically more fully understand what's available was -- was
24 the key, along with all the mitigation of the conservation

1 set up, if flows go below 3.2 CFS -- and so that triggers
2 actions by the signatories.
3 If, as I understand it in the analysis of the
4 results of Order 1169, the -- the flow volumes that are
5 included in the actions under the triggers are not sufficient
6 in returning flows to 3.2 CFS, then the HRT is required to
7 convene and to begin modifying those actions or making
8 recommendations to modify those actions under the triggers,
9 which include, potentially, additional restrictions to
10 pumping.
11 The HRT, if they don't come to agreement, there's
12 provision in the MOA that they will obtain a third party to
13 essentially make a decision.
14 Through this entire process, the Fish and
15 Wildlife Service also has the discretion to call for a
16 reconsultation of the opinions and reevaluate those -- those
17 pumping restriction actions that are identified under the
18 triggers.
19 Q. And do the pumping restrictions apply to
20 permanent uses of water rights?
21 A. Yes, they do.
22 Q. And, Mr. Marshall, I want to ask you, what is
23 your recommendation to the State Engineer to protect the Moapa
24 Dace in the long-term quantity of groundwater pumping in the

1 measures that came with it.
2 I think the -- the intent of the MOA was to get
3 more information to make better decisions. It was not the
4 intent of the MOA to go on in perpetuity.
5 The -- the information for the -- from the pump
6 test, in my view, should be, you know, evaluated in today's
7 time and, you know, potentially, you know, modify the MOA.
8 MR. TAGGART: Thank you. Just I want to ask the
9 hearing officer, I want to make sure I save five minutes for
10 redirect, if I can.
11 HEARING OFFICER FAIRBANK: You're at 40 minutes
12 and 20-something seconds.
13 MR. TAGGART: Okay. Thank you.
14 BY MR. TAGGART:
15 Q. Mr. Marshall, in your view what will happen under
16 the MOA if flows fall below 3.2 given the current hydrologic
17 condition with pumping?
18 ANSWERS BY MR. MARSHALL:
19 A. I'm not sure I understand the question.
20 Q. Well, do you have an understanding of the -- of
21 the components of the MOA and the committees that are
22 developed under the MOA and how those committees are supposed
23 to react depending on triggers?
24 A. Okay. So, the way the MOA and the opinions are

1 Lower White River Flow System?
2 ANSWERS BY MR. MARSHALL:
3 A. So my recommendation to the State Engineer is to
4 protect 3.2 CFS in -- at the Warm Springs West Gage.
5 It's my understanding from the research that our
6 hydrologists have done and others that a lesser volume in
7 pumping than was contemplated in the MOA may have a greater
8 impact on the springs.
9 And so my recommendation is -- like our
10 hydrologists, is to restrict pumping in the Lower White River
11 Flow System to 4,000 to 6,000 acre-feet per year.
12 And I also think additional hydrologic or pumping
13 studies might benefit our understanding of how long-term
14 pumping in the Lower White River Flow System could impact
15 Moapa Dace habitat in that 3.2 CFS.
16 Q. And if groundwater pumping is authorized that
17 leads to reduction below 3.2 CFS, what are your concerns about
18 what could happen at that point?
19 A. So, the memorandum of agreement and the
20 biological opinions contemplate flexibility, they require
21 flexibility, in terms of pumping restrictions.
22 My concern would be permanent uses, like
23 industrial residential uses, are established and that that
24 flexibility is essentially taken away, where we cannot reduce

1 pumping the impacts that flows and results in something less
2 than 3.2 CFS at the Warm Springs West Gage and causes a
3 significant conflict with the Endangered Species Act and the
4 Lower White River Flow System.

5 ANSWERS BY MR. WILLIAMS:

6 Q. Mr. Williams, same question to you is what's your
7 recommendation to the State Engineer regarding protection of
8 the Moapa Dace and how it relates to the long-term quantity of
9 groundwater pumping in this area?

10 A. Well, my recommendation would be to continue to
11 investigate what is a long-term annual amount. I think that
12 maintaining -- and I agree with Mr. Marshall -- that
13 maintaining 3.2 or above avoids not only jeopardizing the
14 Moapa Dace and adversely modifying its habitat, but you also
15 avoid a conflict with the National Wildlife Refuge as they
16 have a 3.5 to divert for a water right for the refuge, and
17 they, you know, can't arbitrarily, you know, give up a water
18 right. They have reserved that in the MOA to basically, you
19 know, I guess challenge or, you know, ask for a determination
20 on that refuge water right.

21 So, I listened to testimony last week with
22 respect to the hydrologic analysis information. I
23 specifically listened to Tim Mayer, who over the time -- I met
24 Tim Mayer in 1998 when we were negotiating with Moapa Valley

1 CROSS-EXAMINATION
2 BY MR. HERREMA:

3 Q. Good morning. My name is Brad Herrema, and with
4 me is -- I thought Kent was here. Sorry.

5 I'm Brad Herrema. I represent CSI, and I just
6 have a handful of questions.

7 BY MR. HERREMA:

8 Q. Mr. Williams, I believe you said you retired from
9 U.S. Fish and Wildlife Service in 2011; is that correct?

10 ANSWERS BY MR. WILLIAMS:

11 A. That's correct.

12 Q. So the opinions that you've given today are not
13 the opinions of U.S. Fish and Wildlife Service, but your own;
14 is that correct?

15 A. That's correct.

16 Q. All right. Mr. Marshall, in regard to the 3.2
17 CFS and the amount of carbonate pumping in the Lower White
18 River Flow System that would keep flows at Warm Springs West
19 Gage above that trigger, did you do any hydrologic analysis of
20 your own to determine that volume?

21 A. No. I'm not a hydrologist, so I did not do that.

22 Q. Okay. So you're just relying on the folks who
23 testified on Friday for what that quantity is; is that
24 correct?

1 Water District over Arrow Canyon, and his position has not
2 changed.

3 I think that being conservative, going slowly
4 with respect to this decision, is by far in the interests of
5 the public and the species, not -- or not putting yourself in
6 the situation where violating ESA would be critical to, you
7 know, the decision.

8 Q. Thank you.

9 MR. TAGGART: We have no further questions.

10 HEARING OFFICER FAIRBANK: Okay. So that leaves
11 you about 13 minutes.

12 MR. TAGGART: Thank you.

13 HEARING OFFICER FAIRBANK: And so we will go
14 ahead and open it up for questions. And, again, similar as we
15 did last week, we're just going to go ahead and cycle through.
16 We have an amount of time that's allotted.

17 And this week we're going to be a little bit more
18 condensed -- or a lot more condensed on our time frame, so
19 efficiency, then, is going to be of the utmost importance.

20 And for today we have allotted four minutes per
21 participant, and so we will go ahead and start with Coyote
22 Springs Investments.

23
24

1 A. Yes, that's correct.

2 Q. Mr. Marshall, you said that the Moapa Dace
3 depends on flows in Pederson Springs. Do you recall saying
4 that?

5 A. Yes, I do.

6 Q. Table A2, which is on page A3 of Appendix A to
7 your June 2019 report, that shows the Dace counts in Reach 5
8 over the last 11 or 12 years.

9 What that shows, when I read it, is that there's
10 been an increase in the Dace counts over the last couple
11 years, while at the same time the water authorities hydrology
12 panel testified last Friday that groundwater levels at EH-4
13 have been declining.

14 This seems to indicate as Dace population has
15 increased during that period, there's been a decline at the
16 same time in EH-4 groundwater levels.

17 Are there successful mitigation measures that
18 were being used that can explain this inverse relationship?

19 A. I'm sorry. I'm going to need you to restate the
20 time period that you're referencing.

21 Q. 2017 winter through 2019 winter, Reach 5, which
22 is under Pederson; do you see that?

23 A. I do.

24 Q. Okay. The Dace counts have steadily increased

1 during that period at the same time the EH-4 groundwater level
2 was declining.
3 So are there mitigation measures that have been
4 successfully implemented that can explain the fact that the
5 Dace count has been increasing while EH-4 pumping levels have
6 been -- or I'm sorry -- groundwater levels have been
7 decreasing?
8 A. So these numbers that you're talking about --
9 just so that I am sure what you're saying -- winter of 2017
10 was 29 animals?
11 Q. Yes.
12 A. And then 32 and then 49 and then 51 and then 88.
13 Q. Yep, you got them.
14 A. Yeah. So, since 2017, I'm not aware of any
15 specific restoration efforts, but I do know that Fish and
16 Wildlife Service is actively doing management in terms of the
17 removal of non-native plant species in that system from one
18 year to the next. And I would submit that this is a
19 relatively small variation in numbers in that specific area.
20 I also want to caution that comparing summer to
21 winter numbers is not appropriate because the summer numbers
22 include a larval animals and juveniles, where the winter
23 animals is mostly adults.
24 Q. Okay.

1 period of time when we reviewed and commented on Fish and
2 Wildlife Service -- the Fish and Wildlife Service biological
3 opinion, but the final opinion was a Fish and Wildlife Service
4 product.
5 MR. BURLEY: Right. Mr. Williams, this was done
6 13 years ago, 2006. In your opinion, is the MOA still
7 protective of the Moapa Dace?
8 MR. WILLIAMS: Yes.
9 MR. BURLEY: Mr. Marshall, would you agree?
10 MR. MARSHALL: Yes, I do, as long as we maintain
11 those flows in Pederson. The 3.2 CFS.
12 BY MR. BURLEY:
13 Q. So you view the MOA as something of a success in
14 terms of the purposes for which this was developed?
15 ANSWERS BY MR. MARSHALL:
16 A. Yes, I do.
17 Q. Are you familiar with an annual process by which
18 the mitigation measures, the pumping restrictions, are
19 reviewed by a hydrologic review team?
20 A. Yes, I am.
21 Q. And that team includes representatives of the
22 Fish and Wildlife Service and SNWA and the Moapa Band of
23 Paiutes and Coyote Springs?
24 A. Yes.

1 MR. HERREMA: I think I heard my buzzer. Thank
2 you.
3 HEARING OFFICER FAIRBANK: United States Fish and
4 Wildlife Service? I'm not seeing any questions.
5 National Park Service?
6 MS. GLASGOW: No questions.
7 HEARING OFFICER FAIRBANK: Seeing no questions,
8 Moapa Band of Paiute Indians?
9 MR. BURLEY: Thank you. For the record, I'm
10 Richard Burley, attorney for the Moapa Band of Paiutes.
11 CROSS-EXAMINATION
12 BY MR. BURLEY:
13 Q. Mr. Williams, I guess and Mr. Marshall, you were
14 both involved in helping to formulate and -- the 2006
15 memorandum of agreement?
16 MR. MARSHALL: Yes.
17 MR. WILLIAMS: Yes.
18 MR. BURLEY: And at the time it was done, you
19 prepared -- Mr. Marshall, you were involved in preparation of
20 the biological opinion, which indicated that the MOA was
21 sufficiently protective of the Dace at that time; is that
22 accurate?
23 MR. WILLIAMS: So I was involved in the
24 preparation of the biological assessment, and there was a

1 Q. Are you aware that every year, annually, there
2 have been no suggestions thus far to change the mitigation
3 measures and pumping restrictions within -- by the HRT?
4 A. Yes, I am aware that there have been no
5 recommendations so far. There has been significant -- a
6 significant amount of lively discussion within that team,
7 though, each year.
8 Q. Fair enough.
9 Are you aware that the mitigation measures, the
10 pumping restrictions are different in -- for Coyote Springs
11 than for California Wash?
12 A. Yes, I am.
13 Q. The proportionalities are different, just the
14 general rates of reduction are different?
15 A. Yes.
16 Q. Do you think that was a rational choice by the
17 MOA parties?
18 A. It was based on the understanding of the
19 hydrology of the system at the time. And so, again, I'm not a
20 hydrologist, but it does seem to be a rational approach.
21 Q. Do you know the status of temperature monitoring
22 in the springs these days?
23 A. No. No, I don't.
24 Q. Do you know if there is any temperature --

1 ongoing temperature monitoring in the springs?
2 A. I'm not aware of Fish and Wildlife Services
3 conducting temperature monitoring.
4 I know that SNWA is looking at installing a
5 network of publications through the system to begin monitoring
6 temperature.
7 Q. What about chemical or isotopic monitoring?
8 A. I'm not aware.
9 Q. Okay. So the only active monitoring that you
10 know about is flow monitoring; is that -- is that fair?
11 A. Flow monitoring and monitoring of the Moapa Dace
12 population.
13 Q. Okay. Were either of you involved in the design
14 of the 1169 pump test?
15 A. I was not.
16 MR. BURLEY: Is that my time being up?
17 HEARING OFFICER FAIRBANK: That is your time, but
18 if we have time --
19 MR. BURLEY: Okay.
20 HEARING OFFICER FAIRBANK: -- at the end, we'll
21 circle back around. Thank you.
22 MR. BURLEY: No more questions. Thank you.
23 HEARING OFFICER FAIRBANK: Next is the Moapa
24 Valley Water District.

1 MR. MORRISON: Good morning. Greg Morrison for
2 Moapa Valley Water District.
3 CROSS-EXAMINATION
4 BY MR. MORRISON:
5 Q. Mr. Marshall, I just want to clarify one thing.
6 I wasn't sure if I heard it correctly.
7 Did you say that the MOA was or was not intended
8 to apply in perpetuity?
9 ANSWERS BY MR. MARSHALL:
10 A. I believe the MOA was intended for the long-term
11 development of the 16,100 acre-feet of water rights that --
12 that -- that the parties that signed the MOA had identified at
13 the time.
14 So, I believe it was for the test. There were
15 elements of the MOA that were specific to the test, but I
16 believe the MOA overall was intended for the long-term
17 development of the -- of the -- of those water rights.
18 Q. All right. And you're aware of the Moapa Valley
19 Water District's dedication of its join springs water right
20 pursuant to the MOA?
21 A. Yes.
22 Q. Was that dedication intended in any way to be
23 temporary or is that a permanent dedication?
24 A. It's a permanent dedication, and it's very

1 important to the conservation of Moapa Dace.
2 MR. MORRISON: Thanks a lot.
3 HEARING OFFICER FAIRBANK: Next is Lincoln
4 County, Vidler Water Company.
5 CROSS-EXAMINATION
6 MS. PETERSON: Good morning. Karen Peterson
7 representing Lincoln County Water District and Vidler Water
8 Company.
9 BY MS. PETERSON:
10 Q. Mr. Williams, I had a couple questions for you.
11 I'm showing you -- or I had provided to you Fish and Wildlife
12 Service Exhibit 59. It's a biological opinion dated October
13 29th, 2008 for Kane Springs Valley.
14 Do you see that in front of you?
15 ANSWERS BY MR. WILLIAMS:
16 A. Yes, I do.
17 Q. And it was signed on page 50 by Robert D.
18 Williams, Field Supervisor?
19 A. Yes.
20 Q. Do you see that?
21 A. Yes.
22 Q. Was that you?
23 A. That was me. Still is me.
24 Q. Okay. And do you -- sorry. Do you remember --

1 or if you could turn to page 37, there -- there was a
2 statement there regarding the Dace.
3 Do you see that?
4 A. In the middle of -- in the middle of the page?
5 Q. Yes.
6 A. Yes.
7 Q. And it was the service's biological opinion that
8 the action as proposed and analyzed the Kane Springs Valley
9 Groundwater Development Project is not likely to jeopardize
10 the continued existence of the endangered Moapa Dace.
11 Do you see that?
12 A. Yes.
13 Q. And then also implementation of the project's
14 conservation action will minimize any potential impacts.
15 Do you agree with that?
16 A. Yes.
17 Q. And then directing your attention to the other
18 document I provided to you, it's an amended stipulation for
19 withdrawal of protests. It's Fish and Wildlife Service
20 Exhibit 57 and Lincoln County-Vidler Exhibit 16.
21 Do you see that in front of you?
22 A. Yes, I see the Exhibit.
23 Q. Do you remember the negotiations regarding the
24 monitoring, management, and mitigation plan for this

1 stipulation?
2 A. Yes, I do. I do remember those negotiations with
3 Vidler and Lincoln County.
4 Q. And you were involved in those?
5 A. Yes, I was.
6 Q. And there's a trigger that set forth the action
7 criteria under page 3 and 4 of Exhibit A to the amended
8 stipulation.
9 Do you see that?
10 A. Yes.
11 Q. And under paragraph 2, do you see that the
12 trigger for the -- for the flows is 3.2 CFS?
13 A. Yes, I believe that's correct.
14 Q. And then in paragraph 1 it indicates it's for
15 flow measurements at the Warm Springs west flume.
16 Do you see that?
17 A. Yes.
18 Q. All right. Would you agree -- I think you had a
19 question from your attorney that indicated that signatories to
20 the MOU were compliant, I think -- I think -- I believe you
21 said, with the Endangered Species Act.
22 Is that what you said?
23 A. Repeat your question, please.
24 Q. Did -- you indicate in response to a question

1 CROSS-EXAMINATION
2 BY MR. DONNELLY:
3 Q. I'll start with Mr. Williams.
4 The definition of "Take" in Section 3 of the ESA
5 is to "harass, harm, pursue, hunt, shoot, wound, kill, trap,
6 capture or collect or attempt to engage in any such conduct";
7 is that accurate?
8 ANSWERS BY MR. WILLIAMS:
9 A. That sounds very accurate.
10 Q. And regulation in 50 CFR Section 17-3 defines
11 that harm includes habitat, modification, or degradation where
12 it kills or injures wildlife by significantly impairing
13 essential behavior patterns, including breeding, feeding, or
14 sheltering; is that accurate?
15 A. That's correct.
16 Q. Is it true that Section 9 of the ESA prohibits
17 unpermitted take?
18 A. Yes.
19 Q. Might individuals or agencies taking action which
20 result in unpermitted take be in violation of Section 9?
21 A. Yes.
22 Q. That you are aware of, are citizens able to file
23 lawsuits to enforce the ESA, including Section 9, suits
24 against entities responsible for an unauthorized take?

1 from Mr. Taggart that signatories to the MOU and on the basis
2 of the biological opinion, that those signatories were
3 compliant with the Endangered Species Act?
4 Is that what you said?
5 A. I think Mr. Taggart's question was asking me if
6 parties outside of the MOU did not have Endangered Species Act
7 compliance, and I think I said yes.
8 I would like to correct that statement by saying
9 that the parties of the Kane Springs agreement and
10 stipulation, the biological opinion, are clearly covered under
11 ESA.
12 MS. PETERSON: Okay. Thank you. No further
13 questions.
14 HEARING OFFICER FAIRBANK: City of North Las
15 Vegas?
16 MS. URE: No questions.
17 HEARING OFFICER FAIRBANK: Thank you.
18 Seeing no questions, Center for Biological
19 Diversity.
20 MR. DONNELLY: Good morning. Patrick Donnelly
21 with the Center for Biological Diversity. I'll try to be
22 quick here because I do have a number of questions.
23
24

1 A. Yes.
2 Q. We heard testimony that carbonate pumping in the
3 Lower White River Flow System causes spring flow declines,
4 including on reports you were apart of from the Southern
5 Nevada Water Authority; is that correct?
6 A. Yes.
7 Q. And spring declines cause a loss in habitat,
8 correct?
9 A. Yes.
10 Q. And a loss in habitat can cause a loss in overall
11 Dace numbers; is that correct?
12 A. Yes.
13 Q. Therefore, can we make the connection that
14 carbonate pumping causes take of Moapa Dace?
15 A. Yes.
16 Q. And, thus, carbonate pumping would be a violation
17 of Section 9 of the Endangered Species Act if it was not
18 permitted through MOA's and other agreements?
19 A. If it was not permitted, that's correct.
20 Q. Would entities authorizing water withdrawals
21 causing take that is not permitted take be in violation of
22 Section 9?
23 A. Potentially. But I'm not an attorney, nor do I
24 do law enforcement. I've never --

1 Q. Absolutely. Just asking within your capacity.
2 A. Within, yes, potentially they could.
3 Q. Thank you. I guess this will be a question for
4 Mr. Marshall. You stated that the MOA allows for flows to get
5 as low as 2.78; is that accurate?
6 ANSWERS BY MR. MARSHALL:
7 A. The MOA has triggers down to 2.7.
8 Q. Uh-huh.
9 A. The tiered biological opinions allow flows to get
10 to 2.78 under the incidental take statements that are in those
11 tiered opinions.
12 Q. Given what we know now, might flows as low as 2.7
13 have severe impacts on overall Dace numbers?
14 A. So that analysis was done in the biological
15 opinions and -- and is supported by the modeling efforts that
16 I mentioned that were done as part of the BOs and as part of
17 the mitigation package or conservation package in the MOA, and
18 those -- that analysis stands today.
19 Q. So, there would be significant impacts on Dace
20 numbers at that pumping level?
21 A. So, the -- the opinions don't speak to specific
22 numbers. They speak -- they use habitat and habitat reduction
23 as a proxy for take and for Dace numbers.
24 Q. Okay.

1 HEARING OFFICER FAIRBANK: Seeing no questions,
2 Bedroc?
3 MS. URE: No questions.
4 HEARING OFFICER FAIRBANK: Seeing no questions,
5 Nevada Energy?
6 MS. CAVIGLIA: Justina Caviglia on behalf of NV
7 Energy, and I just have a quick one.
8 CROSS-EXAMINATION
9 BY MS. CAVIGLIA:
10 Q. Do you consider the MOA alone to be adequate
11 enough to protect the Dace?
12 ANSWERS BY MR. MARSHALL:
13 A. Where is the question going?
14 Q. I'm just asking do you believe the 3. -- well,
15 I'll rephrase it.
16 Do you believe the 3.2 in the MOA alone to be
17 adequate to protect the Dace?
18 A. Are you talking to Bob or myself?
19 Q. Either one of you.
20 A. So the MOA is protective of the Dace as it
21 relates to the signatories.
22 There are other water right holders in the Lower
23 White River Flow System that are not signatory to the MOA, and
24 so it is -- well, it doesn't address those other -- those

1 A. And so I can't speak to what the changes in flows
2 would specifically result in --
3 Q. Sure.
4 A. -- in the population numbers.
5 But changes in flows are expected to impact
6 habitat that's important for the Dace.
7 Q. Does the MOA explicitly state that it applies
8 beyond the duration of the pump test?
9 A. I -- off the top of my head, I do not know where
10 the specific statement is.
11 Q. You're not aware of a specific statement, then?
12 A. I -- I am not, but I -- I -- I do understand the
13 MOA. I mean, I was part of the development of the MOA and I
14 understand it to apply to the long-term development of -- of
15 the water rights that are contained or addressed in the MOA.
16 MR. DONNELLY: Thank you.
17 HEARING OFFICER FAIRBANK: Thank you.
18 Next, Georgia Pacific-Republic?
19 MS. HARRISON: No questions.
20 HEARING OFFICER FAIRBANK: Seeing no questions,
21 Nevada Cogeneration?
22 Seeing no questions, Muddy Valley Irrigation
23 Company?
24 MR. KING: No questions.

1 other entities, so it could potentially be insufficient in
2 terms of protecting the Moapa Dace.
3 MR. WILLIAMS: Well, I guess if I could add a
4 little bit to what Zane -- or Mr. Marshall said. The -- if
5 you look at, I think, Section 8 of the MOA, it talks about a
6 comprehensive type of a program amongst the parties, and I
7 think that the intent of the MOA was for primarily the period
8 for the pump test, but it was looking for the parties of the
9 MOA to expand and to -- and to look outside just those parties
10 to bring in other, you know, parties that may be impacting the
11 Dace.
12 So I don't believe that MOA in and of itself, by
13 itself, is enough to achieve recovery or protect the Dace
14 long-term.
15 MS. CAVIGLIA: Thank you. That answered my
16 question.
17 HEARING OFFICER FAIRBANK: I will now open it up
18 to questions from the State Engineer Division of Water
19 Resources staff.
20 Okay. We will go ahead and open it back up for
21 the participants to ask additional questions and go ahead and
22 offer three minutes.
23 And we'll start with Coyote Spring Investments.
24 MR. HERREMA: Thank you. Brad Herrema again for

1 the record.
2 RECROSS-EXAMINATION
3 BY MR. HERREMA:
4 Q. Mr. Marshall -- excuse me -- isn't it true that
5 under the MOA, CSI got two restoration and recovery
6 obligations.
7 Namely, under Section 3A to dedicate
8 460-acre-feet per year in water rights for survival on
9 recovery of the Dace; and, number two, under Section 4E of the
10 MOA, to pay \$200,000 for restoration of a Dace habitat?
11 ANSWERS BY MR. MARSHALL:
12 A. Yes, that's true.
13 Q. And isn't it true that CSI has fully completed
14 these obligations dedicated to 460 acre-feet per year in water
15 rights in paying the \$200,000?
16 A. Yes, that is my understanding.
17 Q. Figure A-1 of your June 2019 report shows a
18 diagram of the streams and reaches that are accounted for the
19 Moapa Dace, and you talked a few minutes ago about Reach 5,
20 which is the upper Pederson reach.
21 In your opinion, is the upper Pederson stream
22 good habitat for the Dace to spawn?
23 A. The upper Pederson?
24 Q. Yes.

1 has had some discussion about the potential for removing that
2 gage as in order replacing it, as -- or with another gage that
3 would allow fish movement up into the upper Pederson.
4 There is potential by increasing that fish
5 movement upstream to the upper Pederson to improve total
6 numbers of fish in that area.
7 MR. HERREMA: Thank you.
8 HEARING OFFICER FAIRBANK: United States Fish and
9 Wildlife Service? Seeing none.
10 National Park Service.
11 MS. GLASGOW: No questions.
12 HEARING OFFICER FAIRBANK: Seeing no questions.
13 Moapa Band of Paiutes?
14 MR. BURLEY: Richard Burley for the record for
15 the Moapa Band of Paiutes.
16 RECROSS-EXAMINATION
17 BY MR. BURLEY:
18 Q. I think, Mr. Williams -- or maybe it was Mr.
19 Marshall -- you made a recommendation that the State Engineer
20 looked particularly hard at permanent uses that might affect
21 the springs.
22 Do you have any similar opinion regarding
23 temporary uses? I assume they're just -- you have just less
24 of a concern?

1 A. Yes, it is.
2 Q. Are you aware of any impediments to that
3 particular reach, such as the Warm Springs West Gage?
4 A. Yes, I am.
5 Q. Do you know what the drop is at that gage that
6 causes the impediment to reach in that area?
7 A. No, I do not.
8 Q. Would 18 inches sound about right?
9 A. I have no idea.
10 Q. Are you aware whether a Dace can get through
11 that -- that gage?
12 A. It's my understanding from discussions of the
13 biological advisory committee that the Warm Springs West Gage
14 is a barrier to upstream movement from Moapa Dace.
15 Q. Okay. And are there other impediments in that
16 area, such as the outflow from a culvert under the road or
17 fast-moving water upstream of the gage? Any other impediments
18 to Dace reaching that spawning habitat?
19 A. Not that I'm aware of.
20 Q. In regard to the gage itself, in your opinion if
21 flows remained constant, what would happen to the population
22 of the Dace if the -- that gage impediment was removed or
23 remediated?
24 A. Well, the -- the biological advisory committee

1 ANSWERS BY MR. MARSHALL:
2 A. I do have less of a concern. I think the
3 important thing is that the MOA and the opinions assume that
4 there is some flexibility; that the pumping restrictions can
5 be implemented to return flows back to 3.2 CFS at the Warm
6 Springs Gage.
7 Q. And do you agree with that? Do you think that
8 assumption regarding flexibility is appropriate and correct --
9 A. I do.
10 MR. BURLEY: Thank you. No further questions.
11 HEARING OFFICER FAIRBANK: Moapa Valley Water
12 District?
13 MR. MORRISON: No.
14 HEARING OFFICER FAIRBANK: Seeing no questions.
15 Lincoln County-Vidler? Seeing no questions.
16 City of North Las Vegas? No questions.
17 Center for Biological Diversity?
18 MR. DONNELLY: Thank you. Patrick Donnelly,
19 Center for Biological Diversity.
20 I would just offer to the State Engineer's office
21 that I think this section is supposed to go till 10:30. It
22 looks like there will be a little bit of extra time, and this
23 is pretty important to why we're here, so we'd appreciate a
24 few extra minutes after this.

1 RECROSS-EXAMINATION
2 BY MR. DONNELLY:
3 Q. Mr. Marshall, to the best of your knowledge, are
4 there groundwater withdrawals from the carbonate aquifer
5 occurring right now at parties not -- by entities not party to
6 the MOA?
7 ANSWERS BY MR. MARSHALL:
8 A. I don't know for sure.
9 Q. What were the parties to the MOA?
10 A. The CSI, SNWA, Moapa Band of Paiutes, Fish and
11 Wildlife Service, and Moapa Valley Water District.
12 Q. So there may be other users of water who are not
13 party to the MOA?
14 A. There may be, but I'm not aware of the
15 specific -- you know, to your question, I'm not aware of
16 parties that are -- that might be or not.
17 Q. Okay.
18 A. Signatory to the MOA.
19 Q. At 3.2 CFS, what happens?
20 A. The MOA and the opinions call for the parties to
21 convene, the HRT to convene, and to assess the -- the cause of
22 the decline of flows in the spring.
23 They are -- if decline continues beyond 3.2, the
24 parties are -- are thought to begin discussing involuntary

1 The biological opinion and the stipulated
2 agreement while -- for Kane Springs Valley was tied to the --
3 you know, the conditions, basically, that were going to
4 happen, you know, after the pump test, or, you know,
5 information from the pump test.
6 I don't -- I'm not a hydrologist, and I don't
7 know if the -- the theory, if you will, the Kane Springs water
8 could still be delivered and be counted at Warm Springs West
9 Gage. I don't know if that -- that connection has been proven
10 or disproven, so...
11 MR. DONNELLY: May I finish the question?
12 HEARING OFFICER FAIRBANK: We're going to go
13 ahead and circle back around --
14 MR. DONNELLY: Okay.
15 HEARING OFFICER FAIRBANK: -- if we have
16 additional time.
17 MR. DONNELLY: Thank you.
18 HEARING OFFICER FAIRBANK: Georgia Pacific?
19 MS. HARRISON: No questions.
20 HEARING OFFICER FAIRBANK: Seeing no questions.
21 Nevada Cogeneration. Not seeing any questions.
22 Muddy Valley Irrigation Company.
23 MR. KING: No questions.
24 HEARING OFFICER FAIRBANK: Seeing no questions.

1 actions to return the flows back to 3.2.
2 Q. In some ways, given that all the MOA participants
3 are in this proceeding and we're having discussions about
4 those very topics, in some way have we commenced the 3.2
5 action? Not formally but in spirit?
6 MR. TAGGART: Objection. Calls for speculation
7 and a legal conclusion.
8 HEARING OFFICER FAIRBANK: I'll sustain the
9 question, if you want to ask the question differently.
10 BY MR. DONNELLY:
11 Q. The intent of the MOAs was to commence a
12 discussion about the topics you just elucidated among the
13 parties once 3.2 is reached.
14 Have we commenced a discussion here similar in
15 scope to that which would have been commenced under the MOA?
16 MR. TAGGART: Same objection. And relevance.
17 MR. DONNELLY: I'll just withdraw it.
18 BY MR. DONNELLY:
19 Q. With regard to Kane Springs, Mr. Williams, would
20 you say that the pump test provides new information now that
21 wasn't available at the time of that biological opinion?
22 ANSWERS BY MR. WILLIAMS:
23 A. The pump tests clearly provide new information
24 for the parties of the MOA.

1 Bedroc? No questions.
2 Nevada Energy, any additional questions? Okay.
3 No questions.
4 And I'll open it up to State Engineer and
5 Division of Water Resources staff.
6 EXAMINATION
7 MR. WILSON: Good morning, gentlemen. Tim Wilson
8 for the record. I just have one quick question.
9 Is there any type of expiration date within the
10 MOA that you're aware of?
11 MR. MARSHALL: No. I'm not aware of any
12 expiration date.
13 MR. WILLIAMS: And I concur with him.
14 HEARING OFFICER FAIRBANK: Mr. Donnelly, I will
15 give you an additional three minutes, and then we need to take
16 a -- send it back to Las Vegas Valley Water District and
17 Southern Nevada Water Authority and then have time for a
18 break.
19 MR. DONNELLY: I appreciate your indulgence.
20 Patrick Donnelly, for the record.
21 FURTHER RECROSS-EXAMINATION
22 BY MR. DONNELLY:
23 Q. I'm just going to finish that question, Mr.
24 Williams, but in a more general sense.

1 In general, when substantial new information is
2 available, does that trigger a reconsultation?
3 ANSWERS BY MR. WILLIAMS:
4 A. It's called reinitiation --
5 Q. Reinitiation.
6 A. -- consultation, but, yes, that's correct.
7 Q. Thank you.
8 This is for either of you. The term
9 "conservation reliance species" is defined as a species that
10 requires continuing species-specific wildlife management
11 interventions to survive. Does that sound right, Mr.
12 Williams?
13 A. Yes, I think that's correct.
14 Q. Do you think that the Moapa Dace is a
15 conservation-reliant species?
16 A. Very much so.
17 Q. Would Moapa Dace numbers fall if ongoing
18 conservation actions were terminated?
19 A. I would say yes to that.
20 Q. Is there any point at which the Moapa Dace
21 conceivably, in your expert opinion, could be no longer a
22 conservation-reliant species?
23 A. I think if it reaches -- if we attain the
24 recovery goals, I think at that point it would become, you

1 particularly.
2 A. Yes. Throughout the system, yes.
3 Q. All right.
4 MR. DONNELLY: Thank you. I have no further
5 questions.
6 HEARING OFFICER FAIRBANK: Thank you. So we'll
7 go ahead and open it back up to Southern Nevada Water
8 Authority and Las Vegas Valley Water District. And you have
9 just shy of 13 minutes remaining.
10 REDIRECT EXAMINATION
11 BY MR. TAGGART:
12 Q. Okay. Again for the record, Paul Taggart for the
13 Water Authority and the District.
14 Mr. Marshall, do you have your report in front of
15 you?
16 A. Yes, I do.
17 Q. And could you turn to Figure 3-3?
18 MR. TAGGART: And I'm not sure, Mr. Bailey. Get
19 that up on the screen, please.
20 BY MR. TAGGART:
21 Q. This should be a bar chart that shows fish counts
22 over a series of years; is that right?
23 A. Yes.
24 Q. Okay. There were some questions asked regarding

1 know, a species that would rely on constant, you know,
2 management or co-conservation. I think that's what, you know
3 recovery plans are trying to --
4 Q. Sure.
5 A. -- to gather.
6 Q. I'm going to just ask you a straight-up question
7 instead of a number of questions to get there since my time is
8 short.
9 Is 3.2 CFS a sufficient amount of flow and
10 habitat to meet recovery goals, in particular of 75 percent of
11 historic habitat? Restore it to full function?
12 A. I think, in my opinion, maintenance and
13 protection of 3.2 for that area, or that portion of -- for the
14 high-elevation springs is sufficient for that area, for
15 that -- for the Pederson Springs.
16 But to reach conservation goals or the recovery,
17 it requires, you know, a broader look at where the species
18 historically was. At least bring in, you know --
19 Q. So the bottom-line question is there would need
20 to be more --
21 A. Yes.
22 Q. -- water flowing to meet your recovery goals?
23 A. There would be more -- yeah. Well --
24 Q. Throughout the system. Not at Warm Springs West,

1 the counts in a segment of Pederson between 2017 and 2019.
2 Could you describe, using this figure, the change
3 in fish counts as a result of conservation activities? And
4 specifically whether conservation can lead to benefits in fish
5 counts in subsequent years to those activities.
6 A. Right. So, the figure -- the bars show different
7 colors, and there is a table in the far right-hand corner
8 which shows the stream reaches that are associated with those
9 colors.
10 And the period of time that I would like to focus
11 on is soon after the signing of the MOA 2006-'7
12 through 2015-'16.
13 During that period, there was significant work
14 being done in the Pederson and Apcar stream reaches which did
15 result in some disturbance to the stream, short-term
16 disturbance, and -- and also there was construction of fish
17 barriers and -- and also poisoning of certain reaches of
18 stream to remove tilapia out of the system.
19 And I believe during the 2008 through 2012 time
20 period that the amount of disturbance that was occurring
21 related to those activities might be the cause of the drop in
22 population numbers.
23 But as that restoration matured and the habitat
24 matured in the system and we removed -- or successfully were

1 moving tilapia out of the system, we then saw the population
2 rebound.
3 And the Apcar strain, the pink in the lower
4 portion of each bar, is -- provides a good example of that.
5 When there was significant restoration, there were a lot of
6 tilapia in that stream, and by doing that restoration and
7 removing the tilapia, we had a significant improvement in the
8 total numbers of Moapa Dace in the system.
9 Q. And could those conservation efforts have
10 assisted in fish populations between 2017 and 2019?
11 A. Yes.
12 Q. There was also some questions about the HRT
13 meeting. I think this was from the Moapa Band and. And, Mr.
14 Marshall, is it true that you are not part of the hydrologic
15 review team and you did not participate in the determination
16 at Southern Nevada Water Authority participates in with that
17 HRT?
18 A. Yes, that is correct.
19 MR. TAGGART: Okay. And just -- just for the
20 record, the State Engineer's files have the most recent annual
21 determination report in it. It was filed in July of 2019.
22 And in that document there is an appendix which is provid- --
23 each party can provide an appendix to the determination.
24 And in that appendix the water district indicated

1 ANSWERS BY MR. MARSHALL:
2 A. I'm sorry, Paul. I don't -- Mr. Taggart, I
3 don't --
4 Q. Okay. Let me ask it a different way.
5 You provided testimony that when the MOA was
6 developed, there was an understanding that it would
7 accommodate 16,000 acre-feet of pumping; correct?
8 A. Yes.
9 Q. Okay. And you heard all the hydrologic testimony
10 regarding reaction at the hydrologic system to the 1169
11 pumping test; right?
12 A. Yes.
13 Q. And I know you're not a hydrologist so I just
14 want you to rely on what you understand their opinions to be,
15 and specifically the SNWA hydrologist.
16 Does it appear that there's -- you know, that --
17 that there's less ability to restrict pumping than was
18 anticipated when the parties developed the triggers in the
19 MOA?
20 A. Yes, I think there's -- that our hydrologic
21 analysis calls into question the -- the -- the volumes of
22 allowed pumping under the triggers and whether or not those
23 changes in pumping volumes will have the intended result of
24 restoring flows back to 3.2 CFS at Warm Springs West.

1 that the annual 2019 termination does not recommend
2 adjustments to the pumping restrictions, but recovery data
3 collected from the State Engineer 1169 aquifer test and
4 analysis presented in this appendix indicate the pumping
5 restrictions may have to be adjusted in future years to
6 maintain the corresponding trigger ranges.
7 BY MR. TAGGART:
8 Q. Mr. -- Mr. Williams, you were asked by Mr.
9 Donnelly regarding 3.2 CFS and its relationship to recovery of
10 the fish.
11 And I just wanted to clarify that the analysis of
12 3.2 and the biological opinion, the focus of that analysis is
13 on whether take is occurring as opposed to whether recovery of
14 the fish can occur; is that a fair statement?
15 ANSWERS BY MR. WILLIAMS:
16 A. Yes, I think that's a fair statement.
17 MR. TAGGART: And the -- the last question -- I
18 think I'll probably ask both of you this -- but would you --
19 do you believe that the options that are available to the
20 parties and to the service, if flows go below 3.2, are more
21 restricted now than they were when the MOA was developed?
22 And specifically the pumping -- the ability to
23 restrict pumping below 16,000.
24

1 Q. And, I mean, I guess the obvious point I'm asking
2 about is that the MOA anticipated 16,000 acre-feet of water
3 could be pumped and then pumping restrictions would cut back
4 16,000. We don't have 16,000 acre-feet of pumping now, right?
5 A. Right. I think it's important to know that the
6 MOA was entered into prior to order 1169, right? And so the
7 results of Order 1169 is what we're here, I think, partially
8 talking about.
9 And so the MOA was -- you know, was based on that
10 understanding of the aquifer and how it would respond to that
11 pumping prior to Order 1169.
12 Q. And so the uncertainty of reaching 3.2 and going
13 below it, now without those pumping restrictions, is it -- is
14 that the type of uncertainty you're talking about trying to
15 avoid?
16 A. Yes. I think particularly in the situation where
17 the State Engineer were to approve permanent uses, there is
18 significant uncertainty in terms of how you would mitigate
19 impacts from those permanent, that permanent pumping to Warm
20 Springs West to the Pederson Unit.
21 Q. Okay. Thank you.
22 Well, Mr. Williams, do you have anything to add
23 to that?
24 MR. WILLIAMS: Yeah. I -- listening to your

1 question, I clearly believe that the results of -- and
2 listening to the hydrology reports from the last week -- I
3 clearly believe that the available water is much less than
4 sixteen one in Coyote Springs that were in the carbonate.
5 So the analysis, and then in looking at the MOA
6 in today's life, I think there needs to be, you know, more
7 done to really look at how to -- you know, look at the finite
8 amount, I think it's 4,000 to 6,000 -- how, basically, to
9 distribute that amongst the parties.
10 I think a key element of the MOA was a
11 development of the recovery implementation program, and I
12 think that the language in the MOA around -- in Section A that
13 talks about the collaborative, you know, development of the
14 parties to solve problems is -- is kind of what's lacking
15 right now.
16 I think that there -- you know, there clearly
17 needs to be, you know, a 3.2 minimum to protect the Dace, and
18 I think that, you know, it's incumbent on the State Engineer
19 to really look hard at the numbers and the hydrology and
20 really try to come up with a plan for assessing what's really
21 available and distribution of that. So --
22 MR. TAGGART: Great. Thank you, very much.
23 HEARING OFFICER FAIRBANK: Is that it, Mr.
24 Taggart?

1 and go back on the record. And we will go ahead and proceed
2 with the Moapa Valley Water District.
3 And Mr. Morrison, you may go ahead and proceed.
4 MR. MORRISON: All right. Good morning,
5 everybody. I'm Greg Morrison. I represent the Moapa Valley
6 Water District. With me today are Joseph Davis, general
7 manager at the district, and Jay Lazarus, our expert witness.
8 As a preliminary matter that I think is very
9 important, somebody left a really nice pen up here probably
10 want to come back and get.
11 Thank you to the State Engineer and staff for
12 allowing us this opportunity to present our testimony today.
13 We do want to start with a little corrective
14 matter, and we've addressed it before, but it bears repeating.
15 The State Engineer Exhibit marked as NSE244, a
16 graph representation of the triggers from the 2006 MOA is not
17 an accurate Exhibit.
18 It shows that the district must cease pumping in
19 Earl Canyon if flow levels drop below a certain threshold. In
20 fact, that trigger only applied to the district during the
21 pendency of the Order 1169 pump testing.
22 I also wanted to state that it seems to us the
23 point of Interim Order 1303 and this hearing is to provide the
24 State Engineer with guidance relevant to the management of the

1 MR. TAGGART: It is. Thank you. And that is all
2 that we have as well.
3 HEARING OFFICER FAIRBANK: Thank you. And I'll
4 go ahead and open it up lastly for any questions from Division
5 of Water Resources staff and the State Engineer.
6 And just before we take a break, I wanted to go
7 ahead and let everyone know that we have made the video
8 recordings of these proceedings publicly available on our
9 website.
10 And so if you go to this water.nv.gov, and then
11 in our "Lower White River Flow System" tab, under the "News"
12 tab, there's a subfolder that is Order 1303 hearing documents,
13 and within that, there is a link to a PDF document that
14 contains the links to the video recordings of these
15 proceedings.
16 So if there's people that weren't able to observe
17 all the dates or all the hearing proceedings thus far, they
18 are currently available, and then we will update that when we
19 get the additional recordings published to us.
20 And with that, we'll go ahead and take a break.
21 Let's go ahead and take about a 15-minute break, and then
22 we'll come back at 10:25. Thank you.
23 (Recess.)
24 HEARING OFFICER FAIRBANK: Okay. Let's go ahead

1 carbonate aquifer that spans multiple basins.
2 And although there could be some unique
3 characteristics within that carbonate aquifer, we do not
4 believe that proper management of that basin in any way,
5 shape, or form involves segmenting any of those basins into
6 even smaller sub-basins.
7 With that, I would like to start our direct
8 examination of Mr. Davis.
9 DIRECT EXAMINATION
10 BY MR. MORRISON:
11 Q. Will you introduce yourself for the record?
12 State your title?
13 A. I'm Joseph Davis with the Moapa Valley Water
14 District. I'm the general manager. Last name is D-A-V-I-S.
15 Q. How long have you been at the Moapa Valley Water
16 District and in what capacities?
17 A. I've worked at Moapa Valley Water District for 35
18 years, 20 years in a supervisory role, and the last eight as a
19 general manager.
20 Q. All right. We want to talk really briefly --
21 HEARING OFFICER FAIRBANK: Mr. Morrison, if I may
22 just interrupt. I apologize. If we can go ahead and have the
23 witnesses sworn.
24 And then also I'm going to Mr. Davis and Mr.

1 Lazarus if you'll make sure that you speak into the
2 microphone. There are people who are listening and observing
3 remotely. And if you're soft-spoken or sitting too far back,
4 it becomes difficult for those remote user or participants to
5 hear what is being said.

6 (Witnesses sworn.)

7 MR. MORRISON: Thank you.

8 All right. So we're going to talk really
9 briefly, just some basic points about the district.

10 I understand at least one party to this hearing
11 has already objected to Mr. Davis's testimony as beyond the
12 scope of the hearing, but we do believe that these points are
13 crucial to get on the record now, and Mr. Davis's testimony
14 should take under ten minutes.

15 BY MR. MORRISON:

16 Q. With that, if you would please go to your first
17 slide, Slide No. 3.

18 A. (Complies.) This is not projecting.

19 Q. Mr. Davis's testimony may now take about
20 12 minutes.

21 All right. Please tell everybody what this slide
22 shows.

23 A. This is the service territory for the Moapa
24 Valley Water District. It includes the Warm Springs, Moapa,

1 total of 3,147 acre-feet annually.

2 Q. All right. Now, 2006 -- if you'll go to your
3 next slide, please -- the district entered into a series of
4 agreements with several properties. It's dual goals of
5 restoring and protecting Moapa Dace habitat and allowing water
6 development for human use.

7 You'll tell us quickly about those agreements,
8 starting with the 2006 MOA, which we've already discussed at
9 length here.

10 A. The MOA supplied funds for conservation efforts.
11 The district agreed to dedicate the Jones Springs water right.
12 There was dedication of CSI groundwater and habitat
13 restoration and the protection of in-stream flows through the
14 Warm Springs West Gage trigger levels.

15 Q. All right. So the trigger levels in the 2006
16 MOA, do those require any action or cessation of pumping on
17 the part of the district?

18 A. No. Those only apply to CSI, SNWA and Moapa Band
19 of Paiutes.

20 Q. All right and 2006 MOA is still binding on all of
21 the parties thereto; is that correct?

22 A. Yes.

23 Q. All right. Talk about the other agreements that
24 were executed coincidentally with the 2006 MOA.

1 Moapa Band of Paiutes, Logandale, and Overton communities. We
2 have a population of 8,500 with a service area territory of 79
3 square miles.

4 We're situated between the headwaters of the
5 Muddy River and the Lake Mead National Recreation area.

6 Q. All right. Next slide, please.

7 You're just going to give us a brief history and
8 water development in the area.

9 A. The Moapa Band of Paiutes is the oldest community
10 in our service territory, and then the European settlements
11 began in January of 1865, and the first recorded water supply
12 gage was completed in May of 1865.

13 Q. Your next slide? We have one missing. Looks
14 like we have one missing. That's okay. It's just where the
15 district evolution stands today as far as service connection.

16 A. Currently there are 3,250 service connections
17 serving 8,500 people in the Moapa Valley communities.

18 Q. All right. Give us a brief overview of the
19 district's water rights portfolio.

20 A. The MX-6 is the district's oldest permitted
21 carbonate aquifer right from 1983. In 1988 was the first
22 Arrow Canyon permit was filed, and the last filing was done in
23 1992.

24 Proofs of beneficial use have been filed on a

1 A. The Jones Springs agreement was the dedication of
2 the district's oldest water right from increasing water flows
3 in the Apcar stream.

4 The water settlement agreement, it transferred
5 the Las Vegas Valley Water District to the Moapa Band of
6 Paiutes. There was withdrawal of protest. There were 70 --
7 or 3,700 acre-feet of -- or the acknowledgement of
8 3,700 acre-feet of Moapa Band of Paiutes Federal Reserve,
9 Muddy River Water Rights, and a cap the Moapa Band of Paiutes
10 claimed to reserve groundwater rights at 14,400 acre-feet
11 underneath the 1980 edition.

12 The water settlement agreement was dedication of
13 Las Vegas Valley Water District's 2,500 acre-feet to the Moapa
14 Band of Paiutes in California Wash.

15 NVAC, Muddy River surface water rights to Moapa
16 Band of Paiutes, and the NVWD dedication of 520 acre-feet of
17 Muddy River rights to Moapa Band of Paiutes in the abandonment
18 of curtailment.

19 Q. Your next slide. The district has taken steps to
20 address threats to Moapa Dace habitat, hasn't it?

21 A. Yes. Contribution of water to provide additional
22 direct in-stream flows to critical Moapa Dace habitat. That
23 was equivalent to 724 acre-feet from the Jones Springs. It's
24 the district's most single right, and it's basically a quarter

1 of the district's certificated water rights.
2 Q. Okay. To wrap it up, I want to ask you quickly
3 about the district's legal obligations. You have a legal
4 obligation to provide water to your customers, do you not?
5 A. Yes.
6 Q. And where does that legal obligation arise from,
7 and what does it require of the district?
8 A. It arises out of the 1983 Nevada legislature when
9 it created the district under Chapter 477, and it declared
10 that adequate and efficient water service is vital to the
11 economy and well-being of the Moapa Valley area and empowered
12 the district to secure water resources necessary to serve its
13 communities. The Moapa Valley Water community was founded on
14 the resources of the Muddy River.
15 Q. All right. You have a final slide. Just wraps
16 up your legal obligation?
17 A. Yeah. The district has a legal obligation to
18 supply a reliable water resource that is beneficial to the
19 economy and well-being of its community.
20 Curtailment of water resources of a district
21 would prove detrimental to the public safety of the Moapa
22 Valley community.
23 MR. MORRISON: Thank you, Mr. Davis.
24 We will move on to Jay Lazarus.

1 Before that -- I did contract work previous to
2 that. So I have more than 40 years' experience in the areas
3 of geology, hydrology, geomorphology, and related fields.
4 Q. And you prepared, along with Mr. Davis, both the
5 initial report and the rebuttal reports the District submitted
6 in response to State Engineer Interim Order 1303?
7 A. Yes, sir.
8 Q. Will you quickly talk us through the process you
9 used in creating your reports?
10 A. Well, from the very beginning, Mr. Davis made it
11 very clear to me that we didn't have the kind of budget to do
12 original work like a lot of my other colleagues have had.
13 And so our work was restricted to looking at and
14 evaluating existing data and statements from the other
15 stakeholders and evaluating their data and conclusions, and at
16 the same time looking at the data and coming up with some of
17 our own conclusions.
18 Q. And in your opinion, is that an appropriate
19 methodology for the preparation of an expert report?
20 A. In this case with a limited budget, absolutely.
21 Q. Okay. Let us start walking through some of the
22 conclusions from your report. Let's go to Slide 3, please.
23 What are we looking at here?
24 A. So, what we've got here is the current boundary

1 And thanks to everyone for the indulgence. I
2 understand that line of questioning wasn't directly in Order
3 1303.
4 Jay, while he's loading that up -- Mr. Lazarus,
5 while he's loading that up --
6 A. I was trying to make sure it was working.
7 Q. Would you introduce yourself for the record?
8 ANSWERS BY MR. LAZARUS:
9 A. Good morning. My name is Jay Lazarus, and I'm
10 president and senior geohydrologist of Glorieta Geoscience.
11 Q. Perhaps get closer to the microphone so we can
12 hear you.
13 A. No one's ever accused me of speaking softly.
14 My name is Jay Lazarus, L-A-Z-A-R-U-S, Like in
15 the Bible. I am president and senior geohydrologist of
16 Glorieta Geoscience, and I am here today presenting testimony
17 on behalf of the Moapa Valley Water District on State Engineer
18 Interim Order 1303.
19 Q. Would you just describe how long you've been
20 doing what you do and some of your areas of expertise?
21 A. I've been -- well, I've been consultant to the
22 Moapa Valley Water District since, I think, 2011. Next
23 month -- I founded the Glorieta Geoscience in November of
24 1979, and next month is our 40th year in business.

1 of the 1303 super basin as proposed by the State Engineer in
2 the Interim Order 1303. And it's a six-basin super basin,
3 which we believe another basin should be added to it, but we
4 can go on.
5 Q. Okay. Next slide, please. What do you think's
6 wrong with the State Engineer's proposed management area?
7 A. It's my professional opinion that Kane Springs
8 Valley should be included in the Lower White River Flow System
9 connected groundwater basin and administered as such.
10 Q. Going to our next slide. Do all the stakeholders
11 participating in this matter agree with the State Engineer's
12 proposed geographic boundary?
13 A. No. The following entities, as we have up here
14 on the slide, recommend the inclusion of Kane Springs Valley
15 basin. We did the park service, fish and wildlife, Center for
16 Biological Diversity, and Las Vegas Valley Water District, and
17 SNWA.
18 CSA recognizes the hydrologic connection between
19 Kane Springs Valley and Coyote Springs Valley. You know
20 there's the specific reference of 4,200 acre-feet of
21 groundwater flowing into Coyote Springs basin from Kane
22 Springs Valley basin.
23 But despite that, despite CSI recognizing the
24 hydrologic connection between Kane Springs Valley and Coyote

1 Springs Valley, they did not suggest including it in the super
2 basin.
3 Q. I want to circle back a little bit. I'd like
4 your statement to be as accurate as possible.
5 You say SNWA, Las Vegas Valley Water District
6 recommended addition of Kane Springs, is that true for this
7 hearing?
8 A. Las Vegas Valley Water District and SNWA
9 recommended inclusion of Kane Springs Valley in an October
10 letter from Ms. Colby Pellegrino to Jason King and the report
11 accompanying that letter.
12 So at that time in October, SNWA strongly stated
13 that Kane Springs Valley should be included in the super
14 basin.
15 Q. We didn't want to misrepresent their position
16 today.
17 Go ahead.
18 A. And in term- -- so these next -- the bulk of
19 these next slides has to do with geographic boundary of Lower
20 White River Flow Systems. Multiple reports have cited
21 differences in heads in Coyote Springs basin valley and
22 northern Coyote Springs Valley, and wells in the southern
23 Coyote -- CSV is a hydrologic barrier. It will flow. And we
24 disagree with this assertion.

1 shockingly flat to us. Okay? And we really don't see these
2 kinds of flat gradients almost anywhere we work in the western
3 U.S., especially in highly fractured areas.
4 And based on the work that other parties have
5 done, based on what we've got here, we're seeing this flat
6 continuous gradient from KMW-1 down to EH-4, and continuing
7 these ten to the minus four gradients, working our way to the
8 south, and then back east towards EH-4.
9 And the most -- I would say the most important
10 thing here is the uninterrupted, continuous, exceptionally
11 flat gradient.
12 Q. Now, it's not just the hydraulic gradient that
13 shows the hydrologic connection with Kane Springs to the rest
14 of the flow system, is it?
15 A. That's correct. There are other factors.
16 Q. All right. Let's go to your next slide.
17 Miss Braumiller of the Fish and Wildlife Service
18 in her testimony expressed a need for some additional
19 information regarding Kane Springs. You believe you've
20 located some additional information that might help her out;
21 is that accurate?
22 A. That's correct. And, Mr. Davis, could you please
23 go back one slide? My lovely assistant Joe will go back one
24 slide, please.

1 Q. You don't believe that's a valid conclusion based
2 upon the evidence.
3 A. That's correct.
4 Q. So I think this slide goes a long way towards
5 explaining why you don't believe that's accurate. What are we
6 looking at here?
7 A. We're looking at a slide of a hydraulic gradient
8 that we calculated sort of similar to how the park service
9 calculated it. And we're looking at the hydraulic gradient
10 from KMW-1. KMW-1 up here at the north, down to EH-4, and
11 from CSVM-4 to M -- to CSVM-1, which is a proxy for MX-5, and
12 from CSVM-1 over to EH-4.
13 And previous experts, Andrew Burns and Rick
14 Waddell referred to EH-4 sort of as one of the sentinel or
15 index wells.
16 So what we did was calculate a groundwater
17 gradient from these -- 1, 2 -- 3 wells to EH-4 right by the
18 Warm Springs area, and the gradient is remarkably flat. And
19 other folks have said there's a lot of structure and faulting
20 and fracturing in the area.
21 Well, based on how flat these gradients are, the
22 structures have no significant impact on these gradients, and
23 we're looking at gradients of ten to minus four feet per foot.
24 This is an incredibly flat water table. It was

1 What we're seeing here -- you know, if I
2 remembered Ms. Braumiller's testimony correctly, she was
3 looking for pumping test data in the vicinity of the boundary
4 between Kane Springs Valley basin and Coyote Springs basin.
5 And KMW-1 here was an observation well in a long-term pumping
6 test that Lincoln-Vidler conducted adjacent to it in KPW.
7 Next slide, please.
8 So, in 2006, URS Corporation under contract to
9 Lincoln County conducted -- drilled and tested KPW-1. They
10 conducted a seven-day pumping test at 1,800 gallons a minute
11 showing very highly transmissive aquifer without any limiting
12 boundaries.
13 Q. Do you generally recall who signed that well
14 completion report as both hydrologist and geologist?
15 A. I believe it was Mr. Red Bushner.
16 Q. In both capacities?
17 A. Yes.
18 Q. Okay. Let's go to your next slide. That URS
19 well completion report, did it make any statements about the
20 well locations in Kane Springs Valley?
21 A. Whoever located this well, or if Mr. Bushner
22 located this well, they did a great job. Okay?
23 This well is a really high producer. It's got a
24 specific capacity on the order of ten gallons per minute per

1 foot, which is very acceptable for production a well,
2 especially for municipal purposes.
3 You know, when we locate wells anywhere, we're
4 always trying to find a fracture intersection because that's
5 where the rock is theoretically more broken up and more
6 transmissive and will transmit water generally or hopefully in
7 higher quantities and at faster rates.
8 So they located -- so URS did a really great job
9 of locating this well. And these are direct quotes from the
10 report. The well was cited in close proximity to the Willow
11 Springs fault and Kane Springs Wash fault zone in area of
12 extensive tectonic activity leading to significant fracture in
13 the carbonate-rock aquifer.
14 By locating the well in a highly fractured
15 geologic terrain, the well is drilled in rocks with a
16 secondary permeability that has been enhanced by faulting and
17 fracturing. And like I said, they did a really great job
18 locating this well. It's really in a great location.
19 Q. Let's go on to the next slide. I think you show
20 that location.
21 What are we looking at here?
22 A. So what we're looking at here is just a cut out
23 of the URS2006, report Figure 4, and what this shows is the
24 Willow Spring fault, Kane Springs Valley fault, the

1 such as it is or isn't, the KPW-1 seven-day pumping test
2 summary was the carbonate aquifer behaves as a force media and
3 can be analyzed as such, and we agree.
4 We located, drilled and completed and tested
5 wells in fractured Bedroc environments where the fracturing
6 was so extensive that the fractured aquifer system really
7 behaved as an equivalent porous media. Okay? And, once
8 again, kudos to the folks who located this well from URS.
9 And they also pointed out that hydraulic barriers
10 to groundwater flow were not encountered during the seven-day
11 aquifer test, and we agree with that.
12 Q. But you don't agree with everything in that
13 report. Point out a few of the issues you found.
14 A. Well, actually a couple -- the major issue that
15 we disagreed within the report was that when we assess the
16 seven-day pumping test, we determined that a leaky confined
17 aquifer solution, or Hantush-Jacob in this instant, isn't an
18 appropriate method to analyze aquifer characteristics
19 character.
20 Q. Mr. Lazarus, can I slow you down for one second
21 just for our reporter's sake? Would you spell Hantush-Jacob?
22 A. H-A-N-T-U-S-H, hyphen, J-A-C-O-B.
23 Q. Thank you very much. Sorry to interrupt.
24 A. Okay. So, URS used a leaky confined aquifer

1 intersection, the location of KPW-1, which was the production
2 well that was tested, and the location of KMW-1, which was the
3 observation well. And for scale on here, these wells are
4 located either 143 or 144 feet from each other.
5 So KMW-1 was drilled specifically as the
6 monitoring well for KPW-1 pumping test.
7 Q. The information on this slide, did you alter it
8 in any way other than to blow it up to increase the
9 resolution?
10 A. No, sir.
11 Q. Let's go on to your next slide.
12 That URS report, that had a -- some seven-day
13 pump test results described within it, didn't it?
14 A. It had a seven-day pumping test result.
15 Just for a matter of semantics, we conduct
16 pumping tests to test the aquifer. We conduct the pump test
17 to test the pump. So this is a seven-day pumping test to try
18 and determine aquifer characteristics.
19 Q. And you pulled a couple of statements directly
20 out of that report leading to the results of that pumping
21 test.
22 A. That is correct.
23 Q. Talk us through them.
24 A. So, for the first portion of this, or paragraph,

1 solution saying that there was leakage coming from the fault
2 zone.
3 Well, Hantush-Jacob leaky confined solution isn't
4 appropriate for a fracture flow fault zone like this. It's
5 appropriate if you have a confining bed above or below your
6 producing zone and you're getting leakage from above those
7 confining beds, above or below.
8 The way to determine whether or not you really
9 have a leaky confined aquifer situation in any type of
10 incident is to complete a well test where you've got an upper
11 zone, middle-producing zone, say, or a lower zone, or some
12 combination thereof isolated from each other, and then your
13 pumping well in your screen solely in the production zone and
14 conduct a pumping test on that production well and observe a
15 drawdown in any of the zones that you've done with your nested
16 piezometer, P-I-E-Z-O-M-E-T-E-R.
17 And that way you can determine if there is
18 leakage occurring from overlying beds or underlying beds into
19 your producing zone.
20 So, we did a quick calculation of transmissivity,
21 came up with a T of between 200,000 and 380,000 gallons per
22 acre foot. Not unexpected or out of line for this kind of
23 super highly fractured aquifer system.
24 An average T in between them is reasonable.

1 290,000 gallons per day per foot is reasonable to represent
2 the aquifer. And a lot of the aquifers I work in, my clients
3 would kill to have transmissivities this high. These are
4 really high T's.
5 Q. Let's move on to your next slide. What is this
6 slide? What does it show?
7 A. So, this slide came directly from the Figure 4.4
8 of the Lincoln-Vidler report. All we modified on this was
9 blowing it up for better ease of reading and looking at the
10 scale.
11 So, what we're seeing here, this stippled zone
12 here, Lincoln-Vidler has in as the Kane Springs Wash fault
13 zone. You can see that this Kane Springs Wash fault zone, the
14 way they have this right here is the basin boundary -- excuse
15 me -- between Kane Springs Valley basin and the Coyote Springs
16 Valley basin.
17 This is the basin boundary. Right here in really
18 small font you can see this is KMW-1, which was monitored
19 during the 1169 pumping test as well as being the observation
20 well for the KPW-1 pumping test.
21 Once again, you can see it's located right at the
22 intersection of the Kane Springs fault and the Willow Springs
23 fault.
24 Now, and then CSVM-4 is located right here.

1 conclusions.
2 A. Well, first of all, for a broad-blanket
3 statement, we ago agree with the four conclusions that are on
4 this slide, and I'll read them as quickly, but slowly enough
5 for the court reporter to get it.
6 So URS concluded its evident, then, from the
7 aquifer testing of well KPW-1 that the residual recovery data
8 represents fault-induced, high transmissivity. We agree.
9 The carbonate rock aquifer behaves as a porous
10 media similar to an alluvial aquifer system, and thereby can
11 be analyzed as such. We agree it behaves as an equivalent
12 force media.
13 Residual draw-down data demonstrate that
14 hydraulic barriers, the groundwater flow, were not encountered
15 during the seven-day aquifer test. We agree.
16 And S values are on the order of 1.9 times ten to
17 the minus four, which we agree with, and it is a confined S.
18 And it is also two orders of magnitude less than the S value
19 used by Ms. Moran of Stetson when she did her simplified Theis
20 analysis.
21 Ms. Moran, representing the whole area, used an
22 undefined storage coefficient of .03, or maybe perhaps -- yep.
23 It's a specific yield.
24 This is a very large, extensive, connected,

1 Now, what this slide shows is that this fault
2 zone knows no administrative basin boundary. Okay?
3 You know, the fault zone extends, if we go from
4 southwest to northeast, you know, parallel to the strike of
5 Kane Springs Valley itself.
6 This fault zone extends from the northeastern
7 portion of Coyote Spring Valley up into Kane Spring Valley and
8 goes right underneath the basin boundary.
9 So, what this shows to us is that the carbonate
10 aquifer, which is highly transmissive -- and URS's study for
11 Lincoln County showed no limiting boundaries during their
12 seven-day pumping test, it shows that this fault zone, which
13 is highly transmissive, is continuous across the basin
14 boundary now going from northeast to southwest.
15 Now, coming from -- going back in the opposite
16 direction from south to north, this portion here in Coyote
17 Springs -- Coyote Spring basin and in Kane Spring Valley, this
18 is a continuation of the regionally extensive, highly
19 fractured, confined aquifer system that extends from Kane
20 Spring Valley down to the Muddy River Spring area.
21 Q. All right. Thanks.
22 Let's go to your next slide. URS report draws
23 some conclusions from the work it did in the well completion
24 report, and I'd like to hear your opinion of those

1 confined aquifer system that is very system to -- very
2 sensitive to pressure changes and pressure responses within
3 the system, as evidenced by the drawdowns at some distance
4 from the MX-5 pumping well during that time.
5 So an S value -- a storage coefficient value of
6 ten to the minus four is a much more appropriate value to use
7 than an unconfined specific yield of ten to the minus three.
8 Q. Thanks. Let's go onto your next slide here.
9 We've seen this slide a few times in different forms, but will
10 you talk us through what this is?
11 A. Everybody wants to see this slide again. I know
12 that.
13 Yeah. So you could probably do the testimony for
14 me. This really is -- these are hydrographs of KMW-1, CSVM-1
15 and CSVM-4 before, during, and after the 1169 pumping test.
16 I think the salient -- the thing that we know is
17 that we know their locations. CSVM-1 is located very close to
18 MX-5.
19 And you can see its response to when MX-5 was
20 turned on and off and there's an instantaneous response in the
21 hydrograph during the pumping test of CSVM-1 when the water
22 level was -- when the pump was shut off in MX-5, water level
23 jumps up. Pump shut off, water level drops, and then it
24 repeats itself.

1 Now, what we see here is that, you know, other
2 than the, you know, 2004-2005 significant recharge event,
3 water levels before the pumping test were fairly flat. Water
4 levels after the pumping test were somewhat -- they recovered
5 after the pumping test and fairly flat since. The steepest
6 portion of the hydrograph in CSVM-1 occurred during the MX-5
7 pumping test.
8 Why do we have these other wells on here? KMW-1
9 located in Kane Springs Valley, fairly flat hydrograph before
10 the pumping test, some recovery after the pumping test, and a
11 fairly flat hydrograph afterwards. The steepest portion of
12 the hydrograph of KMW-1 occurs during the 1169 pumping test.
13 CSVM-4 located at the north end of Coyote Spring
14 Valley, fairly flat hydrograph before the pumping test, taking
15 out the recharge event in 2004-2005, some recovery after the
16 1169, fairly flat hydrograph afterwards, and the steepest
17 portion of the hydrograph occurring during the 1169 pumping
18 test.
19 So we've got all three of these wells, regardless
20 of any other stresses, are showing the steepest portion of
21 their hydrographs during the 1169 pumping test.
22 Q. All right. A few of the people testifying here
23 over the last week have suggested that a lot of these
24 responses are directly due to climate influences.

1 occurred during the 1169 pumping test. And it mimics the
2 drawdown pattern in CSVM-1 during and after the Order 1169
3 pumping test.
4 Q. But do you see any evidence of seasonal
5 fluctuations on these hydrographs?
6 A. You know, before and after the pumping test there
7 are some seasonal fluctuations in these hydrographs, yes.
8 And, you know, if there are any seasonal fluctuations during
9 the pumping test, the pressure response -- the pressure
10 response from the MX-5 pumping test throughout the highly
11 confined aquifer system, you know, had overridden any type of
12 climate response.
13 Q. Moving up. So, talk us through what we have
14 here. This is CSVM-4 and the PDSI curves.
15 A. So what we have here -- and this was taken from
16 Mr. Umstock, Umstock (phonetic) -- I don't now how to
17 pronounce it -- from Daniel E. Stevens as part of the Lincoln
18 County-Vidler report, you know, asserting that water level
19 changes in CSVM-4 are solely climate driven and don't reflect
20 pumping during the Order 1169 pumping test. We disagree with
21 that.
22 You know, during 2008 to 2010, before the pumping
23 test, you know, water levels were stable despite drought.
24 And -- there we go. That one looks better. It contradicts

1 Do you agree with that conclusion?
2 A. No, I do not.
3 Q. Why is that?
4 A. I think we'll get to that in the next couple
5 slides.
6 Q. Okay. So let's move on.
7 A. So this next slide, just for ease of correlation
8 and sort of making it easier on the eyes, is just KMW-1 and
9 CSVM-1. CSVM-1, I say, is very close proximity to MX-5.
10 Once again, you can see the steepest portion of
11 the hydrographs in KMW-1 in Coyote Springs valley located in
12 this highly fractured, very transmissive portion of the
13 aquifer, and CSVM-1 have the same slope -- or the steepest
14 portion of their hydrographs are during the 1169 pumping test.
15 Next slide, please.
16 Q. Talk us through what we have here.
17 A. So, this one, once again for ease of
18 visualization on this, you know, is comparing CSVM-4 to CSVM-1
19 hydrograph.
20 Once again, the highest rate of sustained
21 drawdown in CSVM-4, you know, located in this area of highly
22 fractured Bedroc as shown in the URS and shown in the Lincoln
23 County report -- Lincoln-Vidler report, the highest rate of
24 drawdown, the highest sustainment of drawdown in both of them

1 the idea that the declining water levels during the test were
2 normalizing after 2004-2005.
3 And during the 1169 pumping test, you know, we
4 had rapid drawdown in CSVM-4 despite normal or near normal
5 Palmer Drought Severity Index climate indicators here.
6 So while we're seeing the PDSI rise, we're seeing
7 the most -- you know, the first portion of the most rapid
8 drawdown in the CSVM-4 hydrograph, and that's during the
9 pumping test.
10 Q. What about since the pumping test has concluded?
11 A. Well, so since the pumping test has concluded,
12 we're seeing portions of -- I think this more yellow or sort
13 of yellowish-colored line is Region 3 and the black is Region
14 4, we're seeing the Palmer Drought Severity Index drop while
15 levels in CSVM-4 are increasing, and we're seeing water levels
16 dropping while the drought severity index was -- was showing
17 less severe drought.
18 Q. So what does that data lead you to conclude?
19 A. There's no direct correlation between the drought
20 index and water levels in CSVM-4, especially during the
21 pumping test.
22 Q. Next slide, please?
23 A. So this is pretty much the same slide as the
24 previous one except we have the hydrograph for CSVM-4 -- I'm

1 sorry -- for KMW-1 compared to the Palmer Drought Severity
2 Index.
3 Once again, the 2008 to 2010 water levels were
4 stable despite drought, and rapid water level declines above
5 normal or near normal occurred, despite having normal or near
6 normal moisture conditions during the 1169 pumping test.
7 Q. So, this leads you to the same conclusion about
8 the other well?
9 A. Yes, sir.
10 Q. Which was?
11 A. That drought cannot be identified as the single
12 driver for water level declines in any of these wells during
13 the 1169 pumping test.
14 Q. All right. I think you summed that up for us in
15 your next slide.
16 A. So, once again, the title is self-explanatory.
17 You know, the drought severity was less during the entirety of
18 the 1169 pumping test than from 2008 to 2010, but yet the
19 water levels declined more rapidly during any other time.
20 Really, I think what we have bolted here is that
21 the drawdown observed during the 1169 pumping test cannot be
22 explained solely by drought severity. And water levels began
23 to recover before the drought severity lessened, and that
24 contradicts the assertion that climate is the sole driver.

1 objection if you're restating your question like that.
2 I think there needs to be a foundation laid as to
3 what this witness knows about the evidence in that proceeding,
4 since you and your client were not parties in that proceeding.
5 BY MR. MORRISON:
6 Q. Mr. Lazarus, have you read Ruling 5712 in its
7 entirety?
8 A. I have read Ruling 5712 in its entirety and the
9 stipulation between Lincoln County and Fish and Wildlife
10 Service.
11 Q. Do you understand the facts in that ruling that
12 the State Engineer relied upon in issuing the conclusions of
13 fact in that ruling?
14 A. I believe I do.
15 HEARING OFFICER FAIRBANK: So we will go ahead
16 and allow the line of questions just under the recognition
17 that the State Engineer is the one who offered the particular
18 ruling and understands the bases of the State Engineer's
19 determination, and we'll take it in the weight of the evidence
20 in light of the State Engineer's own determinations.
21 MR. MORRISON: That's fair.
22 BY MR. MORRISON:
23 Q. I just want to ask you what data from Ruling 5712
24 indicates to you that it isn't, per se, exclusion of Kane

1 Q. Thank you. Next slide, please. We've heard a
2 few people talk about State Engineer Ruling 5712 as support
3 for the exclusion of Kane Springs. Does Ruling 5712, when
4 read in it's entirety, really support that conclusion?
5 A. No, it does not.
6 MS. PETERSON: Objection. Calling for a legal
7 conclusion.
8 HEARING OFFICER FAIRBANK: I'm sorry, Ms.
9 Peterson, will you speak up? I could not hear the basis for
10 your objection.
11 MS. PETERSON: The question was whether the
12 witness agreed with what the State Engineer's opinion says and
13 the ruling, and I don't know -- I'm objecting based on it
14 calls for a legal conclusion. So please restate.
15 MR. MORRISON: I'd be happy to answer that
16 objection.
17 Actually, I didn't ask for a legal conclusion. I
18 asked if the data that was relied upon in Ruling 5712
19 supported the conclusions of fact within that ruling. Not any
20 conclusions of law.
21 HEARING OFFICER FAIRBANK: Go ahead and answer
22 the question to the extent you understand the question.
23 MR. LAZARUS: Thank you, Madam Hearing Officer.
24 MS. PETERSON: Actually, I do have another

1 Springs from the management area?
2 A. Well, you know, what I'm look at here really is
3 the stipulation, and the stipulation is between Fish and
4 Wildlife -- Fish and Wildlife Service and Lincoln-Vidler.
5 And that stipulation includes a requirement for
6 preparation and implementation of a 3M plan using the
7 discharge at the Warm Springs West Gage. Somewhat as the
8 canary in the coal mine, if you may.
9 Now, Lincoln-Vidler agreed to trigger levels in
10 the Muddy River Springs area being the guidance for when
11 Lincoln-Vidler would cut back on their pumping.
12 So one can only infer that if Lincoln-Vidler has
13 applications in the Kane Springs Valley and has agreed to
14 subjecting their pumping to limits based on spring
15 discharge -- or lowering of spring discharges in the Muddy
16 River Springs area, one can only infer that Kane Springs
17 Valley is hydrologically connected to the Muddy River Springs
18 area, or otherwise why would a prudent individual or a prudent
19 group agree to limit their pumping based on impacts to spring
20 flow in the Muddy River Springs area?
21 And they agreed to the following trigger levels,
22 which I think might have been discussed earlier and we don't
23 have to go through all of them, but I think everyone is
24 familiar with these, and we'll take a minute or so for -- to

1 make sure the people have read this and see what the numbers
2 are.
3 Q. Let's move on. This is all going to be on the
4 record.
5 So, you wanted to quickly summarize your
6 conclusion on Kane Springs. Did you find someone else who
7 summed it up real nicely for you?
8 A. Actually, I really have to thank Colby Pellegrino
9 because I couldn't have written this better. I wished I would
10 have written it like this. Okay? But Colby won't read it for
11 me, so I guess I will.
12 So, in her October 23rd, 2018 letter to Jason
13 King, which was a letter of transmittal for a SNWA assessment
14 of aquifer conditions in the Lower White River Flow System,
15 page 1, conclusion from SNWA's letter to Jason, was that Kane
16 Springs Valley should be included as part of the LWRFS
17 administrative unit because the carbonate aquifer extends
18 beneath the basin, recharged derived local within the basin
19 flows in the Coyote Springs Valley, and responses to natural
20 and anthropogenic stresses observed in monitor wells located
21 in northern Coyote Spring Valley, parentheses CSVM-4, end
22 paren, and southwest Kane Springs Valley, parentheses KMW-1,
23 end paren, indicate there is hydraulic continuity within the
24 aquifer system between this area and production wells in

1 the conclusion of that testing?
2 A. You know, the water levels and spring discharge,
3 you know, have remained fairly constant since the cessation of
4 the 1169 pumping, but the water levels and spring discharge
5 haven't recovered the pre-1169 water levels or levels of -- or
6 discharge -- or discharge.
7 It's possible, and we're not saying -- we're not
8 putting probability on it, but it's possible that the
9 carbonate aquifer system is reaching somewhat of a steady
10 state condition at current pumping rates, but additional data
11 are required to verify this conclusion.
12 Q. And your next slide kind of indicates where
13 you -- what you relied upon to reach that conclusion.
14 A. So what we looked at was the discharge from the
15 Pederson -- or Pederson -- and Pederson East Springs.
16 You know, we can -- we can see here that, you
17 know, somewhat sort of flat discharge between .2 and .3 CFS at
18 Pederson, and then bouncing around .2 at Pederson East.
19 Before the pumping test, we do see some seasonal
20 fluctuations in these hydrographs, but -- and then after the
21 pumping -- cessation of the pumping test, fairly flat
22 hydrograph in Pederson, fairly flat hydrograph in Pederson
23 East with seasonal fluctuations.
24 And -- but both of these springs showing the

1 southern Coyote Spring Valley.
2 And the Moapa Valley Water District agrees with
3 this statement from SNWA.
4 Q. Let's go on to your next slide. So what are we
5 looking at here?
6 A. So, what we're looking at really is the summation
7 of my testimony regarding the geographic boundary of the Lower
8 White River Flow System, and the water district proposes, and
9 we believe we have sound science to back it up, that Kane
10 Spring Valley basin should be included as part of a
11 seven-basin super basin and be part of the administrative
12 basin regulated by the Department of Water Resources State
13 Engineer.
14 Q. So just because there's a little bit of confusion
15 in at least one rebuttal report, how many basins are within
16 the management area that we're proposing?
17 A. We're proposing a seven-basin management area.
18 Q. That wasn't a typo?
19 A. That wasn't a typo.
20 Q. Okay. Let's move on to the next topic the State
21 Engineer asked for information on, and that would be the 1169
22 aquifer test and recovery.
23 What does the data you've reviewed tell you about
24 Order 1169 pumping tests and the recovery of the aquifer since

1 steepest water level declines in their hydrographs during the
2 1169 pumping test.
3 Q. Okay. So the next slide, the data you've
4 reviewed tells you that the State Engineer's current
5 understanding of post-1169 recovery is pretty accurate?
6 A. Yes. We agree with the statements that the State
7 Engineers made in the Interim Order 1303.
8 Q. Please go through those statements briefly.
9 A. Okay. Moapa Valley Water District agrees with
10 DWR IO 1303, parentheses, P10, end paren, quote, the current
11 amount of pumping corresponds to a period of time in which
12 spring flows have remained relatively stable and have not
13 demonstrated a continuing decline.
14 Although water levels and spring discharge have
15 remained fairly constant since the cessation of the Order 1169
16 pumping test, water levels and spring discharges have not
17 recovered the pre-1169 test levels or discharges.
18 Q. Next slide. We can move on.
19 A. So we're discussing here the annual groundwater
20 that may be pumped in relationship between pumping location
21 discharge, the MRS, and capture the Muddy River flow.
22 We concur with SNWA and Dr. Johnson that the
23 alluvial wells are in direct hydrologic communication with the
24 Muddy River and directly capture Muddy River flows.

1 We also believe that additional carbonate pumping
2 in excess of current diversions in the Lower White River Flow
3 System will accelerate spring depletions.
4 Q. Okay. Next slide. What conclusions did you
5 reach about the State Engineer's fourth question posed in
6 Interim Order 1303?
7 A. Regarding movement between alluvial and carbonate
8 wells. I think all the parties in the room agree that
9 carbonate aquifer discharge provides Moapa -- provides water
10 for Moapa Dace habitat. Alluvial pumping does not affect
11 Muddy River's spring discharge which is discharging from the
12 carbonate aquifer.
13 We believe that -- it's our professional opinion
14 that transfer of alluvial rights to the carbonate aquifer will
15 increase and accelerate spring depletions.
16 Our opinion is that pumping from a carbonate
17 aquifer in greater than current volumes will increase and
18 accelerate spring depletions, and the transfer of carbonate
19 water rights to the alluvial aquifer will reduce flows in the
20 Muddy River.
21 Q. All right. So we're going to move on to the
22 fifth question the State Engineer posed, which is somewhat of
23 a catch-all on the information relevant to the previous
24 questions.

1 planning that the district has conducted, we did their 50-year
2 water resource plan, it's all having to do with acquisition of
3 water rights and maintaining those water rights and making
4 sure that they've been put to beneficial use.
5 So ruling 6259 and 6261 were denied, and they
6 caused the district to seek alternative sources to accommodate
7 the growth scenarios from the integrated water resource plan.
8 And then curtailment of district's water rights
9 will not only have an effect on the non-Indian communities
10 that Mr. Davis pointed out in his slideshow in the district
11 service area, but curtailment of the water rights will have an
12 adverse effect on the Moapa Band of Paiutes, which in addition
13 to the non-Indians, we have a legal obligation to serve and
14 provide water to.
15 Q. All right. The next slide is one more thing that
16 you believe the State Engineer needs to know?
17 A. Yeah. I think, you know, we can't stress enough
18 how much the district has sacrificed to help maintain habitat
19 for the Moapa Dace.
20 So, you know, in the 2006 MOA, you know, and this
21 was described -- and I forget if it was Mr. Marshall or Mr.
22 Williams who was saying MOA's in perpetuity. You know, that
23 we've dedicated 724 acre-feet, or 1 CFS, 25 percent of our
24 district's water use, for Moapa Dace habitat protection and

1 And you were offered as a witness on water
2 rights, so as an expert on water rights, what other
3 information do you think the State Engineer needs to properly
4 analyze Lower White River Flow System?
5 A. Well, I think it's really important that the
6 State Engineer and the other parties and stakeholders to this
7 hearing recognize that the district has spent many dozens of
8 years doing water resource planning and acquiring and
9 developing water rights to provide for the health, safety, and
10 welfare of the customers it serves within the district
11 boundaries that Mr. Davis showed, and in responding to
12 enabling legislation that Mr. Davis referred to.
13 And we also agree and appreciate that the State
14 Engineer in Interim Order 1303 recognizes that we need a
15 reasonable -- reasonably certain supply of water for future
16 pertinent uses without jeopardizing economies, and we are the
17 economy in the area right now in the communities we serve, and
18 the State Engineer IO 1303 recognizes that we need to protect
19 the health and safety of those who rely on that water supply.
20 Q. Below that you've cited a law that authorizes a
21 mechanism. I don't think we need to discuss it at length. I
22 think the slide speaks for itself. So we can go to the next
23 slide.
24 A. So, as part of the over -- overall water resource

1 enhancement.
2 And that's a really big deal to the district.
3 It's 25 percent of our water supply. It's our senior right.
4 Infrastructure is already in place to divert it, and the
5 district took a big hit with that. Okay?
6 You know, and it's our professional opinion and
7 the district's stance that dedication of the pipeline, Jones 1
8 CFS for base habitat, mitigated any effects we have to Dace
9 habitat 13 years ago, and we have met any obligations to
10 protect the Dace habitat and the senior water rights.
11 Q. Let's go to our next slide. You talk about what
12 the district needs are in order to comply with its statutory
13 mandate to provide water. Can you talk us through those
14 needs?
15 A. Right. Yes. And so, you know, the district
16 needs to have a sustainable water supply to provide for the
17 health, safety and well-being of our customers.
18 Well, you know, right now the district is pumping
19 from the Arrow Canyon wells. We need redundancy in the
20 system. We need additional points of diversion if Arrow
21 Canyon for any reason goes down, or both Arrow Canyon well
22 goes down.
23 One of my clients in the last couple weeks lost a
24 lot of their main producing wells to a lightning strike, you

1 know, and we're very sensitive to all of our water suppliers
2 needing redundancy and backup in their systems.
3 So additional wells are needed as part of the
4 district's long-term plans. You know, we need to protect the
5 communities we serve, you know.
6 We believe that -- you know, it's really
7 important as we -- outcome of this hearing and the ruling
8 and -- ruling and final order that comes out of this is that,
9 you know, municipal -- current -- current municipal uses of
10 water should be preferred use and most protected and highest
11 use of water in seven-basin flow systems, seven-basin
12 administrative system, recognition of municipal water that's
13 been currently put to beneficial use.
14 The district requests 6,791 acre-feet for
15 municipal and related uses. Preferred use designation is as
16 we talked about.
17 And we don't know exactly what this looks -- this
18 last bullet looks like, but we do need and want support for
19 transfers of carbonate water rights from Arrow Canyon to other
20 basins not in the Lower White River Flow System as currently
21 defined.
22 Q. Okay. So we're getting pretty close to our
23 one-hour limit, so can you briefly talk us through your last
24 few slides, which are just a summation of your conclusions?

1 increase or accelerate, which would cause adverse impacts to
2 today's habitat as a result of transfer of alluvial water
3 rights to the carbonate aquifer or pumping from carbonate
4 aquifer wells involving use greater than currently being
5 pumped.
6 Q. We wanted to leave with a couple of
7 recommendations and then we'll turn it over to cross.
8 So --
9 A. This is our last slide. So, we recommend that
10 the Kane Springs Valley basin should be included in the super
11 basin to form a seven-basin administrative area.
12 Existing municipal use should be designated as
13 the most protected and highest use of water in the seven-basin
14 administrative area.
15 Carbonate pumping should not exceed current rates
16 of diversion.
17 The State Engineer should recognize water put to
18 beneficial use by the district from its wells and springs and
19 grant the district the right to divert 6,791 acre-feet of
20 water per year.
21 MR. MORRISON: Thank you. That ends my direct
22 testimony.
23 HEARING OFFICER FAIRBANK: Thank you. So we'll
24 go ahead and open up to cross-examination. And based upon our

1 A. You know, our conclusions, the hydraulic gradient
2 of ten to minus four feet per foot is effectively flat and is
3 continuous from Coyote Springs Valley to Muddy Springs, Big
4 Muddy Springs area.
5 KMW-1, CSVM-4 responded to the 1169 pumping test,
6 as well as springs in the Muddy River Springs area responded
7 to 1169 pumping test.
8 Lincoln-Vidler is willing to curtail Kane Springs
9 Valley carbonate pumping if trigger levels are met or exceeded
10 in the Warm Springs West Gage in the Muddy River Springs area.
11 Residual drawdown collected during
12 Lincoln-Vidler's KPI pumping test demonstrate hydraulic
13 barriers to groundwater flows were not encountered during the
14 seven-day pumping aquifer testing.
15 Water levels and spring discharges have remained
16 fairly constant since the end of the pumping test but have not
17 recovered to pretest discharges of water levels.
18 You know, additional data required to verify what
19 state or steady state condition that the carbonate aquifer may
20 be reaching.
21 Alluvial wells are in the direct hydrologic
22 communication with the Muddy River and directly capture Muddy
23 River flows.
24 And Muddy River spring area spring flows may

1 calculations, we have -- we'll go ahead and start out with
2 seven minutes for each of the participants for
3 cross-examination.
4 MR. MORRISON: Madam Hearing Officer, before we
5 start cross, I neglected to offer our reports into evidence,
6 so if I may please offer those.
7 HEARING OFFICER FAIRBANK: Mr. Morrison has
8 offered his exhibits -- his expert reports into evidence, and
9 those reports will be so admitted.
10 MR. MORRISON: Thank you.
11 HEARING OFFICER FAIRBANK: Okay. Coyote Spring
12 Investment?
13 CROSS-EXAMINATION
14 BY MR. HERREMA:
15 Q. Thank you. Brad Herrema for Coyote Spring
16 Investment.
17 Good morning, Mr. Lazarus and Mr. Davis.
18 Mr. Lazarus, you testified that faults don't
19 cause any impact to the occurrence and movement of groundwater
20 in the Lower White River Flow System based on relatively flat
21 water levels; is that correct?
22 ANSWERS BY MR. LAZARUS:
23 A. I believe I stated that faults do not change the
24 very flat ten to minus four gradient.

1 Q. Do changes in groundwater levels indicate the
2 presence of faults?
3 A. Changes in groundwater elevations just indicate a
4 change in potentiometric head from higher to lower
5 potentiometric head.
6 Q. So can water levels themselves be used to
7 identify faults?
8 A. Water levels would be something one would
9 consider to identify if faults were or were not present.
10 Q. Can water levels by themselves to be used to
11 identify faults?
12 A. It all depends how far the water is to a fault.
13 The faults that we have here and the series of faults that I
14 believe Mr. -- that Mr. Reich -- I don't know if it's Dr.
15 Reich, Mr. -- Steve --
16 Let's make it clear. You know, everyone -- a lot
17 of people have been talking about faults as barriers to flow.
18 Q. And I just have a very simple --
19 A. Let me just please finish. We don't have --
20 these faults, we don't have a 30-foot-wide drought curtain
21 going down to 3,000 feet where there's a
22 barrier-to-groundwater flow. Okay?
23 All the places where faults have been mapped or
24 inferred are showing that the water is being transmitted

1 A. I don't remember those. I haven't looked at it
2 in a long time.
3 Q. If I told you that the 2012 report indicated
4 specific storage was E to the minus five expressed in terms of
5 one divided by number of feet, would that sound right to you?
6 A. You refer to specific storage, and I was talking
7 about a storage coefficient and specific yield. Those are two
8 different numbers and two different calculations.
9 Specific storage, I believe, is a storage
10 coefficient provided by the thickness of the aquifer, but I
11 would have to check my reference on that.
12 Q. Okay. Would you agree that if the aquifer was
13 assumed to be a thousand feet, the storage value would be .01
14 or H to the minus two?
15 A. I don't understand the question.
16 Q. Okay. In regard to the Pederson Spring water
17 level data, did you try to determine the impact of Arrow
18 Canyon pumping as opposed to pumping from other carbonate
19 wells in the Lower White River Flow System?
20 A. No, I did not.
21 Q. Turning to page 2 of your July 1, 2019, report,
22 right under "Post-Testing water level recovery," there's a
23 statement there. It says: "NVWD agrees with DWR statement in
24 Interim Order 1303 that the current amount of pumping

1 across the structures.
2 I believe it was Rick Waddell said that the
3 faults are transmissive enough to transmit heat flow, and
4 Andrew Burns said that the faults are transmitting both
5 anthropogenic and natural changes in the aquifer system across
6 the faults themselves.
7 Q. Okay. My question was, can water levels by
8 themselves be used to identify faults?
9 A. And as I said before --
10 Q. -- you have -- the question --
11 A. -- it depends on the location of the wells
12 relative to the faults.
13 Q. Okay. In reviewing the work that was done on
14 behalf of CSI, did you realize that CSI's expert, Ms. Moran,
15 provided a comparative analysis of impacts to an observation
16 point based on pumping in one well compared to pumping in
17 another well?
18 A. I believe so.
19 Q. If she had used a lower storativity value, what
20 would have been the results of that analysis?
21 A. The drawdown would have been greater than she had
22 shown.
23 Q. Okay. Were you aware of the values of
24 storativity used in the tetradic model?

1 corresponds to a period of time in which spring flows have
2 remained relatively stable and have not demonstrated a
3 continuing decline."
4 Did you do any independent analysis in
5 preparation of your report?
6 A. No.
7 Q. So what was the basis for your agreement?
8 A. Well, I'll rephrase that. This com- -- we
9 prepare an annual report for the hydrology review team.
10 So all of the hydrographs for Pederson and
11 Pederson East were something that we've been preparing and
12 looking at for several years now.
13 Q. Page 4 of your report, the first paragraph under
14 heading C: "Moapa Valley Water District agrees with DWR
15 statement in Interim Order 1303." Do you see that paragraph?
16 A. Yes, sir.
17 Q. What additional data is required to determine
18 whether the system is in a steady state?
19 A. Can I have an unlimited budget?
20 You know, many more years of measuring water
21 levels, spring discharges, pump- -- pumping. You know,
22 really -- and I think Ms. Braumiller referred to it earlier,
23 you know, you really want to look at long-term pumping in
24 different portions of the super basin where wells, some are,

1 and where wells, you know, could be drilled.
2 You know, for instance, in the stipulation that
3 was attached Ruling 5712, you know, there was a technical
4 review team that was supposed to have been formed there and
5 two wells were supposed to have been drilled.
6 One well, I think it was substituted. SNWA
7 substituted. I forget which well it was. But the second
8 well, as part of that stipulation, wasn't drilled, and that's
9 the kind of information that we'd like to see. That would be
10 more additional data.
11 MR. HERREMA: Did I use my time up?
12 HEARING OFFICER FAIRBANK: Yes. That was your
13 timer.
14 MR. HERREMA: Thank you.
15 HEARING OFFICER FAIRBANK: Thank you.
16 Next we'll go to Fish and Wildlife Service.
17 MS. BRAUMILLER: We don't have a solicitor here
18 today, otherwise we have two questions.
19 HEARING OFFICER FAIRBANK: Okay. So then
20 we'll -- as counsel's not here, we'll move to National Park
21 Service and then Moapa Band of Paiute.
22 MR. BURLEY: Rich Burley, for the record, for the
23 Tribe.
24

1 specific reference.
2 Q. Do you think the 9,000 acre-feet goes to the
3 Muddy River or does it bypass -- is there any water that
4 bypasses the river and the springs?
5 A. I don't know.
6 Q. Ordinarily do you think it makes sense to move
7 well withdrawals further from a sensitive area if you wanted
8 to do less direct harm to the sensitive area? As a general
9 matter.
10 A. I was going to say "ordinarily" doesn't describe
11 all the different kinds of aquifer systems I would do it in.
12 So, it may just slow down the time that it takes for the
13 impacts to hit the sensitive area.
14 Q. You pointed out looking northward that things
15 were relatively non-heterogeneous, I guess, if you want to
16 talk about gradients between Kane Springs through Coyote
17 Springs and then down to the Muddy Springs complex.
18 Do you see any relevant heterogeneity anywhere
19 within the super basin, or do you think it makes sense to
20 treat the super basin as somewhat analogous to just a bathtub
21 where it really doesn't matter where you take water out of?
22 A. You have heterogeneities in the system that have
23 been discussed. Previous testimony have to do with structural
24 geologic features.

1 CROSS-EXAMINATION
2 BY MR. BURLEY:
3 Q. Mr. Lazarus, do you believe that all of the
4 carbonate flow that is being taken out of pumps comes out at
5 the Muddy Springs area?
6 A. I don't understand the question.
7 Q. Do you think there's any water from the carbonate
8 aquifer that bypasses the Muddy Springs complex?
9 A. Based on previous investigations, and I haven't
10 verified any of these numbers, but, yes.
11 Q. Where do you think it goes if it doesn't go to
12 the springs?
13 A. South.
14 Q. South towards Lake Mead? Towards Las Vegas?
15 A. I can't really break those. I haven't looked at
16 it.
17 Q. Okay. Do you have a sense of how much water we
18 might be talking about within the carbonate aquifer that might
19 bypass the springs?
20 A. I would have to go back and look at some of the
21 State Engineer numbers, or numbers from SNWA. I'm going to
22 say -- and I want to qualify this by saying I have to check
23 the reference -- specific reference, but possibly as much as
24 9,000 acre-feet, in that ball park, but I have to check the

1 I think what's been overlooked in this hearing in
2 terms of heterogeneities in this really regionally expensive
3 hunk of aquifer system is you've got K flow in certain areas,
4 and you have Karst flow.
5 And the Karst flow is so important that the park
6 service hired a guy name Gary Carson to come to this hearing.
7 So we -- we've got all sorts of heterogeneities that move
8 water around within the limestone aquifer, the regional
9 carbonate aquifer.
10 Q. Okay. If there were carbonate water available
11 within the super basin that had bypassed the springs and that
12 does bypass the river, would that be water that you think
13 could be safely withdrawn?
14 A. I'd have to look to see what the results were of
15 aquifer tests in those areas and then draw conclusions based
16 on that.
17 Q. When you talk about that it wouldn't help to move
18 alluvial pumping to ground- -- to the carbonate or carbonate
19 pumping to the alluvium, those are fairly general statements
20 and kind of ignore some of these heterogeneity questions that
21 we're talking about. Isn't this true?
22 A. The gradients that we calculated from KMW-1 to
23 EH-4 and the other gradients are very flat. Whatever
24 heterogeneities might be there aren't affecting the

1 groundwater gradient in these areas.
2 Q. So you were focused on the particular issues
3 relating to Kane Springs and whether it should be included in
4 the super basin when you made those recommendations and came
5 to those conclusions.
6 Is that fair?
7 A. Our focus was on Kane Springs, yes.
8 Q. So you might have a different focus if the
9 question was whether moving an alluvial right that's very
10 close to Muddy Springs to a carbonate right in a far portion
11 of California Wash, just as an example, would you have to look
12 at the specific questions that might come into play before
13 reaching a conclusion along those lines?
14 A. No.
15 Q. Why not?
16 A. You know, as I stated in my direct, any increase
17 in carbonate pumping will result in increased depletions on
18 the Muddy River Springs area.
19 So it's a matter of location of your pumping
20 center, and then what you are doing is just something
21 becomes -- the magnitude and the timing of the effects are
22 specifically guided or -- magnitude and timing of the effects
23 is based on the distance from the Muddy River Spring area that
24 a new carbonate well would be located.

1 to alluvium and alluvium to carbonate, is it a recommendation
2 that goes throughout the entire Lower White River Flow System?
3 A. The entire seven-basin flow system, yes, sir.
4 Q. Okay. You were also asked about underflow. And
5 I think Mr. Burley on behalf of the Tribe asked you some
6 questions about that.
7 Do you recall that?
8 A. He didn't use the term underflow, but I believe I
9 understand what you're saying.
10 Q. Bypass flow is maybe the term that he used, but
11 water that went past the springs. And my question is, have
12 you seen any wells in the Lower White River Flow System that's
13 captured this underflow without impacting the springs or the
14 river?
15 A. I don't know if I have or haven't.
16 Q. Okay. You have reviewed hydrographs for
17 groundwater levels in the Lower White River Flow System in
18 California Wash, Garnet Valley, Coyote Spring Valley. Is that
19 true?
20 A. I'd say I've reviewed the hydrographs from the
21 1169 pumping test and whatever wells are in our annual
22 reports.
23 Q. Okay. So, do you know or have an opinion on
24 whether or not groundwater levels in other locations in the

1 Q. If the water had bypassed the sensitive area,
2 though, if it was in effect down-gradient, wouldn't some of
3 those answers be different? At least in -- in light of the
4 time that it might take for the effects to show up?
5 A. I don't know. That's why we wanted -- that's
6 what we said in one of our requests that we wanted the ability
7 to move carbonate water rights from Arrow Canyon to other
8 basins outside the super basin.
9 And I said -- in my direct I said I don't know
10 exactly know what it looks like yet, and to add to that, more
11 testing would need to be done.
12 MR. BURLEY: Okay. Thank you, very much.
13 HEARING OFFICER FAIRBANK: Las Vegas Valley Water
14 District, Southern Nevada Water Authority.
15 CROSS-EXAMINATION
16 BY MR. TAGGART:
17 Q. Good morning. For the record Paul Taggart for
18 the water authority and district.
19 Mr. Lazarus, there was just some questions asked
20 about your opinion regarding moving carbonate to the alluvium,
21 moving alluvium to carbonate, and the question I thought was
22 whether your recommendation regarding that type of movement
23 was restricted to Kane Springs only.
24 Is your recommendation regarding moving carbonate

1 Lower White River Flow System, specifically Garnet Valley,
2 California Wash and Coyote Spring Valley, whether those
3 groundwater levels are declining currently?
4 A. I'd have to go back and look at the data.
5 Q. Okay. There was testimony from CSI regarding
6 some resistivity data.
7 Do you recall that?
8 A. Yes, sir.
9 Q. And do you believe that that resistivity data can
10 be used to identify an impermeable fault in the Coyote Spring
11 area?
12 A. I'm not a geophysicist. I don't see -- based on
13 the work we've done, I don't see those faults interrupting
14 groundwater flow.
15 Q. And in -- when you make that conclusion, are you
16 relying on certain lines of evidence?
17 A. Of course.
18 Q. Okay. And I'd like to kind of compare the
19 evidence you're relying upon versus that resistivity evidence.
20 Are you relying on water level data when you make that
21 conclusion?
22 A. We're relying on water level data that has been
23 collected before, during and after the 1169 pumping test, and
24 spring discharges also.

1 Q. So do you think that information is more reliable
2 and more probative to the question of whether a fault in the
3 Coyote Spring area can be impermeable?
4 You sounded pretty confident about a grouted
5 3,000-foot structure?
6 A. I don't see any of those.
7 Q. Okay. So, do you think there are any
8 compartments in Coyote Spring Valley that can be pumped
9 without impacting the Muddy River Springs?
10 A. Based on data available to date, no.
11 Q. Do you think carbonate pumping should be
12 increased in the Lower White River Flow System?
13 A. I stated in my direct it shouldn't be increased
14 beyond what's being pumped now.
15 Q. And did you state in your opinion on page 4 in
16 your report that no new subdivision parcel maps should be
17 approved?
18 Was that you, Mr. Davis, that said that?
19 MR. DAVIS: No, it wasn't me. I don't remember
20 making that statement.
21 MR. MORRISON: Do you need your report to help?
22 MR. DAVIS: On what page of the report?
23 MR. TAGGART: Page 4. I can move on to another
24 question.

1 Is that a fair statement?
2 A. Yes, sir.
3 Q. Okay. When -- are you aware that in recent
4 years, pumping at Arrow Canyon declined, and it probably fell
5 by a third of its pumping previously to that. Are you aware
6 of that?
7 A. I believe so. I'd have to look at the data. But
8 go ahead.
9 Q. And if it -- if Arrow Canyon pumping had
10 continued at the same rate, do you think that would affect
11 your conclusion about whether there's declining trends at the
12 Warm Springs West Gage?
13 A. We'd have to look at those data.
14 Q. Okay.
15 MR. TAGGART: Thank you.
16 HEARING OFFICER FAIRBANK: Lincoln County,
17 Vidler.
18 MR. FREHNER: Dylan Frehner for the record for
19 Lincoln County Water District and Vidler Water Company.
20 CROSS-EXAMINATION
21 BY MR. FREHNER:
22 Q. You just stated that your focus was on Kane
23 Springs Valley with regards to the boundaries?
24 A. Not the southern portions. Yes.

1 BY MR. TAGGART:
2 Q. And back to you, Mr. Lazarus. I'm sorry. Is it
3 Dr. Lazarus?
4 A. Mister.
5 Q. Mister. Okay.
6 There has been discussion of water budgets and
7 the use of water budgets in determining what the long-term
8 quantity of groundwater that should be pumped in this area is.
9 Can you describe your view of the ability to use
10 water budgets in this flow system versus the other type of
11 empirical data you've been describing?
12 A. You know, I forget whether it was Rick Waddell or
13 Ms. Braumiller who said we are past the point of relying on
14 water budgets to do these kind of analyses. I agree with
15 that.
16 MR. TAGGART: Is it -- is it possible to put up
17 slide 26? I'm sorry. Maybe it's the one with the -- could
18 you go up one more? Yeah. Right there.
19 BY MR. TAGGART:
20 Q. And my question again for you, Mr. Lazarus, it
21 just involves your opinion regarding whether we're in a
22 declining trend or a steady trend in water levels in the area,
23 and I think you mentioned you'd like to see more data, that
24 that would be of assistance to make a final conclusion.

1 Q. Just the northern portions?
2 A. Correct.
3 Q. Now, in your report -- let's go back -- you --
4 you also stated that you didn't do any independent data
5 gathering with regards to Kane Springs?
6 A. That is correct.
7 Q. So you pick and choose from other people's
8 information and supplied that here today?
9 A. Well, given the limited budget we have, that's
10 what we are allowed to work with, was what was out there.
11 Q. And given the slides that you've presented today
12 and gone over, those were not submitted in the report,
13 correct?
14 Those hydrographs that you referenced and the
15 other data have not been supplied in the report?
16 A. That's correct, but hydro- -- the hydrographs are
17 out there in the public record, and we've taken, like I said,
18 information from other reports. Yes, sir.
19 Q. With regards to the Figure 1 from your -- or from
20 your rebuttal report, it goes with -- I believe it's your
21 Slide 7.
22 Now, the area depicted in this Figure 1, you
23 would agree that this is a geologically complex area?
24 A. It's geologically complex, but the geology really

1 doesn't seem to have a huge effect on groundwater flow.
2 Q. So one of the previous questions, I believe it
3 was on the Tribe, had indicated that you're indicating this is
4 like a flat bathtub, then?
5 A. I would say it's sort of a remarkably flat.
6 Q. And so you would agree that your figure is
7 showing that this would be more appropriate in a uniform-like,
8 sandy aquifer?
9 A. If I remember my direct testimony correctly, it
10 was a report for Lincoln-Vidler says that it be -- the aquifer
11 behaves as an equivalent porous media, which a sandy aquifer
12 would be.
13 Q. And you're saying this is for the entire super
14 basin?
15 A. I'd say for the areas that we have depicted here
16 on the map, yes. The rest of the super basin, I'd have to do
17 other calculations.
18 Q. So the area from the map, you've shown a line
19 from KMW-1 down to I believe it's EH-4; is that correct?
20 A. Yes, sir.
21 Q. And you're aware that that line goes directly
22 over the Meadow Valley mountains?
23 A. Yes.
24 Q. Now, you've indicated that a part of your focus

1 HEARING OFFICER FAIRBANK: I don't recall that
2 being part of his testimony today, or was that an analysis in
3 the reports?
4 MR. FREHNER: They have supplied in the reports
5 their water plan, which does include -- indicate the flows in
6 those areas.
7 And if we're looking at the overall basin and
8 they want to include flows from one area, we believe it's
9 appropriate to ask questions of flow from all of the areas.
10 HEARING OFFICER FAIRBANK: I think his testimony
11 was, though, that the water report did not -- wasn't inclusive
12 of the Lower White River Flow System as a joint administrative
13 unit, hadn't been designated at that time.
14 So I guess I'm trying to wonder what the
15 relevancy to this particular line of questions are to those
16 questions set forth in Order 1303.
17 MR. FREHNER: Thank you. We'll move on.
18 BT MR. FREHNER:
19 Q. So you haven't requested any other basins besides
20 Kane that may flow into this area be included?
21 A. That is correct. And we limited it to Kane
22 because that's as far out as observation well data were
23 available for order 1169 pumping test effects.
24 So we went as far as out the data took us, and it

1 on Kane Springs was because there's, I believe, flow from Kane
2 Springs into the northern Coyote Springs basin; correct?
3 A. Yes, sir.
4 Q. Now, you also agree that there's flow from the
5 Pahrangat Valley and Delamar Valleys into the northern Coyote
6 Springs Valley?
7 A. Based on testimony from other parties, they
8 seemed to be in agreement on that.
9 Q. You're not in agreement with that?
10 A. I haven't looked at it.
11 Q. You haven't prepared a water plan for the Moapa
12 Valley Water District?
13 A. Yes, I have.
14 Q. And so did you look at the flows from the Lower
15 White River Flow System all the way from the upper right river
16 flow system?
17 A. When we were doing the report, the Lower White
18 River Flow System administrative boundary area wasn't anything
19 that was conceptualized administratively.
20 Q. But you would agree there is flow coming in from
21 Delamar?
22 MR. MORRISON: I object because I don't believe
23 he testified in either of his reports or in his testimony
24 today about flow from Delamar.

1 took us into Kane Springs Valley.
2 Q. I believe it's Slide 33. That's not the one.
3 You make specific reference that you make a
4 recommendation to the State Engineer's office that you be
5 allowed to take the Arrow Canyon wells and move them to basins
6 outside of the Lower White River Flow System; is that correct?
7 A. Yes, sir.
8 Q. What basins are you inferring?
9 A. I have no idea.
10 Q. So that can include the Las Vegas Valley?
11 A. I -- it could, but I doubt we would build a
12 pipeline from there.
13 Q. Delamar Valley?
14 A. As I said in my direct testimony, you know, and I
15 believe I was very specific on it, that we like -- we would
16 request that, but we don't know what it looks like yet. We
17 want to have the flexibility.
18 Q. So you don't know how far you could go to
19 possibly pump those wells if you wanted to move them outside
20 of the basins?
21 A. That is correct.
22 Q. If Kane Springs was excluded from this as
23 Lincoln-Vidler have requested, would you consider Kane as a
24 potential spot?

1 A. I can't speak for the district on this, but I'd
 2 say my opinion is that, no, I would not do it from Kane
 3 because that would just accelerate the drawdowns at the Muddy
 4 River Springs area and accelerate the point at which trigger
 5 levels would be hit.
 6 MR. FREHNER: Thank you.
 7 HEARING OFFICER FAIRBANK: City of North Las
 8 Vegas.
 9 CROSS-EXAMINATION
 10 BY MS. URE:
 11 Q. Good morning, Therese Ure, representing the City
 12 of North Las Vegas, and I have more of a point or a question
 13 for clarification.
 14 In -- in one of your slides, you requested as
 15 part of your recommendation that the State Engineer grant the
 16 right to the district to divert 6,791-acre-feet per year; is
 17 that correct?
 18 A. Yes.
 19 Q. Would that 6,79 -- or 6,791-acre-feet constitute
 20 an increase of carbonate pumping than what the district is
 21 currently pumping?
 22 A. Yes.
 23 MS. URE: Okay. Thank you.
 24 HEARING OFFICER FAIRBANK: All right. We'll go

1 STATE OF NEVADA)
) ss.
 2 CARSON CITY)
 3
 4 I, MICHEL LOOMIS, a Certified Court Reporter, do
 5 hereby certify;
 6 That on the 30th of September, 2019, in Carson
 7 City, Nevada, I was present and took stenotype notes of the
 8 hearing held before the Nevada Department of Conservation and
 9 Natural Resources, Division of Water in the within entitled
 10 matter, and thereafter transcribed the same into typewriting
 11 as herein appears;
 12 That the foregoing transcript, consisting of
 13 pages 1092 through 1230 hereof, is a full, true and correct
 14 transcription of my stenotype notes of said hearing to the
 15 best of my ability.
 16
 17 Dated at Carson City, Nevada, this 1st day of
 18 October, 2019.
 19
 20
 21
 22 _____
 MICHEL LOOMIS, RPR
 NV CCR #228
 23
 24

1 ahead and take a break for lunch. So, let's go ahead and
 2 we'll be pack at 1:00 p.m.
 3 Thank you.
 4 (Lunch recess at 11:58 a.m.)
 5
 6
 7
 8
 9
 10
 11
 12
 13
 14
 15
 16
 17
 18
 19
 20
 21
 22
 23
 24

	acknowledgement (1) 1171:7	additional (18) 1121:21;1126:9; 1127:12;1147:21; 1154:16;1155:2,15; 1165:19;1171:21; 1178:18,20;1198:10; 1200:1;1203:20; 1204:3;1205:18; 1211:17;1212:10	1096:17;1101:7,24; 1106:12;1112:14; 1115:8,22;1118:23; 1129:14;1135:19; 1147:24;1158:12; 1182:8;1184:21; 1187:11;1189:10,17, 20;1192:3,16;1221:20	1096:22
#	acquainted (1) 1101:5	address (2) 1146:24;1171:20	against (1) 1142:24	allotted (2) 1129:16,20
#228 (1) 1230:22	acquire (1) 1103:19	addressed (2) 1145:15;1166:14	agencies (4) 1099:20;1106:22; 1107:1;1142:19	allow (8) 1114:21;1119:5; 1123:21;1124:12,22; 1144:9;1150:3; 1194:16
\$	acquiring (1) 1201:8	addressing (1) 1116:23	agency (1) 1100:7	allowed (6) 1107:3;1120:8,19; 1162:22;1223:10; 1227:5
\$200,000 (2) 1148:10,15	acquisition (2) 1113:14;1202:2	adequate (3) 1146:10,17;1172:10	ago (4) 1134:6;1148:19; 1186:3;1203:9	allowing (2) 1166:12;1170:5
A	acre (1) 1183:22	adjacent (1) 1179:6	agree (28) 1109:21;1123:8; 1124:15;1128:12; 1134:9;1139:15; 1140:18;1151:7; 1175:11;1182:3,11,12; 1186:3,8,11,15,17; 1189:1;1195:19; 1199:6;1200:8; 1201:13;1210:12; 1221:14;1223:23; 1224:6;1225:4,20	allows (3) 1123:23;1124:10; 1144:4
A&M (1) 1102:6	acre-feet (24) 1120:7,13,20; 1123:24;1124:6; 1127:11;1137:11; 1148:14;1162:7; 1163:2,4;1170:1; 1171:7,8,10,13,16,23; 1175:20;1202:23; 1204:14;1206:19; 1213:24;1214:2	adjusted (1) 1161:5	ADMINISTRATION (1) 1092:7	alluvial (10) 1186:10;1199:23; 1200:7,10,14,19; 1205:21;1206:2; 1215:18;1216:9
A-1 (1) 1148:17	Act (21) 1098:17;1099:2,2; 1100:16,20;1102:13; 1103:7;1106:18,21,23; 1107:8,16,17;1108:8; 1118:13;1120:21; 1128:3;1140:21; 1141:3,6;1143:17	adjustments (1) 1161:2	administered (1) 1175:9	alluvium (5) 1215:19;1217:20,21; 1218:1,1
A2 (1) 1131:6	Acting (1) 1093:4	ADMINISTRATIVE (8) 1185:2;1196:17; 1197:11;1204:12; 1206:11,14;1225:18; 1226:12	ADMINISTRATION (1) 1092:7	almost (1) 1178:2
A3 (1) 1131:6	action (7) 1119:22;1139:8,14; 1140:6;1142:19; 1153:5;1170:16	administrative (8) 1185:2;1196:17; 1197:11;1204:12; 1206:11,14;1225:18; 1226:12	ADMINISTRATION (1) 1092:7	alone (2) 1146:10,16
abandonment (1) 1171:17	actions (14) 1099:22,22;1105:23; 1109:9,12;1118:2; 1124:9;1126:2,5,7,8, 17;1153:1;1156:18	administratively (1) 1225:19	ADMINISTRATION (1) 1092:7	along (3) 1124:24;1174:4; 1216:13
ability (7) 1115:16;1117:9; 1161:22;1162:17; 1217:6;1221:9; 1230:15	active (1) 1136:9	admitted (3) 1104:21;1105:1; 1207:9	ADMINISTRATION (1) 1092:7	alter (1) 1181:7
able (4) 1120:11,14;1142:22; 1165:16	actively (1) 1132:16	adult (2) 1112:23;1113:9	ADMINISTRATION (1) 1092:7	alternative (1) 1202:6
above (9) 1111:3;1116:11,13; 1128:13;1130:19; 1183:5,6,7;1192:4	activities (4) 1113:6;1159:3,5,21	adults (2) 1110:24;1132:23	ADMINISTRATION (1) 1092:7	Although (3) 1123:3;1167:2; 1199:14
Absolutely (2) 1144:1;1174:20	activity (1) 1180:12	adverse (2) 1202:12;1206:1	ADMINISTRATION (1) 1092:7	always (1) 1180:4
accelerate (6) 1200:3,15,18; 1206:1;1228:3,4	actually (5) 1119:11;1182:14; 1193:17,24;1196:8	adversely (1) 1128:14	ADMINISTRATION (1) 1092:7	amended (2) 1139:18;1140:7
acceptable (1) 1180:1	Adam (1) 1093:5	advisory (3) 1103:22;1149:13,24	ADMINISTRATION (1) 1092:7	among (1) 1153:12
accommodate (2) 1162:7;1202:6	add (4) 1108:18;1147:3; 1163:22;1217:10	afar (1) 1098:4	ADMINISTRATION (1) 1092:7	amongst (2) 1147:6;1164:9
accompanied (1) 1099:19	added (2) 1112:7;1175:3	affect (4) 1121:2;1150:20; 1200:10;1222:10	ADMINISTRATION (1) 1092:7	amount (9) 1128:11;1129:16; 1130:17;1135:6; 1157:9;1159:20; 1164:8;1199:11; 1210:24
accompanying (1) 1176:11	addition (2) 1176:6;1202:12	affected (1) 1107:17	ADMINISTRATION (1) 1092:7	analogue (1) 1214:20
accomplished (1) 1113:20		affecting (1) 1215:24	ADMINISTRATION (1) 1092:7	analyses (1) 1221:14
account (1) 1107:17		afternoon (1) 1096:14	ADMINISTRATION (1) 1092:7	analysis (18) 1120:9;1121:5,16; 1126:3;1128:22; 1130:19;1144:14,18; 1161:4,11,12;1162:21; 1164:5;1186:20;
accounted (1) 1148:18		afterwards (3) 1122:5;1188:11,16	ADMINISTRATION (1) 1092:7	
accurate (10) 1133:22;1142:7,9, 14;1144:5;1166:17; 1176:4;1177:5; 1178:21;1199:5		again (21)	ADMINISTRATION (1) 1092:7	
accused (1) 1173:13			ADMINISTRATION (1) 1092:7	
achieve (1) 1147:13			ADMINISTRATION (1) 1092:7	

<p>1209:15,20;1211:4; 1226:2 analyze (2) 1182:18;1201:4 analyzed (6) 1120:5;1123:20,20; 1139:8;1182:3; 1186:11 and- (1) 1094:3 Andrew (2) 1177:13;1209:4 Angeles (1) 1093:23 animals (5) 1110:16;1112:23; 1132:10,22,23 annual (10) 1105:15,20;1108:20; 1128:11;1134:17; 1160:20;1161:1; 1199:19;1211:9; 1218:21 annually (2) 1135:1;1170:1 answered (1) 1147:15 anthropogenic (2) 1196:20;1209:5 anticipated (2) 1162:18;1163:2 apart (1) 1143:4 Apcar (8) 1112:1;1113:15,18; 1117:3;1119:15; 1159:14;1160:3; 1171:3 apologize (1) 1167:22 appear (1) 1162:16 APPEARANCES (2) 1093:1;1094:1 appears (1) 1230:11 Appendix (5) 1131:6;1160:22,23, 24;1161:4 applications (1) 1195:13 applied (1) 1166:20 applies (1) 1145:7 apply (4) 1126:19;1137:8; 1145:14;1170:18 appreciate (3) 1151:23;1155:19; 1201:13 approach (2) 1106:6;1135:20</p>	<p>appropriate (9) 1132:21;1151:8; 1174:18;1182:18; 1183:4,5;1187:6; 1224:7;1226:9 appropriated (1) 1108:1 appropriately (1) 1121:14 approval (1) 1120:2 approve (1) 1163:17 approved (1) 1220:17 approximately (4) 1110:12;1112:4,6; 1113:11 aquatic (2) 1099:7;1112:19 aquifer (58) 1106:3;1107:10; 1152:4;1161:3; 1163:10;1167:1,3; 1169:21;1179:11; 1180:13;1181:16,18; 1182:2,6,11,17,18,24; 1183:9,23;1184:2; 1185:10,19;1186:7,9, 10,15;1187:1;1189:13; 1190:11;1196:14,17, 24;1197:22,24;1198:9; 1200:9,12,14,17,19; 1205:14,19;1206:3,4; 1209:5;1210:10,12; 1213:8,18;1214:11; 1215:3,8,9,15;1224:8, 10,11 aquifers (1) 1184:2 arbitrarily (1) 1128:17 AREA (58) 1092:12;1098:11; 1103:20;1104:1; 1113:14;1120:16; 1128:9;1132:19; 1149:6,16;1150:6; 1157:13,14;1169:2,5,8; 1172:11;1175:6; 1177:18,20;1180:11; 1185:20;1186:21; 1189:21;1195:1,10,16, 18,20;1196:24; 1197:16,17;1201:17; 1202:11;1205:4,6,10, 24;1206:11,14;1213:5; 1214:7,8,13;1216:18, 23;1217:1;1219:11; 1220:3;1221:8,22; 1223:22,23;1224:18; 1225:18;1226:8,20; 1228:4</p>	<p>areas (10) 1108:15;1173:20; 1174:2;1178:3;1215:3, 15;1216:1;1224:15; 1226:6,9 Area's (1) 1111:13 arise (1) 1172:6 arises (1) 1172:8 arising (1) 1096:8 around (9) 1105:21;1112:1; 1114:15;1116:15; 1136:21;1154:13; 1164:12;1198:18; 1215:8 Arrow (13) 1101:9;1124:4; 1129:1;1169:22; 1203:19,20,21; 1204:19;1210:17; 1217:7;1222:4,9; 1227:5 arts (1) 1102:21 Aspen (1) 1099:17 asserting (1) 1190:18 assertion (2) 1176:24;1192:24 assess (2) 1152:21;1182:15 assessing (1) 1164:20 assessment (3) 1103:12;1133:24; 1196:13 assistance (1) 1221:24 assistant (1) 1178:23 assisted (1) 1160:10 associated (3) 1118:1;1124:6; 1159:8 Association (1) 1102:5 assume (2) 1150:23;1151:3 assumed (1) 1210:13 assumption (1) 1151:8 attached (1) 1212:3 attain (1) 1156:23 attempt (1)</p>	<p>1142:6 attention (1) 1139:17 attorney (3) 1133:10;1140:19; 1143:23 authorities (1) 1131:11 Authority (15) 1096:21;1097:9,13; 1101:23;1102:24; 1113:13;1118:20; 1120:13;1143:5; 1155:17;1158:8,13; 1160:16;1217:14,18 Authority's (1) 1096:12 authorized (1) 1127:16 authorizes (1) 1201:20 authorizing (1) 1143:20 available (16) 1104:18;1105:21; 1106:9,10,13;1124:23; 1153:21;1156:2; 1161:19;1164:3,21; 1165:8,18;1215:10; 1220:10;1226:23 average (1) 1183:24 avoid (2) 1128:15;1163:15 avoids (1) 1128:13 aware (20) 1132:14;1135:1,4,9; 1136:2,8;1137:18; 1142:22;1145:11; 1149:2,10,19;1152:14, 15;1155:10,11; 1209:23;1222:3,5; 1224:21 away (1) 1127:24</p>	<p>1099:1;1102:16 backup (1) 1204:2 Bailey (1) 1158:18 ball (1) 1213:24 band (20) 1118:9,21;1133:8, 10;1134:22;1150:13, 15;1152:10;1160:13; 1169:1,9;1170:18; 1171:5,8,9,14,16,17; 1202:12;1212:21 bar (2) 1158:21;1160:4 Barnes (1) 1093:8 barrier (2) 1149:14;1176:23 barriers (7) 1114:19,21;1159:17; 1182:9;1186:14; 1205:13;1208:17 barrier-to-groundwater (1) 1208:22 bars (1) 1159:6 base (1) 1203:8 based (19) 1121:14;1135:18; 1163:9;1177:1,21; 1178:4,5;1193:13; 1195:14,19;1206:24; 1207:20;1209:16; 1213:9;1215:15; 1216:23;1219:12; 1220:10;1225:7 bases (1) 1194:18 basic (1) 1168:9 basically (13) 1099:21;1100:7; 1107:1;1108:1,13; 1118:23;1119:4,12; 1124:23;1128:18; 1154:3;1164:8; 1171:24 BASIN (42) 1092:9,10,11,13; 1167:4;1175:1,2,3,9, 15,21,22;1176:2,14,21; 1179:4,4;1184:14,15, 16,17;1185:2,8,13,17; 1196:18,18;1197:10, 11,12;1206:10,11; 1211:24;1214:19,20; 1215:11;1216:4; 1217:8;1224:14,16; 1225:2;1226:7 basins (9)</p>
B				
<p>back (27) 1096:5;1106:2; 1124:13;1136:21; 1147:20;1151:5; 1153:1;1154:13; 1155:16;1158:7; 1162:24;1163:3; 1165:22;1166:1,10; 1168:3;1176:3;1178:8, 23,23;1185:15; 1195:11;1197:9; 1213:20;1219:4; 1221:2;1223:3 background (2)</p>				

1167:1,5;1197:15; 1204:20;1217:8; 1226:19;1227:5,8,20	besides (1) 1226:19	1100:21	broken (1) 1180:5	1152:20
basis (3) 1141:1;1193:9; 1211:7	best (2) 1152:3;1230:15	bonytail (1) 1100:1	Brownstein (1) 1093:22	called (3) 1114:20;1120:12; 1156:4
bathhtub (2) 1214:20;1224:4	better (5) 1100:8;1125:3; 1184:9;1190:24; 1196:9	BOs (1) 1144:16	BT (1) 1226:18	Calling (1) 1193:6
Bay (1) 1122:6	beyond (4) 1145:8;1152:23; 1168:11;1220:14	both (11) 1098:8,17;1133:14; 1161:18;1174:4; 1179:14,16;1189:24; 1198:24;1203:21; 1209:4	budget (4) 1174:11,20;1211:19; 1223:9	Calls (3) 1153:6;1162:21; 1193:14
bears (1) 1166:14	Bible (1) 1173:15	bottom (1) 1117:1	budgets (4) 1221:6,7,10,14	came (5) 1106:7;1125:1; 1183:21;1184:7; 1216:4
became (4) 1100:5,12,22;1101:5	Big (5) 1117:3;1119:16; 1203:2,5;1205:3	bottom-line (1) 1157:19	build (2) 1123:10;1227:11	can (53) 1105:16;1106:3; 1107:10;1111:9,11; 1112:7,16;1114:5,8; 1115:15;1117:13,22; 1121:11;1125:10; 1131:18;1132:4; 1143:10,13;1149:10; 1151:4;1159:4; 1160:23;1161:14; 1167:22;1173:11; 1175:4;1182:3,20; 1183:17;1184:13,18, 21;1186:10;1187:19; 1189:10;1195:12,16; 1198:16,16;1199:18; 1201:22;1203:13; 1204:23;1208:6,10; 1209:7;1211:19; 1219:9;1220:3,8,23; 1221:9;1227:10
become (1) 1156:24	biggest (1) 1115:2	bounced (1) 1114:15	building (1) 1114:19	canary (1) 1195:8
becomes (2) 1168:4;1216:21	binding (1) 1170:20	bouncing (2) 1116:15;1198:18	bulk (1) 1176:18	Canyon (15) 1099:16;1101:9; 1124:4;1129:1; 1166:19;1169:22; 1203:19,21,21; 1204:19;1210:18; 1217:7;1222:4,9; 1227:5
bed (1) 1183:5	biologic (1) 1096:23	boundaries (4) 1179:12;1185:11; 1201:11;1222:23	bullet (1) 1204:18	cap (1) 1171:9
Bedroc (5) 1094:9;1146:2; 1155:1;1182:5; 1189:22	biological (43) 1097:18;1098:11; 1101:20;1103:11,17, 22,22;1104:3;1109:22; 1110:1;1118:7,8; 1120:1,12;1121:3,5,16; 1122:12,21;1123:20; 1124:7,11,18;1127:20; 1133:20,24;1134:2; 1138:12;1139:7; 1141:2,10,18,21; 1144:9,14;1149:13,24; 1151:17,19;1153:21; 1154:1;1161:12; 1175:16	boundary (11) 1174:24;1175:12; 1176:19;1179:3; 1184:14,17;1185:2,8, 14;1197:7;1225:18	Bureau (4) 1099:13;1100:3,4,12	capacities (2) 1167:16;1179:16
beds (3) 1183:7,18,18	biologist (4) 1099:10,11;1103:3,3	box (1) 1112:1	Burley (20) 1095:5;1133:9,10, 12,18;1134:5,9,12; 1136:16,19,22; 1150:14,14,17; 1151:10;1212:22,22; 1213:2;1217:12; 1218:5	capacity (8) 1100:3,15;1102:5; 1103:2;1122:22,24; 1144:1;1179:24
began (2) 1169:11;1192:22	biology (2) 1098:12;1102:21	Brad (4) 1130:3,5;1147:24; 1207:15	Burns (2) 1177:13;1209:4	capture (4) 1142:6;1199:21,24; 1205:22
begin (4) 1099:4;1126:7; 1136:5;1152:24	bit (7) 1097:3;1111:5; 1129:17;1147:4; 1151:22;1176:3; 1197:14	Braumiller (4) 1178:17;1211:22; 1212:17;1221:13	Bushner (2) 1179:15,21	captured (1) 1218:13
beginning (3) 1106:1,1;1174:10	biologist (4) 1099:10,11;1103:3,3	Braumiller's (1) 1179:2	business (1) 1173:24	carbonate (47) 1106:3;1107:10; 1130:17;1143:2,14,16; 1152:4;1164:4;1167:1, 3;1169:21;1182:2; 1185:9;1186:9;
behalf (4) 1146:6;1173:17; 1209:14;1218:5	biology (2) 1098:12;1102:21	break (6) 1155:18;1165:6,20, 21;1213:15;1229:1	buzzer (1) 1133:1	
behaved (1) 1182:7	blow (1) 1181:8	breed (1) 1112:14	bypass (4) 1213:19;1214:3; 1215:12;1218:10	
behaves (4) 1182:2;1186:9,11; 1224:11	blowing (1) 1184:9	breeding (1) 1142:13	bypassed (2) 1215:11;1217:1	
behavior (1) 1142:13	blue (1) 1114:6	Bridget (1) 1093:14	bypasses (2) 1213:8;1214:4	
Belaustegui (1) 1093:19	BO (2) 1103:13,23	brief (3) 1102:16;1169:7,18		
below (13) 1123:22,22;1124:21; 1125:16;1126:1; 1127:17;1161:20,23; 1163:13;1166:19; 1183:5,7;1201:20	Bob (2) 1097:21;1146:18	briefly (7) 1098:24;1109:19; 1110:8;1167:20; 1168:9;1199:8; 1204:23	calculate (1) 1177:16	
beneath (1) 1196:18	bolded (1) 1192:20	Brigham (1) 1099:6	calculated (3) 1177:8,9;1215:22	
Benedict (1) 1093:11	Bonneville (1)	bring (2) 1147:10;1157:18	calculation (1) 1183:20	
beneficial (5) 1169:24;1172:18; 1202:4;1204:13; 1206:18		broad (1) 1106:21	calculations (3) 1207:1;1210:8; 1224:17	
benefit (1) 1127:13		broad-blanket (1) 1186:2	California (9) 1093:23;1102:3,8; 1124:1;1135:11; 1171:14;1216:11; 1218:18;1219:2	
benefits (1) 1159:4		broader (2) 1110:23;1157:17	call (3) 1097:20;1126:15;	
			C	

<p>1196:17;1198:9; 1200:1,7,9,12,14,16, 18;1204:19;1205:9,19; 1206:3,3,15;1210:18; 1213:4,7,18;1215:9,10, 18,18;1216:10,17,24; 1217:7,20,21,24; 1218:1;1220:11; 1228:20 carbonate-rock (1) 1180:13 career (1) 1099:5 carrying (2) 1122:22,23 Carson (6) 1093:17;1096:1; 1215:6;1230:2,6,17 case (2) 1108:10;1174:20 catch-all (1) 1200:23 cause (7) 1105:23;1143:7,10; 1152:21;1159:21; 1206:1;1207:19 caused (2) 1108:13;1202:6 causes (4) 1128:2;1143:3,14; 1149:6 causing (1) 1143:21 caution (1) 1132:20 cautious (1) 1106:6 Caviglia (6) 1093:24;1095:10; 1146:6,6,9;1147:15 CCR (1) 1230:22 cease (1) 1166:18 Celsius (3) 1110:21;1111:17,18 center (7) 1112:9;1141:18,21; 1151:17,19;1175:15; 1216:20 Central (1) 1099:14 certain (5) 1159:17;1166:19; 1201:15;1215:3; 1219:16 certificated (1) 1172:1 Certified (1) 1230:4 certify (1) 1230:5 cessation (4)</p>	<p>1170:16;1198:3,21; 1199:15 CFR (1) 1142:10 CFS (23) 1113:17;1116:11,15; 1121:17,23;1124:10; 1126:1,6;1127:4,15,17; 1128:2;1130:17; 1134:11;1140:12; 1151:5;1152:19; 1157:9;1161:9; 1162:24;1198:17; 1202:23;1203:8 challenge (1) 1128:19 change (4) 1135:2;1159:2; 1207:23;1208:4 changed (1) 1129:2 changes (12) 1122:7,8,10,20; 1145:1,5;1162:23; 1187:2;1190:19; 1208:1,3;1209:5 Chapter (1) 1172:9 character (1) 1182:19 characteristics (3) 1167:3;1181:18; 1182:18 characterize (1) 1118:4 charge (2) 1101:10,18 chart (1) 1158:21 check (3) 1210:11;1213:22,24 chemical (1) 1136:7 Chief (2) 1093:7,10 choice (1) 1135:16 choose (1) 1223:7 Christi (1) 1098:3 chub (3) 1100:1,1,21 circle (3) 1136:21;1154:13; 1176:3 cited (3) 1176:20;1180:10; 1201:20 citizens (1) 1142:22 City (11) 1093:17;1094:10;</p>	<p>1096:1;1099:9; 1141:14;1151:16; 1228:7,11;1230:2,7,17 claimed (1) 1171:10 clarification (2) 1104:21;1228:13 clarify (2) 1137:5;1161:11 Clark (1) 1103:8 clear (3) 1111:20;1174:11; 1208:16 clearly (5) 1141:10;1153:23; 1164:1,3,16 client (1) 1194:4 clients (2) 1184:2;1203:23 climate (5) 1188:24;1190:12,19; 1191:5;1192:24 close (6) 1116:15;1180:10; 1187:17;1189:9; 1204:22;1216:10 closer (1) 1173:11 coal (1) 1195:8 co-conservation (1) 1157:2 coefficient (4) 1186:22;1187:5; 1210:7,10 Cogeneration (2) 1145:21;1154:21 coincidentally (1) 1170:24 Colby (3) 1176:10;1196:8,10 collaborative (1) 1164:13 colleagues (1) 1174:12 collect (2) 1110:15;1142:6 collected (3) 1161:3;1205:11; 1219:23 Colorado (5) 1099:15,23;1100:6, 8;1103:8 colors (4) 1111:16;1112:12; 1159:7,9 column (1) 1118:1 com- (1) 1211:8 combination (1)</p>	<p>1183:12 combined (2) 1112:11;1117:2 coming (5) 1106:15;1174:16; 1183:1;1185:15; 1225:20 commence (1) 1153:11 commenced (3) 1153:4,14,15 commented (1) 1134:1 commitments (1) 1122:13 committee (3) 1103:22;1149:13,24 committees (2) 1125:21,22 communication (2) 1199:23;1205:22 communities (6) 1169:1,17;1172:13; 1201:17;1202:9; 1204:5 community (4) 1169:9;1172:13,19, 22 Company (8) 1096:15;1102:2,4; 1138:4,8;1145:23; 1154:22;1222:19 comparative (1) 1209:15 compare (1) 1219:18 compared (2) 1192:1;1209:16 comparing (2) 1132:20;1189:18 compartments (1) 1220:8 competed (1) 1114:11 complete (1) 1183:10 completed (9) 1097:6;1101:21; 1116:10;1120:1; 1122:13,18;1148:13; 1169:12;1182:4 completing (2) 1099:14;1100:16 completion (3) 1179:14,19;1185:23 complex (6) 1115:12;1117:8; 1213:8;1214:17; 1223:23,24 complexes (1) 1113:1 compliance (12) 1098:12,16;1099:2;</p>	<p>1102:2,7,12;1103:7; 1118:9,13;1120:22; 1121:1;1141:7 compliant (2) 1140:20;1141:3 Complies (1) 1168:18 comply (1) 1203:12 component (1) 1117:19 components (4) 1117:15;1119:7,9; 1125:21 comprehensive (1) 1147:6 conceivably (1) 1156:21 conceptualized (1) 1225:19 concern (3) 1127:22;1150:24; 1151:2 concerned (1) 1109:5 concerns (1) 1127:17 conclude (1) 1191:18 concluded (3) 1186:6;1191:10,11 conclusion (18) 1153:7;1177:1; 1189:1;1192:7;1193:4, 7,14,17;1196:6,15; 1198:1,11,13;1216:13; 1219:15,21;1221:24; 1222:11 conclusions (14) 1174:15,17,22; 1185:23;1186:1,3; 1193:19,20;1194:12; 1200:4;1204:24; 1205:1;1215:15; 1216:5 concur (2) 1155:13;1199:22 condensed (2) 1129:18,18 condition (4) 1116:23;1125:17; 1198:10;1205:19 conditions (5) 1116:21;1124:21; 1154:3;1192:6; 1196:14 conduct (5) 1099:20;1142:6; 1181:15,16;1183:14 conducted (4) 1179:6,9,10;1202:1 conducting (1) 1136:3</p>
--	--	---	--	---

confident (1) 1220:4	1103:11,14;1120:18; 1122:4;1156:6	correlation (2) 1189:7;1191:19	1140:7	1172:4;1201:10; 1203:17
confined (8) 1182:16,24;1183:3, 9;1185:19;1186:17; 1187:1;1190:11	consultations (1) 1101:22	corresponding (1) 1161:6	critical (3) 1124:19;1129:6; 1171:22	cut (3) 1163:3;1180:22; 1195:11
confining (2) 1183:5,7	consulting (1) 1102:2	corresponds (2) 1199:11;1211:1	CROSS (3) 1095:2;1206:7; 1207:5	cutthroat (4) 1100:21;1101:3; 1107:23;1108:3
conflict (3) 1106:8;1128:3,15	contained (1) 1145:15	counsel's (1) 1212:20	cross-examination (14) 1104:18;1130:1; 1133:11;1137:3; 1138:5;1142:1;1146:8; 1206:24;1207:3,13; 1213:1;1217:15; 1222:20;1228:9	cycle (1) 1129:15
confusion (1) 1197:14	contains (1) 1165:14	count (3) 1113:9,9;1132:5		D
connected (3) 1175:9;1186:24; 1195:17	contemplate (1) 1127:20	counted (1) 1154:8		
connection (7) 1122:23;1143:13; 1154:9;1169:15; 1175:18,24;1178:13	contemplated (1) 1127:7	counts (7) 1131:7,10,24; 1158:21;1159:1,3,5	crucial (1) 1168:13	Dace (99) 1098:16;1099:3; 1101:5,13;1102:17; 1104:6;1105:14,19; 1106:4;1107:11; 1108:19;1109:1,9,14, 20,22,23;1110:1,4,9; 1112:3,14,16;1113:23; 1114:2,9,12,12,14,24; 1115:2,4,7,15;1116:21; 1117:2,6,9,17;1118:11; 1119:6,13;1121:2,18, 23;1122:21;1123:6,12, 15,17;1126:24; 1127:15;1128:8,14; 1131:2,7,10,14,24; 1132:5;1133:21; 1134:7;1136:11; 1138:1;1139:2,10; 1143:11,14;1144:13, 19,23;1145:6;1146:11, 17,20;1147:2,11,13; 1148:9,10,19,22; 1149:10,14,18,22; 1156:14,17,20;1160:8; 1164:17;1170:5; 1171:20,22;1200:10; 1202:19,24;1203:8,10
connections (1) 1169:16	continuation (2) 1096:11;1185:18	County (13) 1094:2;1096:14; 1100:17;1103:9; 1138:4,7;1140:3; 1179:9;1185:11; 1189:23;1194:9; 1222:16,19	CSA (1) 1175:18	
consecutive (1) 1112:23	continue (2) 1100:8;1128:10	County-Vidler (3) 1139:20;1151:15; 1190:18	CSI (13) 1093:19,22;1116:18; 1123:2;1130:5;1148:5, 13;1152:10;1170:12, 18;1175:23;1209:14; 1219:5	
CONSERVATION (30) 1092:2;1098:12,15; 1100:20;1102:4; 1103:8,9;1104:2; 1109:8;1113:3; 1117:19,20;1119:2,10, 12,14,19,21;1124:24; 1138:1;1139:14; 1144:17;1156:9,18; 1157:16;1159:3,4; 1160:9;1170:10; 1230:8	continues (1) 1152:23	couple (11) 1099:12;1110:2; 1123:13;1124:3; 1131:10;1138:10; 1181:19;1182:14; 1189:4;1203:23; 1206:6	CSI's (1) 1209:14	
conservation-reliant (2) 1156:15,22	continuing (5) 1119:21;1156:10; 1178:6;1199:13; 1211:3	course (2) 1108:9;1219:17	CSV (1) 1176:23	
conservations (1) 1100:19	continuity (1) 1196:23	court (2) 1186:5;1230:4	CSVM-1 (11) 1177:11,12;1187:14, 17,21;1188:6;1189:9,9, 13,18;1190:2	
conservative (1) 1129:3	continuous (4) 1178:6,10;1185:13; 1205:3	covered (1) 1141:10	CSVM-4 (15) 1177:11;1184:24; 1187:15;1188:13; 1189:18,21;1190:14, 19;1191:4,8,15,20,24; 1196:21;1205:5	
consider (5) 1105:6;1109:13; 1146:10;1208:9; 1227:23	contract (3) 1102:6;1174:1; 1179:8	Coyote (38) 1101:14,22;1118:19; 1120:15,18;1123:24; 1129:21;1134:23; 1135:10;1147:23; 1164:4;1175:19,21,24; 1176:21,22,23;1179:4; 1184:15;1185:7,16,17; 1188:13;1189:11; 1196:19,21;1197:1; 1205:3;1207:11,15; 1214:16;1218:18; 1219:2,10;1220:3,8; 1225:2,5	cui-ui (1) 1108:3	
consideration (1) 1109:6	contracted (3) 1122:6,9,14	crafted (2) 1106:24;1120:3	culvert (1) 1149:16	Dam (1) 1099:16
considered (1) 1105:24	contradicts (2) 1190:24;1192:24	create (1) 1122:19	current (11) 1125:16;1174:24; 1198:10;1199:4,10; 1200:2,17;1204:9,9; 1206:15;1210:24	Daniel (1) 1190:17
consisting (1) 1230:12	contributing (1) 1119:2	created (1) 1172:9	currently (7) 1165:18;1169:16; 1204:13,20;1206:4; 1219:3;1228:21	data (33) 1110:14;1123:5; 1161:2;1174:14,15,16; 1179:3;1186:7,13; 1191:18;1193:18; 1194:23;1197:23; 1198:10;1199:3; 1205:18;1210:17; 1211:17;1212:10; 1219:4,6,9,20,22; 1220:10;1221:11,23; 1222:7,13;1223:4,15; 1226:22,24
constant (5) 1149:21;1157:1; 1198:3;1199:15; 1205:16	Contribution (1) 1171:21	creating (1) 1174:9	curtail (1) 1205:8	date (5) 1113:5;1121:4; 1155:9,12;1220:10
constitute (1) 1228:19	convene (3) 1126:7;1152:21,21	Creek (1) 1107:22	curtailed (1) 1108:14	dated (2) 1138:12;1230:17
construction (2) 1120:15;1159:16	cooler (1) 1111:1	criteria (1)	curtailment (4) 1171:18;1172:20; 1202:8,11	
consultant (1) 1173:21	Cooper (1) 1098:3		curtain (1) 1208:20	
consultation (8) 1099:13,21;1100:11;	copy (1) 1097:15		curves (1) 1190:14	
	corner (2) 1112:8;1159:7		customers (3)	
	Corporation (1) 1179:8			
	corrective (1) 1166:13			
	correctly (3) 1137:6;1179:2; 1224:9			
	correlating (1) 1111:16			

dates (1) 1165:17	degrees (9) 1110:20;1111:17,17, 20,21,21,22;1112:15, 15	dessert (1) 1100:17	1185:16	5,12,15,18;1204:14; 1206:18,19;1211:14; 1217:14,18;1222:19; 1225:12;1228:1,16,20
Davis (15) 1166:6;1167:8,13, 24;1172:23;1174:4,10; 1178:22;1201:11,12; 1202:10;1207:17; 1220:18,19,22	Delamar (4) 1225:5,21,24; 1227:13	determination (5) 1128:19;1160:15,21, 23;1194:19	directly (7) 1173:2;1181:19; 1184:7;1188:24; 1199:24;1205:22; 1224:21	District's (12) 1137:19;1169:19,20; 1171:2,13,24;1172:1,3; 1202:8,24;1203:7; 1204:4
D-A-V-I-S (1) 1167:14	delivered (1) 1154:8	determinations (1) 1194:20	director (2) 1103:4,21	disturbance (3) 1159:15,16,20
Davis's (3) 1168:11,13,19	demonstrate (4) 1115:14,22;1186:13; 1205:12	determine (6) 1130:20;1181:18; 1183:8,17;1210:17; 1211:17	disagree (2) 1176:24;1190:20	diversion (2) 1203:20;1206:16
day (4) 1097:5,5;1184:1; 1230:17	demonstrated (2) 1199:13;1211:2	determined (1) 1182:16	disagreed (1) 1182:15	diversions (1) 1200:2
days (1) 1135:22	demonstrates (1) 1116:7	determining (1) 1221:7	discharge (12) 1195:7,15;1198:2,4, 6,6,14,17;1199:14,21; 1200:9,11	Diversity (6) 1094:13;1141:19,21; 1151:17,19;1175:16
deal (1) 1203:2	denied (1) 1202:5	detrimental (1) 1172:21	discharges (7) 1195:15;1199:16,17; 1205:15,17;1211:21; 1219:24	divert (4) 1128:16;1203:4; 1206:19;1228:16
decades (1) 1123:13	DEPARTMENT (8) 1092:2;1103:4,20; 1109:11;1113:6; 1114:17;1197:12; 1230:8	develop (2) 1106:3;1120:19	discharging (1) 1200:11	divided (1) 1210:5
decision (3) 1126:13;1129:4,7	depend (1) 1118:10	developed (10) 1098:10;1101:18; 1103:16;1106:12; 1107:10;1125:22; 1134:14;1161:21; 1162:6,18	discretion (1) 1126:15	DIVISION (5) 1092:3;1147:18; 1155:5;1165:4;1230:9
decisions (2) 1107:17;1125:3	depending (1) 1125:23	developing (4) 1100:5,19;1101:20; 1201:9	discuss (1) 1201:21	document (5) 1097:16;1116:2; 1139:18;1160:22; 1165:13
declared (1) 1172:9	depends (5) 1109:1;1115:23; 1131:3;1208:12; 1209:11	development (16) 1100:18;1103:6,10; 1108:14;1113:17; 1123:24;1124:6; 1137:11,17;1139:9; 1145:13,14;1164:11, 13;1169:8;1170:6	discussed (3) 1170:8;1195:22; 1214:23	documents (5) 1103:11;1105:5,10; 1118:9;1165:12
decline (5) 1131:15;1152:22,23; 1199:13;1211:3	depicted (2) 1223:22;1224:15	Devil's (4) 1108:9,11,15,16	discussing (2) 1152:24;1199:19	done (20) 1113:14;1120:17; 1121:22;1122:4,5,18; 1123:14;1127:6; 1133:18;1134:5; 1144:14,16;1159:14; 1164:7;1169:22; 1178:5;1183:15; 1209:13;1217:11; 1219:13
declined (2) 1192:19;1222:4	depletions (4) 1200:3,15,18; 1216:17	diagram (1) 1148:18	discussion (5) 1135:6;1150:1; 1153:12,14;1221:6	Donnelly (21) 1094:13;1095:9; 1141:20,20;1142:2; 1145:16;1151:18,18; 1152:2;1153:10,17,18; 1154:11,14,17; 1155:14,19,20,22; 1158:4;1161:9
declines (5) 1143:3,7;1192:4,12; 1199:1	derived (1) 1196:18	differences (1) 1176:21	discussing (2) 1152:24;1199:19	doubt (1) 1227:11
declining (6) 1131:13;1132:2; 1191:1;1219:3; 1221:22;1222:11	described (2) 1181:13;1202:21	different (14) 1098:2;1112:12; 1135:10,13,14;1159:6; 1162:4;1187:9;1210:8, 8;1211:24;1214:11; 1216:8;1217:3	discussion (5) 1135:6;1150:1; 1153:12,14;1221:6	down (16) 1111:1;1116:11; 1120:16;1121:7; 1124:11;1144:7; 1177:10;1178:6; 1182:20;1185:20; 1203:21,22;1208:21; 1214:12,17;1224:19
deconstructing (1) 1114:21	describing (2) 1110:1;1221:11	difficult (1) 1168:4	discussing (2) 1152:24;1199:19	down-gradient (1) 1217:2
decreasing (1) 1132:7	desert (2) 1102:7;1122:8	DIRECT (16) 1095:2;1098:21; 1167:7,9;1171:22; 1180:9;1191:19; 1199:23;1205:21; 1206:21;1214:8; 1216:16;1217:9; 1220:13;1224:9; 1227:14	discussion (5) 1135:6;1150:1; 1153:12,14;1221:6	
dedicate (2) 1148:7;1170:11	described (2) 1181:13;1202:21	directing (1) 1139:17	discussing (2) 1152:24;1199:19	
dedicated (4) 1113:16,17;1148:14; 1202:23	describing (2) 1110:1;1221:11	direction (1)	discussing (2) 1152:24;1199:19	
dedication (10) 1119:15;1137:19,22, 23,24;1170:12;1171:1, 12,16;1203:7	design (2) 1119:4;1136:13		discussing (2) 1152:24;1199:19	
defined (3) 1107:5;1156:9; 1204:21	designated (2) 1206:12;1226:13		discussing (2) 1152:24;1199:19	
defines (1) 1142:10	designation (1) 1204:15		discussing (2) 1152:24;1199:19	
definition (1) 1142:4	designed (1) 1119:21		discussing (2) 1152:24;1199:19	
degradation (1) 1142:11	despite (6) 1175:23,23;1190:23; 1191:4;1192:4,5		discussing (2) 1152:24;1199:19	
degree (1) 1099:7			discussing (2) 1152:24;1199:19	

<p>dozens (1) 1201:7</p> <p>Dr (10) 1109:17,24;1110:11,19;1111:10;1122:15,16;1199:22;1208:14;1221:3</p> <p>drafted (1) 1123:3</p> <p>draw (1) 1215:15</p> <p>drawdown (10) 1183:15;1189:21,24,24;1190:2;1191:4,8;1192:21;1205:11;1209:21</p> <p>draw-down (1) 1186:13</p> <p>drawdowns (2) 1187:3;1228:3</p> <p>drawn (1) 1112:1</p> <p>draws (1) 1185:22</p> <p>drilled (7) 1179:9;1180:15;1181:5;1182:4;1212:1,5,8</p> <p>driven (2) 1107:9;1190:19</p> <p>driver (2) 1192:12,24</p> <p>drop (6) 1124:11,12;1149:5;1159:21;1166:19;1191:14</p> <p>dropping (1) 1191:16</p> <p>drops (1) 1187:23</p> <p>drought (14) 1108:14;1190:23;1191:5,14,16,17,19;1192:1,4,11,17,22,23;1208:20</p> <p>dual (1) 1170:4</p> <p>Duchesne (1) 1099:24</p> <p>due (1) 1188:24</p> <p>duration (1) 1145:8</p> <p>during (41) 1101:10,12,12;1116:8;1120:17;1122:4;1131:15;1132:1;1159:13,19;1166:20;1182:10;1184:19;1185:11;1186:15;1187:4,15,21;1188:6,12,17,21;1189:14;1190:1,2,8,20,</p>	<p>22;1191:1,3,8,20;1192:6,12,17,19,21;1199:1;1205:11,13;1219:23</p> <p>DWR (3) 1199:10;1210:23;1211:14</p> <p>Dylan (1) 1222:18</p> <p style="text-align: center;">E</p> <p>Earl (1) 1166:19</p> <p>earlier (3) 1116:24;1195:22;1211:22</p> <p>ease (3) 1184:9;1189:7,17</p> <p>easier (1) 1189:8</p> <p>easily (1) 1110:17</p> <p>east (6) 1115:21;1178:8;1198:15,18,23;1211:11</p> <p>eat (1) 1114:13</p> <p>ecohydrologic (1) 1122:15</p> <p>ecology (1) 1099:7</p> <p>economies (1) 1201:16</p> <p>economy (3) 1172:11,19;1201:17</p> <p>edition (1) 1171:11</p> <p>effect (5) 1114:23;1202:9,12;1217:2;1224:1</p> <p>effectively (1) 1205:2</p> <p>effects (5) 1203:8;1216:21,22;1217:4;1226:23</p> <p>efficiency (1) 1129:19</p> <p>efficient (1) 1172:10</p> <p>effort (3) 1119:17;1122:7,18</p> <p>efforts (9) 1098:16;1113:5;1114:16,17;1122:4;1132:15;1144:15;1160:9;1170:10</p> <p>EH-4 (12) 1131:12,16;1132:1,5;1177:10,12,14,17;1178:6,8;1215:23;1224:19</p> <p>eight (1)</p>	<p>1167:18</p> <p>either (6) 1113:12;1136:13;1146:19;1156:8;1181:4;1225:23</p> <p>element (1) 1164:10</p> <p>elements (1) 1137:15</p> <p>elevation (1) 1117:5</p> <p>elevations (1) 1208:3</p> <p>else (1) 1196:6</p> <p>elucidated (1) 1153:12</p> <p>embedded (2) 1103:17,23</p> <p>empirical (1) 1221:11</p> <p>empowered (1) 1172:11</p> <p>enabling (1) 1201:12</p> <p>encountered (3) 1182:10;1186:14;1205:13</p> <p>end (8) 1117:1;1123:17;1136:20;1188:13;1196:21,23;1199:10;1205:16</p> <p>Endangered (26) 1098:17;1099:2,9;1100:16;1102:1,13;1103:6,7;1106:15,18,21,23;1107:2,8,16,17;1108:7;1118:13;1120:21;1123:5;1128:3;1139:10;1140:21;1141:3,6;1143:17</p> <p>endangering (1) 1107:11</p> <p>ends (1) 1206:21</p> <p>Energy (4) 1093:24;1146:5,7;1155:2</p> <p>enforce (1) 1142:23</p> <p>enforcement (1) 1143:24</p> <p>engage (1) 1142:6</p> <p>engaged (1) 1101:13</p> <p>Engineer (44) 1093:4;1096:19;1104:6,11,23;1105:5;1106:9;1107:16,18,20,24;1108:6;1109:5,13;</p>	<p>1126:23;1127:3;1128:7;1147:18;1150:19;1155:4;1161:3;1163:17;1164:18;1165:5;1166:11,15,24;1173:17;1174:6;1175:1;1193:2;1194:12,17;1197:13,21;1200:22;1201:3,6,14,18;1202:16;1206:17;1213:21;1228:15</p> <p>Engineers (2) 1123:3;1199:7</p> <p>Engineer's (13) 1097:1;1105:15;1106:6;1151:20;1160:20;1175:6,11;1193:12;1194:18,20;1199:4;1200:5;1227:4</p> <p>enhanced (1) 1180:16</p> <p>enhancement (1) 1203:1</p> <p>enough (6) 1135:8;1146:11;1147:13;1186:4;1202:17;1209:3</p> <p>ensure (1) 1099:21</p> <p>enter (1) 1118:24</p> <p>entered (3) 1109:10;1163:6;1170:3</p> <p>entire (4) 1126:14;1218:2,3;1224:13</p> <p>entirely (1) 1193:4</p> <p>entirety (3) 1192:17;1194:7,8</p> <p>entities (5) 1142:24;1143:20;1147:1;1152:5;1175:13</p> <p>entitled (2) 1115:9;1230:9</p> <p>environmental (5) 1098:12,13,14;1102:12;1103:3</p> <p>environments (1) 1182:5</p> <p>EOD (1) 1102:7</p> <p>equivalent (4) 1171:23;1182:7;1186:11;1224:11</p> <p>errata (1) 1097:14</p> <p>error (1) 1111:13</p>	<p>ESA (6) 1121:1;1129:6;1141:11;1142:4,16,23</p> <p>especially (3) 1178:3;1180:2;1191:20</p> <p>Esq (4) 1093:18,20,24;1094:4</p> <p>essential (1) 1142:13</p> <p>essentially (2) 1126:13;1127:24</p> <p>established (1) 1127:23</p> <p>European (1) 1169:10</p> <p>evaluate (3) 1121:6,17,22</p> <p>evaluated (2) 1122:10;1125:6</p> <p>evaluating (2) 1174:14,15</p> <p>even (2) 1121:13;1167:6</p> <p>event (2) 1188:2,15</p> <p>everybody (4) 1106:23;1166:5;1168:21;1187:11</p> <p>everyone (4) 1165:7;1173:1;1195:23;1208:16</p> <p>evidence (11) 1104:17;1122:19;1177:2;1190:4;1194:3,19;1207:5,8;1219:16,19,19</p> <p>evidenced (1) 1187:3</p> <p>evident (1) 1186:6</p> <p>evolution (1) 1169:15</p> <p>exactly (2) 1204:17;1217:10</p> <p>EXAMINATION (5) 1098:21;1155:6;1158:10;1167:8,9</p> <p>example (2) 1160:4;1216:11</p> <p>examples (1) 1107:15</p> <p>exceed (1) 1206:15</p> <p>exceeded (1) 1205:9</p> <p>except (1) 1191:24</p> <p>exceptionally (1) 1178:10</p> <p>excess (1) 1200:2</p>
--	---	--	---	---

<p>excluded (1) 1227:22</p> <p>exclusion (2) 1193:3;1194:24</p> <p>excuse (2) 1148:4;1184:14</p> <p>executed (2) 1121:22;1170:24</p> <p>Exhibit (12) 1097:15;1104:17; 1105:10;1116:1; 1123:2;1138:12; 1139:20,20,22;1140:7; 1166:15,17</p> <p>exhibits (1) 1207:8</p> <p>existence (3) 1106:4;1115:7; 1139:10</p> <p>existing (4) 1120:7;1123:4; 1174:14;1206:12</p> <p>expand (1) 1147:9</p> <p>expected (1) 1145:5</p> <p>expensive (1) 1215:2</p> <p>experience (5) 1099:1;1102:17,23; 1107:14;1174:2</p> <p>expert (9) 1104:22;1105:1; 1116:17;1156:21; 1166:7;1174:19; 1201:2;1207:8; 1209:14</p> <p>expertise (1) 1173:20</p> <p>experts (3) 1097:17,19;1177:13</p> <p>expiration (2) 1155:9,12</p> <p>explain (2) 1131:18;1132:4</p> <p>explained (1) 1192:22</p> <p>explaining (1) 1177:5</p> <p>explicitly (1) 1145:7</p> <p>express (1) 1106:13</p> <p>expressed (2) 1178:18;1210:4</p> <p>extends (4) 1185:3,6,19;1196:17</p> <p>extensive (4) 1180:12;1182:6; 1185:18;1186:24</p> <p>extent (4) 1109:3;1113:3; 1116:20;1193:22</p>	<p>extra (2) 1151:22,24</p> <p>eyes (1) 1189:8</p> <p style="text-align: center;">F</p> <p>facilitated (1) 1124:18</p> <p>fact (4) 1132:4;1166:20; 1193:19;1194:13</p> <p>factors (1) 1178:15</p> <p>facts (1) 1194:11</p> <p>Fair (7) 1135:8;1136:10; 1161:14,16;1194:21; 1216:6;1222:1</p> <p>FAIRBANK (52) 1092:4;1093:2; 1096:4;1097:23; 1104:20;1125:11; 1129:10,13;1133:3,7; 1136:17,20,23;1138:3; 1141:14,17;1145:17, 20;1146:1,4;1147:17; 1150:8,12;1151:11,14; 1153:8;1154:12,15,18, 20,24;1155:14;1158:6; 1164:23;1165:3,24; 1167:21;1193:8,21; 1194:15;1206:23; 1207:7,11;1212:12,15, 19;1217:13;1222:16; 1226:1,10;1228:7,24</p> <p>fairly (12) 1188:3,5,9,11,14,16; 1198:3,21,22;1199:15; 1205:16;1215:19</p> <p>fall (2) 1125:16;1156:17</p> <p>familiar (3) 1116:17;1134:17; 1195:24</p> <p>far (14) 1111:18;1118:1; 1129:4;1135:2,5; 1159:7;1165:17; 1168:3;1169:15; 1208:12;1216:10; 1226:22,24;1227:18</p> <p>Farber (1) 1093:22</p> <p>fast (1) 1097:4</p> <p>faster (1) 1180:7</p> <p>fast-moving (1) 1149:17</p> <p>fault (17) 1180:11,11,24,24;</p>	<p>1183:1,4;1184:12,13, 22,23;1185:1,3,6,12; 1208:12;1219:10; 1220:2</p> <p>fault-induced (1) 1186:8</p> <p>faulting (2) 1177:19;1180:16</p> <p>faults (17) 1207:18,23;1208:2, 7,9,11,13,13,17,20,23; 1209:3,4,6,8,12; 1219:13</p> <p>features (1) 1214:24</p> <p>federal (4) 1099:20;1106:22; 1107:1;1171:8</p> <p>federally (1) 1105:22</p> <p>feeding (2) 1108:15;1142:13</p> <p>feet (8) 1177:23,23;1181:4; 1205:2,2;1208:21; 1210:5,13</p> <p>fell (2) 1114:9;1222:4</p> <p>few (8) 1116:14;1148:19; 1151:24;1182:13; 1187:9;1188:22; 1193:2;1204:24</p> <p>field (4) 1102:23;1103:5; 1110:15;1138:18</p> <p>fields (1) 1174:3</p> <p>fifth (1) 1200:22</p> <p>Figure (20) 1097:16;1111:7,10, 11,12,14;1112:8,10; 1113:24;1114:2; 1116:1;1148:17; 1158:17;1159:2,6; 1180:23;1184:7; 1223:19,22;1224:6</p> <p>file (1) 1142:22</p> <p>filed (4) 1101:8;1160:21; 1169:22,24</p> <p>files (1) 1160:20</p> <p>filing (2) 1101:14;1169:22</p> <p>final (4) 1134:3;1172:15; 1204:8;1221:24</p> <p>finalized (1) 1099:19</p> <p>finally (1)</p>	<p>1113:19</p> <p>find (2) 1180:4;1196:6</p> <p>finding (1) 1110:13</p> <p>finish (3) 1154:11;1155:23; 1208:19</p> <p>finite (1) 1164:7</p> <p>first (10) 1107:20;1108:12; 1116:16;1168:16; 1169:11,21;1181:24; 1186:2;1191:7; 1211:13</p> <p>Fish (59) 1099:8;1100:2,13, 24;1101:1,8,13; 1102:11;1103:12; 1107:14;1108:4; 1110:10,12,13; 1112:23;1113:5,8,8,12; 1114:18,19,21,21; 1116:23;1118:21,24; 1120:2;1122:6; 1124:19;1126:14; 1130:9,13;1132:15; 1133:3;1134:1,2,3,22; 1136:2;1138:11; 1139:19;1150:3,4,6,8; 1152:10;1158:21; 1159:3,4,16;1160:10; 1161:10,14;1175:15; 1178:17;1194:9; 1195:3,4;1212:16</p> <p>fisheries (1) 1099:7</p> <p>fishing (1) 1099:10</p> <p>fits (1) 1096:18</p> <p>five (5) 1112:23;1113:1; 1115:11;1125:9; 1210:4</p> <p>fixed (2) 1121:9,10</p> <p>Flaming (1) 1099:16</p> <p>flat (22) 1177:18,21,24; 1178:1,2,5,11;1188:3, 5,9,11,14,16;1198:17, 21,22;1205:2;1207:20, 24;1215:23;1224:4,5</p> <p>flexibility (6) 1127:20,21,24; 1151:4,8;1227:17</p> <p>flexible (1) 1121:8</p> <p>FLOW (81) 1092:8;1096:7;</p>	<p>1098:15;1099:3; 1100:10;1102:18; 1105:17;1106:20; 1107:21;1108:21; 1109:4;1112:11; 1113:18;1121:17; 1122:7,8,10,20;1123:6, 22,22;1126:4;1127:1, 11,14;1128:4;1130:18; 1136:10,11;1140:15; 1143:3,3;1146:23; 1157:9;1165:11; 1166:19;1175:8; 1176:20,23;1178:14; 1182:10;1183:4; 1186:14;1195:20; 1196:14;1197:8; 1199:21;1200:2; 1201:4;1204:11,20; 1207:20;1208:17,22; 1209:3;1210:19; 1213:4;1215:3,4,5; 1218:2,3,10,12,17; 1219:1,14;1220:12; 1221:10;1224:1; 1225:1,4,15,16,18,20, 24;1226:9,12,20; 1227:6</p> <p>flowing (2) 1157:22;1175:21</p> <p>flows (49) 1109:1,5;1113:16; 1115:6,15;1116:7,10, 14;1117:2,8,17; 1118:10;1122:23; 1123:11;1124:11,12; 1125:16;1126:1,6; 1128:1;1130:18; 1131:3;1134:11; 1140:12;1144:4,9,12; 1145:1,5;1149:21; 1151:5;1152:22; 1153:1;1161:20; 1162:24;1170:13; 1171:2,22;1196:19; 1199:12,24;1200:19; 1205:13,23,24;1211:1; 1225:14;1226:5,8</p> <p>fluctuations (5) 1190:5,7,8;1198:20, 23</p> <p>flume (1) 1140:15</p> <p>focus (6) 1159:10;1161:12; 1216:7,8;1222:22; 1224:24</p> <p>focused (1) 1216:2</p> <p>focuses (1) 1117:7</p> <p>focusing (1) 1116:22</p>
---	---	--	--	--

folks (3) 1130:22;1177:19; 1182:8	1095:8;1222:18,18, 21;1226:4,17,18; 1228:6	1109:21;1117:14; 1179:13;1180:6	1207:24;1216:1	1103:9;1107:5,12; 1109:15;1110:24;
follow (1) 1118:12	Friday (4) 1097:14,18;1130:23; 1131:12	gentlemen (1) 1155:7	gradients (8) 1177:21,22,23; 1178:2,7;1214:16; 1215:22,23	1112:5,6,24;1113:1,12, 15;1114:12;1115:5,15, 23;1117:18;1119:6;
following (2) 1175:13;1195:21	front (3) 1138:14;1139:21; 1158:14	geographic (3) 1175:12;1176:19; 1197:7	graduating (1) 1099:6	1120:10;1122:8,20; 1127:15;1128:14;
font (1) 1184:18	full (5) 1120:6,9;1122:23; 1157:11;1230:13	geohydrologist (2) 1173:10,15	grant (2) 1206:19;1228:15	1142:11;1143:7,10; 1144:22,22;1145:6;
foot (3) 1180:1;1183:22; 1184:1	fully (3) 1124:22,23;1148:13	geologic (2) 1180:15;1214:24	granted (1) 1108:1	1148:10,22;1149:18; 1157:10,11;1159:23;
force (2) 1182:2;1186:12	function (1) 1157:11	geologically (2) 1223:23,24	graph (2) 1116:6;1166:16	1170:5,12;1171:20,22; 1200:10;1202:18,24;
foregoing (1) 1230:12	fund (1) 1099:20	geologist (1) 1179:14	grass (1) 1122:7	1203:8,9,10;1206:2
forget (3) 1202:21;1212:7; 1221:12	funding (3) 1099:22;1119:20; 1122:13	geology (2) 1174:3;1223:24	Great (6) 1105:2;1164:22; 1179:22;1180:8,17,18	habitats (1) 1111:3
Fork (2) 1117:2,3	funds (1) 1170:10	geomorphology (1) 1174:3	greater (4) 1127:7;1200:17; 1206:4;1209:21	handful (1) 1130:6
form (2) 1167:5;1206:11	further (6) 1129:9;1141:12; 1151:10;1155:21; 1158:4;1214:7	geophysicist (1) 1219:12	Greg (2) 1137:1;1166:5	H-A-N-T-U-S-H (1) 1182:22
formalize (1) 1100:10	future (2) 1161:5;1201:15	Georgia (2) 1145:18;1154:18	ground- (1) 1215:18	Hantush-Jacob (3) 1182:17,21;1183:3
formally (1) 1153:5	G			
formed (1) 1212:4	Gage (29) 1111:4;1112:7,9,10; 1116:21,24;1117:8,13, 13;1121:17;1127:4; 1128:2;1130:19; 1149:3,5,11,13,17,20, 22;1150:2,2;1151:6; 1154:9;1169:12; 1170:14;1195:7; 1205:10;1222:12	Geoscience (3) 1173:10,16,23	groundwater (35) 1101:5;1105:16; 1106:19;1108:13,21; 1109:3,14;1126:24; 1127:16;1128:9; 1131:12,16;1132:1,6; 1139:9;1152:4; 1170:12;1171:10; 1175:9,21;1177:16; 1182:10;1186:14; 1199:19;1205:13; 1207:19;1208:1,3; 1216:1;1218:17,24; 1219:3,14;1221:8; 1224:1	happen (4) 1125:15;1127:18; 1149:21;1154:4
forms (1) 1187:9	gallons (4) 1179:10,24;1183:21; 1184:1	gets (1) 1110:12	group (1) 1195:19	happens (1) 1152:19
formulate (1) 1133:14	Gardnerville (2) 1100:24;1101:1	given (8) 1096:23;1097:5; 1125:16;1130:12; 1144:12;1153:2; 1223:9,11	grouted (1) 1220:4	happy (1) 1193:15
forth (2) 1140:6;1226:16	GARNET (3) 1092:10;1218:18; 1219:1	GLASGOW (2) 1133:6;1150:11	growth (1) 1202:7	harass (1) 1142:5
found (3) 1114:11;1123:15; 1182:13	Gary (3) 1114:10;1123:14; 1215:6	Glen (1) 1099:16	guess (8) 1128:19;1133:13; 1144:3;1147:3;1163:1; 1196:11;1214:15; 1226:14	harassing (2) 1107:4,5
foundation (1) 1194:2	gather (1) 1157:5	Glorieta (3) 1173:10,16,23	guided (1) 1216:22	hard (2) 1150:20;1164:19
founded (2) 1172:13;1173:23	gathering (1) 1223:5	goal (1) 1112:18	Guillory (1) 1098:3	harm (3) 1142:5,11;1214:8
four (13) 1096:17;1099:5; 1122:19,24;1123:10; 1129:20;1177:23; 1178:7;1186:3,17; 1187:6;1205:2; 1207:24	general (8) 1135:14;1155:24; 1156:1;1166:6; 1167:14,19;1214:8; 1215:19	goals (9) 1112:16,17,20,22; 1156:24;1157:10,16, 22;1170:4	guy (1) 1215:6	harming (1) 1107:4
fracture (3) 1180:4,12;1183:4	generally (4)	good (19) 1096:4;1097:12; 1098:20,23;1102:20; 1106:6;1109:24; 1130:3;1137:1;1138:6; 1141:20;1148:22; 1155:7;1160:4;1166:4; 1173:9;1207:17; 1217:17;1228:11	H	HARRISON (2) 1145:19;1154:19
fractured (8) 1178:3;1180:14; 1182:5,6;1183:23; 1185:19;1189:12,22		Gorge (1) 1099:16	Habitat (45)	Hatchery (2) 1100:24;1101:1
fracturing (3) 1177:20;1180:17; 1182:5		gradient (10) 1177:7,9,17,18; 1178:6,11,12;1205:1;		Hatten (1) 1122:15
frame (2) 1114:7;1129:18				HCP (1) 1100:17
Frehner (8)				head (5) 1102:11;1122:7; 1145:9;1208:4,5

<p>heard (6) 1117:12;1133:1; 1137:6;1143:2;1162:9; 1193:1</p> <p>HEARING (69) 1092:4;1093:7; 1096:4,8;1097:23; 1104:16,20;1125:9,11; 1129:10,13;1133:3,7; 1136:17,20,23;1138:3; 1141:14,17;1145:17, 20;1146:1,4;1147:17; 1150:8,12;1151:11,14; 1153:8;1154:12,15,18, 20,24;1155:14;1158:6; 1164:23;1165:3,12,17, 24;1166:23;1167:21; 1168:10,12;1176:7; 1193:8,21,23;1194:15; 1201:7;1204:7; 1206:23;1207:4,7,11; 1212:12,15,19;1215:1, 6;1217:13;1222:16; 1226:1,10;1228:7,24; 1230:8,14</p> <p>heat (1) 1209:3</p> <p>held (1) 1230:8</p> <p>help (4) 1178:20;1202:18; 1215:17;1220:21</p> <p>helping (1) 1133:14</p> <p>hereby (1) 1230:5</p> <p>herein (1) 1230:11</p> <p>hereof (1) 1230:13</p> <p>Herrema (14) 1095:4;1130:2,3,5,7; 1133:1;1147:24,24; 1148:3;1150:7; 1207:14,15;1212:11,14</p> <p>heterogeneities (4) 1214:22;1215:2,7,24</p> <p>heterogeneity (2) 1214:18;1215:20</p> <p>high (4) 1179:23;1184:3,4; 1186:8</p> <p>high-elevation (1) 1157:14</p> <p>higher (3) 1117:5;1180:7; 1208:4</p> <p>highest (5) 1189:20,23,24; 1204:10;1206:13</p> <p>highly (10) 1178:3;1179:11; 1180:14;1183:23;</p>	<p>1185:10,13,18; 1189:12,21;1190:10</p> <p>hired (2) 1099:8;1215:6</p> <p>historic (1) 1157:11</p> <p>historical (5) 1112:4,6,24; 1113:12;1117:1</p> <p>historically (1) 1157:18</p> <p>history (2) 1114:2;1169:7</p> <p>hit (3) 1203:5;1214:13; 1228:5</p> <p>holders (1) 1146:22</p> <p>Hole (3) 1108:9,11,15</p> <p>hopefully (1) 1180:6</p> <p>hour (2) 1096:23,24</p> <p>hours (1) 1096:22</p> <p>HRT (6) 1126:6,11;1135:3; 1152:21;1160:12,17</p> <p>huge (1) 1224:1</p> <p>human (1) 1170:6</p> <p>humpback (1) 1099:24</p> <p>hunk (1) 1215:3</p> <p>hunt (1) 1142:5</p> <p>Hyatt (1) 1093:22</p> <p>hydraulic (8) 1177:7,9;1178:12; 1182:9;1186:14; 1196:23;1205:1,12</p> <p>hydro- (1) 1223:16</p> <p>hydrograph (15) 1116:3,4;1187:21; 1188:6,9,11,12,14,16, 17;1189:19;1191:8,24; 1198:22,22</p> <p>HYDROGRAPHIC (1) 1092:11</p> <p>hydrographs (13) 1187:14;1188:21; 1189:11,14;1190:5,7; 1198:20;1199:1; 1211:10;1218:16,20; 1223:14,16</p> <p>hydrologic (15) 1125:16;1127:12; 1128:22;1130:19;</p>	<p>1134:19;1160:14; 1162:9,10,20;1175:18, 24;1176:23;1178:13; 1199:23;1205:21</p> <p>hydrologically (2) 1121:13;1195:17</p> <p>hydrologist (6) 1130:21;1135:20; 1154:6;1162:13,15; 1179:14</p> <p>hydrologists (2) 1127:6,10</p> <p>Hydrology (8) 1093:10;1097:17; 1131:11;1135:19; 1164:2,19;1174:3; 1211:9</p> <p>hyphen (1) 1182:22</p>	<p>1149:2,15,17</p> <p>impermeable (2) 1219:10;1220:3</p> <p>Implementation (8) 1100:6,18;1102:1; 1104:2;1119:20; 1139:13;1164:11; 1195:6</p> <p>implemented (4) 1109:12;1121:9; 1132:4;1151:5</p> <p>implementing (1) 1100:16</p> <p>importance (1) 1129:19</p> <p>important (15) 1108:24;1109:7; 1113:20;1116:9; 1122:3;1138:1;1145:6; 1151:3,23;1163:5; 1166:9;1178:9;1201:5; 1204:7;1215:5</p> <p>improve (1) 1150:5</p> <p>improvement (1) 1160:7</p> <p>inches (1) 1149:8</p> <p>incident (1) 1183:10</p> <p>incidental (1) 1144:10</p> <p>include (5) 1126:9;1132:22; 1226:5,8;1227:10</p> <p>included (12) 1103:11;1104:2; 1117:13;1118:7; 1126:5;1175:8; 1176:13;1196:16; 1197:10;1206:10; 1216:3;1226:20</p> <p>includes (4) 1134:21;1142:11; 1168:24;1195:5</p> <p>including (5) 1098:12;1142:13,23; 1143:4;1176:1</p> <p>inclusion (2) 1175:14;1176:9</p> <p>inclusive (1) 1226:11</p> <p>increase (8) 1114:24;1131:10; 1181:8;1200:15,17; 1206:1;1216:16; 1228:20</p> <p>increased (5) 1131:15,24;1216:17; 1220:12,13</p> <p>increasing (4) 1132:5;1150:4; 1171:2;1191:15</p>	<p>incredibly (1) 1177:24</p> <p>incremental (1) 1115:15</p> <p>incumbent (1) 1164:18</p> <p>independent (2) 1211:4;1223:4</p> <p>INDEX (7) 1095:1;1177:15; 1191:5,14,16,20; 1192:2</p> <p>Indians (1) 1133:8</p> <p>indicate (8) 1112:2;1131:14; 1140:24;1161:4; 1196:23;1208:1,3; 1226:5</p> <p>indicated (6) 1133:20;1140:19; 1160:24;1210:3; 1224:3,24</p> <p>indicates (3) 1140:14;1194:24; 1198:12</p> <p>indicating (1) 1224:3</p> <p>indicators (1) 1191:5</p> <p>individual (2) 1102:3;1195:18</p> <p>individuals (2) 1107:1;1142:19</p> <p>indulgence (2) 1155:19;1173:1</p> <p>industrial (1) 1127:23</p> <p>infer (2) 1195:12,16</p> <p>inferred (1) 1208:24</p> <p>inferring (1) 1227:8</p> <p>influences (1) 1188:24</p> <p>information (19) 1096:18;1121:15; 1125:3,5;1128:22; 1153:20,23;1154:5; 1156:1;1178:19,20; 1181:7;1197:21; 1200:23;1201:3; 1212:9;1220:1;1223:8, 18</p> <p>Infrastructure (1) 1203:4</p> <p>initial (1) 1174:5</p> <p>initiate (1) 1120:15</p> <p>initiated (1) 1100:17</p>
I				
<p>ICF (1) 1102:3</p> <p>idea (3) 1149:9;1191:1; 1227:9</p> <p>identifiable (1) 1110:14</p> <p>identified (5) 1105:10;1119:11; 1126:17;1137:12; 1192:11</p> <p>identify (6) 1110:17;1208:7,9, 11;1209:8;1219:10</p> <p>ignore (1) 1215:20</p> <p>impact (14) 1109:4;1113:22; 1114:13;1115:16; 1120:6;1122:8,10,20; 1127:8,14;1145:5; 1177:22;1207:19; 1210:17</p> <p>impacting (4) 1107:11;1147:10; 1218:13;1220:9</p> <p>impacts (17) 1109:14;1115:6,15; 1117:5;1119:12; 1120:9;1122:21,22; 1128:1;1139:14; 1144:13,19;1163:19; 1195:19;1206:1; 1209:15;1214:13</p> <p>impairing (1) 1142:12</p> <p>impeded (1) 1113:4</p> <p>impediment (2) 1149:6,22</p> <p>impediments (3)</p>				

injures (1) 1142:12	1098:1;1167:11; 1173:7	jeopardy (1) 1105:23	key (7) 1109:12;1119:7,9, 14,14;1124:24; 1164:10	larval (1) 1132:22
installing (1) 1136:4	introduced (3) 1114:4,8,9	job (4) 1109:24;1179:22; 1180:8,17	kill (2) 1142:5;1184:3	Las (20) 1094:10;1097:13; 1098:2;1101:4; 1102:24;1120:3; 1141:14;1151:16; 1155:16;1158:8; 1171:5,13;1175:16; 1176:5,8;1213:14; 1217:13;1227:10; 1228:7,12
instance (1) 1212:2	inverse (1) 1131:18	Joe (1) 1178:23	killings (1) 1107:4	last (19) 1099:5;1109:17; 1111:16;1116:14; 1128:21;1129:15; 1131:8,10,12;1161:17; 1164:2;1167:14,18; 1169:22;1188:23; 1203:23;1204:18,23; 1206:9
instant (1) 1182:17	investigate (1) 1128:11	John (1) 1098:3	kills (1) 1142:12	lastly (1) 1165:4
instantaneous (1) 1187:20	investigations (1) 1213:9	Johnson (1) 1199:22	kind (9) 1096:17;1164:14; 1174:11;1183:22; 1198:12;1212:9; 1215:20;1219:18; 1221:14	later (3) 1110:23;1114:22; 1117:21
instead (1) 1157:7	Investment (5) 1101:22;1118:20; 1120:19;1207:12,16	join (1) 1137:19	kinds (2) 1178:2;1214:11	Law (4) 1094:10;1143:24; 1193:20;1201:20
Institute (2) 1102:6;1122:9	Investments (2) 1129:22;1147:23	joint (1) 1226:12	KING (4) 1145:24;1154:23; 1176:10;1196:13	lawsuits (1) 1142:23
in-stream (6) 1100:9;1107:21; 1117:17;1118:10; 1170:13;1171:22	involuntary (1) 1152:24	Jon (1) 1093:11	KMW-1 (17) 1177:10,10;1178:6; 1179:5;1181:2,5; 1184:18;1187:14; 1188:8,12;1189:8,11; 1192:1;1196:22; 1205:5;1215:22; 1224:19	lays (1) 1112:20
insufficient (1) 1147:1	involved (8) 1106:24,24;1109:8; 1133:14,19,23; 1136:13;1140:4	Jones (6) 1113:18;1119:15; 1170:11;1171:1,23; 1203:7	knowledge (1) 1152:3	Lazarus (18) 1166:7;1168:1; 1172:24;1173:4,8,9,14; 1182:20;1193:23; 1194:6;1207:17,18,22; 1213:3;1217:19; 1221:2,3,20
integrated (1) 1202:7	involves (2) 1167:5;1221:21	Joseph (2) 1166:6;1167:13	knows (2) 1185:2;1194:3	L-A-Z-A-R-U-S (1) 1173:14
intended (7) 1117:17;1121:9; 1137:7,10,16,22; 1162:23	involving (3) 1104:6,11;1206:4	July (2) 1160:21;1210:21	KP1 (1) 1205:12	lead (2) 1159:4;1191:18
intent (6) 1124:9,12;1125:2,4; 1147:7;1153:11	IO (2) 1199:10;1201:18	jumps (1) 1187:23	KPW (1) 1179:6	leading (2) 1180:12;1181:20
interest (1) 1123:5	irrigation (3) 1108:13;1145:22; 1154:22	June (2) 1131:7;1148:17	KPW-1 (6) 1179:9;1181:1,6; 1182:1;1184:20; 1186:7	leads (2) 1127:17;1192:7
interests (1) 1129:4	isolated (1) 1183:12	Justina (2) 1093:24;1146:6	kudos (1) 1182:8	leagues (1) 1100:21
interim (10) 1123:4;1166:23; 1173:18;1174:6; 1175:2;1199:7;1200:6; 1201:14;1210:24; 1211:15	isotopic (1) 1136:7	juveniles (1) 1132:22	L	leakage (3) 1183:1,6,18
International (1) 1102:3	issue (5) 1101:5;1106:2,2,7; 1182:14	K	lacking (1) 1164:14	leaky (4) 1182:16,24;1183:3,9
interrupt (2) 1167:22;1182:23	issued (1) 1121:4	Kane (53) 1138:13;1139:8; 1141:9;1153:19; 1154:2,7;1175:7,14,19, 21,24;1176:6,9,13; 1178:13,19;1179:4,20; 1180:11,24;1184:12, 13,15,22;1185:5,7,17, 19;1188:9;1193:3; 1194:24;1195:13,16; 1196:6,15,22;1197:9; 1205:8;1206:10; 1214:16;1216:3,7; 1217:23;1222:22; 1223:5;1225:1,1; 1226:20,21;1227:1,22, 23;1228:2	laid (1) 1194:2	least (4) 1157:18;1168:10; 1197:15;1217:3
interrupting (1) 1219:13	issues (4) 1101:13;1102:7; 1182:13;1216:2	Karen (2) 1094:4;1138:6	Lahontan (4) 1101:1,2;1107:22; 1108:3	leave (1) 1206:6
intersection (3) 1180:4;1181:1; 1184:22	issuing (1) 1194:12	Karst (2) 1215:4,5	language (1) 1164:12	leaves (1) 1129:10
interventions (1) 1156:11	J	keep (1) 1130:18	large (1) 1186:24	left (4) 1111:15,18;1118:1;
into (26) 1097:2,7;1104:17; 1107:16;1109:6,10; 1111:2;1114:15; 1118:24;1150:3; 1162:21;1163:6; 1167:5;1168:1;1170:3; 1175:21;1183:18; 1185:7;1207:5,8; 1216:12;1225:2,5; 1226:20;1227:1; 1230:10	J-A-C-O-B (1) 1182:22	Keeper (1) 1108:12	larger (1) 1110:24	
introduce (3)	January (2) 1101:24;1169:11	Kent (2) 1093:20;1130:4		
	Jason (3) 1176:10;1196:12,15			
	Jay (5) 1166:7;1172:24; 1173:4,9,14			
	jeopardize (3) 1099:23;1106:4; 1139:9			
	jeopardized (1) 1108:7			
	jeopardizing (2) 1128:13;1201:16			

<p>1166:9 legal (10) 1153:7;1172:3,3,6, 16,17;1193:6,14,17; 1202:13 legislation (1) 1201:12 legislature (1) 1172:8 length (3) 1112:5;1170:9; 1201:21 less (9) 1128:1;1150:23; 1151:2;1162:17; 1164:3;1186:18; 1191:17;1192:17; 1214:8 lessened (1) 1192:23 lesser (1) 1127:6 letter (5) 1176:10,11;1196:12, 13,15 level (13) 1132:1;1144:20; 1187:22,22,23; 1190:18;1192:4,12; 1199:1;1210:17,22; 1219:20,22 levels (41) 1131:12,16;1132:5, 6;1166:19;1170:14,15; 1188:3,4;1190:23; 1191:1,15,15,20; 1192:3,19,22;1195:9, 21;1198:2,4,5,5; 1199:14,16,17;1205:9, 15,17;1207:21;1208:1, 6,8,10;1209:7; 1211:21;1218:17,24; 1219:3;1221:22; 1228:5 life (2) 1110:23;1164:6 light (2) 1194:20;1217:3 lightning (1) 1203:24 likely (1) 1139:9 limestone (1) 1215:8 limit (2) 1195:19;1204:23 limited (4) 1104:24;1174:20; 1223:9;1226:21 limiting (3) 1107:5;1179:11; 1185:11 limits (1)</p>	<p>1195:14 Lincoln (14) 1094:2;1096:14; 1138:3,7;1139:20; 1140:3;1151:15; 1179:9;1185:11; 1189:22;1190:17; 1194:9;1222:16,19 Lincoln-Vidler (11) 1179:6;1184:8,12; 1189:23;1195:4,9,11, 12;1205:8;1224:10; 1227:23 Lincoln-Vidler's (1) 1205:12 line (8) 1114:6;1173:2; 1183:22;1191:13; 1194:16;1224:18,21; 1226:15 lines (2) 1216:13;1219:16 link (1) 1165:13 linkage (1) 1123:10 linking (1) 1123:5 links (1) 1165:14 listed (2) 1105:22,22 listened (2) 1128:21,23 listening (3) 1163:24;1164:2; 1168:2 little (9) 1097:3;1111:5; 1117:20;1129:17; 1147:4;1151:22; 1166:13;1176:3; 1197:14 lively (1) 1135:6 LLC (1) 1102:4 load (1) 1122:9 loading (2) 1173:4,5 local (1) 1196:18 locate (1) 1180:3 located (17) 1112:10;1178:20; 1179:21,22;1180:8; 1181:4;1182:4,8; 1184:21,24;1187:17; 1188:9,13;1189:11,21; 1196:20;1216:24 locating (3)</p>	<p>1180:9,14,18 location (8) 1116:22;1180:18,20; 1181:1,2;1199:20; 1209:11;1216:19 locations (3) 1179:20;1187:17; 1218:24 Logandale (1) 1169:1 long (7) 1105:21;1109:9; 1134:10;1167:15; 1173:19;1177:4; 1210:2 longer (1) 1156:21 long-term (18) 1105:15,20;1108:20; 1115:16;1119:23; 1124:5;1126:24; 1127:13;1128:8,11; 1137:10,16;1145:14; 1147:14;1179:5; 1204:4;1211:23; 1221:7 look (18) 1113:24;1120:9; 1121:12;1147:5,9; 1157:17;1164:7,7,19; 1195:2;1211:23; 1213:20;1215:14; 1216:11;1219:4; 1222:7,13;1225:14 looked (5) 1150:20;1198:14; 1210:1;1213:15; 1225:10 looking (20) 1110:5;1136:4; 1147:8;1164:5; 1174:13,16,23;1177:6, 7,9,23;1179:3;1180:21, 22;1184:9;1197:5,6; 1211:12;1214:14; 1226:7 looks (7) 1151:22;1169:13; 1190:24;1204:17,18; 1217:10;1227:16 Loomis (2) 1092:24;1230:4 Los (1) 1093:23 loss (3) 1143:7,10,10 lost (1) 1203:23 lot (9) 1129:18;1138:2; 1160:5;1174:12; 1177:19;1184:2; 1188:23;1203:24;</p>	<p>1208:16 lovely (1) 1178:23 low (2) 1144:5,12 Lower (41) 1096:7;1098:15; 1099:3;1102:17; 1103:7;1105:16; 1106:19;1108:21; 1109:4;1112:8,9; 1127:1,10,14;1128:4; 1130:17;1143:3; 1146:22;1160:3; 1165:11;1175:8; 1176:19;1183:11; 1196:14;1197:7; 1200:2;1201:4; 1204:20;1207:20; 1208:4;1209:19; 1210:19;1218:2,12,17; 1219:1;1220:12; 1225:14,17;1226:12; 1227:6 lowering (1) 1195:15 Ltd (1) 1093:16 lunch (2) 1229:1,4 LWRFS (1) 1196:16</p>	<p>1132:16;1139:24; 1156:10;1157:2; 1166:24;1167:4; 1175:6;1195:1; 1197:16,17 manager (5) 1101:19;1103:3; 1166:7;1167:14,19 mandate (1) 1203:13 mandatory (2) 1118:5,11 many (3) 1197:15;1201:7; 1211:20 map (4) 1111:5,16;1224:16, 18 mapped (1) 1208:23 maps (1) 1220:16 marked (2) 1116:1;1166:15 Marshall (47) 1097:21;1098:11; 1102:16,19;1104:8,14; 1105:7;1108:18,23; 1109:16;1113:24; 1115:1;1117:11; 1121:21;1122:1; 1123:1,19;1125:15,18; 1126:22;1127:2; 1128:12;1130:16; 1131:2;1133:13,16,19; 1134:9,10,15;1137:5,9; 1144:4,6;1146:12; 1147:4;1148:4,11; 1150:19;1151:1; 1152:3,7;1155:11; 1158:14;1160:14; 1162:1;1202:21 master's (1) 1102:21 MATTER (10) 1092:7;1117:9; 1166:8,14;1175:11; 1181:15;1214:9,21; 1216:19;1230:10 matured (2) 1159:23,24 may (18) 1110:23;1127:7; 1147:10;1152:12,14; 1154:11;1161:5; 1166:3;1167:21; 1168:19;1169:12; 1195:8;1199:20; 1205:19,24;1207:6; 1214:12;1226:20 maybe (5) 1121:13;1150:18; 1186:22;1218:10;</p>
M				
<p>Madam (2) 1193:23;1207:4 magnitude (3) 1186:18;1216:21,22 Mahogany (1) 1107:21 main (4) 1099:15;1111:2; 1117:15;1203:24 maintain (8) 1108:15;1112:24; 1115:17;1117:17; 1124:10;1134:10; 1161:6;1202:18 maintaining (3) 1128:12,13;1202:3 maintenance (1) 1157:12 major (3) 1114:16;1115:7; 1182:14 makes (2) 1214:6,19 making (4) 1126:7;1189:8; 1202:3;1220:20 management (12) 1103:24;1119:23;</p>				

1221:17 Mayer (2) 1128:23,24 Mead (2) 1169:5;1213:14 Meadow (1) 1224:22 mean (4) 1102:15;1106:23; 1145:13;1163:1 meaning (1) 1120:5 measurements (1) 1140:15 measures (16) 1103:16;1104:2; 1112:11;1117:2,8,20; 1119:10,12,15,19; 1125:1;1131:17; 1132:3;1134:18; 1135:3,9 measuring (1) 1211:20 mechanism (3) 1118:22,24;1201:21 media (5) 1182:2,7;1186:10, 12;1224:11 meet (2) 1157:10,22 meeting (1) 1160:13 member (1) 1098:2 memorandum (14) 1103:13,17;1104:3; 1109:11;1113:7; 1116:12,16;1117:16, 23;1118:18;1119:8; 1122:14;1127:19; 1133:15 mentioned (6) 1110:11,19;1122:16; 1123:10;1144:16; 1221:23 met (3) 1128:23;1203:9; 1205:9 method (1) 1182:18 methodology (1) 1174:19 Michel (2) 1092:24;1230:4 MICHELINE (2) 1092:4;1093:2 Michelle (1) 1093:8 microphone (2) 1168:2;1173:11 mid-1990s (1) 1114:11 middle (2)	1139:4,4 middle-producing (1) 1183:11 might (15) 1117:5;1127:13; 1142:19;1144:12; 1150:20;1152:16; 1159:21;1178:20; 1195:22;1213:18,18; 1215:24;1216:8,12; 1217:4 miles (2) 1112:5;1169:3 millimeters (1) 1110:12 mimics (1) 1190:1 mind (1) 1107:19 mine (1) 1195:8 minimize (1) 1139:14 minimum (1) 1164:17 minus (9) 1177:23;1178:7; 1186:17;1187:6,7; 1205:2;1207:24; 1210:4,14 minute (3) 1179:10,24;1195:24 minutes (12) 1125:9,11;1129:11, 20;1147:22;1148:19; 1151:24;1155:15; 1158:9;1168:14,20; 1207:2 misrepresent (1) 1176:15 Miss (1) 1178:17 missing (2) 1169:13,14 Mister (2) 1221:4,5 mitigate (2) 1101:16;1163:18 mitigated (1) 1203:8 mitigation (9) 1103:16;1124:24; 1131:17;1132:3; 1134:18;1135:2,9; 1139:24;1144:17 MOA (90) 1098:17;1101:18,19; 1103:23;1113:16; 1114:17;1117:7; 1118:16,17,23;1119:4, 9;1120:2,21;1121:3,8, 9,10,22;1123:19,21,23; 1124:5,10,17,18;	1125:2,4,7,16,21,22, 24;1126:12;1127:7; 1128:18;1133:20; 1134:6,13;1135:17; 1137:7,10,12,15,16,20; 1144:4,7,17;1145:7,13, 13,15;1146:10,16,20, 23;1147:5,7,9,12; 1148:5,10;1151:3; 1152:6,9,13,18,20; 1153:2,15,24;1155:10; 1159:11;1161:21; 1162:5,19;1163:2,6,9; 1164:5,10,12;1166:16; 1170:8,10,16,20,24; 1202:20 Moapa (115) 1094:7;1096:13; 1097:2;1098:16; 1099:3;1101:5,13; 1102:17;1104:6; 1105:14,19;1106:4; 1107:11;1108:19; 1109:1,9,14;1110:1,4; 1111:4;1112:3,7,14; 1113:22;1114:2,9,12, 12,14,24;1115:4,7,15; 1116:3,21,24;1117:1,6, 9,17;1118:9,11,19,20; 1119:6;1122:21; 1123:6,11,15,17; 1126:23;1127:15; 1128:8,14,24;1131:2; 1133:8,10;1134:7,22; 1136:11,23;1137:2,18; 1138:1;1139:10; 1143:14;1147:2; 1148:19;1149:14; 1150:13,15;1151:11; 1152:10,11;1156:14, 17,20;1160:8,13; 1166:2,5;1167:13,15, 17;1168:23,24;1169:1, 9,17;1170:5,18;1171:5, 8,9,13,15,17,20,22; 1172:11,13,21; 1173:17,22;1197:2; 1199:9;1200:9,10; 1202:12,19,24; 1211:14;1212:21; 1225:11 MOAs (11) 1153:11 MOA's (2) 1143:18;1202:22 model (6) 1122:7,10,15,15,17; 1209:24 modeling (4) 1121:22;1122:4,7; 1144:15 models (1) 1122:19	modification (1) 1142:11 modified (2) 1121:11;1184:8 modify (2) 1125:7;1126:8 modifying (2) 1126:7;1128:14 moisture (1) 1192:6 MONDAY (2) 1092:20;1096:1 monitor (1) 1196:20 monitored (1) 1184:18 monitoring (12) 1098:13;1135:21; 1136:1,3,5,7,9,10,11, 11;1139:24;1181:6 month (2) 1173:23,24 months (1) 1112:6 Moran (3) 1186:19,21;1209:14 more (30) 1097:3;1110:24; 1111:1;1119:1; 1124:23;1125:3; 1129:17,18;1136:22; 1155:24;1157:20,23; 1161:20;1164:6; 1174:2;1180:5,5; 1187:6;1191:12; 1192:19;1202:15; 1211:20;1212:10; 1217:10;1220:1,2; 1221:18,23;1224:7; 1228:12 morning (19) 1096:4,10,21,22; 1097:12,18;1098:20, 23;1102:20;1130:3; 1137:1;1138:6; 1141:20;1155:7; 1166:4;1173:9; 1207:17;1217:17; 1228:11 Morrison (24) 1095:6;1137:1,1,4; 1138:2;1151:13; 1166:3,4,5;1167:10,21; 1168:7,15;1172:23; 1193:15;1194:5,21,22; 1206:21;1207:4,7,10; 1220:21;1225:22 most (10) 1111:5;1113:19; 1160:20;1171:24; 1178:9,9;1191:7,7; 1204:10;1206:13 mostly (1)	1132:23 MOU (3) 1140:20;1141:1,6 mountains (1) 1224:22 move (19) 1097:2,6;1113:10; 1172:24;1184:5; 1189:6;1196:3; 1197:20;1199:18; 1200:21;1212:20; 1214:6;1215:7,17; 1217:7;1220:23; 1226:17;1227:5,19 moved (3) 1100:12,22;1101:7 movement (6) 1149:14;1150:3,5; 1200:7;1207:19; 1217:22 moving (6) 1160:1;1190:13; 1216:9;1217:20,21,24 MRS (1) 1199:21 much (13) 1101:13;1106:8,23; 1156:16;1164:3,22; 1182:23;1187:6; 1191:23;1202:18; 1213:17,23;1217:12 MUDDY (40) 1092:12;1109:2; 1110:22;1112:19; 1116:21;1117:3; 1120:16;1145:22; 1154:22;1169:5; 1171:9,15,17;1172:14; 1185:20;1195:10,15, 17,20;1199:21,24,24; 1200:11,20;1205:3,4,6, 10,22,22,24;1213:5,8; 1214:3,17;1216:10,18, 23;1220:9;1228:3 multi-federal (1) 1100:7 multiple (3) 1097:4;1167:1; 1176:20 Multispecies (2) 1103:8,9 municipal (6) 1180:2;1204:9,9,12, 15;1206:12 must (1) 1166:18 MX-5 (8) 1177:11;1187:4,18, 19,22;1188:6;1189:9; 1190:10 MX-6 (1) 1169:20 myself (1)
---	---	--	--	---

1146:18	new (6) 1121:14;1153:20,23; 1156:1;1216:24; 1220:16	1230:7,14 November (1) 1173:23 NSE244 (1) 1166:15 number (7) 1114:4,7;1115:3; 1141:22;1148:9; 1157:7;1210:5 numbers (21) 1117:9;1132:8,19, 21,21;1143:11; 1144:13,20,22,23; 1145:4;1150:6; 1156:17;1159:22; 1160:8;1164:19; 1196:1;1210:8; 1213:10,21,21 NV (3) 1093:24;1146:6; 1230:22 NVAC (1) 1171:15 NVWD (2) 1171:16;1210:23	1192:5 occurrence (3) 1114:3;1117:1; 1207:19 occurring (6) 1099:23;1152:5; 1159:20;1161:13; 1183:18;1188:17 occurs (3) 1108:4;1112:3; 1188:12 O'Connor (1) 1093:18 October (5) 1138:12;1176:9,12; 1196:12;1230:18 off (4) 1145:9;1187:20,22, 23 offer (4) 1147:22;1151:20; 1207:5,6 offered (4) 1104:17;1194:17; 1201:1;1207:8 office (10) 1097:1;1098:3; 1099:10;1100:23; 1101:4;1102:11; 1106:6;1120:4; 1151:20;1227:4 OFFICER (56) 1092:4;1093:7; 1096:4;1097:23; 1104:16,20;1125:9,11; 1129:10,13;1133:3,7; 1136:17,20,23;1138:3; 1141:14,17;1145:17, 20;1146:1,4;1147:17; 1150:8,12;1151:11,14; 1153:8;1154:12,15,18, 20,24;1155:14;1158:6; 1164:23;1165:3,24; 1167:21;1193:8,21,23; 1194:15;1206:23; 1207:4,7,11;1212:12, 15,19;1217:13; 1222:16;1226:1,10; 1228:7,24 offset (1) 1119:12 oldest (3) 1169:9,20;1171:2 once (9) 1114:8;1153:13; 1182:7;1184:21; 1189:10,17,20;1192:3, 16 one (44) 1096:24;1108:9; 1113:17,19;1115:11, 12,20;1116:12; 1117:16;1119:14;	1120:14;1132:17; 1137:5;1146:7,19; 1155:8;1164:4; 1168:10;1169:13,14; 1177:14;1178:23,23; 1182:20;1189:17; 1190:24;1191:24; 1194:17;1195:12,16; 1197:15;1202:15; 1203:23;1208:8; 1209:16;1210:5; 1212:6;1217:6; 1221:17,18;1224:2; 1226:8;1227:2; 1228:14 one-hour (1) 1204:23 ones (1) 1115:12 one's (1) 1173:13 one-third (1) 1112:4 ongoing (3) 1098:16;1136:1; 1156:17 only (11) 1108:4,4;1114:11; 1128:13;1136:9; 1166:20;1170:18; 1195:12,16;1202:9; 1217:23 onto (1) 1187:8 open (7) 1129:14;1147:17,20; 1155:4;1158:7;1165:4; 1206:24 operation (2) 1099:15;1124:5 opinion (43) 1101:20,21;1103:18; 1115:1;1117:4;1118:7; 1120:1,6,13;1121:5,16; 1122:12;1123:20; 1124:7,18;1133:20; 1134:3,3,6;1138:12; 1139:7;1141:2,10; 1148:21;1149:20; 1150:22;1153:21; 1154:1;1156:21; 1157:12;1161:12; 1174:18;1175:7; 1185:24;1193:12; 1200:13,16;1203:6; 1217:20;1218:23; 1220:15;1221:21; 1228:2 opinions (16) 1118:8;1120:12; 1121:4;1124:11; 1125:24;1126:16; 1127:20;1130:12,13;
N				
name (5) 1130:3;1167:14; 1173:9,14;1215:6 Namely (1) 1148:7 National (9) 1100:24;1101:1; 1102:5,6;1128:15; 1133:5;1150:10; 1169:5;1212:20 NATURAL (8) 1092:2;1103:20; 1104:1;1111:13; 1113:14;1196:19; 1209:5;1230:9 nature (2) 1120:5,8 near (4) 1116:3;1191:4; 1192:5,5 necessary (1) 1172:12 need (14) 1123:15;1131:19; 1155:15;1157:19; 1178:18;1201:14,18, 21;1203:19,20;1204:4, 18;1217:11;1220:21 needed (1) 1204:3 needing (1) 1204:2 needs (9) 1100:9;1164:6,17; 1194:2;1201:3; 1202:16;1203:12,14,16 neglected (1) 1207:5 negotiating (1) 1128:24 negotiations (2) 1139:23;1140:2 nested (1) 1183:15 network (1) 1136:5 NEVADA (34) 1092:1;1093:17; 1096:1,12,21;1097:9, 13;1100:23;1101:23; 1102:12,24;1107:16, 18;1109:11;1113:6,13; 1114:17;1116:3; 1118:20;1120:12; 1143:5;1145:21; 1146:5;1154:21; 1155:2,17;1158:7; 1160:16;1172:8; 1217:14;1230:1,7,8,17	News (1) 1165:11 next (42) 1096:13;1097:7,7; 1115:18;1132:18; 1136:23;1138:3; 1145:18;1169:6,13; 1170:3;1171:19; 1173:22,24;1175:5,10; 1176:18,19;1178:16; 1179:7,18;1180:19; 1181:11;1184:5; 1185:22;1187:8; 1189:4,7,15;1191:22; 1192:15;1193:1; 1197:4,20;1198:12; 1199:3,18;1200:4; 1201:22;1202:15; 1203:11;1212:16 nice (1) 1166:9 nicely (1) 1196:7 Nobody (1) 1107:3 none (1) 1150:9 non-heterogeneous (1) 1214:15 non-Indian (1) 1202:9 non-Indians (1) 1202:13 non-native (3) 1113:2,21;1132:17 non-natives' (1) 1119:20 nor (1) 1143:23 normal (6) 1191:4,4;1192:5,5,5, 6 normalizing (1) 1191:2 North (9) 1094:10;1117:2; 1141:14;1151:16; 1177:10;1185:16; 1188:13;1228:7,12 northeast (2) 1185:4,14 northeastern (1) 1185:6 northern (5) 1176:22;1196:21; 1223:1;1225:2,5 northward (1) 1214:14 notes (2)	November (1) 1173:23 NSE244 (1) 1166:15 number (7) 1114:4,7;1115:3; 1141:22;1148:9; 1157:7;1210:5 numbers (21) 1117:9;1132:8,19, 21,21;1143:11; 1144:13,20,22,23; 1145:4;1150:6; 1156:17;1159:22; 1160:8;1164:19; 1196:1;1210:8; 1213:10,21,21 NV (3) 1093:24;1146:6; 1230:22 NVAC (1) 1171:15 NVWD (2) 1171:16;1210:23	O	
		o0o- (1) 1096:2 object (1) 1225:22 objected (2) 1123:5;1168:11 objecting (1) 1193:13 objection (7) 1104:22;1153:6,16; 1193:6,10,16;1194:1 obligation (5) 1172:4,6,16,17; 1202:13 obligations (4) 1148:6,14;1172:3; 1203:9 observation (6) 1110:16;1179:5; 1181:3;1184:19; 1209:15;1226:22 observe (2) 1165:16;1183:14 observed (2) 1192:21;1196:20 observing (2) 1098:3;1168:2 obtain (1) 1126:12 obvious (2) 1114:13;1163:1 occur (2) 1114:22;1161:14 occurred (3) 1188:6;1190:1;		

<p>1144:9,11,15,21; 1151:3;1152:20; 1162:14 opportunity (2) 1107:3;1166:12 opposed (2) 1161:13;1210:18 opposite (1) 1185:15 options (1) 1161:19 Order (35) 1096:7,9,19;1106:7; 1116:8;1118:22; 1123:4;1124:1;1126:4; 1150:2;1163:6,7,11; 1165:12;1166:21,23; 1173:2,18;1174:6; 1175:2;1179:24; 1186:16;1190:2,20; 1197:24;1199:7,15; 1200:6;1201:14; 1203:12;1204:8; 1210:24;1211:15; 1226:16,23 ordered (1) 1120:7 orders (1) 1186:18 Ordinarily (2) 1214:6,10 original (1) 1174:12 originally (1) 1114:4 others (1) 1127:6 otherwise (3) 1108:6;1195:18; 1212:18 Otis (1) 1122:6 out (27) 1096:8;1106:7; 1107:7;1112:20; 1118:13;1123:2; 1159:18;1160:1; 1172:8;1178:20; 1180:22;1181:20; 1182:9,13;1183:22; 1188:15;1202:10; 1204:8;1207:1;1213:4, 4;1214:14,21;1223:10, 17;1226:22,24 outcome (2) 1204:7 outflow (1) 1149:16 outside (5) 1141:6;1147:9; 1217:8;1227:6,19 over (16) 1097:15,16;1099:5;</p>	<p>1108:11;1115:3; 1128:23;1129:1; 1131:8,10;1158:22; 1177:12;1188:23; 1201:24;1206:7; 1223:12;1224:22 overall (6) 1104:1;1137:16; 1143:10;1144:13; 1201:24;1226:7 overlooked (1) 1215:1 overlying (1) 1183:18 overridden (1) 1190:11 oversaw (2) 1102:12;1120:4 overseen (1) 1103:21 oversees (1) 1104:1 Overton (1) 1169:1 overview (1) 1169:18 own (5) 1102:3;1130:13,20; 1174:17;1194:20 ownership (1) 1113:12</p>	<p>16,17;1202:12 Palmer (3) 1191:5,14;1192:1 panel (3) 1096:23;1098:7; 1131:12 PANELS (1) 1095:2 paper (1) 1114:11 paragraph (5) 1140:11,14;1181:24; 1211:13,15 parallel (1) 1185:4 parasites (1) 1113:3 parcel (1) 1220:16 paren (3) 1196:22,23;1199:10 parentheses (3) 1196:21,22;1199:10 Park (7) 1133:5;1150:10; 1175:15;1177:8; 1212:20;1213:24; 1215:5 part (24) 1105:5;1113:16; 1119:16,18;1120:2,14; 1121:3;1122:13,18; 1144:16,16;1145:13; 1160:14;1170:17; 1190:17;1196:16; 1197:10,11;1201:24; 1204:3;1212:8; 1224:24;1226:2; 1228:15 partially (1) 1163:7 participant (2) 1097:7;1129:21 participants (5) 1097:1;1147:21; 1153:2;1168:4;1207:2 participate (1) 1160:15 participated (2) 1103:5,10 participates (1) 1160:16 participating (1) 1175:11 particular (9) 1096:8;1097:5; 1107:19;1111:10; 1149:3;1157:10; 1194:17;1216:2; 1226:15 particularly (5) 1109:2;1124:4; 1150:20;1158:1;</p>	<p>1163:16 parties (35) 1097:5;1101:16; 1106:8;1117:24; 1118:16;1119:22; 1120:22,24;1121:1; 1124:22;1135:17; 1137:12;1141:6,9; 1147:6,8,9,10;1152:5, 9,16,20,24;1153:13,24; 1161:20;1162:18; 1164:9,14;1170:21; 1178:4;1194:4;1200:8; 1201:6;1225:7 party (7) 1097:6;1106:12; 1126:12;1152:5,13; 1160:23;1168:10 passage (1) 1114:21 past (3) 1103:1;1218:11; 1221:13 Patrick (4) 1094:13;1141:20; 1151:18;1155:20 pattern (1) 1190:2 patterns (1) 1142:13 Paul (4) 1097:12;1158:12; 1162:2;1217:17 pay (1) 1148:10 paying (1) 1148:15 payment (1) 1104:3 PDF (1) 1165:13 PDSI (2) 1190:14;1191:6 PE (1) 1093:13 Pederson (32) 1109:2;1112:2,11; 1113:15;1115:9,12,22; 1117:3,8;1123:6; 1131:3,22;1134:11; 1148:20,21,23;1150:3, 5;1157:15;1159:1,14; 1163:20;1198:15,15, 15,18,18,22,22; 1210:16;1211:10,11 Pellegrino (2) 1176:10;1196:8 pen (1) 1166:9 pendency (1) 1166:21 people (7) 1165:16;1168:2;</p>	<p>1169:17;1188:22; 1193:2;1196:1; 1208:17 people's (1) 1223:7 per (14) 1127:11;1129:20; 1148:8,14;1177:23; 1179:24,24;1183:21; 1184:1,1;1194:24; 1205:2;1206:20; 1228:16 percent (6) 1112:3,24;1113:11; 1157:10;1202:23; 1203:3 Perhaps (2) 1173:11;1186:22 period (12) 1101:10;1122:5; 1131:15,20;1132:1; 1134:1;1147:7; 1159:10,13,20; 1199:11;1211:1 permanent (8) 1126:20;1127:22; 1137:23,24;1150:20; 1163:17,19,19 permeability (1) 1180:16 permit (2) 1123:22;1169:22 permitted (4) 1143:18,19,21; 1169:20 perpetuity (3) 1125:4;1137:8; 1202:22 person (1) 1100:5 perspective (1) 1124:14 pertinent (1) 1201:16 pesticide (1) 1114:20 Peterson (10) 1094:4;1095:7; 1138:6,6,9;1141:12; 1193:6,9,11,24 phonetic (1) 1190:16 photograph (1) 1115:19 physically (1) 1110:11 pick (1) 1223:7 picture (3) 1110:3;1115:8,13 piezometer (1) 1183:16 P-I-E-Z-O-M-E-T-E-R (1)</p>
	P			
	<p>P10 (1) 1199:10 pace (1) 1097:4 Pacific (1) 1154:18 Pacific-Republic (1) 1145:18 pack (1) 1229:2 package (3) 1117:20;1144:17,17 page (13) 1097:16;1115:18; 1131:6;1138:17; 1139:1,4;1140:7; 1196:15;1210:21; 1211:13;1220:15,22,23 Pages (2) 1092:19;1230:13 Pahrnanagat (1) 1225:5 Paiute (2) 1133:8;1212:21 Paiutes (16) 1118:9;1133:10; 1134:23;1150:13,15; 1152:10;1169:1,9; 1170:19;1171:6,8,9,14,</p>			

<p>1183:16 pikeminnow (1) 1099:24 pink (1) 1160:3 pipeline (3) 1120:15;1203:7; 1227:12 pivotal (1) 1107:12 place (2) 1096:6;1203:4 places (1) 1208:23 Plan (12) 1103:8,9;1111:13; 1112:19,19;1139:24; 1164:20;1195:6; 1202:2,7;1225:11; 1226:5 planning (2) 1201:8;1202:1 plans (2) 1157:3;1204:4 plant (1) 1132:17 play (1) 1216:12 played (1) 1107:12 player (1) 1109:12 please (18) 1140:23;1158:19; 1168:16,21;1169:6; 1170:3;1174:22; 1175:5;1178:22,24; 1179:7;1189:15; 1191:22;1193:1,14; 1199:8;1207:6; 1208:19 Plummer (5) 1112:2;1113:15; 1115:20,21;1117:3 pm (1) 1229:2 point (14) 1100:4,5;1115:13; 1116:11;1127:18; 1156:20,24;1163:1; 1166:23;1182:13; 1209:16;1221:13; 1228:4,12 pointed (3) 1182:9;1202:10; 1214:14 points (3) 1168:9,12;1203:20 poisoning (2) 1114:19;1159:17 population (17) 1112:3,22;1113:8, 22;1114:3,9,14,24;</p>	<p>1117:6;1122:17; 1131:14;1136:12; 1145:4;1149:21; 1159:22;1160:1; 1169:2 populations (1) 1160:10 porous (3) 1182:7;1186:9; 1224:11 portfolio (1) 1169:19 PORTION (16) 1092:9;1109:1; 1157:13;1160:4; 1181:24;1185:7,16; 1188:6,11,17,20; 1189:10,12,14;1191:7; 1216:10 portions (5) 1110:21;1191:12; 1211:24;1222:24; 1223:1 posed (2) 1200:5,22 position (2) 1129:1;1176:15 positive (1) 1113:22 possible (4) 1176:4;1198:7,8; 1221:16 possibly (2) 1213:23;1227:19 post-1169 (1) 1199:5 Post-Testing (1) 1210:22 potential (7) 1109:4,14;1111:1; 1139:14;1150:1,4; 1227:24 potentially (5) 1125:7;1126:9; 1143:23;1144:2; 1147:1 potentiometric (2) 1208:4,5 pre-1169 (2) 1198:5;1199:17 precedence (1) 1109:13 precipitously (1) 1114:9 predate (1) 1114:12 preferred (2) 1204:10,15 preliminary (1) 1166:8 preparation (5) 1133:19,24;1174:19; 1195:6;1211:5</p>	<p>prepare (1) 1211:9 prepared (4) 1098:18;1133:19; 1174:4;1225:11 preparing (1) 1211:11 prequalification (1) 1098:10 presence (1) 1208:2 present (4) 1109:16;1166:12; 1208:9;1230:7 presentation (2) 1096:12,23 presented (4) 1097:17;1104:17; 1161:4;1223:11 presenting (1) 1173:16 preserve (1) 1107:1 president (2) 1173:10,15 pressure (4) 1187:2,2;1190:9,9 pretest (1) 1205:17 pre-tilapia (1) 1114:6 pretty (7) 1106:23;1114:13; 1151:23;1191:23; 1199:5;1204:22; 1220:4 previous (7) 1174:1;1177:13; 1191:24;1200:23; 1213:9;1214:23; 1224:2 previously (2) 1104:23;1222:5 primarily (2) 1120:3;1147:7 primary (2) 1112:22;1115:7 prior (3) 1116:7;1163:6,11 private (1) 1106:24 probability (1) 1198:8 probably (5) 1113:19;1161:18; 1166:9;1187:13; 1222:4 probative (1) 1220:2 problems (1) 1164:14 procedure (1) 1098:10</p>	<p>proceed (3) 1096:13;1166:1,3 proceeding (4) 1098:9;1153:3; 1194:3,4 proceedings (7) 1096:8,16;1104:24; 1105:1;1165:8,15,17 process (7) 1099:14,21;1100:11; 1101:12;1126:14; 1134:17;1174:8 processes (2) 1101:17;1107:9 produced (1) 1114:10 producer (1) 1179:23 producing (3) 1183:6,19;1203:24 product (1) 1134:4 production (5) 1180:1;1181:1; 1183:13,14;1196:24 professional (3) 1175:7;1200:13; 1203:6 proffered (1) 1104:22 Program (6) 1100:6,7,18; 1119:20;1147:6; 1164:11 programmatically (6) 1101:21;1118:7; 1120:5,6,8,17 programs (2) 1101:16;1103:7 progress (1) 1112:17 prohibits (1) 1142:16 Project (3) 1099:15,16;1139:9 projecting (1) 1168:18 project's (1) 1139:13 pronounce (1) 1190:17 Proofs (1) 1169:24 proper (1) 1167:4 properly (1) 1201:3 properties (1) 1170:4 proportionalities (1) 1135:13 proposed (4) 1139:8;1175:1,6,12</p>	<p>proposes (1) 1197:8 proposing (2) 1197:16,17 protect (13) 1098:16;1112:24; 1117:17;1123:4; 1126:23;1127:4; 1146:11,17;1147:13; 1164:17;1201:18; 1203:10;1204:4 protected (4) 1107:21;1108:11; 1204:10;1206:13 protecting (3) 1106:15;1147:2; 1170:5 protection (7) 1107:23;1108:3; 1118:10;1128:7; 1157:13;1170:13; 1202:24 protective (3) 1133:21;1134:7; 1146:20 protest (1) 1171:6 protests (3) 1101:8,14;1139:19 prove (1) 1172:21 proven (1) 1154:9 provid- (1) 1160:22 provide (12) 1117:4;1118:21; 1120:21;1153:23; 1160:23;1166:23; 1171:21;1172:4; 1201:9;1202:14; 1203:13,16 provided (10) 1097:15;1104:11; 1105:4;1123:2,7; 1138:11;1139:18; 1162:5;1209:15; 1210:10 provides (7) 1113:18;1124:1,5; 1153:20;1160:4; 1200:9,9 providing (1) 1113:1 provision (1) 1126:12 provisions (1) 1124:3 proximity (2) 1180:10;1189:9 proxy (2) 1144:23;1177:11 prudent (3)</p>
---	--	---	--	---

<p>1107:6;1195:18,18 public (4) 1123:5;1129:5; 1172:21;1223:17 publications (1) 1136:5 publicly (1) 1165:8 published (2) 1114:10;1165:19 pulled (1) 1181:19 pump (27) 1106:10,11;1116:8, 10;1118:22,22;1119:5, 22;1121:13;1124:2,19, 22;1125:5;1136:14; 1145:8;1147:8; 1153:20,23;1154:4,5; 1166:21;1181:13,16, 17;1187:22,23; 1227:19 pump- (1) 1211:21 pumped (8) 1105:16;1108:21; 1163:3;1199:20; 1206:5;1220:8,14; 1221:8 pumping (143) 1101:6,9,15; 1105:20;1106:19; 1109:3,14;1118:2,4,6; 1119:11;1120:6; 1121:11;1125:17; 1126:10,17,19,24; 1127:7,10,12,14,16,21; 1128:1,9;1130:17; 1132:5;1134:18; 1135:3,10;1143:2,14, 16;1144:20;1151:4; 1161:2,4,22,23;1162:7, 11,17,22,23;1163:3,4, 11,13,19;1166:18; 1170:16;1179:3,5,10; 1181:6,14,16,17,20; 1182:1,16;1183:13,14; 1184:19,20;1185:12; 1187:4,15,21;1188:3,4, 5,7,10,10,12,14,17,21; 1189:14;1190:1,3,6,9, 10,20,20,22;1191:3,9, 10,11,21;1192:6,13,18, 21;1195:11,14,19; 1197:24;1198:4,10,19, 21,21;1199:2,11,16,20; 1200:1,10,16;1203:18; 1205:5,7,9,12,14,16; 1206:3,15;1209:16,16; 1210:18,18,24; 1211:21,23;1215:18, 19;1216:17,19; 1218:21;1219:23;</p>	<p>1220:11;1222:4,5,9; 1226:23;1228:20,21 pumps (1) 1213:4 pupfish (3) 1108:10,11,16 purpose (3) 1118:16,18;1121:12 purposes (5) 1104:21,24;1107:22; 1134:14;1180:2 pursuant (1) 1137:20 pursue (1) 1142:5 put (5) 1110:3;1202:4; 1204:13;1206:17; 1221:16 putting (2) 1129:5;1198:8 Pyramid (2) 1108:2,5</p>	<p>1192:19 rate (3) 1189:20,23;1222:10 rates (4) 1135:14;1180:7; 1198:10;1206:15 rational (2) 1135:16,20 razorback (1) 1100:1 Reach (9) 1131:7,21;1148:19, 20;1149:3,6;1157:16; 1198:13;1200:5 reached (1) 1153:13 reaches (5) 1148:18;1156:23; 1159:8,14,17 reaching (5) 1149:18;1163:12; 1198:9;1205:20; 1216:13 react (1) 1125:23 reaction (1) 1162:10 read (8) 1123:1;1131:9; 1186:4;1193:4;1194:6, 8;1196:1,10 readily (1) 1110:14 reading (1) 1184:9 real (2) 1097:24;1196:7 realize (1) 1209:14 really (32) 1119:9;1164:7,19, 20,20;1166:9;1167:20; 1168:8;1178:1; 1179:23;1180:8,17,18; 1182:6;1183:8;1184:4, 17;1187:14;1192:20; 1193:4;1195:2;1196:8; 1197:6;1201:5;1203:2; 1204:6;1211:22,23; 1213:15;1214:21; 1215:2;1223:24 reason (1) 1203:21 reasonable (3) 1183:24;1184:1; 1201:15 reasonably (1) 1201:15 rebound (1) 1160:2 rebuttal (3) 1174:5;1197:15; 1223:20</p>	<p>recall (6) 1107:20;1131:3; 1179:13;1218:7; 1219:7;1226:1 received (1) 1102:22 recent (4) 1109:10;1110:13; 1160:20;1222:3 Recess (2) 1165:23;1229:4 recharge (2) 1188:2,15 recharged (1) 1196:18 Reclamation (3) 1099:14;1100:4,5 recognition (2) 1194:16;1204:12 recognize (3) 1122:3;1201:7; 1206:17 recognizes (3) 1175:18;1201:14,18 recognizing (1) 1175:23 recommend (3) 1161:1;1175:14; 1206:9 recommendation (11) 1126:23;1127:3,9; 1128:7,10;1150:19; 1217:22,24;1218:1; 1227:4;1228:15 recommendations (4) 1126:8;1135:5; 1206:7;1216:4 recommended (2) 1176:6,9 reconsultation (2) 1126:16;1156:2 record (20) 1097:14;1098:8; 1105:5,9;1133:9; 1148:1;1150:14; 1155:8,20;1158:12; 1160:20;1166:1; 1167:11;1168:13; 1173:7;1196:4; 1212:22;1217:17; 1222:18;1223:17 recorded (1) 1169:11 recordings (3) 1165:8,14,19 recover (1) 1192:23 recovered (4) 1188:4;1198:5; 1199:17;1205:17 Recovery (33) 1100:6;1101:2; 1107:23;1109:8;</p>	<p>1112:16,18,18,20; 1113:4,10;1119:17,20, 23;1123:17;1147:13; 1148:5,9;1156:24; 1157:3,10,16,22; 1161:2,9,13;1164:11; 1186:7;1188:10,15; 1197:22,24;1199:5; 1210:22 Recreation (1) 1169:5 recreational (1) 1107:22 RECROSS (1) 1095:2 RECROSS-EXAMINATION (4) 1148:2;1150:16; 1152:1;1155:21 Red (1) 1179:15 REDIRECT (3) 1095:2;1125:10; 1158:10 reduce (2) 1127:24;1200:19 reduction (5) 1123:21,22;1127:17; 1135:14;1144:22 redundancy (2) 1203:19;1204:2 reevaluate (1) 1126:16 refer (2) 1116:20;1210:6 reference (6) 1175:20;1210:11; 1213:23,23;1214:1; 1227:3 referenced (1) 1223:14 referencing (1) 1131:20 referred (3) 1177:14;1201:12; 1211:22 reflect (1) 1190:19 Refuge (9) 1102:5;1112:2; 1113:15;1115:21; 1117:3;1119:16; 1128:15,16,20 regard (4) 1130:16;1149:20; 1153:19;1210:16 regarding (22) 1096:7;1108:19; 1109:22;1114:14,17; 1116:22;1128:7; 1139:2,23;1150:22; 1151:8;1158:24; 1161:9;1162:10; 1178:19;1197:7;</p>
	Q			
<p>qualified (2) 1098:9;1104:23 qualify (1) 1213:22 quality (2) 1122:21;1123:11 quantities (1) 1180:7 quantity (10) 1105:16;1108:10,20; 1122:8,20;1123:11; 1126:24;1128:8; 1130:23;1221:8 quarter (1) 1171:24 quick (6) 1096:16;1097:24; 1141:22;1146:7; 1155:8;1183:20 quickly (7) 1101:4;1102:10; 1170:7;1172:2;1174:8; 1186:4;1196:5 quote (1) 1199:10 quotes (1) 1180:9</p>	R			
<p>range (3) 1110:20,23;1117:1 ranges (1) 1161:6 rapid (3) 1191:4,7;1192:4 rapidly (1)</p>				

<p>1200:7;1217:20,22,24; 1219:5;1221:21 regardless (1) 1188:19 regards (4) 1096:18;1222:23; 1223:5,19 Region (2) 1191:13,13 regional (2) 1101:19;1215:8 regionally (2) 1185:18;1215:2 regulated (1) 1197:12 regulation (1) 1142:10 regulations (1) 1099:18 Reich (2) 1208:14,15 reinitiation (2) 1156:4,5 related (3) 1159:21;1174:3; 1204:15 relates (2) 1128:8;1146:21 relating (1) 1216:3 relationship (3) 1131:18;1161:9; 1199:20 relative (1) 1209:12 relatively (5) 1132:19;1199:12; 1207:20;1211:2; 1214:15 relevance (4) 1105:14,19;1108:19; 1153:16 relevancy (1) 1226:15 relevant (3) 1166:24;1200:23; 1214:18 reliable (2) 1172:18;1220:1 reliance (1) 1156:9 relied (3) 1193:18;1194:12; 1198:13 rely (3) 1157:1;1162:14; 1201:19 relying (6) 1130:22;1219:16,19, 20,22;1221:13 remained (6) 1149:21;1198:3; 1199:12,15;1205:15;</p>	<p>1211:2 remaining (1) 1158:9 remarkably (2) 1177:18;1224:5 remediated (1) 1149:23 remember (6) 1138:24;1139:23; 1140:2;1210:1; 1220:19;1224:9 remembered (1) 1179:2 reminder (1) 1096:16 remote (1) 1168:4 remotely (1) 1168:3 removal (4) 1113:20;1115:4; 1119:19;1132:17 remove (2) 1113:2;1159:18 removed (3) 1114:18;1149:22; 1159:24 removing (2) 1150:1;1160:7 Reno (1) 1100:23 Repeat (1) 1140:23 repeating (1) 1166:14 repeats (1) 1187:24 rephrase (2) 1146:15;1211:8 replacing (1) 1150:2 report (43) 1098:18;1104:5,10; 1111:7;1114:1;1131:7; 1148:17;1158:14; 1160:21;1174:5,19,22; 1176:10;1179:14,19; 1180:10,23;1181:12, 20;1182:13,15;1184:8; 1185:22,24;1189:23, 23;1190:18;1197:15; 1210:3,21;1211:5,9,13; 1220:16,21,22;1223:3, 12,15,20;1224:10; 1225:17;1226:11 Reported (1) 1092:24 reporter (2) 1186:5;1230:4 reporter's (1) 1182:21 reports (19) 1104:19,20;1105:6;</p>	<p>1106:11;1116:18,20; 1143:4;1164:2;1174:5, 9;1176:20;1207:5,8,9; 1218:22;1223:18; 1225:23;1226:3,4 remediated (1) 1112:12;1130:5; 1166:5;1184:1 representation (1) 1166:16 representatives (1) 1134:21 representing (3) 1138:7;1186:21; 1228:11 represents (1) 1186:8 reproduce (4) 1110:19,21;1115:16; 1117:10 reproductive (1) 1111:1 request (1) 1227:16 requested (3) 1226:19;1227:23; 1228:14 requests (2) 1204:14;1217:6 require (4) 1110:19;1127:20; 1170:16;1172:7 required (5) 1099:20;1126:6; 1198:11;1205:18; 1211:17 requirement (3) 1121:18,23;1195:5 requirements (5) 1099:18;1100:10; 1109:22;1110:1,10 requires (2) 1156:10;1157:17 requiring (1) 1106:22 research (5) 1099:20;1100:8; 1122:9;1123:13; 1127:5 researchers (1) 1123:14 Reserve (2) 1171:8,10 reserved (1) 1128:18 residential (1) 1127:23 residual (3) 1186:7,13;1205:11 resistivity (3) 1219:6,9,19 resolution (2) 1117:4;1181:9</p>	<p>resource (7) 1097:19;1102:6; 1172:18;1201:8,24; 1202:2,7 RESOURCES (13) 1092:2,3;1098:11, 15;1123:15;1147:19; 1155:5;1165:5; 1172:12,14,20; 1197:12;1230:9 respect (9) 1096:17;1097:4; 1098:14;1099:1; 1102:17;1105:20; 1106:19;1128:22; 1129:4 respond (1) 1163:10 responded (2) 1205:5,6 responding (1) 1201:11 response (7) 1140:24;1174:6; 1187:19,20;1190:9,10, 12 responses (3) 1187:2;1188:24; 1196:19 responsible (3) 1101:2,20;1142:24 rest (2) 1178:13;1224:16 restate (2) 1131:19;1193:14 restating (1) 1194:1 restoration (10) 1113:15;1115:5; 1119:18;1132:15; 1148:5,10;1159:23; 1160:5,6;1170:13 Restore (1) 1157:11 restoring (2) 1162:24;1170:5 restrict (3) 1127:10;1161:23; 1162:17 restricted (4) 1111:3;1161:21; 1174:13;1217:23 restriction (1) 1126:17 restrictions (17) 1118:2,5,6;1119:11; 1121:11,14;1126:9,19; 1127:21;1134:18; 1135:3,10;1151:4; 1161:2,5;1163:3,13 result (8) 1142:20;1145:2; 1159:3,15;1162:23;</p>	<p>1181:14;1206:2; 1216:17 resulting (1) 1123:17 results (8) 1126:4;1128:1; 1163:7;1164:1; 1181:13,20;1209:20; 1215:14 retired (3) 1101:11,24;1130:8 return (2) 1151:5;1153:1 returning (1) 1126:6 review (5) 1121:12;1134:19; 1160:15;1211:9; 1212:4 reviewed (6) 1134:1,19;1197:23; 1199:4;1218:16,20 reviewing (1) 1209:13 revolved (1) 1104:10 Rich (1) 1212:22 Richard (2) 1133:10;1150:14 Rick (3) 1177:13;1209:2; 1221:12 right (70) 1097:2,6,23;1110:5, 11;1111:6,6,7,24; 1117:15;1128:16,18, 20;1130:16;1134:5; 1137:18,19;1140:18; 1146:22;1149:8; 1152:5;1156:11; 1158:3,22;1159:6; 1162:11;1163:4,5,6; 1164:15;1166:4; 1167:20;1168:8,21; 1169:6,18,21;1170:2, 11,15,20,23;1171:2,24; 1172:15;1177:17; 1178:16;1184:14,17, 21,24;1185:8,21; 1188:22;1192:14; 1200:21;1201:17; 1202:15;1203:3,15,18; 1206:19;1210:5,22; 1216:9,10;1221:18; 1225:15;1228:16,24 right-hand (2) 1112:8;1159:7 rights (31) 1107:21;1108:1; 1117:24;1120:7; 1123:4,24;1126:20; 1137:11,17;1145:15;</p>
---	--	--	--	---

1148:8,15;1169:19; 1171:9,10,15,17; 1172:1;1200:14,19; 1201:2,2,9;1202:3,3,8, 11;1203:10;1204:19; 1206:3;1217:7	Sacramento (1) 1101:19	1190:4,7,8;1198:19, 23	1208:13	shelf (1) 1108:11
rise (1) 1191:6	sacrificed (1) 1202:18	second (4) 1116:6,6;1182:20; 1212:7	serve (4) 1172:12;1201:17; 1202:13;1204:5	sheltering (1) 1142:14
RIVER (76) 1092:8,12;1096:7; 1098:15;1099:3,15,24, 24;1100:8,18;1102:18; 1103:8;1105:17; 1106:19;1108:2,21; 1109:2,4;1110:22; 1112:19;1116:21; 1120:16;1127:1,10,14; 1128:4;1130:18; 1143:3;1146:23; 1165:11;1169:5; 1171:9,15,17;1172:14; 1175:8;1176:20; 1185:20;1195:10,16, 17,20;1196:14;1197:8; 1199:21,24,24;1200:2, 20;1201:4;1204:20; 1205:6,10,22,23,24; 1207:20;1210:19; 1214:3,4;1215:12; 1216:18,23;1218:2,12, 14,17;1219:1;1220:9, 12;1225:15,15,18; 1226:12;1227:6; 1228:4	safely (1) 1215:13	secondary (1) 1180:16	Service (47) 1099:9;1100:2,13; 1101:8,14;1102:11; 1103:12;1107:15; 1113:6,13;1114:18; 1118:21,24;1120:2; 1122:6;1124:19; 1126:15;1130:9,13; 1132:16;1133:4,5; 1134:2,2,3,22;1138:12; 1139:19;1150:9,10; 1152:11;1161:20; 1168:23;1169:2,10,15, 16;1172:10;1175:15; 1177:8;1178:17; 1194:10;1195:4; 1202:11;1212:16,21; 1215:6	shockingly (1) 1178:1
River's (1) 1200:11	safety (4) 1172:21;1201:9,19; 1203:17	seconds (1) 1125:12	serve's (1) 1139:7	shoot (1) 1142:5
road (1) 1149:16	sake (1) 1182:21	Section (23) 1093:7,10;1099:10, 10,13,18,19;1100:20; 1103:10,13;1119:1; 1142:4,10,16,20,23; 1143:17,22;1147:5; 1148:7,9;1151:21; 1164:12	services (2) 1124:14;1136:2	short (1) 1157:8
Robert (1) 1138:17	salient (1) 1187:16	sections (1) 1114:19	service's (1) 1139:7	short-term (1) 1159:15
Robison (2) 1093:19,20	Salt (1) 1099:9	secure (1) 1172:12	settling (1) 1169:17	show (8) 1111:4;1114:5; 1115:8,24;1159:6; 1180:19;1184:6; 1217:4
rock (2) 1180:5;1186:9	same (14) 1099:8;1104:11; 1106:2;1128:6; 1131:11,16;1132:1; 1153:16;1174:16; 1189:13;1191:23; 1192:7;1222:10; 1230:10	seeing (22) 1133:4,7;1141:18; 1145:20,22;1146:1,4; 1150:9,12;1151:14,15; 1154:20,21,24;1178:5; 1179:1;1184:11; 1191:6,6,12,14,15	SESSION (1) 1096:1	showed (3) 1116:24;1185:11; 1201:11
rocks (1) 1180:15	sandy (2) 1224:8,11	seek (1) 1202:6	set (6) 1096:6;1117:16; 1124:8;1126:1;1140:6; 1226:16	showing (9) 1115:10;1117:14; 1138:11;1179:11; 1188:20;1191:16; 1198:24;1208:24; 1224:7
role (3) 1106:18;1107:13; 1167:18	sat (1) 1103:15	seem (2) 1135:20;1224:1	settling (1) 1171:4,12	shown (6) 1111:9;1114:1; 1189:22,22;1209:22; 1224:18
room (1) 1200:8	save (1) 1125:9	seemed (1) 1225:8	settlements (1) 1169:10	shows (16) 1112:10;1114:2; 1117:22;1122:20; 1131:7,9;1148:17; 1158:21;1159:8; 1166:18;1168:22; 1178:13;1180:23; 1185:1,9,12
Rotenone (1) 1114:20	saw (1) 1160:1	seems (2) 1131:14;1166:22	settlement (2) 1171:4,12	shut (2) 1187:22,23
RPR (1) 1092:24	saying (9) 1131:3;1132:9; 1141:8;1183:1;1198:7; 1202:22;1213:22; 1218:9;1224:13	segment (1) 1159:1	settlements (1) 1169:10	shy (1) 1158:9
Ruling (15) 1193:2,3,13,18,19; 1194:6,8,11,13,18,23; 1202:5;1204:7,8; 1212:3	scale (4) 1111:15,18;1181:3; 1184:10	segmenting (1) 1167:5	seven (1) 1207:2	sign (1) 1121:1
S	Scapatoni (2) 1114:10;1123:14	self-explanatory (1) 1192:16	seven-basin (7) 1197:11,17;1204:11, 11;1206:11,13;1218:3	signatories (7) 1113:7;1117:23; 1126:2;1140:19; 1141:1,2;1146:21
	scenarios (1) 1202:7	semantics (1) 1181:15	seven-day (10) 1179:10;1181:12,14, 17;1182:1,10,16; 1185:12;1186:15; 1205:14	signatory (2) 1146:23;1152:18
	Schreck (1) 1093:22	send (1) 1155:16	several (2) 1170:4;1211:12	signed (6) 1101:19;1118:19; 1120:4;1137:12; 1138:17;1179:13
	Schroeder (1) 1094:10	senior (5) 1123:4;1173:10,15; 1203:3,10	severe (2) 1144:13;1191:17	significant (16) 1113:14,22;1114:23; 1115:4,16;1128:3; 1135:5,6;1144:19; 1159:13;1160:5,7; 1163:18;1177:22; 1180:12;1188:2
	Schwemm (5) 1109:24;1110:11,19; 1111:10;1122:16	sense (4) 1155:24;1213:17; 1214:6,19	Severity (7) 1191:5,14,16; 1192:1,17,22,23	significantly (1) 1142:12
	Schwemm's (1) 1109:17	sensitive (7) 1107:1;1187:2; 1204:1;1214:7,8,13; 1217:1	shape (1) 1167:5	
	science (2) 1102:21;1197:9	sentinel (1) 1177:14	Sharp (1) 1093:19	
	scope (3) 1106:22;1153:15; 1168:12	SEPTEMBER (3) 1092:20;1096:1; 1230:6		
	screen (4) 1110:3;1115:9; 1158:19;1183:13	series (3) 1158:22;1170:3;		
	se (1) 1194:24			
	seasonal (5)			

1139:2;1141:8; 1145:10,11;1161:14, 16;1176:4;1186:3; 1197:3;1210:23,23; 1211:15;1220:20; 1222:1	1160:3 stream (11) 1110:17;1112:5; 1114:20;1122:22; 1148:21;1159:8,14,15, 18;1160:6;1171:3	sufficiently (1) 1133:21 suggest (1) 1176:1 suggested (1) 1188:23	surface (1) 1171:15 surveys (2) 1103:5;1110:15 survival (2) 1123:6;1148:8	14,18,22;1131:6; 1159:7;1177:24 Taggart (40) 1093:16,16;1095:3; 1097:10,11,12;1098:8; 1104:9,15;1105:2,3,9, 12;1121:20;1125:8,13, 14;1129:9,12;1141:1; 1153:6,16;1158:11,12, 18,20;1160:19;1161:7, 17;1162:2;1164:22,24; 1165:1;1217:16,17; 1220:23;1221:1,16,19; 1222:15
statements (7) 1144:10;1174:14; 1179:19;1181:19; 1199:6,8;1215:19	streams (5) 1112:2;1113:16; 1115:6;1117:3; 1148:18	suggestions (1) 1135:2 suits (1) 1142:23	survive (1) 1156:11 sustain (1) 1153:8	Taggart's (1) 1141:5
states (5) 1106:24;1108:12; 1123:3;1133:3;1150:8	stress (1) 1202:17	Sullivan (1) 1093:5	sustainable (1) 1203:16	talk (16) 1117:12,20;1167:20; 1168:8;1170:23; 1174:8;1181:23; 1187:10;1189:16; 1190:13;1193:2; 1203:11,13;1204:23; 1214:16;1215:17
statistics (1) 1102:22	stresses (2) 1188:20;1196:20	summarize (1) 1196:5	sustained (1) 1189:20	talked (2) 1148:19;1204:16
status (1) 1135:21	strike (2) 1185:4;1203:24	summary (1) 1182:2	sustainment (1) 1189:24	talking (9) 1097:18;1132:8; 1146:18;1163:8,14; 1208:17;1210:6; 1213:18;1215:21
statutory (1) 1203:12	strongly (1) 1176:12	summation (2) 1197:6;1204:24	swear (2) 1097:24;1098:5	talks (2) 1147:5;1164:13
steadily (1) 1131:24	structural (1) 1214:23	summed (2) 1192:14;1196:7	sworn (4) 1097:22;1098:7; 1167:23;1168:6	team (11) 1103:15,19,22; 1104:1;1121:12; 1134:19,21;1135:6; 1160:15;1211:9; 1212:4
steady (4) 1198:9;1205:19; 1211:18;1221:22	structure (3) 1121:10;1177:19; 1220:5	summer (2) 1132:20,21	SYSTEM (83) 1092:8;1096:7; 1098:15;1099:3; 1100:8;1102:18; 1105:17;1106:20; 1108:22;1109:4; 1110:13;1113:3,18,21; 1114:4,19;1115:5,17, 21,22;1117:10; 1119:24;1122:11,24; 1123:12,18;1124:10, 13;1127:1,11,14; 1128:4;1130:18; 1132:17;1135:19; 1136:5;1143:3; 1146:23;1157:24; 1158:2;1159:18,24; 1160:1,8;1162:10; 1165:11;1175:8; 1178:14;1182:6; 1183:23;1185:19; 1186:10;1187:1,1,3; 1190:11;1196:14,24; 1197:8;1198:9;1200:3; 1201:4;1203:20; 1204:12,20;1207:20; 1209:5;1210:19; 1211:18;1214:22; 1215:3;1218:2,3,12,17; 1219:1;1220:12; 1221:10;1225:15,16, 18;1226:12;1227:6	tells (1) 1199:4
steepest (7) 1188:5,11,16,20; 1189:10,13;1199:1	structured (1) 1123:21	Summit (1) 1107:21	SYSTEM (83) 1092:8;1096:7; 1098:15;1099:3; 1100:8;1102:18; 1105:17;1106:20; 1108:22;1109:4; 1110:13;1113:3,18,21; 1114:4,19;1115:5,17, 21,22;1117:10; 1119:24;1122:11,24; 1123:12,18;1124:10, 13;1127:1,11,14; 1128:4;1130:18; 1132:17;1135:19; 1136:5;1143:3; 1146:23;1157:24; 1158:2;1159:18,24; 1160:1,8;1162:10; 1165:11;1175:8; 1178:14;1182:6; 1183:23;1185:19; 1186:10;1187:1,1,3; 1190:11;1196:14,24; 1197:8;1198:9;1200:3; 1201:4;1203:20; 1204:12,20;1207:20; 1209:5;1210:19; 1211:18;1214:22; 1215:3;1218:2,3,12,17; 1219:1;1220:12; 1221:10;1225:15,16, 18;1226:12;1227:6	technical (3) 1103:15;1121:12; 1212:3
stem (2) 1099:15;1111:2	structures (2) 1177:22;1209:1	super (15) 1175:1,2;1176:1,13; 1183:23;1197:11; 1206:10;1211:24; 1214:19,20;1215:11; 1216:4;1217:8; 1224:13,16	SYSTEM (83) 1092:8;1096:7; 1098:15;1099:3; 1100:8;1102:18; 1105:17;1106:20; 1108:22;1109:4; 1110:13;1113:3,18,21; 1114:4,19;1115:5,17, 21,22;1117:10; 1119:24;1122:11,24; 1123:12,18;1124:10, 13;1127:1,11,14; 1128:4;1130:18; 1132:17;1135:19; 1136:5;1143:3; 1146:23;1157:24; 1158:2;1159:18,24; 1160:1,8;1162:10; 1165:11;1175:8; 1178:14;1182:6; 1183:23;1185:19; 1186:10;1187:1,1,3; 1190:11;1196:14,24; 1197:8;1198:9;1200:3; 1201:4;1203:20; 1204:12,20;1207:20; 1209:5;1210:19; 1211:18;1214:22; 1215:3;1218:2,3,12,17; 1219:1;1220:12; 1221:10;1225:15,16, 18;1226:12;1227:6	tectonic (1) 1180:12
stenotype (2) 1230:7,14	studies (3) 1122:24;1123:10; 1127:13	supervised (2) 1100:23,24	SYSTEM (83) 1092:8;1096:7; 1098:15;1099:3; 1100:8;1102:18; 1105:17;1106:20; 1108:22;1109:4; 1110:13;1113:3,18,21; 1114:4,19;1115:5,17, 21,22;1117:10; 1119:24;1122:11,24; 1123:12,18;1124:10, 13;1127:1,11,14; 1128:4;1130:18; 1132:17;1135:19; 1136:5;1143:3; 1146:23;1157:24; 1158:2;1159:18,24; 1160:1,8;1162:10; 1165:11;1175:8; 1178:14;1182:6; 1183:23;1185:19; 1186:10;1187:1,1,3; 1190:11;1196:14,24; 1197:8;1198:9;1200:3; 1201:4;1203:20; 1204:12,20;1207:20; 1209:5;1210:19; 1211:18;1214:22; 1215:3;1218:2,3,12,17; 1219:1;1220:12; 1221:10;1225:15,16, 18;1226:12;1227:6	telling (1) 1099:4
steps (1) 1171:19	study (1) 1185:10	supervising (1) 1103:3	SYSTEM (83) 1092:8;1096:7; 1098:15;1099:3; 1100:8;1102:18; 1105:17;1106:20; 1108:22;1109:4; 1110:13;1113:3,18,21; 1114:4,19;1115:5,17, 21,22;1117:10; 1119:24;1122:11,24; 1123:12,18;1124:10, 13;1127:1,11,14; 1128:4;1130:18; 1132:17;1135:19; 1136:5;1143:3; 1146:23;1157:24; 1158:2;1159:18,24; 1160:1,8;1162:10; 1165:11;1175:8; 1178:14;1182:6; 1183:23;1185:19; 1186:10;1187:1,1,3; 1190:11;1196:14,24; 1197:8;1198:9;1200:3; 1201:4;1203:20; 1204:12,20;1207:20; 1209:5;1210:19; 1211:18;1214:22; 1215:3;1218:2,3,12,17; 1219:1;1220:12; 1221:10;1225:15,16, 18;1226:12;1227:6	tells (1) 1199:4
Stetson (2) 1123:3;1186:19	sub-basins (1) 1167:6	Supervisor (6) 1093:13;1100:13,23; 1101:9;1120:18; 1138:18	SYSTEM (83) 1092:8;1096:7; 1098:15;1099:3; 1100:8;1102:18; 1105:17;1106:20; 1108:22;1109:4; 1110:13;1113:3,18,21; 1114:4,19;1115:5,17, 21,22;1117:10; 1119:24;1122:11,24; 1123:12,18;1124:10, 13;1127:1,11,14; 1128:4;1130:18; 1132:17;1135:19; 1136:5;1143:3; 1146:23;1157:24; 1158:2;1159:18,24; 1160:1,8;1162:10; 1165:11;1175:8; 1178:14;1182:6; 1183:23;1185:19; 1186:10;1187:1,1,3; 1190:11;1196:14,24; 1197:8;1198:9;1200:3; 1201:4;1203:20; 1204:12,20;1207:20; 1209:5;1210:19; 1211:18;1214:22; 1215:3;1218:2,3,12,17; 1219:1;1220:12; 1221:10;1225:15,16, 18;1226:12;1227:6	temperature (8) 1110:9,20;1123:16; 1135:21,24;1136:1,3,6
Steve (1) 1208:15	subdivision (1) 1220:16	supervisory (1) 1167:18	SYSTEM (83) 1092:8;1096:7; 1098:15;1099:3; 1100:8;1102:18; 1105:17;1106:20; 1108:22;1109:4; 1110:13;1113:3,18,21; 1114:4,19;1115:5,17, 21,22;1117:10; 1119:24;1122:11,24; 1123:12,18;1124:10, 13;1127:1,11,14; 1128:4;1130:18; 1132:17;1135:19; 1136:5;1143:3; 1146:23;1157:24; 1158:2;1159:18,24; 1160:1,8;1162:10; 1165:11;1175:8; 1178:14;1182:6; 1183:23;1185:19; 1186:10;1187:1,1,3; 1190:11;1196:14,24; 1197:8;1198:9;1200:3; 1201:4;1203:20; 1204:12,20;1207:20; 1209:5;1210:19; 1211:18;1214:22; 1215:3;1218:2,3,12,17; 1219:1;1220:12; 1221:10;1225:15,16, 18;1226:12;1227:6	temperatures (5) 1111:15,17;1112:13, 14;1122:11
Stevens (1) 1190:17	subfolder (1) 1165:12	supplied (4) 1170:10;1223:8,15; 1226:4	SYSTEM (83) 1092:8;1096:7; 1098:15;1099:3; 1100:8;1102:18; 1105:17;1106:20; 1108:22;1109:4; 1110:13;1113:3,18,21; 1114:4,19;1115:5,17, 21,22;1117:10; 1119:24;1122:11,24; 1123:12,18;1124:10, 13;1127:1,11,14; 1128:4;1130:18; 1132:17;1135:19; 1136:5;1143:3; 1146:23;1157:24; 1158:2;1159:18,24; 1160:1,8;1162:10; 1165:11;1175:8; 1178:14;1182:6; 1183:23;1185:19; 1186:10;1187:1,1,3; 1190:11;1196:14,24; 1197:8;1198:9;1200:3; 1201:4;1203:20; 1204:12,20;1207:20; 1209:5;1210:19; 1211:18;1214:22; 1215:3;1218:2,3,12,17; 1219:1;1220:12; 1221:10;1225:15,16, 18;1226:12;1227:6	temporary (5) 1119:5;1123:21; 1124:4;1137:23; 1150:23
stewardship (1) 1111:13	subjecting (1) 1195:14	suppliers (1) 1204:1	SYSTEM (83) 1092:8;1096:7; 1098:15;1099:3; 1100:8;1102:18; 1105:17;1106:20; 1108:22;1109:4; 1110:13;1113:3,18,21; 1114:4,19;1115:5,17, 21,22;1117:10; 1119:24;1122:11,24; 1123:12,18;1124:10, 13;1127:1,11,14; 1128:4;1130:18; 1132:17;1135:19; 1136:5;1143:3; 1146:23;1157:24; 1158:2;1159:18,24; 1160:1,8;1162:10; 1165:11;1175:8; 1178:14;1182:6; 1183:23;1185:19; 1186:10;1187:1,1,3; 1190:11;1196:14,24; 1197:8;1198:9;1200:3; 1201:4;1203:20; 1204:12,20;1207:20; 1209:5;1210:19; 1211:18;1214:22; 1215:3;1218:2,3,12,17; 1219:1;1220:12; 1221:10;1225:15,16, 18;1226:12;1227:6	ten (9) 1168:14;1177:23; 1178:7;1179:24; 1186:16;1187:6,7; 1205:2;1207:24
still (6) 1101:2;1106:14; 1134:6;1138:23; 1154:8;1170:20	submit (1) 1132:18	supply (6) 1169:11;1172:18; 1201:15,19;1203:3,16	SYSTEM (83) 1092:8;1096:7; 1098:15;1099:3; 1100:8;1102:18; 1105:17;1106:20; 1108:22;1109:4; 1110:13;1113:3,18,21; 1114:4,19;1115:5,17, 21,22;1117:10; 1119:24;1122:11,24; 1123:12,18;1124:10, 13;1127:1,11,14; 1128:4;1130:18; 1132:17;1135:19; 1136:5;1143:3; 1146:23;1157:24; 1158:2;1159:18,24; 1160:1,8;1162:10; 1165:11;1175:8; 1178:14;1182:6; 1183:23;1185:19; 1186:10;1187:1,1,3; 1190:11;1196:14,24; 1197:8;1198:9;1200:3; 1201:4;1203:20; 1204:12,20;1207:20; 1209:5;1210:19; 1211:18;1214:22; 1215:3;1218:2,3,12,17; 1219:1;1220:12; 1221:10;1225:15,16, 18;1226:12;1227:6	
stipulated (2) 1101:15;1154:1	submitted (5) 1104:6,19;1116:18; 1174:5;1223:12	sure (12) 1125:9,19;1132:9; 1137:6;1145:3;1152:8; 1157:4;1158:18; 1168:1;1173:6;1196:1; 1202:4	SYSTEM (83) 1092:8;1096:7; 1098:15;1099:3; 1100:8;1102:18; 1105:17;1106:20; 1108:22;1109:4; 1110:13;1113:3,18,21; 1114:4,19;1115:5,17, 21,22;1117:10; 1119:24;1122:11,24; 1123:12,18;1124:10, 13;1127:1,11,14; 1128:4;1130:18; 1132:17;1135:19; 1136:5;1143:3; 1146:23;1157:24; 1158:2;1159:18,24; 1160:1,8;1162:10; 1165:11;1175:8; 1178:14;1182:6; 1183:23;1185:19; 1186:10;1187:1,1,3; 1190:11;1196:14,24; 1197:8;1198:9;1200:3; 1201:4;1203:20; 1204:12,20;1207:20; 1209:5;1210:19; 1211:18;1214:22; 1215:3;1218:2,3,12,17; 1219:1;1220:12; 1221:10;1225:15,16, 18;1226:12;1227:6	
stipulation (10) 1139:18;1140:1,8; 1141:10;1194:9; 1195:3,3,5;1212:2,8	subsequent (1) 1159:5	supported (2) 1144:15;1193:19	SYSTEM (83) 1092:8;1096:7; 1098:15;1099:3; 1100:8;1102:18; 1105:17;1106:20; 1108:22;1109:4; 1110:13;1113:3,18,21; 1114:4,19;1115:5,17, 21,22;1117:10; 1119:24;1122:11,24; 1123:12,18;1124:10, 13;1127:1,11,14; 1128:4;1130:18; 1132:17;1135:19; 1136:5;1143:3; 1146:23;1157:24; 1158:2;1159:18,24; 1160:1,8;1162:10; 1165:11;1175:8; 1178:14;1182:6; 1183:23;1185:19; 1186:10;1187:1,1,3; 1190:11;1196:14,24; 1197:8;1198:9;1200:3; 1201:4;1203:20; 1204:12,20;1207:20; 1209:5;1210:19; 1211:18;1214:22; 1215:3;1218:2,3,12,17; 1219:1;1220:12; 1221:10;1225:15,16, 18;1226:12;1227:6	
stochastic (1) 1122:17	substantial (1) 1156:1	supposed (6) 1119:2,21;1125:22; 1151:21;1212:4,5	SYSTEM (83) 1092:8;1096:7; 1098:15;1099:3; 1100:8;1102:18; 1105:17;1106:20; 1108:22;1109:4; 1110:13;1113:3,18,21; 1114:4,19;1115:5,17, 21,22;1117:10; 1119:24;1122:11,24; 1123:12,18;1124:10, 13;1127:1,11,14; 1128:4;1130:18; 1132:17;1135:19; 1136:5;1143:3; 1146:23;1157:24; 1158:2;1159:18,24; 1160:1,8;1162:10; 1165:11;1175:8; 1178:14;1182:6; 1183:23;1185:19; 1186:10;1187:1,1,3; 1190:11;1196:14,24; 1197:8;1198:9;1200:3; 1201:4;1203:20; 1204:12,20;1207:20; 1209:5;1210:19; 1211:18;1214:22; 1215:3;1218:2,3,12,17; 1219:1;1220:12; 1221:10;1225:15,16, 18;1226:12;1227:6	
storage (8) 1186:22;1187:5; 1210:4,6,7,9,9,13	successful (1) 1131:17	sure (12) 1125:9,19;1132:9; 1137:6;1145:3;1152:8; 1157:4;1158:18; 1168:1;1173:6;1196:1; 1202:4	SYSTEM (83) 1092:8;1096:7; 1098:15;1099:3; 1100:8;1102:18; 1105:17;1106:20; 1108:22;1109:4; 1110:13;1113:3,18,21; 1114:4,19;1115:5,17, 21,22;1117:10; 1119:24;1122:11,24; 1123:12,18;1124:10, 13;1127:1,11,14; 1128:4;1130:18; 1132:17;1135:19; 1136:5;1143:3; 1146:23;1157:24; 1158:2;1159:18,24; 1160:1,8;1162:10; 1165:11;1175:8; 1178:14;1182:6; 1183:23;1185:19; 1186:10;1187:1,1,3; 1190:11;1196:14,24; 1197:8;1198:9;1200:3; 1201:4;12	

term (3) 1156:8;1218:8,10	1166:21;1186:7; 1198:1;1205:14; 1217:11	1166:19	towards (7) 1106:7;1112:17; 1113:10;1177:4; 1178:8;1213:14,14	1113:8
term- (1) 1176:18	tests (4) 1153:23;1181:16; 1197:24;1215:15	Throughout (4) 1157:24;1158:2; 1190:10;1218:2	trout (3) 1101:3;1107:23; 1108:3	Truckee (1) 1108:2
terminated (1) 1156:18	tetradic (1) 1209:24	thus (3) 1135:2;1143:16; 1165:17	trajectory (1) 1113:10	true (9) 1142:16;1148:4,12, 13;1160:14;1176:6; 1215:21;1218:19; 1230:13
termination (1) 1161:1	Texas (1) 1102:6	tied (2) 1118:2;1154:2	transcribed (1) 1230:10	try (5) 1107:9;1141:21; 1164:20;1181:17; 1210:17
terms (10) 1111:5;1121:9; 1123:15;1127:21; 1132:16;1134:14; 1147:2;1163:18; 1210:4;1215:2	Thanks (4) 1138:2;1173:1; 1185:21;1187:8	tiered (9) 1101:22;1103:13; 1118:7;1120:12,13,18; 1124:11;1144:9,11	transcript (1) 1230:12	trying (8) 1106:8,12,13; 1157:3;1163:14; 1173:6;1180:4; 1226:14
terrain (1) 1180:15	Theis (1) 1186:19	tilapia (13) 1113:21;1114:3,3,7, 8,11,14,18;1115:5; 1159:18;1160:1,6,7	transcription (1) 1230:14	T's (1) 1184:4
territory (3) 1168:23;1169:2,10	theoretically (1) 1180:5	till (1) 1151:21	transfer (3) 1200:14,18;1206:2	turn (3) 1139:1;1158:17; 1206:7
test (86) 1106:10,11;1116:8, 10;1118:22,22;1119:5, 22;1121:13;1124:2,19, 22;1125:6;1136:14; 1137:14,15;1145:8; 1147:8;1153:20; 1154:4,5;1161:3; 1162:11;1179:3,6,10; 1181:6,13,14,16,16,17, 17,21;1182:1,11,16; 1183:10,14;1184:19, 20;1185:12;1186:15; 1187:15,21;1188:3,4,5, 7,10,10,12,14,18,21; 1189:14;1190:1,3,6,9, 10,20,23;1191:1,3,9, 10,11,21;1192:6,13,18, 21;1197:22;1198:19, 21;1199:2,16,17; 1205:5,7,12,16; 1218:21;1219:23; 1226:23	theory (1) 1154:7	Tim (4) 1093:18;1128:23,24; 1155:7	transferred (2) 1100:3;1171:4	turned (1) 1187:20
tested (3) 1179:9;1181:2; 1182:4	thereafter (1) 1230:10	timer (1) 1212:13	transfers (1) 1204:19	Turning (1) 1210:21
testified (4) 1130:23;1131:12; 1207:18;1225:23	thereby (1) 1186:10	times (2) 1186:16;1187:9	transmissive (6) 1179:11;1180:6; 1185:10,13;1189:12; 1209:3	two (16) 1096:22;1105:4; 1111:16;1112:5; 1117:15;1122:4,5; 1123:23;1148:5,9; 1186:18;1210:7,8,14; 1212:5,18
testify (1) 1098:17	Therefore (1) 1143:13	timing (2) 1216:21,22	transmissivities (1) 1184:3	type (8) 1123:16;1147:6; 1155:9;1163:14; 1183:9;1190:11; 1217:22;1221:10
testifying (1) 1188:22	thereof (1) 1183:12	title (2) 1167:12;1192:16	transmissivity (2) 1183:20;1186:8	typewriting (1) 1230:10
testimony (25) 1108:19;1109:17,21; 1128:21;1143:2; 1162:5,9;1166:12; 1168:11,13,19; 1173:16;1178:18; 1179:2;1187:13; 1197:7;1206:22; 1214:23;1219:5; 1224:9;1225:7,23; 1226:2,10;1227:14	Therese (1) 1228:11	today (17) 1098:1;1106:2; 1107:13;1115:5; 1129:20;1130:12; 1144:18;1166:6,12; 1169:15;1173:16; 1176:16;1212:18; 1223:8,11;1225:24; 1226:2	transmittal (1) 1196:13	typo (2) 1197:18,19
testing (5)	thereto (1) 1170:21	today's (3) 1125:6;1164:6; 1206:2	transmitted (1) 1208:24	U
	thermal (2) 1110:9;1122:9	together (2) 1119:23;1122:19	transmitting (1) 1209:4	Umstock (2) 1190:16,16
	thermophilics (1) 1110:18	told (1) 1210:3	trap (1) 1142:5	unappropriated (1) 1108:1
	thickness (1) 1210:10	took (5) 1107:16;1203:5; 1226:24;1227:1; 1230:7	treat (1) 1214:20	unauthorized (1) 1142:24
	think's (1) 1175:5	top (3) 1116:6,6;1145:9	treason (1) 1221:22,22	uncertainty (3) 1163:12,14,18
	third (4) 1108:9;1112:9; 1126:12;1222:5	topic (2) 1104:12;1197:20	trends (1) 1222:11	unconfined (1) 1187:7
	though (4) 1122:3;1135:7; 1217:2;1226:11	topics (2) 1153:4,12	tribe (5) 1108:2;1118:21; 1212:23;1218:5; 1224:3	undefined (1) 1186:22
	thought (4) 1106:13;1130:4; 1152:24;1217:21	tortoise (2) 1100:17;1102:7	tributaries (1) 1110:22	under (26) 1100:20;1119:1; 1124:9;1125:15,22;
	thousand (1) 1210:13	total (4) 1113:9;1150:5; 1160:8;1170:1	trigger (13) 1116:16;1130:19; 1140:6,12;1156:2; 1161:6;1166:20; 1170:14,15;1195:9,21; 1205:9;1228:4	
	threat (2) 1115:2,7	toward (1) 1119:2	triggers (25) 1103:16;1116:12; 1117:16,24;1118:3,6, 10,12;1119:5,10; 1120:9;1121:6,8,10; 1124:8,9;1125:23; 1126:1,5,8,18;1144:7; 1162:18,22;1166:16	
	threatened (1) 1103:6		tripled (1)	
	threats (2) 1115:4;1171:20			
	three (6) 1104:19;1107:19; 1147:22;1155:15; 1187:7;1188:19			
	three-state (1) 1100:7			
	threshold (1)			

1096:4 welfare (1) 1201:10 well-being (3) 1172:11,19;1203:17 wells (29) 1101:9;1176:22; 1177:15,17;1180:3; 1181:3;1182:5;1188:8, 19;1192:12;1196:20, 24;1199:23;1200:8; 1203:19,24;1204:3; 1205:21;1206:4,18; 1209:11;1210:19; 1211:24;1212:1,5; 1218:12,21;1227:5,19 weren't (1) 1165:16 West (22) 1112:9;1116:3,5,7, 11;1117:8,12;1121:17; 1127:4;1128:2; 1130:18;1140:15; 1149:3,13;1154:8; 1157:24;1162:24; 1163:20;1170:14; 1195:7;1205:10; 1222:12 western (1) 1178:2 what's (11) 1106:10;1115:18,19, 24;1116:9;1124:23; 1128:6;1164:14,20; 1215:1;1220:14 WHITE (35) 1092:8;1096:7; 1098:15;1099:3; 1102:17;1105:16; 1106:19;1108:21; 1109:4;1127:1,10,14; 1128:4;1130:17; 1143:3;1146:23; 1165:11;1175:8; 1176:20;1196:14; 1197:8;1200:2;1201:4; 1204:20;1207:20; 1210:19;1218:2,12,17; 1219:1;1220:12; 1225:15,17;1226:12; 1227:6 whole (1) 1186:21 Wildlife (43) 1099:9;1100:2,13; 1101:8,14;1102:5,11; 1103:12;1107:15; 1109:11;1113:5,6,13; 1114:17,18;1118:21, 24;1120:2;1122:6; 1124:19;1126:15; 1128:15;1130:9,13; 1132:16;1133:4;	1134:2,2,3,22;1136:2; 1138:11;1139:19; 1142:12;1150:9; 1152:11;1156:10; 1175:15;1178:17; 1194:9;1195:4,4; 1212:16 Williams (44) 1097:21;1098:14,19, 22;1102:9,15;1104:7, 13,22;1105:8,13,18; 1106:17;1118:14,15; 1124:14,16;1128:5,6; 1130:8,10;1133:13,17, 23;1134:5,8;1138:10, 15,18;1142:3,8; 1147:3;1150:18; 1153:19,22;1155:13, 24;1156:3,12;1161:8, 15;1163:22,24; 1202:22 Williams' (1) 1108:19 willing (1) 1205:8 Willow (3) 1180:10,24;1184:22 WILSON (2) 1155:7,7 winter (5) 1131:21,21;1132:9, 21,22 wished (1) 1196:9 withdraw (1) 1153:17 withdrawal (2) 1139:19;1171:6 withdrawals (3) 1143:20;1152:4; 1214:7 withdrawn (1) 1215:13 WITHIN (24) 1092:8;1103:17,23; 1124:4;1135:3,6; 1144:1,2;1155:9; 1165:13;1167:3; 1181:13;1182:15; 1187:2;1193:19; 1196:18,23;1197:15; 1201:10;1213:18; 1214:19;1215:8,11; 1230:9 without (8) 1104:22;1107:10,11; 1163:13;1179:11; 1201:16;1218:13; 1220:9 witness (4) 1166:7;1193:12; 1194:3;1201:1 witnesses (7)	1097:20,24;1098:5, 9;1104:18;1167:23; 1168:6 wonder (1) 1226:14 work (18) 1100:15;1101:15; 1102:1,2,4;1104:5,10; 1159:13;1174:1,12,13; 1178:2,4;1184:2; 1185:23;1209:13; 1219:13;1223:10 worked (10) 1099:12;1100:2; 1102:12;1103:2,6,15, 19,21,24;1167:17 working (12) 1099:13;1100:4,19; 1101:15,21;1102:7,23; 1103:12;1106:1; 1119:23;1173:6; 1178:7 wound (1) 1142:5 wrap (1) 1172:2 wraps (1) 1172:15 writing (1) 1124:17 written (2) 1196:9,10 wrong (1) 1175:6	Young (1) 1099:6 Z Zane (2) 1097:21;1147:4 zone (16) 1180:11;1183:2,4,6, 11,11,11,13,19; 1184:11,13,13;1185:2, 3,6,12 zones (1) 1183:15 0 01 (1) 1210:13 03 (1) 1186:22 1 1 (8) 1140:14;1177:17; 1196:15;1202:23; 1203:7;1210:21; 1223:19,22 1,500 (1) 1113:8 1,800 (1) 1179:10 1.9 (1) 1186:16 1:00 (1) 1229:2 10:25 (1) 1165:22 10:30 (1) 1151:21 1092 (1) 1230:13 1092-1230 (1) 1092:19 1098 (1) 1095:3 11 (1) 1131:8 11:58 (1) 1229:4 1130,1207 (1) 1095:4 1133 (1) 1095:5 1137 (1) 1095:6 1138 (1) 1095:7 1142 (1) 1095:9 1146 (1) 1095:10	1148 (1) 1095:4 1150 (1) 1095:5 1152,1155 (1) 1095:9 1158 (1) 1095:3 1167 (1) 1095:6 1169 (38) 1106:7;1116:8; 1118:22,22;1124:2; 1126:4;1136:14; 1161:3;1162:10; 1163:6,7,11;1166:21; 1184:19;1187:15; 1188:12,16,17,21; 1189:14;1190:1,2,20; 1191:3;1192:6,13,18, 21;1197:21,24;1198:4; 1199:2,15;1205:5,7; 1218:21;1219:23; 1226:23 12 (2) 1131:8;1168:20 120 (1) 1110:12 1213 (1) 1095:5 1217 (1) 1095:3 1222 (1) 1095:8 1228 (1) 1095:11 1230 (1) 1230:13 13 (4) 1129:11;1134:6; 1158:9;1203:9 1303 (17) 1096:7,19;1165:12; 1166:23;1173:3,18; 1174:6;1175:1,2; 1199:7,10;1200:6; 1201:14,18;1210:24; 1211:15;1226:16 14,400 (1) 1171:10 143 (1) 1181:4 144 (1) 1181:4 15-minute (1) 1165:21 16 (1) 1139:20 16,000 (5) 1161:23;1162:7; 1163:2,4,4 16,100 (4) 1120:7;1123:24;
		Y year (10) 1099:8;1127:11; 1132:18;1135:1,7; 1148:8,14;1173:24; 1206:20;1228:16 years (22) 1099:5,12;1102:23; 1103:1;1108:14; 1109:10;1110:13; 1112:23;1116:14; 1131:8,11;1134:6; 1158:22;1159:5; 1161:5;1167:18,18; 1201:8;1203:9; 1211:12,20;1222:4 years' (1) 1174:2 yellow (1) 1191:12 yellowish-colored (1) 1191:13 Yep (2) 1132:13;1186:22 yield (3) 1186:23;1187:7; 1210:7		

1124:6;1137:11 17-3 (1) 1142:10 18 (1) 1149:8 1865 (2) 1169:11,12 1978 (1) 1099:19 1979 (2) 1099:6;1173:24 1980 (1) 1171:11 1983 (2) 1169:21;1172:8 1988 (1) 1169:21 1991 (1) 1107:20 1992 (2) 1100:12;1169:23 1995-'96 (1) 1114:7 1997 (3) 1100:22;1101:7; 1102:10 1998 (4) 1101:8;1106:2; 1107:24;1128:24 1st (1) 1230:17	1192:3,18 2010 (4) 1103:20;1190:22; 1192:3,18 2011 (5) 1101:10,24;1102:10; 1130:9;1173:22 2012 (4) 1114:16,24;1159:19; 1210:3 2013 (1) 1106:11 2015-'16 (1) 1159:12 2017 (5) 1131:21;1132:9,14; 1159:1;1160:10 2018 (1) 1196:12 2019 (12) 1092:20;1096:1; 1131:7,21;1148:17; 1159:1;1160:10,21; 1161:1;1210:21; 1230:6,18 20-something (1) 1125:12 210 (1) 1092:9 215 (1) 1092:10 217 (1) 1092:11 218 (1) 1092:12 219 (1) 1092:13 22 (1) 1111:21 23rd (1) 1196:12 24 (1) 1103:1 25 (2) 1202:23;1203:3 26 (1) 1221:17 27 (4) 1102:23;1111:17,20, 22 28 (2) 1111:17,21 29 (1) 1132:10 290,000 (1) 1184:1 29th (1) 1138:13	1142:4;1146:14; 1168:17;1174:22; 1177:17;1191:13; 1198:17 3,000 (1) 1208:21 3,000-foot (1) 1220:5 3,147 (1) 1170:1 3,250 (1) 1169:16 3,700 (2) 1171:7,8 3.2 (34) 1116:11;1121:7,17, 23;1123:22,22; 1124:10,21;1125:16; 1126:1,6;1127:4,15,17; 1128:2,13;1130:16; 1134:11;1140:12; 1146:16;1151:5; 1152:19,23;1153:1,4, 13;1157:9,13;1161:9, 12,20;1162:24; 1163:12;1164:17 3.3 (1) 1116:15 3.4 (1) 1116:15 3.5 (1) 1128:16 30 (3) 1092:20;1096:1; 1110:20 30-foot-wide (1) 1208:20 30th (1) 1230:6 3-1 (1) 1111:7 32 (4) 1110:20;1112:15,15; 1132:12 3-2 (1) 1113:24 33 (1) 1227:2 3-3 (1) 1158:17 35 (1) 1167:17 37 (1) 1139:1 38 (1) 1105:10 380,000 (1) 1183:21 3A (1) 1148:7 3M (1) 1195:6	4 4 (6) 1140:7;1180:23; 1191:14;1211:13; 1220:15,23 4,000 (2) 1127:11;1164:8 4,100 (1) 1120:20 4,200 (1) 1175:20 4.4 (1) 1184:7 40 (2) 1125:11;1174:2 40th (1) 1173:24 460 (1) 1148:14 460-acre-feet (1) 1148:8 477 (1) 1172:9 49 (1) 1132:12 4E (1) 1148:9	6,79 (1) 1228:19 6,791 (2) 1204:14;1206:19 6,791-acre-feet (2) 1228:16,19 6-2 (1) 1097:16 6259 (1) 1202:5 6261 (1) 1202:5 6-7 (1) 1097:16
2			5	7
2 (6) 1124:13;1140:11; 1177:17;1198:17,18; 1210:21 2,500 (1) 1171:13 2.7 (4) 1121:7;1124:11; 1144:7,12 2.78 (3) 1124:12;1144:5,10 20 (1) 1167:18 200,000 (1) 1183:21 2000's (1) 1114:16 2004-2005 (3) 1188:2,15;1191:2 2006 (11) 1102:22;1133:14; 1134:6;1166:16; 1170:2,8,15,20,24; 1179:8;1202:20 2006-'7 (1) 1159:11 2008 (6) 1113:8;1138:13; 1159:19;1190:22;			7 (11) 1097:15;1099:10,10, 13,18,19;1103:10,13; 1104:17;1116:1; 1223:21 70 (1) 1171:6 724 (2) 1171:23;1202:23 75 (2) 1112:24;1157:10 79 (1) 1169:2 7A-1 (1) 1119:1	
			6	8
			6 (1) 1100:20 6,000 (3) 1112:23;1127:11; 1164:8	8 (2) 1104:17;1147:5 8,500 (2) 1169:2,17 87 (1) 1113:11 88 (1) 1132:12
	3			9
	3 (9) 1124:13;1140:7;			9 (6) 1104:17;1142:16,20, 23;1143:17,22 9,000 (3) 1120:13;1213:24; 1214:2 95 (1) 1112:3 97 (2) 1101:10;1102:10

In The Matter Of:
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCED
DIVISION OF WATER

Vol. VI
September 30, 2019

Capitol Reporters
123 W. Nye Lane, Ste 107

Carson City, Nevada 89706

Original File 093019pmfinalWater.txt
Min-U-Script® with Word Index

SE ROA 53491

JA_17888

1 STATE OF NEVADA
2 DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
3 DIVISION OF WATER RESOURCES
4 BEFORE MICHELINE FAIRBANK, HEARING OFFICER
5 ---oOo---
6 IN THE MATTER OF THE ADMINISTRATION
7 AND MANAGEMENT OF THE LOWER
8 WHITE RIVER FLOW SYSTEM WITHIN
9 COYOTE SPRING VALLEY HYDROGRAPHIC
10 BASIN (210), A PORTION OF BLACK
11 MOUNTAIN'S AREA HYDROGRAPHIC
12 BASIN (215), GARNET VALLEY
13 HYDROGRAPHIC BASIN (216), HIDDEN
14 VALLEY HYDROGRAPHIC BASIN (217),
15 CALIFORNIA WASH HYDROGRAPHIC BASIN
16 (218), AND MUDDY RIVER SPRINGS AREA
17 (AKA UPPER MOAPA VALLEY HYDROGRAPHIC
18 BASIN (219)).

13 _____ /
14 TRANSCRIPT OF PROCEEDINGS
15 PUBLIC HEARING
16 HEARING ON ORDER 1303
17 VOLUME VI
18 (P.M. SESSION, Pages 1231 - 1369)

19 MONDAY, SEPTEMBER 30, 2019

20 REPORTED BY: CAPITOL REPORTERS
21 Certified Shorthand Reporters
22 BY: CHRISTY Y. JOYCE, CCR
23 Nevada CCR #625
24 123 W. Nye Lane Suite 107
Carson City, Nevada 89706
(775)882-5322

1 A P P E A R A N C E S
(Continued)
2
3 For SNWA: Taggart & Taggart, Ltd.
By: Paul G. Taggart, Esq.
4 Carson City, Nevada
-and-
5 Tim O'Connor, Esq.
6 For CSI: Robison, Belaustegui, Sharp
& Low
7 By: Kent R. Robison, Esq.
Reno, Nevada
8
9 For CSI: Brownstein Hyatt Farber Schreck
By: Bradley J. Herrema, Esq.
Los Angeles, California
10
11 For NV Energy: Justina Caviglia, Esq.
Reno, Nevada
12 For Lincoln County
Water District/
13 Vidler Water Company: Allison MacKenzie
By: Karen Peterson, Esq.
14 Carson City, Nevada
15 For NCA: Alex Flangas, Esq.
Reno, Nevada
16
17 For Moapa Band of Paiutes: Richard Berley, Esq.
18
19 For Moapa Valley
Water District: Greg Morrison, Esq.
20 For Muddy Valley Irrigation: Steve King
For Bedroc: Therese Ure, Esq.
21 For City of North Las Vegas: Therese Ure, Esq.
22 For National Park Service: Karen Glasgow
23 For Center for Biologic
Diversity: Patrick Donnelly
24

1 A P P E A R A N C E S

2
3 Micheline N. Fairbank,
Hearing Officer
4
5 Tim Wilson,
Acting State Engineer
6 Adam Sullivan,
Deputy State Engineer
7
8 Melissa Flatley,
Chief of the Hearing Officer Section
9 Michelle Barnes,
Supervising Professional Engineer
10
11 Levi Kryder,
Chief of the Hydrology Section
12 Jon Benedict,
Senior Hydrologist
13
14 Christi Cooper,
Well Supervisor
15 Bridget Bliss,
Basin Engineer
16
17
18
19
20
21
22
23
24

1 I N D E X
2 WITNESS PAGE
3 2-WITNESS PANEL CONSISTING OF JAY LAZARUS and JOSEPH DAVIS
4 Cross-Examination by Mr. Donnelly 1236
5 Cross-Examination by Ms. Harrison 1239
6 Cross-Examination by Mr. King 1241
7 Cross-Examination by Ms. Ure 1243
8 Examination by Mr. Benedict 1243
9 Examination by Ms. Barnes 1244
10 Examination by Hearing Officer Fairbank 1244
11 Cross-Examination by Mr. Herrema 1245
12 Cross-Examination by Mr. Taggart 1248
13 Cross-Examination by Mr. Frehner 1249
14
15 5-WITNESS PANEL CONSISTING OF NORMAN CARLSON, THOMAS BUTLER,
TODD UMSTOT, PETER MOCK, AND GREG BUSHNER
16
17 NORMAN CARLSON
18 Direct Examination by Ms. Peterson 1257
19 THOMAS BUTLER
20 Direct Examination by Ms. Peterson 1279
21 TODD UMSTOT
22 Direct Examination by Ms. Peterson 1291
23 PETER MOCK
24 Direct Examination by Ms. Peterson 1318

1 INDEX
2 (Continued)
3 WITNESS PAGE
4 5-WITNESS PANEL
5 Cross-Examination by Mr. Herrema 1323
6 Cross-Examination by Ms. Glasgow 1327
7 Cross-Examination by Mr. Berley 1332
8 Cross-Examination by Mr. Taggart 1336
9 Cross-Examination by Mr. Morrison 1343
10 Cross-Examination by Ms. Ure 1347
11 Cross-Examination by Ms. Caviglia 1349
12 Examination by Mr. Benedict 1351
13 Examination by Mr. Kryder 1360
14 Examination by Mr. Sullivan 1362

1 decline in groundwater levels. But I would have to go back
2 and look at the data.
3 Q. If there was a decline in groundwater levels
4 would that indicate that the system is out of steady state?
5 An ongoing decline, I should say.
6 A. Can you repeat that?
7 Q. If there were an ongoing decline in carbonate
8 groundwater levels would that imply that the system was not
9 in a steady state?
10 A. Yes.
11 Q. And would that then imply that current pumping is
12 too high for a steady state to be achieved?
13 A. It all depends on the location.
14 Q. You based your recommendation for pumping on the
15 State Engineer's recommendation. I believe you quoted text
16 from actually Order 1303. Are you saying that the number
17 you've provided is contingent on location as much as the
18 actual number?
19 MR. MORRISON: I object. I don't --
20 (The court reporter interrupts)
21 MR. MORRISON: Greg Morrison, Moapa Valley Water
22 District's attorney. Mr. Lazarus didn't provide a number in
23 his report, so I object to the implication that he did.
24 MR. DONNELLY: I'll restate.

1 CARSON CITY, MONDAY, SEPTEMBER 30, 2019, P.M. SESSION
2 ---oOo---
3 HEARING OFFICER FAIRBANK: Okay. Let's go ahead
4 and go back on the record. And next up will be the Center
5 for Biological Diversity.
6 CROSS-EXAMINATION
7 By Mr. Donnelly:
8 ANSWERS BY MR. REICH:
9 Q. Thank you. Patrick Donnelly, Center for
10 Biological Diversity. I will be brief. Mr. Lazarus, if you
11 could take a look at the exhibit I've put there. It is
12 Exhibit 3-3 from SNWA's rebuttal report. It's a series of
13 hydrographs for CSVM-1. I have it written down on my
14 computer which one is there. CSVM-1, Paiute TH-2 and GV-1.
15 There we go. And SNWA put a trend line on from 2016 until
16 current showing a decline in levels in those wells since
17 then. Do you agree with that trend line and that assessment?
18 A. I would have to have time to look at this because
19 there's continuous monitoring and periodic measurements. So
20 I would have to look at the individual measurements.
21 Q. So you're not able to look at this and say
22 whether those charts show a decline in groundwater levels as
23 measured and displayed there?
24 A. As you have -- As someone drew on there, it shows

1 Q. (By Mr. Donnelly) The report implied that the
2 number from the State Engineer was agreed with. There was an
3 implication in the report that the finding in Order 1303 that
4 groundwater levels were stable and that pumping, current
5 pumping, is sustainable was implied in the report. Is that
6 true?
7 A. Additional data is needed. That is true, but I
8 also said additional data is needed.
9 Q. So do you have sufficient data to know whether
10 the current groundwater rights of the water district are a
11 sustainable pumping amount or is additional data needed to
12 even know if that's a sustainable amount?
13 A. The hydrographs we showed of Pederson and
14 Pederson East showed a flat -- no decline in discharge
15 significantly since the end of the pumping test. And the
16 district has been pumping since then. We use those to make
17 our presentation today.
18 Q. What do you think about the potential for
19 carbonate monitoring wells declining, given what you just
20 said?
21 A. Well, we would have to look at each well.
22 Q. So static levels, relatively static levels, at
23 Pederson is the justification for I believe it was 6700
24 acre-feet of carbonate water rights?

1 MR. MORRISON: I'll object again. He never
2 stated a number.
3 Q. (By Mr. Donnelly) Of the existing Moapa Valley
4 Water District carbonate water rights which were detailed in
5 the presentation just given and it was asserted that that's a
6 sustainable amount of pumping. Is the basis of that
7 statement that there are stable water levels at Pederson East
8 over a given period of time?
9 A. I believe that inaccurately characterizes my
10 testimony.
11 Q. Okay. Please recharacterize it for me.
12 A. At current levels of pumping in the seven basin,
13 super basin, it appears that Pederson and Pederson East have
14 pretty much stable flows for the last several years.
15 MR. DONNELLY: Thank you.
16 HEARING OFFICER FAIRBANK: Georgia Pacific and
17 Republic.
18 CROSS-EXAMINATION
19 By Ms. Harrison:
20 ANSWERS BY MR. LAZARUS:
21 Q. Good afternoon. Sylvia Harrison for Republic
22 Environmental Technologies and Georgia Pacific. Just a
23 question for Mr. Lazarus. Mr. Lazarus, were you present
24 during the presentation of US Fish and Wildlife Service last

1 week?
2 A. Yes, I was.
3 Q. Do you recall Ms. Braumiller's testimony
4 regarding her hypothesis about a separate source for the Big
5 Muddy Springs which would be or which could be different from
6 the Pederson Spring source or the Pederson Springs area
7 source?
8 A. Vaguely.
9 Q. I'll refresh your memory. I believe that she
10 testified that there was a significantly different hydrograph
11 for Big Muddy Springs and that she thought the water was
12 notably hotter and testified that there was a potential
13 source from deep carbonates possibly from Lower Meadow Valley
14 Wash. Does that sound correct based on your recollection?
15 A. My memory is not as good as yours, but I'll take
16 your word for it.
17 Q. All right. Would you agree that the estimate of
18 about 15 percent of the Muddy River flow being contributed by
19 Big Muddy Springs sound accurate to you?
20 A. I don't know.
21 Q. If that were the case would you agree that
22 investigating a possible source for that spring would be a
23 very potentially significant undertaking for the district?
24 A. Can you maybe simplify that question?

1 Q. Sure. Would you agree that it's important for
2 the district to understand the sources of water to the Muddy
3 River?
4 A. I think it's important for all of the
5 stakeholders.
6 Q. Has the district evaluated the possibility of any
7 other sources to the Muddy River other than the alluvial and
8 carbonate aquifers?
9 A. A long time ago the district had a cost estimate
10 for a surface water diversion.
11 Q. But as far as actual natural sources there hasn't
12 been any investigation other than the carbonate aquifer and
13 alluvial aquifer sources; correct?
14 A. To the best of my knowledge that is correct.
15 MS. HARRISON: Thank you. That's all I have.
16 HEARING OFFICER FAIRBANK: Nevada Cogen? Seeing
17 no questions.
18 Muddy Valley Irrigation Company.
19 CROSS-EXAMINATION
20 By Mr. King:
21 Q. Good afternoon, Mr. Davis, Mr. Lazarus. I'm
22 Steve King for Muddy Valley Irrigation Company. Just several
23 questions and for either one of you who should answer. Are
24 you aware that Muddy Valley Irrigation Company, my clients,

1 interest in this proceeding is to protect the senior decreed
2 water rights that were adjudicated in the Muddy River Decree?
3 MR. DAVIS: Joseph Davis. Yes.
4 MR. LAZARUS: Jay Lazarus. Yes. And we also are
5 shareholders in the MVIC.
6 MR. KING: Thank you. That was my next question
7 for the record to show that the Moapa Valley Water District
8 is a shareholder in Muddy Valley Irrigation Company.
9 Then there's been as part of the presentation and
10 the reports that Moapa Valley Water District has filed
11 discussion on the Jones Spring and how important that
12 resource is to the Moapa Valley Water District and that
13 that's been dedicated to support the Moapa case under the
14 memorandum of agreement. Do you recall that discussion?
15 MR. LAZARUS: Yes.
16 MR. KING: And then just to, for the record,
17 isn't it also accurate that that Jones Spring right, the base
18 right for that, actually emanates from the Muddy River
19 decreed senior rights that the Muddy Valley Irrigation
20 Company was awarded in the decree; is that correct?
21 MR. DAVIS: Joseph Davis. Yes.
22 MR. KING: Those are my questions. Thank you,
23 Gentlemen.
24 HEARING OFFICER FAIRBANK: Bedroc.

1 CROSS-EXAMINATION
 2 MS. URE: Good afternoon. Therese Ure
 3 representing Bedroc. Did you make any independent analysis
 4 of the alluvium water rights in Coyote Springs Valley and
 5 their effect on the Muddy River Springs area?
 6 MR. LAZARUS: No.
 7 MS. URE: Thank you.
 8 HEARING OFFICER FAIRBANK: Nevada Energy.
 9 MS. CAVIGLIA: No questions.
 10 HEARING OFFICER FAIRBANK: Seeing no questions,
 11 I'll go ahead and open it up to Division of Water Resources
 12 staff and the State Engineer.
 13 EXAMINATION
 14 By Mr. Benedict:
 15 Jon Benedict for the record. I would like to go
 16 back to the gradient slide, I think it's slide number seven,
 17 if you wouldn't mind. So there's relatively limited data
 18 with respect to water levels between the various wells out
 19 there. And I guess I just want your opinion. You've
 20 indicated that the gradients are relatively consistent,
 21 suggesting that Coyote Spring Valley is part of this system.
 22 And I'm just curious would additional data -- I mean, is it
 23 possible that additional data could show gradients that are
 24 steeper if you had those data?

1 earlier in the hearing. And do you recall US Fish and
 2 Wildlife Service's recommendation for the inclusion of the
 3 Lower Meadow Valley Wash in the Lower White River Flow System
 4 basins?
 5 A. I think so.
 6 Q. And did you do any analysis or do you have an
 7 opinion regarding the inclusion of the Lower Meadow Valley
 8 Wash?
 9 A. I did not. And so, no, I don't.
 10 HEARING OFFICER FAIRBANK: Okay. Thank you.
 11 All right. Given that we have additional time,
 12 we'll go ahead and open it back up for additional questions.
 13 Coyote Spring Investments, do you have any additional
 14 questions?
 15 MR. HERREMA: We just have one topic we want to
 16 hit.
 17 HEARING OFFICER FAIRBANK: Okay. So what we'll
 18 do is we'll go ahead and given the amount of time that we
 19 have left, we'll limit you to not more than five minutes.
 20 CROSS-EXAMINATION
 21 By Mr. Herrema:
 22 ANSWERS BY JAY LAZARUS:
 23 Q. Brad Herrema again for the record for CSI.
 24 Mr. Lazarus, on page five of your report under the section

1 MR. LAZARUS: Well, it's going to be hard to get
 2 a flatter gradient. But even if -- Yes, it is possible that
 3 gradients could be steeper. But, like I said, there's not a
 4 30-foot drop there in 3,000 feet deep. It just means that
 5 that flow might be a little slower but it's all connected.
 6 MR. BENEDICT: Okay. All right. Thank you.
 7 EXAMINATION
 8 MS. BARNES: Michelle Barnes for the record.
 9 Just to follow up on this slide. I'm just curious if you say
 10 the gradients were consistent if you looked at multiple times
 11 of year, multiple years, or is this average or a snapshot in
 12 time?
 13 MR. LAZARUS: It's a snapshot in time.
 14 MS. BARNES: Do you know for, I guess, what
 15 season are all the wells on the same measurement?
 16 MR. LAZARUS: I would have to go back and look.
 17 MS. BARNES: Okay. Thank you.
 18 EXAMINATION
 19 By Hearing Officer Fairbank:
 20 ANSWERS BY MR. LAZARUS:
 21 Q. Mr. Lazarus, Micheline Fairbank. I have one or
 22 two questions for you. Do you recall -- Previously you
 23 stated that you were present or you were listening to the
 24 testimony by the United States Fish and Wildlife Service

1 regarding movement of water rights, it's that top paragraph
 2 that I'll just read so we have it on the record. It says,
 3 the timing and magnitude of carbonate pumping effects on
 4 spring discharge is dependent on the volume of water pumped
 5 and the proximity of a pumping center to the springs. The
 6 closer it is, the sooner it will occur. The further away it
 7 is, the longer it will take to show effects. But in any
 8 case, all cumulative carbonate pumping in the seven
 9 inter-connected basins will eventually cause depletions on
 10 the Muddy River Springs.
 11 When you refer here to the magnitude of the
 12 effects of carbonate pumping on spring discharge being
 13 dependent on proximity of the pumping center to the spring,
 14 does the concept of magnitude here suggest that there's a
 15 level of pumping that will not affect spring flow?
 16 A. I don't know. As I said earlier, I would like to
 17 see more data so that we can suss that out.
 18 Q. Okay. Are there other forms of discharge from
 19 the Lower White River Flow System? We've heard that water
 20 from the carbonate aquifer supports flow from the Muddy River
 21 through the alluvium downstream of the springs. Would you
 22 agree that the impacts of the carbonate pumping might be
 23 downstream of the springs?
 24 A. Could you give me the first part of that? Can

1 you repeat the question, please?

2 Q. Are there also other forms of discharge out of

3 the Lower White River Flow System beyond just the spring

4 flow?

5 A. Such as?

6 Q. Evapotranspiration.

7 A. Yes. Well, limited.

8 Q. Subsurface flow out of the Lower White River Flow

9 System?

10 A. Yes.

11 Q. Could pumping affect those forms of outflow as

12 well?

13 A. I guess it would depend on the location of the

14 pumping center.

15 MR. HERREMA: Okay. Thank you.

16 HEARING OFFICER FAIRBANK: United States Fish and

17 Wildlife Service. Seeing no questions.

18 National Park Service.

19 MS. GLASGOW: No questions.

20 HEARING OFFICER FAIRBANK: Moapa Band of Paiutes?

21 MR. MORRISON: No questions.

22 HEARING OFFICER FAIRBANK: No further questions.

23 Las Vegas Valley Water District and Southern

24 Nevada Water Authority.

1 Vidler.

2 CROSS-EXAMINATION

3 By Mr. Frehner:

4 ANSWERS BY MR. LAZARUS:

5 Q. Dylan Frehner for Lincoln County Water District

6 and Vidler Water Company.

7 Mr. Lazarus, wouldn't you agree that the greatest

8 threat to the Moapa dace is the pumping at the Arrow Canyon

9 wells?

10 A. No.

11 Q. You've been asked with regards to whether the

12 Lower Meadow Valley Wash should be included and you said you

13 had no opinion?

14 A. That is correct.

15 Q. Isn't it true that the district has applications

16 in the Lower Meadow Valley Wash?

17 A. That were denied.

18 Q. Do they have new applications pending?

19 MR. DAVIS: There is three applications that are

20 pending?

21 MR. FREHNER: In the Lower Meadow Valley Wash?

22 MR. DAVIS: Yes.

23 MR. FREHNER: But no analysis has been done as to

24 the impact of Lower Meadow Valley Wash on the Muddy River

1 CROSS-EXAMINATION

2 By Mr. Taggart:

3 ANSWERS BY MR. LAZARUS:

4 Q. Good afternoon. Again for the record Paul

5 Taggart on behalf of the District and the Water Authority.

6 Mr. Lazarus, there's been some talk about bypass

7 flow, underflow. You were just asked about it as well. Are

8 you familiar with the 2011 work by the water district and the

9 water authority that conducted some Darcy flow calculations

10 for flow in the Lower White River Flow System?

11 A. No, I'm not.

12 Q. Okay. So that's -- those analyses are not part

13 of the support for your opinion about that -- the occurrence

14 of underflow if there is any?

15 A. Correct.

16 Q. Okay. And then I just wanted to ask again if you

17 stated in your report that to maintain carbonate diversions

18 at current volumes no new subdivision parcel maps should be

19 approved that will require increased pumping. Did you say

20 that in your report?

21 A. Yes, that is in there.

22 MR. TAGGART: All right. Thank you. No further

23 questions.

24 HEARING OFFICER FAIRBANK: Lincoln County,

1 Springs area?

2 MR. DAVIS: Not to my knowledge.

3 Q. (By Mr. Frehner) Thank you. Going back to your

4 testimony with regards to KPW-1 in the aquifer test. Is it

5 your only evidence that the KPW-1 aquifer test showed no

6 boundaries the conclusion that is set forth in the URS 2006

7 report?

8 A. (By Mr. Lazarus) No. Can you please repeat

9 that? I want to make sure I got that.

10 Q. Is your only evidence that the KPW-1 aquifer test

11 showed no boundaries the conclusion set forth in the URS 2006

12 report?

13 A. The URS 2006 report states there were no

14 boundaries encountered. And I would sort of back that up by

15 looking at the drawdown in KMW-1 during the 1169 pumping

16 test. So no boundaries as a result of pumping stresses from

17 the south or from the north.

18 Q. When you updated your estimates of transmissivity

19 and storativity for the KPW-1 aquifer test did you evaluate

20 for the presence of faults?

21 A. No. Because there were none encountered during

22 the pumping test or recovery.

23 Q. Did you use the CSVM-4 data available during the

24 KPW-1 aquifer test to evaluate the presence or absence of

1 boundaries?
2 A. No.
3 Q. What distance from the KPW-1 well were you able
4 to evaluate with the KPW-1 aquifer test for the presence of
5 boundaries?
6 A. Well, specifically 143 feet away. But based on
7 the maps that were submitted by Lincoln-Vidler, the fault
8 zones that these wells were completed into was expansive and
9 in to the Coyote Springs Valley.
10 Q. How long did it take for the effects of pumping
11 at MX-5 well to reach the CSVM-1 well?
12 A. I would have to go back and look.
13 Q. You didn't evaluate that?
14 A. I know we looked at it. I said I would have to
15 go back and look.
16 Q. How long did it take for the effects of the
17 cessation of the pumping at MX-5 well to reach the CSVM-4
18 well?
19 A. We would have to go back and look at the
20 hydrographs. But, you know, in the system like this, and
21 it's straightforward in any system that behaves like this,
22 the further you are from the pumping center, the longer it's
23 going to take for the effects to hit it.
24 Q. Any time estimates that you calculated were they

1 MS. CAVIGLIA: No questions.
2 HEARING OFFICER FAIRBANK: Again, I'll open it up
3 to the State Engineer and staff. All right. Seeing that we
4 don't have any questions, Mr. Morrison, you have some
5 additional time left if you wanted to do any more redirect.
6 MR. MORRISON: I don't think we need it. Thank
7 you.
8 HEARING OFFICER FAIRBANK: Okay. Then we will go
9 ahead and conclude the presentation by the Moapa Valley Water
10 District and we'll move on to Vidler. To allow them a little
11 bit of time to get themselves situated, let's go ahead and
12 take about a five-minute break and we'll go back on the
13 record at 1:30.
14 Actually, let's go back on really quick. One
15 thing I wanted to provide clarification is Mr. Lazarus was
16 proffered as an expert in these proceedings and he was not
17 objected to. He's not -- Mr. Lazarus has not previously been
18 qualified by the State Engineer's office, so his
19 qualification will be limited to these proceedings based upon
20 the absence of any objection. Thank you.
21 (Break was taken)
22 HEARING OFFICER FAIRBANK: Let's go ahead and go
23 back on the record. So this is a continuation of the
24 hearing. And next up is the Lincoln County and Vidler Water

1 consistent with your estimates of transmissivity and
2 storativity from the KPW-1 aquifer test?
3 A. I didn't calculate any time estimates.
4 Q. Why don't KMW-1 and CSVM-4 wells respond to
5 fluctuations in pumping at the MX-5 well?
6 A. They did.
7 MR. FREHNER: Thank you.
8 HEARING OFFICER FAIRBANK: City of North Las
9 Vegas? Seeing no further questions.
10 Center for Biological Diversity. Seeing no
11 further questions.
12 Georgia Pacific Republic.
13 MS. HARRISON: No further questions.
14 HEARING OFFICER FAIRBANK: No further questions.
15 Nevada Cogeneration? Seeing no questions.
16 Muddy Valley Irrigation Company.
17 MR. KING: No questions.
18 HEARING OFFICER FAIRBANK: No additional
19 questions.
20 Bedroc?
21 MS. URE: No.
22 HEARING OFFICER FAIRBANK: No additional
23 questions.
24 And Nevada Energy?

1 Company.
2 MS. PETERSON: Thank you. Karen Peterson and
3 Dylan Frehner representing Lincoln County Water District and
4 Vidler Water Company. And we have a panel of the five
5 experts that have submitted reports to the State Engineer's
6 office, either initial reports and/or rebuttal reports. And
7 I'm going to have -- We are going to present our witnesses as
8 a panel because we are very concerned that we want to get all
9 the information in in the allotted time that we have. We
10 would like to reserve 15 minutes at the end of our
11 presentation for redirect.
12 HEARING OFFICER FAIRBANK: Okay. Let's go ahead
13 and have the witnesses sworn in if we may.
14 (Five witnesses were sworn in)
15 MS. PETERSON: Gentleman, I'd ask each of you to
16 state your full name and spell your last name for the record.
17 MR. BUSHNER: Greg Bushner, B-u-s-h-n-e-r.
18 MR. UMSTOT: Todd Umstot, T-o-d-d U-m-s-t-o-t.
19 MR. CARLSON: Norman Carlson, C-a-r-l-s-o-n.
20 MR. BUTLER: Thomas Butler. Butler B-u-t-l-e-r.
21 MR. MOCK: Peter Mock, M-o-c-k.
22 MS. PETERSON: And I'll just briefly go through
23 and indicate the witnesses that have been qualified as
24 experts before by the State Engineer and the areas that

1 they're being offered in today. So Mr. Bushner has been
2 qualified by the State Engineer as an expert in hydrogeology
3 and obviously that would be the qualification we would ask
4 for today. And nobody objected.

5 Dr. Mock we seek to have qualified by the State
6 Engineer as an expert hydrologist and geologist with a
7 specialty in groundwater modeling in computational hydrology.
8 And no one has objected to that designation as an expert.

9 Mr. Butler has been qualified by the State
10 Engineer in previous proceedings as an expert in geology and
11 geochemistry. And we would ask for that same designation in
12 this proceeding.

13 Mr. Umstot has not been qualified by the State
14 Engineer, but we proffered him as an expert in hydrogeology,
15 Beto zone processes, groundwater recharge, and geostatistical
16 techniques. And there's been no objection to his designation
17 in those expert areas.

18 And Mr. Carlson has been qualified by the State
19 Engineer as an expert in geophysics and testified before the
20 State Engineer near last Monday, I believe.

21 Gentlemen, I ask you if you prepared reports that
22 have been marked as Lincoln County Vidler Exhibits 1 and 2 in
23 this proceeding? If you could each just state yes or no on
24 the record.

1 point presentations were submitted to the State Engineer's
2 office on September 6th. So those have been admitted as
3 exhibits, LCV 08 through 12.

4 Mr. Bushner is not going to give his presentation
5 today, just in the interest of time, but he is available for
6 cross-examination.

7 And we are going to go ahead and start then with
8 Mr. Carlson. And so, Mr. Carlson, I would ask you to then
9 please proceed.

10 Excuse me. Sorry. Sorry. We do have some
11 demonstrative exhibits, slides. And those -- copies of those
12 have been put on the slide desk over there.

13
14 **NORMAN CARLSON**

15 Called as a witness on behalf of
16 Lincoln County/Vidler, having been first duly sworn,
17 Was examined and testified as follows:

18
19 **DIRECT EXAMINATION**

20 By Ms. Peterson:

21 Q. Thanks, Mr. Carlson. Can you proceed?

22 A. Yes. Thank you. Well, we can just go ahead and
23 start with slide two, actually. This is the overview of what
24 we were contracted to do by Lincoln County and Vidler Water.

1 MR. BUSHNER: Yes.

2 MR. UMSTOT: Todd Umstot. Yes.

3 MR. CARLSON: Norman Carlson. Yes.

4 MR. BUTLER: Thomas Butler. Yes.

5 MR. MOCK: Peter Mock. Yes.

6 MS. PETERSON: And I should have asked the other
7 one that goes along with that. Were those reports prepared
8 by you or under your direction?

9 MR. BUSHNER: Greg Bushner. Yes.

10 MR. UMSTOT: Todd Umstot. Yes.

11 MR. CARLSON: Norman Carlson. Yes.

12 MR. BUTLER: Tom Butler. Yes.

13 MR. MOCK: Peter Mock. Yes.

14 MS. PETERSON: Thank you. And I would move that
15 Lincoln County Vidler 1 and 2 be admitted in to evidence.

16 HEARING OFFICER FAIRBANK: They'll be admitted.

17 And also just for Mr. Mock and Mr. Umstot, for
18 the purposes of their qualification as they have not
19 previously been qualified before this office, but their
20 proffering was not objected to by any party. They'll be
21 qualified in the proffered expertise for the limited purpose
22 of these proceedings.

23 MS. PETERSON: Thank you. So we presented our
24 case a little bit differently than everybody else. Our power

1 We're looking at the Rowley map again draped on to the USGS
2 digital elevation model. This just gives you a perspective
3 view like you're looking down towards the north on the valley
4 from a high-flying airplane.

5 And on this, Kane Springs Valley, which we've
6 talked a lot about, is in the upper right. You'll see
7 numerous solid red lines running across that and then one
8 long one running down Kane Springs. Those are geophysical
9 lines that we ran in 2012.

10 Our main topic today is the lines from 2019,
11 March and April, I think. And those are labeled lines ten,
12 11, and 12. And those are a less dark red line with little
13 dots on them for some of the stations.

14 And as I said, Kane Springs is trending to the
15 northeast in that upper right corner. Coyote Spring Valley
16 is the center of the map. It's shaded sort of a very light
17 tan. That's because that's all paternery basin fill. That's
18 covering up all of the bedrock.

19 The colors on the sides of the valley there in
20 the Meadow Valley range and down in the Arrow Canyon range,
21 those colors represent the bedrock that outcrops in those
22 areas, various limestones and dolomites. A lot of it is the
23 carbonate, the carbonate aquifer, that we're talking about
24 and some of it is volcanics. So this is just to give you a

1 very big overview of what we're talking about.
2 If we go to slide three -- Well, actually with
3 the State Engineer's permission, I presented these slides
4 last Monday with CSI. It's just the background of CSAMT, so
5 I'll skip over those if that's okay with everybody up there.
6 HEARING OFFICER FAIRBANK: That's fine.
7 THE WITNESS: That saves time.
8 Slide seven is the layout of the survey lines on
9 an aerial view. The main things that we want to point out
10 here are Kane Springs Valley is in the upper right. It's
11 aiming towards the northeast. Coyote Spring is the center of
12 the aerial view. And, as I mentioned, the red lines crossing
13 Kane Springs we did in 2012. I'll touch on those just for
14 background so you can see what we've seen in this area before
15 and for comparison to lines ten, 11, and 12 there in the
16 center.
17 Other things just to note, you'll hear us talking
18 multiple times about an outcrop of dolomite near the up --
19 the center upper right of the map. You can just barely make
20 it out in the aerial view. But that's an outcrop of dolomite
21 right at the mouth of Kane Springs Valley. It's sort of a
22 little island sticking up there of outcrop.
23 Q. (By Ms. Peterson) And, Mr. Carlson, can you just
24 give another depiction on the map of where that is located?

1 You'll notice in sort of the lower center right
2 there's a big green area labeled MD. That has black faults,
3 blue faults. Some of the blue faults are at perpendicular
4 angles.
5 So, anyway, it's a heavily-faulted area, very
6 complex geology. And that's the whole reason that we do
7 geophysics is to try and understand what's out here in the
8 basin fill where we can't see all the faults that are -- that
9 must be in the bedrock out there.
10 Another point on this slide that is a good place
11 to point out is the orientation of our lines. We have line
12 ten and line 11 that are in the center of this image.
13 They're oriented from southeast towards northwest. They're
14 two parallel lines. Line ten is right at the very mouth of
15 Kane Springs. Line 11 is further out in the Coyote Spring
16 Valley. But the orient of those lines like that because most
17 types of geophysics give the best resolution of subsurface
18 features if you cross that feature perpendicular to the way
19 it's trending.
20 And you'll see that all of these faults in Kane
21 Spring Valley, all of these blue solid lines that are drawn
22 by Rowley and by the previous geological maps, those are
23 mostly all trending southwest towards northeast along the
24 valley. And that makes sense. It's faulted up and these

1 A. Yes. On the map it's in between the label that
2 says 2012 line one and the 2019 line ten. And it's -- being
3 in the desert, it's just sort of a change in color from tan
4 to gray. But that's where a knob of dolomite sticks out of
5 the ground. It's very close to KSPW-1, the well there. And
6 then CSVM-4, that well was located just to the southwest end
7 of that knob.
8 So the point to get from -- Well, let's go ahead
9 and go to line eight and we'll make those points. Slide
10 eight is the same image basically, but in this case we've
11 overlaid the Rowley geological map. The important things
12 there are, as I mentioned earlier, the bulk of the map is
13 this light tan background being basin fill. So bedrock in
14 the faults and the folds and whatever else is down there is
15 all covered up.
16 Out in the outcrop, the colorful rocks out on the
17 outside of Coyote Spring, dolomites, limestones, things like
18 that. You'll notice in all of that outcrop there are
19 numerous fault stone. The faults on the Rowley map are drawn
20 as heavy dashed -- heavy black lines or heavy blue lines.
21 And you can see that anywhere you're in outcrop you're not
22 very far from a fault. It's a heavily faulted-up area,
23 different types of faults, different faults running in
24 different directions.

1 faults are along the valley.
2 So since we are trying to resolve faults, we ran
3 our lines perpendicular to those to give us the best
4 resolution. If we put the faults, if we put a survey line
5 directly on top of a fault and running parallel with it, the
6 image is distorted. You get very ambiguous data. You can't
7 really resolve it. So if we know what direction faults are
8 running. We usually run our lines perpendicular to those
9 faults. So that's why those two, lines ten and 11, are
10 oriented the way they are.
11 And line 12 is an east/west flow right in the
12 center of the image. And we orient that east/west because we
13 wanted a good high resolution of the faults that Rowley draws
14 out underneath the basin fill. Because he's drawn numerous
15 black dashed lines which indicates a concealed fault.
16 There's a blue dashed line with the triangles on the side.
17 That indicates he thinks there's a concealed trust fault
18 there.
19 And most of the faults running and up and down
20 Coyote Spring under the basin fill are drawn as north/south.
21 So we oriented line 12 east/west to give us the best
22 resolution of where those are and what they look like.
23 If we could go now to slide nine. This is just a
24 little bit of background from the 2012 survey that we did

1 running up and down Kane Springs Valley. This is the one
2 called the axis line. It was that solid red line on one of
3 the first maps that runs along Kane Spring -- Kane Springs
4 Valley. So running right along the valley.

5 And the main key here is we see in the middle of
6 the line and on the northeast end of the line we see a lot of
7 green shading and yellow shading. That's indicating
8 moderately low resistivities. And then the moderately low
9 resistivities, as we seen in prior discussion last Monday,
10 that's most likely the basin fill material.

11 But we're seeing the northeast, the right hand
12 part of this plot is over basin fill material in Kane
13 Springs.

14 But as you go to the southwest towards the mouth
15 of Kane Springs, we see that we have this high resistivity in
16 blue, which we associate it in the prior work with
17 carbonates, coming up from very deep and coming up and almost
18 right to the surface on the very last few stations of the
19 line, which is the far left-hand part of this cross-section.
20 The blue actually does come up to the surface.

21 So the surprising thing about this line when we
22 first took it in 2012 was the topography of Kane Springs
23 Valley slopes downward from the northeast towards the
24 southwest. But the underlying basement of carbonate rock

1 like they're mostly vertical. So instead of one big blue
2 blob, it looks like a bunch of blobs all packed together.

3 If we go to slide 11, now we're at, this was
4 called line one in 2012. And in this case it actually went
5 over that knob, over that dolomite outcrop that's right in
6 the center of this. And where we go over that carbonate knob
7 just booming high resistivities. So everything is looking
8 good. It's where we can get ground truth it's looking fine.
9 So we have the high resistivity knob showing up very nicely.

10 Further out on the west side of the plot is also
11 very high resistivities. You see the things are kind of
12 broken up. You see a big red area. That's low resistivity
13 material. It's likely saturated. There may also be a lot of
14 clay there. That also lowers the resistivity. But we're
15 right here very near the mouth of Kane and we're seeing
16 mainly high resistivity features.

17 The KSPW-1 well is also shown on there. It
18 encountered about 200 feet, 250 feet, basin fill and then
19 went directly in to carbonate there. And I believe that's
20 the one that was discussed earlier, a very good producer. It
21 did go through what a geologist called a fault zone. So some
22 additional ground truth is always good to have.

23 If we move to slide 12.

24 Q. Mr. Carlson, was there a correction you needed to

1 slopes in the opposite direction. It's deep on the northeast
2 and becomes shallow on the southwest. So it's actually
3 exactly backwards of what we expected.

4 But what we're seeing in this access line on Kane
5 Springs Valley is a large block of high resistivity carbonate
6 rock coming up close to the surface as we get towards the
7 mouth of Kane Springs.

8 Now, if we go to slide ten, this is one of the
9 short cross-lines of Kane Springs just a little northeast of
10 that knob that I mentioned earlier. So this line, the
11 right-hand side of the plot is dominated by the carbonates
12 and the crew did go up on to the carbonates taking some of
13 the data there. So we know that the outcrop is there. We
14 know that that's quite a high resistivity carbonate.

15 As we get to the center of the line, we see a
16 blue resistant blob coming up from that and it is evidence of
17 a very conductive zone. But that blue blob as you see as we
18 move further towards the mouth of Kane Springs that becomes
19 more shallow. That's sort of part of what we were seeing on
20 the axis line.

21 And then we also see the Kane Springs Wash fault
22 zone, which is on the right-hand half of this line, looks
23 like numerous blue high resistivity blobs. The carbonates
24 are all broken up there. There's multiple faults. They look

1 make in the top part of slides 11 and 12?

2 A. Thank you. Yes. The title on slide 11, it says
3 near the southeast end. I have a little bit of age-related
4 dyslexia or something. But that should say southwest. And
5 then on the next slide it says southeast and it should say
6 southwest. Sorry.

7 So on slide 12, this is line ten, the 2019 work.
8 This is right at the very mouth of Kane Springs right there
9 at the southwest end of the Kane Springs. It does not cross
10 any outcrop there in the middle. It doesn't cross the knob.
11 It's on the southwest end of the knob. As you can see, it's
12 all blue. I mean, this is all high resistivity ground, very
13 high, thousands of ohm meters in many cases.

14 We interpret this to be almost entirety carbonate
15 in the subsurface. Very thin veneer basin fill over it. The
16 carbonate is broken up. We do see some low resistivity
17 features at different angles and things. But the gist of it
18 here is that right there at the mouth of Kane Springs instead
19 of seeing a fault and maybe separate it from other faults
20 with low resistivity basin fill, we see all carbonate high
21 resistivity results.

22 Q. Mr. Carlson, you're about 15 minutes in?

23 A. Okay. Thank you.

24 On slide 13, this is line 11. This is the line

1 that is about two miles from the mouth of Kane Springs. And
2 since I like to keep plots as a one-to-one aspect ratio so
3 you can actually see how steep angles are, this one is kind
4 of skinny. So in slide 14, I have just broken this up. The
5 top plot in the south is the northwestern part of the line.
6 And the bottom plot is the southeastern end of the line. So
7 just so we can see some detail a little bit better.

8 The key features here are, unlike line ten, which
9 is just two miles closer to the mouth of Kane, line 11 is
10 primarily moderately low resistivities, all of those greens
11 and yellows, it's mainly layered. It's not -- The center of
12 the line is broken up, but both of the line is layered.

13 Moderately low resistivity that we interpret as basin fill.

14 On the far right-hand end of the lower plot, we
15 see solid blue again. And that's where the crew went up on
16 to outcrop and carbonate. So good ground truth there, but
17 we're seeing a big, big change as we come away from Kane
18 Springs, from the mouth of Kane Springs Wash.

19 We see some interesting things that probably have
20 nothing to do with the hydrologist but interesting layering
21 in this bottom half of the plot. You see some yellows and
22 then bright reds, very low resistivity material. Again,
23 that's probably saturated. There may be very fine grain low
24 resistivity material map.

1 Across the bulk of the line we see low resistivity layering.
2 That bottom plot is just the same model but we've added a few
3 layers to get a little deeper.

4 In one of the earlier testimonies, I think it was
5 Dr. Waddell, he mentioned that he thought that a large fault
6 that we talked about in our reports didn't show up on this
7 because we just weren't seeing quite deep enough to get it.
8 And that's exactly right. The model that we had put in the
9 report was not the deepest model we had. If we show you the
10 deepest model, which is the bottom half here, and if you'll
11 go ahead and skip to the next slide. And actually one more
12 slide to look at the deeper one.

13 On the lower image here in this cross-section --

14 Q. And you're on slide?

15 A. I'm sorry. Slide 19. Sorry. On this slide 19
16 the lower image is the cross-section of the southeastern half
17 of the line. And you can see at depth high transmissivity
18 the blue material. We would put a fault at the edge of the
19 biggest blue blob you see there and in between the two blobs
20 you see there another fault, a third one actually, on the
21 right-hand side of that mixed blob.

22 But Mr. Waddell was right. The fault that we
23 talk about a little bit later doesn't show up on line 12
24 because it just wasn't looking deep enough on that plot.

1 And if you come from left to right, that reddish
2 layer, it sort of jiggles around, but reddish layer is
3 roughly horizontal and comes to about the middle of that
4 lower plot and then plunges steeply downward.

5 We see that on other lines here and we also saw
6 that on the Coyote Springs lines on Monday. It's a different
7 interesting feature. I'm sure it's telling us something.
8 But, for the current hearing, what's mainly important is the
9 fact that as we've moved away from the mouth of Kane Springs
10 we're in to low resistivity basin fill, a large amount of low
11 resistivity basin fill. This calculates to be 2500 feet to
12 3,000 feet of basin fall.

13 If we can go to slide 15, just a very quick
14 refresher of where we are. We just discussed lines ten and
15 11. Those are the ones on the southeast and northwest there
16 near the center. And now we're going to discuss line, 12
17 which is oriented east-west, and we have oriented it that way
18 so that we can get a look at some of the concealed faults
19 that Rowley had on his map.

20 So, again, so -- it's a very long plot so it
21 plots very skinny if you keep the aspect ratio. So I'm going
22 to break it up. Although first I'm going to show you a
23 slightly different version of that upper plot. We're seeing
24 nice layering. In some ways, this looks a lot like line 11.

1 Other interesting things on here. On the top
2 plot you can see the northwestern half of the line, some very
3 interesting layering in the basin fill material.

4 At about station 7100 through about, oh,
5 10,000 -- 11,500, you'll see that the yellow and red well
6 resistivity material gets all the way to the surface. It's
7 saying that the surface there is very low resistivity.

8 And if you think back to the aerial view, that's
9 where this line crossed a vegetated area. And very near this
10 line is the Coyote Spring, which the valley is named after.
11 So we're seeing the effects of spring water and the
12 vegetation around it and the data here.

13 It's not terribly important for the discussions
14 here, but it's another ground truth for us, something that
15 you want to see when you're trying to make all of these
16 measurements.

17 If we go to slide 20, what I put here is just
18 lines ten and 11. Number ten is right at the very mouth of
19 Kane Springs Valley. And then the lower plot is line 11, and
20 that's about two miles in to Coyote Springs. And this is
21 just to point out the radical difference between the two
22 lines. The top line is virtually all high resistivity
23 material, broken up, but high resistivity material.

24 Whereas, as you move out and parallel out of Kane

1 Springs Valley, we see all low resistivity material looking
2 like 2500 feet, as much as 2500 feet of basin fill. And
3 there are two wells near line 11 here, near line 12, out in
4 the basin fill. And those indicated a minimum of 1500 feet
5 of basin fill material. So some good ground truth again.
6 So, if we go to slide 21, this was sort of a
7 summary slide of the results, sort of the gross features of
8 the results on the Rowley map. And we have our lines, ten,
9 and 11 and 12 again, but in between those two lines, in
10 between ten and 11, we've drawn a heavy red dash line that
11 has small down drawn symbols along the southwestern side.
12 But that's indicating that we're virtually certain that
13 there's a large fault roughly parallel to those two lines and
14 it has to be in between those two lines since we see this big
15 change from line ten to line 11.
16 For graphic purposes, we just put it roughly in
17 the center. But, personally, I believe it's very, very close
18 to line ten. But until we run the line perpendicular to
19 these lines to cross it, we can't place it exactly. But the
20 change in resistivities from line ten to line 11 just demands
21 that there be a big flow right there.
22 And very boldly we called this the boundary --
23 northern boundary -- northern boundary LOWRFS, we gave it a
24 grandiose name. In the discussion actually we called it

1 calibrations always worked. Automatic checks always worked.
2 The data did agree with specific locations of
3 some faults that are mapped as concealed. And other --
4 mapped other faults that Rowley mapped as concealed, we did
5 not see. That's probably because they've been interrupted by
6 the large fault that we did see.
7 And that's probably the most significant finding
8 is that there is a large fault, very significant change,
9 approximately 2500 feet, in between CSAMT lines ten and 11.
10 Now we go to demonstrative exhibits; right?
11 Q. Yes. Please proceed. Yes.
12 A. Okay. Very quickly, the National Park Service
13 pointed out the geologic report by the USGS. It's in open
14 file report 00-420. And we talked a little bit about it in
15 the CSI discussion further south in the valley. And they did
16 do a couple of gravity lines near the Kane Spring line, so
17 we, of course, looked at that to see how things worked.
18 On this plot there's very -- you can -- up at the
19 very top in the center right on the edge of the plot is a
20 very faint blue shaded blob. That's the knob that we talked
21 about, the dolomite knob. So the miles of Kane Springs is
22 right at the very top of this map.
23 Other geology that's shown on this map as faint
24 shading, pink and blue and light green, the bulk of the map

1 Dorothy's fault, but we didn't want to put that in the
2 report. So I've heard multiple comments in the past about
3 our name. But that's how we discuss it. It has to be a
4 major fault and it has to -- Since the carbonates and the
5 higher resistivity material on line ten are virtually right
6 up to the surface, almost, but on line 11 they're down at the
7 depth of 2500 feet, that means that that fault has to be a
8 big step downward of 2500 feet some place in between line ten
9 and 11. So very significant fault.
10 If we go to --
11 Q. Mr. Carlson, you're at 25 minutes.
12 A. Great. Thanks. To summarize and to go back to
13 the perspective view, we're looking downward at the geologic
14 map and then we hung the two lines in their appropriate
15 places on the geologic map. And you can see the big, big
16 difference in data as we go from right at the mouth of Kane
17 Springs, solid blue, high resistivity carbonate, to two miles
18 away, low resistivity, a minimum of 2500 feet of basin fill.
19 So that's why we put Dorothy's fault in there and considered
20 a major, major feature as far as hydrology goes.
21 And the next slide summarizes things. The CSAMT,
22 it showed realistic results where we crossed out known
23 outcrop and we knew what we were on, it matched. The data
24 work, the equipment worked well, no problems. Automatic

1 though is just a white background because it's on the basin
2 fill and we don't know what it is.
3 The contours that you see, all of these lines,
4 parallel lines, kind of swirling around and curving up
5 from -- going from south to north, it's sort of north-south
6 and then veers off to the side. Those are called isostatic
7 anomaly contours. All it's saying is that as we go from the
8 right side of this plot towards the center of the plot we're
9 going from very high density rocks, the granites and things
10 like that, towards low density rocks out in the middle where
11 you see a big oval and a bulls eye in the middle but a big
12 oval all around it. That's the basin center. That's the
13 center of the valley. That's where the basin material is the
14 deepest.
15 The basin fill material is very low density.
16 It's loose rock. It's sand, gravel, clays, things like that.
17 So the contours are showing from where you're going from high
18 density to low density or from low to high or something like
19 that.
20 In the upper half of this plot there's some very
21 dense little points. Those are their data points along two
22 lines that we did called the N-1, which is the northern line
23 of points, and N-2, which is the southern line of points.
24 All of the other little dots you see are on the map are

1 they're gravity stations. But their lines were high density
2 gravity. In the rest of the plot it's very, very low density
3 stations. They were sometimes two miles and three miles
4 between a gravity station. So they consider this -- And they
5 stated in their report that this is a very low resolution
6 look at the valley. But where they have high density, that's
7 a good gravity cross-section.

8 So if we go to the next slide --
9 Q. And just to clarify, Mr. Carlson, that is not
10 Rowley's geology on that last slide?

11 A. You're right. From memory I think they used Page
12 but I'm not a hundred percent sure. That is not Rowley's
13 geology map. Rowley based a lot of his on Page too.

14 The result of the gravity along these very
15 tightly spaced lines, on the top is that northern line and
16 the gravity line N-1. And they've divided up the subsurface
17 in to just two layers. Along the top you'll see some red
18 dots that look like they have little antennas on them.

19 Q. And you're on the top plot?

20 A. Sorry. On the top image on slide 25. Those
21 little red dots that look like they have antennas, that the
22 surface of the ground, that's where they parked and made a
23 measurement.

24 And then right below those on a line is a very

1 lightly shaded yellow layer and they label that as the
2 Cenozoics, which is the basin fill in this case.

3 And then below that, which is the vast majority
4 of the line is light blue labeled PZ for the Paleozoics, and
5 they identify that as the carbonates. They don't
6 differentiate from dolomite, from limestone, or anything like
7 that. It's just that's their carbonate.

8 So they're saying on line N-1, the northern line
9 which is near our line ten, they see a thin layer of Cenozoic
10 basin fill. And then down to 6,000 feet they see carbonate.

11 The lower image is their line N-2, which is close
12 to our line 11. And you can see we're now on the bottom
13 image on slide 25. The surface of the ground is those red
14 dots with the antennas. And now we see a very thick zone of
15 the pale yellow labeled CS, the Cenozoic basin fill.

16 You can see in the middle of their line it's just
17 about 3,000 feet deep. So they're also seeing basin fill
18 clear down to 3,000 feet as they move away from the mouth of
19 Kane Springs.

20 And then below the basin fill we show the pale
21 blue again as the high density carbonates.

22 If we go to slide 26, this just for reference
23 shows their plate one again and we've just overlaid our CSAMT
24 lines in blue so you can see where they are relative to each

1 other. Lines ten and 11 and 12 and then for reference the
2 Coyote Springs Investment line A down at the very bottom give
3 you a reference of where we are in the valley.

4 So we have line ten in the upper central part of
5 this plot. And you can see that the southeastern half of
6 line ten approximates their line and the gravity line N-1.
7 And then about the southeastern third of line 11 is where
8 they have their gravity line in two.

9 And if we go to slide 27, very quick refresher,
10 there's line ten, solid carbonates, blue.

11 If we go to slide 28, there's line 11. And
12 actually let's go ahead and go to the next one. So on this
13 plot, the top image --

14 Q. You're on 29?

15 A. I'm sorry. Yes. Slide 29. The top image on
16 slide 29 is that southern half of line ten approximating
17 their gravity line in to N-1. The southern -- The bottom
18 image on this slide is the southern third of our line 11 to
19 approximate their line N-2. Confusing.

20 And we're seeing the same thing that they were
21 seeing. By coincidence they use blue for their carbonates
22 and we use blue for our high resistivities. Our line ten and
23 their line N-1 are both solid blue because we're detecting
24 carbonates. They see it as a high resistivity -- or they see

1 it as a high density feature. We see it as a high
2 resistivity.

3 Go further out on the valleys at line 11 and
4 we're seeing basin fill very deep. You'll even notice that
5 in the middle of this section at line 11 the deepest part of
6 these low resistivities is right about in the middle of the
7 line out here, not in the middle of the valley. And that's
8 exactly what we saw on their line N-2 that they had the
9 deepest basin fill in that part of the line and not in the
10 middle of the valley. So we're in agreement with that.

11 We go to the next slide. Thereto, again, we see
12 the same thing. As we move from the mouth of Kane out in to
13 Coyote Springs, a great big huge step of carbonates.
14 Everything drops off 2500 feet.

15 If we go to the next slide. That's really the
16 perspective view again.

17 So -- But I wish we had seen the USGS report
18 before we laid out our lines. Similar to Coyote Springs, we
19 would have laid things out a little differently, because it's
20 unusual when we get two different data sets from two
21 different groups that are measuring two different physical
22 properties of the ground and you're seeing the same
23 surprising unexpected thing. They see this high density
24 change in low density over a very short distance. We see

1 high resistivity change to low resistivity over a very short
2 distance.

3 And the only thing I can come up with is a very
4 significant fault in between lines ten and 11. And I think
5 that probably wraps it up from my end.

6 MS. PETERSON: Thank you.

7

8 THOMAS BUTLER
9 Called as a witness on behalf of
10 Lincoln County/Vidler, having been first duly sworn,
11 Was examined and testified as follows:
12

13 DIRECT EXAMINATION
14 By Ms. Peterson:
15 Q. Now we'll turn to Mr. Butler.
16 A. Sorry. I'm recovering from a really bad cold, so
17 you might have a hard time hearing.
18 I was recently hired by Vidler to provide
19 assessment and geochemical data. More specifically, the
20 question I was hired to answer is whether there is
21 geochemical evidence to support the conclusion that there was
22 a significant component of water from Kane Springs entering
23 Coyote Springs or the Muddy River Springs area.
24 The geochemistry data set that I evaluated was

1 Springs Valley up here, Coyote Springs Valley. A groundwater
2 gradient in Kane Springs Valley is presumed to be based on
3 outpatient data to the southwest. And the northern portion
4 of Coyote Spring Valley it's to the south and southeast.

5 The important thing here I want to draw is
6 gradient alone does not mean flow. You all still have that
7 conduit so it does not necessarily mean the flow is
8 occurring. More importantly, if it is occurring, whether or
9 not it's significant. It's just a potential.

10 Next slide. Okay. So when I first got this data
11 set, you know, one thing that struck me -- And I got this
12 cold, so I had no idea how the context was going on here.
13 This guy has been involved in this for years.

14 The similarities you see between CSV-4 and KPW-1
15 in temperature. They had very similar temperatures compared
16 to every other well in the basin. So I just did a -- You
17 know, if we got these groundwater gradients coming out in
18 Coyote Springs, this groundwater gradient down in Kane
19 Valley, what's the potential for some mixing going on here?
20 So I did a very simple mixing model and I
21 calibrated on water from CSV-7 and KPW-1, the N-members, and
22 see if I could simulate CSV-4. And based upon that model, I
23 come up with an approximate percentage of water for CSV-4 of
24 74 percent. KPW-1, 26 percent. So that's just one

1 from CH2M Hill report dated 2006, which is entitled
2 Hydrologic Assessment of Kane Springs, Geochemical Framework
3 and the whole data sets from that report.

4 I also provided some comments to some findings in
5 some recent reports prepared by Mifflin and Associates from
6 their July 3rd, 2019 report.

7 And together the conclusion that I draw from this
8 is that we're going to show how KPW-1, Kane Springs pumping
9 well, in the southern portion of Kane Springs Valley and
10 CSV-4, which is the northeastern well in Coyote Spring
11 Valley, how they are related and how they differ from other
12 wells in the entire system. And that's the Lower White River
13 Flow System.

14 And we'll do that through a series of Piper plots
15 and Durov plots, the carbon-14 data, the fluoride
16 concentrations, we're going to look a little bit at
17 equilibrium modeling and how things appear to be different in
18 certain areas and we'll talk a little bit about how arsenic
19 is not a very valuable tool in evaluating flow components.

20 This slide is actually meant to be placed over --
21 I was never able to get the proper slide. But it shows the
22 same things I showed before. Mainly deep groundwater
23 elevations to various wells.
24 Other folks that talk about this, this is Kane

1 constituent.

2 So then I took that same mixture and I looked at
3 does it apply to other things that are in this. Does it
4 apply to the fluoride? Does it apply to temperature? How
5 about water isotopes? That's independent of soluble
6 chemistry all together. And the carbon-14. So when I
7 calculate them, model CSV-4 data with all of those different
8 constituents you'll see here, that they actually do compare
9 quite well with temperature being the biggest discrepancy
10 with 15 percent, but most of them plot at a very low percent
11 difference. High probability that these two wells are indeed
12 related. There's a component of the Kane Springs water and
13 there's the component of the Coyote Springs water there.

14 (The court reporter interrupts)
15 THE WITNESS: So taking that same percent of each
16 of these N-members, I then applied that to the major cations
17 and the anions for those two water chemistry types to see if
18 I could simulate a similar water type at CSV-4. And that's
19 what you see in the Piper block here. Actual CSV-4 data is
20 that purple dot, and the simulation is the teal dot. They do
21 compare. We're able to see them. Just provide some evidence
22 that they are very similar.

23 Next slide. And we're able to -- we show that
24 KPW-1 and CSV-4 are related. This plot here is the Piper

1 diagram that brings in a lot of other data. And I want to
2 point out a couple of errors or corrections. The data shows
3 that the Black Mountain data is in this. It is not. Rogers
4 point or -- I'm sorry. Blue Point and Rogers Spring from
5 Black Mountain Springs would plot right about here.
6 Q. (By Ms. Peterson) And describe where you're
7 pointing.
8 A. To the north. To the northeastern corner of the
9 Piper diagram.
10 Also, the circle area, it says it depicts central
11 CSV water. And it actually depicts Kane Springs water. So,
12 a real quick description of these data. So these diamonds
13 right here in the center portion of the Piper diagram, those
14 represent all of the Coyote Spring Valley water chemistry
15 from basically everything except CSV-4, everywhere else in
16 the system.
17 The solid circle indicates -- The blue circle,
18 it's hidden behind the purple circle, is KPW-1 or CSV-4 --
19 (The court reporter interrupts)
20 THE WITNESS: And the black circle is Willow
21 Spring. Willow Spring is also located in the southern end of
22 Kane Springs Valley. The open circles are the northern
23 springs in Kane Valley.
24 The star up here, the stars are actually all of

1 old substances, TDS as well as another variable of pH.
2 Again, what we see here is these are KPW-1
3 springs and CSV-4 in that northeastern portion of Coyote
4 Spring Valley. Willow Springs they kind of plot along a new
5 relationship with each other. We also see central Coyote
6 Spring Valley water right here. We see the MRSA water here.
7 And we have the railroad well, that alluvial well, out in
8 Lower Meadow Valley Wash area. And what we see is mixing
9 relationship here appears to be between alluvial source and
10 the Kane -- or the Coyote Springs -- the Coyote Spring Valley
11 water. Kane and CSV-4 and Willow Springs are not along this
12 trajectory.
13 So, again, these chemistry data suggest that Kane
14 Valley is not a significant component of water entering the
15 MSRA(sic) or is mixing with it.
16 Q. And Mr. --
17 A. Oh, I'm sorry.
18 Q. Mr. -- Mr. Butler, when you were describing the
19 mixing relationship, you were talking about the rectangle on
20 the right-hand side of the slide?
21 A. Yeah. That's the -- Yeah, this -- And there's a
22 line drawn between the points. There is a straight line.
23 And just a clarification here. This also shows
24 that the Black Mountain Basin samples are on this. They're

1 the samples. And I should preface this. I can only create
2 this diagram for where we have complete water chemistry. So
3 these are all the water, all the data from that 2006 report.
4 They have complete water chemistry that enable us to make
5 this diagram for these wells.
6 Star data is from the Muddy Springs, MR -- I'm
7 sorry. MRA --
8 (The court reporter interrupts)
9 THE WITNESS: MSRA springs. I got it backward.
10 And so these are these right here and this one
11 here. This little triangle is actually an alluvial well.
12 It's a railroad well from the Lower Meadow Wash area.
13 What we can see here is there's a potential
14 mixing relationships between either central Coyote Spring
15 Valley and your in-basin recharge in the Muddy River -- Muddy
16 Springs or the Lower Flow Valley Wash.
17 In the Kane Springs and the CSV-4 are chemically
18 unique and do not appear on any of those mixing
19 relationships. That would indicate that they are not a part
20 of that mixing relationship. Not likely a significant
21 component of water to the MRSA.
22 Next slide. Durov diagram is very similar to the
23 Piper diagram in that it presents featured cations and anions
24 in the system and it also brings in the total amount of those

1 not. If we were to plot them, they would plot about right
2 here way off the graph.
3 Q. And you're pointing to the text on the right-hand
4 side?
5 A. Yep. Yeah. Right about where it says recharge
6 in MRSA. And those would again be Blue Point and Rogers
7 Springs.
8 Next slide. This is really hard to see here. I
9 should blow it up more. This is carbon-14 data. And the
10 main point here is that it's measured in percent modern --
11 (The court reporter interrupts)
12 THE WITNESS: Percent modern carbon. And the
13 values here at KPW-1 and CSV-4 are quite low. The values in
14 central Coyote Spring Valley and the MRSA are quite a bit
15 higher. So what that means is if the presumed groundwater
16 flow path is from Kane to the MRSA, the groundwater would
17 have to get younger, not older, as it flowed along the
18 groundwater flow path. So that can't happen unless there's a
19 vary significant influx of much younger water.
20 So, again, the data here suggests that Kane
21 Springs Valley is not a significant component of water to the
22 MRSA and that -- that there's probably another source most
23 likely that's coming from Coyote Springs or somewhere else
24 that the percent margin in these areas they give pretty

1 nicely.
2 Q. (By Ms. Peterson) So you have about five minutes
3 left. But don't talk any faster.
4 A. That's going to be difficult. Okay. So this is
5 just a comment to the Mifflin report. The comments in green,
6 I won't read it for time. But basically it's saying things,
7 arsenic could be used as a tool to define the MRSA capture
8 zone.
9 I just want to state that arsenic is a horrible
10 indicator of anything because it is extremely transient and
11 variable. It's dependent very much so on the REDOX potential
12 of the groundwater. It's dependent on the pH of the
13 groundwater. It's dependent on whether or not it travels
14 through any iron oxyhydroxides because they effectively
15 damage it.
16 And, case in point, we showed earlier that KPW-1
17 and CSVM-4 are likely to replete it and that CSVM-4 from
18 multiple indicators is likely about 76, 75 percent KPW-1
19 water.
20 While KPW-1 has an arsenic concentration of 46
21 micrograms per liter, CSVM-4 has five. If that relationship
22 could hold true, this should be 35.
23 Q. And what are you pointing to?
24 A. I'm pointing to the concentration that is on the

1 temperature.
2 We also did a system that involves calcite,
3 gypsum, and fluoride. These are very common minerals.
4 Nothing exotic here. You expect these. Green line, that's
5 the equilibrium model for calcite, fluoride, gypsum. Blue
6 dash line here is the equilibrium model for calcite and
7 fluoride alone.
8 And what we see is KPW-1 and CSVM-4, they collect
9 right on the concentration of where you expect fluoride to be
10 versus temperature for a system that's dominated by fluoride
11 and calcite, as does this stream. It's only there because
12 that data that was in that data set where they were available
13 and it's in a similar equilibrium of a similar simulation.
14 All of the other minerals -- All of the other
15 samples throughout that 2006 report where we have fluoride
16 temperature data plot below that equilibrium line and more
17 similar to a plot that would keep that gypsum as also being
18 involved in that system.
19 So, again, these data suggest that the Kane
20 Valley is not a significant component. It's very unique
21 compared to many of the other samples in the MRSA and
22 elsewhere in the valley.
23 Water isotopes. So Mifflin again suggests --
24 states that groundwater captures and could be confined by

1 figure on the map for CSVM-4.
2 And if you were to use arsenic, which has been
3 postulated to include Kane, the high concentrations aren't
4 seen anywhere else in the basin. So if you're going to
5 include arsenic, you would use it the exact opposite way.
6 I'm not saying to do that, because it's not good. It would
7 indicate that it should be excluded from the system.
8 And, finally, I want to go on to the next slide
9 and talk about fluoride. Mifflin also stated that fluoride
10 can help define the capture zone due to high concentrations
11 of fluoride present. Kane, again, has some of the highest
12 concentrations of fluoride. So does CSVM-4. Those
13 concentrations aren't seen anywhere else in this immediate
14 area. Most of the equal concentrations of fluoride up here
15 again. Central Coyote Spring Valley as well as MRSA.
16 The fluoride is -- The fluoride is a mineral that
17 is temperature-controlled and it will also show in the next
18 slide, I believe, that the temperature is indeed controlling
19 its concentration, elevated concentration, at the location.
20 Okay. So this is a simulation. This is a
21 PHREEQC. You're probably familiar with PHREEQC modeling.
22 It's a USGS geochemical modeling program. It's a very simple
23 model that takes the -- basically takes mineral calcite and
24 mineral fluoride and sets it in to equilibrium with

1 water isotopes, a difference to signature that these could be
2 related. Kane and CSV-4 got compared to other isotopic
3 valleys in the area are isotopically light in comparison to
4 most of the samples in central Coyote Spring Valley and the
5 MRSA where they're slightly more depleted, slightly less
6 negative, and very similar to one another.
7 So these data would suggest, isotope data, would
8 suggest that KPW-1 and CSVM-4 are isotopically different than
9 central CSV water and the MRSA water. So, again, not the
10 same. Different.
11 So the conclusions here where we looked at
12 several different indicators, not just one mining -- mineral
13 or one parameter. General, slides --
14 (The court reporter interrupts)
15 THE WITNESS: We look at several parameters
16 including general mill chemistry. We plotted in Piper and
17 Durov diagrams, that carbon-14 data, we looked at fluoride
18 concentration, and we did some equilibrium models, and we
19 also looked at water isotope data. All of these data, every
20 single independent parameter, independent parameter suggests
21 that the MRSA is not dominated by Kane water but it's more
22 likely dominated by water from central CSV or the Lower
23 Meadow Wash area. And, again, arsenic is still just a
24 horrible thing to use. So don't use it.

1 MS. PETERSON: So this would maybe be a good time
2 for a break if we were going to take a break this afternoon.
3 HEARING OFFICER FAIRBANK: We can go ahead and do
4 that. We'll go ahead and take a ten-minute break.
5 (Break was taken)
6 HEARING OFFICER FAIRBANK: We'll continue on with
7 Lincoln County and Vidler Water's presentation. Thank you.
8
9 TODD UMSTOT
10 Called as a witness on behalf of
11 Lincoln County/Vidler, having been first duly sworn,
12 Was examined and testified as follows:
13
14 DIRECT EXAMINATION
15 By Ms. Peterson:
16 Q. Todd Umstot.
17 A. Hi. My name is Todd Umstot and I work with
18 Daniel B. Stephens & Associates. My talk today is on drought
19 and groundwater positioning.
20 Q. And I'm sorry. Just briefly could you give the
21 State Engineer's office a little bit of information about
22 your background.
23 A. I have a Bachelor's degree in environmental
24 science and geology from the University of Massachusetts in

1 eighties. And then since the eighties there's been a general
2 increase in occurrence of droughts. So the nineties had a
3 higher drought than the eighties. And then the 2000s had a
4 higher drought to the nineties. And the recent decade has
5 been similar to the past decade.
6 And then you can also see on here I've plotted
7 two different colors. The blue bars represent Nevada Climate
8 Division 3. So when NOAA publishes Palmer drought data, they
9 publish it for different regions of the United States. And
10 so one of the regions is Nevada Climate Division 3. That
11 represents generally central Nevada and it cuts in to the
12 northern portion of Kane Springs and touches on the north
13 part of Coyote Springs Valley.
14 And then Nevada Climate Division 4 is southern
15 Nevada. And that covers the rest of the lower -- covers the
16 Lower White River Flow System.
17 So if you look at the time series analysis of
18 drought conditions in Nevada Climate Division 3 since 1960.
19 So the Y-axis here on the left, this shows whether or not
20 they're drought or wet conditions. So for the Palmer drought
21 index, zero represents normal conditions. And pretty much
22 the range from minus two to two is a normal range of drought
23 and wet conditions.
24 As you get to negative three and negative four,

1 Amherst. And a Master's degree in hydrogeology from the
2 University of Nevada, Reno.
3 I worked for Dan Ravie and Associates in New
4 Jersey for a good part of the nineties. And I've worked for
5 Daniel B. Stephens & Associates since 2002. And I'm
6 currently employed there as a senior scientist.
7 So I'm going to talk about how drought has caused
8 a general decline in the groundwater elevations prior to the
9 MX-5 testing.
10 So the occurrence of drought has increased in
11 recent decades. What I'm showing here is the monthly
12 occurrence of drought decade by decade. So plots bars that
13 are higher indicate higher conditions of drought. Bars that
14 are lower indicate more wet conditions.
15 So the Palmer Drought Index is a simplified water
16 balance model that takes in to account precipitation, soil
17 moisture conditions, and air temperature. And the data that
18 I used is published by the US agency NOAA, National Oceanic
19 and Atmospheric Administration agency.
20 And, so, as you look from decade to decade, in
21 the 1920s it was a very dry condition. I mean kind of wetter
22 condition. Thirties, drought. It was very dry. And a
23 little bit wetter. Then a very dry condition again in the
24 sixties. And then a wetter condition in the seventies and

1 you start to go in to severe drought and extreme drought.
2 And then when you go in to positive values of
3 three and four, you get in to very wet or extremely wet
4 conditions.
5 And so as faintly shown on here for the monthly
6 Palmer drought values from NOAA are shown as the blue line.
7 And then I've taken the trailing 12-month average of that
8 data to kind of show what the general trends are and kind of
9 smooth out the noise that you see in the Palmer drought data.
10 So the groundwater -- what you're going to see in
11 the groundwater elevations, they're going to see a
12 combination of these different processes, depending on where
13 recharge in the system is sourced. If the recharge is
14 sourced from further away, it's going to be a more dense
15 response that's going to reach the well. If it is recharge
16 that is coming from an arroyo that's right next to the well,
17 then that's going to be a quicker response for the well.
18 So it's different recharge areas, different
19 amounts of recharge in these areas. Higher recharge in the
20 mountains. Lower recharge in the valley. And different
21 distances from these recharge sources to the wells. And all
22 of these different processes are going to end up making
23 variations in the hydrographs.
24 And so the Nevada Division Climate 3 showing

1 again over here on the right the climate division, the
2 Climate Division 4 is this southern area divided by the black
3 line. And then Nevada Climate Division 3 is an area to the
4 north.

5 So the rate run time that the 1169 aquifer
6 testing in MX-5 pumping began there was a general decline.
7 There was a general increase in drought conditions that would
8 expect to cause the decline in groundwater elevation. So if
9 you look at the period, the one-year period, before the MX-5
10 pumping began, there were drought conditions about 42 percent
11 of the time. And if you look at the period when the 1169
12 aquifer test took place and the additional time the MX-5
13 pumped beyond that in to April 2013, drought occurred 82
14 percent of the time. So you had drought conditions occurring
15 twice as often during the test as you had occurring in the
16 year just before the test started.

17 You also have in 2005 a very wet period.
18 Precipitation that occurred in 2005 water year is probably
19 the first or second highest precipitation in the hundred
20 years that occurred in this area. So you had a very large
21 recharge pulse to happen in 2005. Smaller recharge pulses in
22 2010. But overall a general decline in groundwater
23 elevations that occurred to this generally increasing level
24 of drought.

1 decline back to normal conditions following a very large
2 recharge event, which is not one that you see in the aquifer
3 system in here.

4 And then you have an increasing amount of drought
5 as you go in to the time of the test.

6 And then groundwater elevations start -- they
7 decline through the test and continue to decline after the
8 test, after the MX-5 testing.

9 And so if the -- what you would expect to see
10 here -- And I'll show this on the next slide in a little more
11 detail, slide seven. What this shows on the top I've broken
12 them out. I have the groundwater elevations for CSVM-4 shown
13 on top. I have the pumping amount shown in the middle plot
14 where I have in blue the total amount of carbonate pumping.
15 And then in red I have the amount of MX-5 pumping. And then
16 on the bottom I have the Palmer drought severity index.
17 Again, that trailing one-year average for regions of Climate
18 Divisions 3 and 4.

19 And so you see due to drought conditions you
20 would expect water levels to decline up in to 2015. And in
21 Division 4 water levels probably start to increase around the
22 end of 2014. In Division 3 that might cause more of them to
23 decline through 2015. Because that's the pattern you see
24 with CSVM-4 is they continue do decline during that whole

1 Q. And you were just talking about slide four; is
2 that correct?

3 A. That was slide four. Now I've moved on to slide
4 five. If you look at Nevada Climate Division 4, this is the
5 southern area, it's very similar to what we just saw. It --
6 Generally, Climate Division 3(sic) is a little bit drier over
7 the past decade or so than Climate Division 3. But, again,
8 you see a similar effect where there's wet conditions just
9 before the MX-5 pumping began and then increasing the level
10 of drought as you go in to the period of time the MX-5 was
11 pumping.

12 So now I show comparison --

13 Q. You're on slide six?

14 A. Slide six. So now showing a comparison of the
15 Palmer drought index. This is using the trailing 12-month or
16 one-year average for the severity index. I have plotting on
17 the darker line here. I can't quite see the color. That's
18 Climate Division 3. And then the orange line is Climate
19 Division 4. And then the blue line is the monthly average
20 water level that most people here have been using for their
21 analyses for the CSVM-4 hydrograph.

22 So there's a big jump in groundwater elevations
23 following the recharge event in 2005. Being that it was such
24 an extreme event, you would expect that you will have a

1 period.

2 Now, if you compare the pumping signal to the
3 hydrographs, you don't see any response to when MX-5 well
4 stopped pumping. So the MX-5 well went through two periods
5 of time where it stopped pumping. And I'll show later on how
6 other wells responded to that cessation of pumping at MX-5.
7 But you don't see any response to CSVM-4 to that change in
8 pumping.

9 So some had postulated that all of this decline
10 is due to pumping, then this well would have to be very well
11 connected to the location of MX-5. And then even if there's
12 any kind of time shift, you would still expect to see maybe a
13 shift in the time the fluctuations due to when MX-5 stopped
14 pumping.

15 And then once MX-5, the end of the test, the
16 complete end of pumping occurred, the MX -- the CSVM-4 well
17 continued to climb and there was no recovery signal seen.

18 So that can be confusing to kind of discern
19 drought and the pumping signals or the potential pumping
20 signals on CSVM-4 during the period of decline. But it's
21 very clear during the period of recovery that you don't have
22 a response to the MX-5. So I think that's very diagnostic
23 that this well is not connected to pumping at the MX-5
24 location.

1 Moving on to slide eight. So this will be a very
2 similar story that we see for KMV-1. KMV-1 again it was --
3 we don't have a record going back to before for this recharge
4 event, but because it's close to CSVM-4 and it shows similar
5 hydrographs, you would expect that this has an increase over
6 what it was in the previous years. And then after that high
7 recharge event you're going to have a general decline. And
8 that's going to be supported by the drying trends that you
9 see in the Palmer drought.

10 And, again, moving on to slide nine, I show the
11 pumping effects. You don't see recovery responses in KMW-1.
12 So it may be hard to discern drought from pumping effects
13 from the declining curve. But you can definitely see because
14 of a lack of recovery signal that the MX-5 is not connected
15 to the KMW-1 well location.

16 And so I want to look at some of the other
17 hydrographs in the region and put the focus on that recovery
18 response.

19 So, prior to the MX-5 pumping, you have wells
20 CSI-1 and CSVM-6 right near the pumping MX-5 well. Prior to
21 the pumping occurring, you had a general decline in
22 groundwater levels. There's some seasonal fluctuations
23 probably due to the pattern of the carbonate pumping from
24 overall in the system.

1 MX-5. KMW-1 and CSVM-4 are the wells near Kane Springs. You
2 don't see that seasonal pattern from the carbonate well
3 pumping before the MX-5 test began. And you also don't see
4 any response when MX-5 turned off during 1169 aquifer test or
5 when MX-5 finally stopped pumping at the end of the MX-5
6 test. And the water levels continued to decline for up to
7 one and a half years after the pumping ends.

8 So people have postulated different lags for why
9 maybe it just takes a long time for the signal to get up to
10 these wells at KMW-1 and CSVM-4 for the MX-5 pumping. I'll
11 talk later about it looks like SNWA is using maybe a
12 three-month lag. I believe National Park Service expert
13 testified there was a nine-month lag. When I looked at his
14 chart I saw a ten-month lag before water levels started to
15 decline at KMW-1 and then a ten-month lag for what he thought
16 when water levels went up.

17 So people don't even agree on what's the lag
18 period for when you might see a response at this well. But
19 if you look overall, there's just no -- there's no response
20 to the recovery.

21 And so another way of looking at this is a
22 special --

23 Q. And, excuse me, you're on slide 15?

24 A. Slide 15. So what I'm showing here is I look at

1 You'll see a recharge event responding to
2 recharge and then decline from that recharge event to heavy
3 precipitation in 2005 and a response that occurred later on
4 in 2006.

5 And then during the MX-5 pumping test you see in
6 the CSVM-6 that when the MX-5 well is temporarily turned off
7 that you get these little bump-ups from the well. So you get
8 these little recovery responses.

9 Moving on to slide 12. So, again, looking at the
10 different wells, this is looking at the CSI wells, one
11 through four, and CSVM-1 at the bottom. You're looking over
12 here at the representative carbonate wells in the system.
13 Again, when you look at wells that are near MX-5 well that
14 are -- it all shows this characteristic bump in January 2012
15 when the MX-5 pumping was turned off.

16 Moving on to slide 13. And so if you look at the
17 hydrographs for all of these wells, you also see a general up
18 and down pattern of all of these wells responding to pumping
19 in the carbonate system. So they're all responding. Not
20 only do they respond to the MX-5 test but they're
21 responding -- you see this characteristic seasonal response
22 to the MX-5 pumping. I mean to the carbonate well pumping.

23 When you look at the hydrographs at KMW-1 and
24 CSVM-4 and you look off at CSVM-1 -- CSVM-1 is right near

1 the change in water level between the end of the MX-5
2 pumping, April of 2013, and January 2014. So I'm showing in
3 blue wells that had a rise in water level. So near the MX-5
4 pumping you see blue locations as you would expect as they
5 have rising and response to the end of the MX-5 pumping. But
6 if you look up to the north you see red where you still have
7 declining water levels.

8 So what this plot is showing is that you're not
9 seeing any response to the MX-5 pumping in the vicinity of
10 CE-VF-1 or CE-VF-2 and areas to the north of that.

11 So now I'm going to talk about some of the other
12 analyses that others have done. Southern Nevada Water
13 Authority has primarily relied on correlation analyses to
14 support hydraulic connection. And then they also use the
15 correlation analyses with a linear regression to estimate
16 drawdown. That's very unusual to me to see people use linear
17 regression to estimate drawdown. Typically you would use
18 Theis equation or some variation of the Theis equation. Or
19 in a system that's this complicated I would use a groundwater
20 flow model. So I'm surprised in the years that they've been
21 working at this that they don't have a groundwater flow model
22 that they're relying on for this. Instead, they're relying
23 on very simple linear regression.

24 And when I look through the USGS report that they

1 cite, I don't see any support for using linear regression to
 2 estimate water level drawdown from an aquifer test.
 3 So when you look at --
 4 Q. You're on slide 17?
 5 A. Slide 17. When you look at hydrographs and you
 6 do comparisons, generally in this area they're all kind of
 7 responding to similar patterns of climate. But you can also
 8 see, you can get kind of spurious correlations. So others
 9 that reported that CSVM-5 that's farther to the north in
 10 Coyote Springs Valley is not connected to the MX-5 pumping
 11 region. And so you could do a regression on that well of
 12 KMW-1 and you come up with a fairly high R-squared of .68 and
 13 is similar to the type of regression that you get using
 14 between EH-4 and KMW-1 without using any type of a lag. So
 15 you could find these types of spurious correlations. And I
 16 don't think this is enough evidence to show hydraulic
 17 connection and it's not sufficient to be used to predict
 18 drawdowns from an aquifer test.
 19 And simply having correlation is not proof of
 20 causation. Causation is neither proved nor evaluated in a
 21 regression analysis.
 22 Slide 18. So kind of an extreme example is you
 23 can look at does MX-4 correlate better to a well in Cave
 24 Valley as it does to CSVM-4. So if we look at the drawdown

1 different calculations and it's used to estimate the half
 2 foot of drawdown from the MX-5 aquifer test in their linear
 3 regression analysis. And what I see is that all that lag
 4 does is improve the R-squared analysis. And that lag does
 5 not apply in the correlation or I don't believe it was tested
 6 with any of the other correlation analysis.
 7 Q. And you were just on slide 21?
 8 A. That was slide 21. I've now moved on to slide
 9 22. Looking at the multiple linear regression that was
 10 provided in the Southern Nevada Water Authority's rebuttal
 11 report. So when you do multiple linear regression, there's
 12 typically you can do it two ways. You can start with just
 13 one coefficient. Coefficients here are listed on the left.
 14 And add one at a time to see how that affects the R-squared
 15 and check the P-values. When you look for the P-values you
 16 want this probability to be less than .05, less than five
 17 percent. Because what that pretty much represents is the
 18 chance that your coefficient here is zero.
 19 And so if you look at the P-values that came out
 20 of the multi-linear regression, for the Black Mountains area,
 21 it's nearly 70 percent. So there's a 70 percent chance that
 22 the coefficient here is zero and that this pumping in the
 23 Black Mountain area has no effect on the EH-4 water level.
 24 And then, similarly, if you look at the Muddy

1 over the MX-5 test or we look at the groundwater elevations,
 2 I can get a higher correlation with this well in Cave Valley
 3 than I do with CSVM-4. So this is just not sufficient
 4 evidence to support hydraulic connection or to estimate
 5 impacts from MX-5 pumping at the CSVM-4 location.
 6 And also when I look at the analysis there's no
 7 justification given for this use of a three-month lag. And
 8 that lag is only applied -- Here you can see they apply it at
 9 the beginning of the test but they don't apply it to the end
 10 of the MX-5 pumping. So you would expect that to be shifted
 11 on both sides there.
 12 And then I heard from the testimony that I guess
 13 the purpose of the three-month lag is they didn't know what
 14 the lag was. There was no other separate calculation or
 15 analysis to support what an appropriate lag was. They just
 16 tried various different lags to see what would give them the
 17 best R-squared. So this to me it's not appropriate. There's
 18 relatively simple equations they could use based on aquifer
 19 properties to be estimated from this testing or from modeling
 20 that you could use to figure out what the delay would be to
 21 reach the -- to see what pressure -- how long it would take
 22 the pressure signal to go from the MX-5 well up to KMW-1 or
 23 CSVM-4.
 24 And so, again, this lag is used consistently in

1 River Springs area, there's a ten percent chance that the
 2 coefficient is zero. And if you look at the certainty
 3 analysis given here for the Muddy River Springs area and the
 4 Black Mountain area, the certainty goes from negative to
 5 positive. So this multiple linear regression can't tell if
 6 the pumping in the Black Mountain area or the Muddy River
 7 Springs area will cause a decline in EH-4 water levels or
 8 might cause an increase in the EH-4 water levels.
 9 And later on I'm going to go in to demonstrative
 10 and I'll go in to some more detail.
 11 But, when I see values, particularly when you
 12 look at P-values, they're very small. When you look at the
 13 P-values that were published I believe by Fish and Wildlife
 14 or maybe it was by National Park Service, they were ten to
 15 minus five, ten to minus ten. They were virtually zero as
 16 you see here.
 17 When you see P-values around one percent and you
 18 have these other high P-values, the next step is to do a
 19 step-by progression where you take out the Black Mountain
 20 area pumping and you take out the Muddy River Springs area
 21 pumping and run the regression again and see how the P-values
 22 change.
 23 And, further, you can remove some of these
 24 others. And I'll show later on that the only one that

1 remains significant is Garnet Valley.
2 So another issue with looking at the response at
3 CSVM-4 is that the water level data are not very accurate.
4 The transducer that was used during the MX-5 pumping interval
5 during the 1169 aquifer test as was described in Southern
6 Nevada Water Authority's report done in June 2013 had a high
7 failure rate due to the high water temperatures in the well
8 so that the data that they got from that transducer data
9 could be off by a foot or less. And then the estimating that
10 the drawdown of this well is a half foot. So the drawdown
11 that they're calculating from the linear regression analysis
12 at this well is less than the amount of air that they're
13 giving in their transducer -- in their transducer
14 measurements. And those transducer measurements will
15 continue to be used in their correlation analysis. So
16 they're included in the monthly average of water level, which
17 is then used in the calculations.
18 And so another anomaly that I noticed --
19 Q. You're on slide 24?
20 A. Slide 24, yes. Another anomaly that I notice is
21 that if you look at the MX-4 well and you look at the
22 groundwater elevations during the MX-5 test, you look at the
23 figure that was published in the June 2013 report, all the
24 water levels are around 1,820 or less.

1 uncertainty at least within the range of groundwater
2 elevations that were considered in this case and the region
3 of the MX-5 aquifer test. And so it may not be appropriate
4 to use the MX-4 well for any kind of a correlation analysis
5 or a linear regression prediction of drawdown.
6 So another thing is looking at barriers. We've
7 looked at -- We've generally looked at CSVM-4, KMW-1, and the
8 offset in this region versus the offset in groundwater
9 elevations to the south. I'm on slide 27 now. But you can
10 see if you look here at region CE-VF-2 and CSI-4 that there's
11 a big drop in groundwater elevations just between those two
12 locations.
13 And so I'm showing on the right I plotted -- I
14 pulled both of these figures from Southern Nevada Water
15 Authority, but I've added the red polygons and the red text
16 and the blue polygons and the blue test and I've incorrectly
17 plotted here CE-VF-W2. It should be just to the east of the
18 highway and more south here. And this red line that I've
19 added should be between CSI-4 and the corrected location of
20 CE-VF-2.
21 Q. And you were just pointing at the right plot?
22 A. I was pointing at the right plot. The right plot
23 needs to have location for CE-VF-2 corrected and moved to the
24 east.

1 If you look at the elevations that were used in
2 all of the MX-4 correlation and linear regression analyses,
3 they're all above 1,820. So there's been an offset here of
4 about two feet. I'm not sure why the offset is there. I
5 don't know if a different time interval was selected that was
6 different from the period of time used for the MX-5 test or
7 there was a survey error. But, ultimately, I think what this
8 shows is that there's errors and uncertainty in these
9 groundwater elevations here of two feet. So, again, if we're
10 looking and trying to estimate a half foot of drawdown to
11 CSVM-4 and there's errors in these data of one to two feet,
12 the data themselves are not sufficient to be used to estimate
13 the drawdown and the estimated impact at KMW-1 or CSVM-4.
14 So if you look at -- This is out of the June
15 report from Southern Nevada Water Authority for the
16 groundwater elevations. Now with this new water level for
17 MX-4 it's much higher than you see than the water elevations
18 that you get from wells around it. So that's really anomaly.
19 That's typically your contour that that would be a source of
20 recharge there.
21 So this well elevation is off now. I don't know
22 what's the status of the other elevation to wells around it.
23 Do they need adjustment or there's something in the MX-4 that
24 needs to be adjusted back down. So there's a lot of

1 But, anyways, you see there's most faults even
2 though they go north-south, you do see evidence of slight
3 slip faults that have more of an east to west direction. We
4 were at the end of a ridge here. Why that ridge terminates
5 near the location of the offset between these two wells is
6 unknown. But that might be an indication that there's some
7 sort of hydraulic barrier, in addition to the hydraulic
8 barrier indicated by the geophysics up to the north.
9 So, if you look at the hydrographs, moving on to
10 slide 28, these wells that are two miles apart, CE-VF-2, that
11 plot in the top is to the north. CSI-4 is the plot in the
12 bottom is the well to the south. There is an anomaly that
13 happens at CE-VF-2 that I believe there's a hole in the
14 casing or something where the groundwater elevation
15 increased. But if you look at the hydrograph even before
16 that, the groundwater elevation was around 1,856, whereas the
17 groundwater elevation of CSI-4 is around 1,822. So there's a
18 change in head here of over 30 feet over for this area a
19 relatively short distance.
20 And others have testified that this is more of a
21 bathtub with fairly flat gradient. You wouldn't expect to
22 see this much offset from these two locations that are only
23 two miles apart.
24 And then you also see -- I do think you see a

1 little bit of the carbonate pumping signal in CE-VF-2 but you
2 see a much dampened effect than you see on CSI-4. So already
3 because this hydraulic barrier and there's at least another
4 one that is up to the north beyond this, you see a dampening
5 of hydraulic effects as you move to the north.

6 And now moving in to my demonstrative slides. So
7 I'm going to go in to some details on the polling of
8 regression. So pulling the reference that was used by
9 Southern Nevada Water Authority as a USGS report is Sell and
10 Hersh, 2002. When you do multiple linear regression,
11 abbreviated MLR, you want to choose the best MLR water model.
12 And the way you do that is you use a stepwise procedure.
13 There's some software now that can do that in an automated
14 sense. But if you're using Excel, you have to do it more
15 manually where you have to look at the P-values.

16 So I replicated Southern Nevada Water Authority's
17 first analysis. I've highlighted here -- And I've moved on
18 to slide 30 demonstrative. I've highlighted here in red --

19 MR. TAGGART: We would like to just object for
20 the record. My understanding is this is a new analysis.
21 This was not provided in the expert reports. If I'm wrong
22 though, I can be corrected. But my understanding is this is
23 new work that was done since the submittal of the expert
24 reports. And I thought our rule was that witnesses would

1 demonstrative slide.

2 MR. TAGGART: Again, yeah, we in our report
3 discussed multi-linear regression. I don't know where they
4 discussed multi-linear regression in their reports nor in any
5 of this analysis on this slide, the next slide, the slide
6 after that, the following slide. So the next four slides are
7 all analysis that was not included in any report that
8 described stepwise linear regression.

9 MS. PETERSON: Again, stepwise -- the linear
10 regression was discussed in Mr. Umstot's report, his rebuttal
11 report, specifically in response to SNWA's information in
12 their report. These figures -- And, frankly, I don't even
13 have the demonstrative exhibits in front me, so I don't even
14 know what the next slides show. I can't remember what they
15 show. But the figures that are used are contained in SNWA's
16 evidence. And you -- I mean, the witness that just appeared
17 for the irrigation district or the Moapa Valley Water
18 District did a totally different analysis than he had
19 contained in his report and you allowed all of that in.

20 HEARING OFFICER FAIRBANK: Mr. Herrema.

21 MR. HERREMA: Brad Herrema for CSI. You know,
22 Mr. Taggart has asked every witness that's come after the CSI
23 witnesses that they thought of that prior testimony provided
24 by CSI witnesses regardless of whether it was in their report

1 testify about the conclusions that they had in their reports
2 and we didn't have a chance to respond to this testimony
3 about the stepwise regression. So if I'm wrong about this
4 being in the reports, I apologize. But I haven't been able
5 to locate it.

6 HEARING OFFICER FAIRBANK: Ms. Peterson, was
7 this -- is this analysis contained either in the initial July
8 3rd report or the August report?

9 MS. PETERSON: Not this specific slide, no.

10 HEARING OFFICER FAIRBANK: Then I would say that
11 Mr. Taggart's objection is reasonable based upon the fact
12 that the testimony and evidence that was to be submitted was
13 limited to the analysis that was performed and provided
14 within those reports. If this is an evidence and analysis
15 that's contained in the reports, then I think that's fair
16 game. But, unless a participant has an opportunity to review
17 and have it in preparation for the proceedings, that does
18 raise a certain level of concern.

19 MS. PETERSON: So the stepwise linear regression
20 was discussed in the report and explained in the report.
21 This specific figure was not in the report. And the
22 information comes from the SNWA chart that's in the rebuttal
23 report. I think it's Figure A-1 in the appendix. And so
24 that figure is in evidence, this figure right here on this

1 or their rebuttal report. So, if we're striking some of
2 this, then we might want to go back and ask for other things
3 to be stricken as well.

4 HEARING OFFICER FAIRBANK: So I guess a couple of
5 considerations is one is, Ms. Peterson, is you guys have
6 about 20 minutes, roughly, left within the time allotted for
7 you for your presentation of your evidence today. If this is
8 a manner in which you guys want to go ahead and extend that
9 time, that's certainly within your discretion and we're not
10 micromanaging that. To the extent the State Engineer finds
11 value in it or not find value in it, the State Engineer will
12 make a determination with regards to the analysis and whether
13 or not it's appropriate within the confines of these
14 proceedings and those reports contained.

15 And so with that I would note Mr. Taggart's
16 objection and we appreciate your response and we'll let you
17 proceed as you see fit.

18 MS. HARRISON: I just --
19 (The court reporter interrupts)

20 HEARING OFFICER FAIRBANK: It's Sylvia Harrison.
21 Ms. Harrison.

22 MS. HARRISON: Sorry. I just want to echo
23 Mr. Taggart's objection. This is a new analysis that we have
24 not seen before. It's not simply a rendition of previous

1 testimony. It appears to me to be a completely new analysis
2 of other rebuttal testimony. So it's in effect a rebuttal of
3 rebuttal. So we haven't got a chance to analyze it. So I
4 just want to put that on the record. Thank you.

5 HEARING OFFICER FAIRBANK: Thank you,
6 Ms. Harrison. And for those who are listening remotely,
7 Ms. Harrison echoed Mr. Taggart's objection. And, again,
8 I'll just reiterate that the State Engineer will take --
9 takes those objections in to consideration and we'll assign
10 the weight to the testimony as appropriate.

11 MR. TAGGART: We do believe your initial ruling
12 was correct. This is far different than anything else we've
13 seen statistical analysis that's been completed and is now
14 going to be testified about. We have no chance to respond to
15 this. And it's different than someone putting up a
16 hydrograph that everyone has been looking at, like
17 Mr. Lazarus did.

18 HEARING OFFICER FAIRBANK: And I understand that,
19 Mr. Taggart, and we appreciate that and your objection is
20 being noted and will be taken under consideration. And
21 you'll have your opportunity to cross-examine the witnesses
22 as well.

23 MR. TAGGART: Okay. Thank you.

24 Q. (By Ms. Peterson) And, Mr. Umstot, you're going

1 these groundwater elevations are collected manually, this is
2 not easy field work, the depth to water is something around I
3 believe a thousand feet. The tape has to be unspooled and
4 stretched. It could change over the course of a day. It
5 could change depending on who went out that month to take the
6 measurement. It could depend on the person who did the
7 electrical tape that was used to make the measurement,
8 different measurement location. Was it done to the ground?
9 Was it done to the top of the casing? So you can see within
10 the manual measurements there's some jumping around from
11 month to month sometimes on the order of a foot or so. So,
12 again, greater error in the manual measurements than the half
13 foot that SNWA has estimated of drawdown at the CSVN-4 well.

14 And then the red values, once they start using
15 calibrated tape -- I'm not sure how that was calibrated --
16 but you see a distinct change in the hydrograph. I mean, it
17 could be that this is just because there's kind of wet
18 conditions that occur around the end of 2014 in the Nevada
19 Climate Division 4 that caused water levels to kind of stop
20 declining. But, again, it's kind of odd to me that the break
21 seems to occur with the change in the water level measurement
22 method.

23 And you see sort of a similar thing again when
24 you look at the KMW-1 well. Again, there's some up and down

1 to proceed ahead; right?

2 A. Yes. This is Todd Umstot. So what my
3 demonstrative just supports is that if you continue to do the
4 stepwise regression you would find that only Garnet Valley in
5 this regression contributes to the decline or the change in
6 water levels in EH-4. So anyone that did the analysis would
7 find the same thing.

8 So I'll skip ahead to another demonstrative.
9 This is slide 34, demonstrative slide, where it's the
10 hydrograph for CSVN-4. What I'm showing here in addition
11 that we haven't seen is in green the transducer levels that
12 have an error rate of around a foot. And, blue, manual water
13 level elevations. And then in red, what are described as
14 calibrated manual groundwater elevation data.

15 So, you can see, you know, the up and down, the
16 kind of jumping around in the transducer data that Southern
17 Nevada Water Authority pointed out in the 2013 report. But
18 what this also calls in to question is the manual
19 measurements. So you can see here the water level went up a
20 foot and went down a foot.

21 Q. What are you pointing to, what months?

22 A. If you look after the MX-5 test, you're looking
23 around it looks to be maybe late 2013, the groundwater
24 elevation from month to month changes by a foot. So when

1 values from month to month. So, you know, there's some error
2 and uncertainty in those groundwater elevation measurements.
3 And then, again, there's a break in the change once there's a
4 switch to using the calibrated measurements. It may be
5 related to climate or it may be related to -- So it's very
6 hard.

7 In summary, there's too much error in the data to
8 be able to discern drawdown response from the MX-5 test and
9 to determine that there's a hydraulic connection to the
10 southern carbonate pumping in the Lower River Flow System to
11 the location of KMW-1 to CSVN-4 and that climate conditions
12 would explain the general trends, the downward trends, that
13 you do see in the groundwater elevations. So I don't see any
14 evidence, hydraulic connection, to southern Lower White River
15 Flow System.

16
17 PETER MOCK

18 Called as a witness on behalf of
19 Lincoln County/Vidler, having been first duly sworn,
20 Was examined and testified as follows:

21
22 DIRECT EXAMINATION

23 By Ms. Peterson:

24 Q. Okay. Dr. Mock, so you have about five minutes.

1 I apologize. Could you just give the State Engineer's office
 2 a brief summary of your experience and then just maybe hit
 3 the high points of your rebuttal presentation.
 4 A. Sure. Good afternoon.
 5 Q. Turn your mic on, please.
 6 A. I'm sorry. So just to give you a quick overview,
 7 I received my Bachelor's degree in hydrology from the
 8 University of Arizona. The first two years of my Bachelor's
 9 work was in mining engineering where I received quite a bit
 10 more geology than you probably would have expected from a
 11 hydrology degree.
 12 And then worked as a hydrologist one, two, and
 13 three for the Arizona Department of Water Resources. I
 14 worked there for three years under a registered geologist,
 15 actually several registered geologists. And worked on basin
 16 models, regional modeling, and also the Regional Groundwater
 17 Pumping Task Force, which is a rather unique opportunity.
 18 I then went to CH2M Hill in Phoenix where I
 19 worked both in Arizona and California. My primary work there
 20 had to do with the beginnings of the superfund program, the
 21 great big flumes of TC that were miles long, finding the
 22 potential responsible parties for that and contracting the
 23 model.
 24 I also did some work with artificial recharge in

1 My doctoral dissertation was on the sedimentary
 2 architecture and how that affects hydraulic conductivity. So
 3 you see a mix of geology in with it. And, in fact, my
 4 advisor had to replace Mr. Shariq with Victor Baker on my
 5 advisory team to address the geologic aspects of what I was
 6 pursuing there.
 7 I finished that and started my own firm for which
 8 I've been working about 22 years. I typically work in teams
 9 as you see here. I do not work as a loan consultant, but I
 10 work with a group. There is generally an overlap in the
 11 expertise of the team. And that's where I work and I enjoy
 12 that sort of work.
 13 I've done many regional models with my own firm.
 14 And I've done some artificial recharge work. I've done water
 15 rights work in the Gila River Indian Community. I was in a
 16 type of prospect of the Water Rights Ranch Settlement Act of
 17 2004 and the subsequent implementation which has included
 18 many factors, also developing artificial recharge projects
 19 for the Gila River Indian Community.
 20 Q. So, let's go on to slide two, okay, because I
 21 think that's all we're going to get to, okay, Dr. Mock. I
 22 apologize.
 23 A. Yes, ma'am. So my summary is that Kane Spring
 24 Valley is outside of and distant from the Muddy River Springs

1 Arizona, in Southern California as well. And I worked for a
 2 registered geologist in California at that time. And I when
 3 I was at CH2 I became a registered geologist both in Arizona
 4 and i California.
 5 And then I went back to school. After working
 6 for 11 years, I went back and became a non-traditional
 7 student and received my doctorate in hydrology groundwater
 8 resources at the University of Arizona. In relevance to
 9 this, I was also the teaching assistance for Tom Maddox
 10 MODFLOW class. And MODFLOW is just the title actually
 11 because he teaches basin dynamics and systems analysis using
 12 MODFLOW. And so being in the teaching system I got to work
 13 with the students and work on basin responses and how models
 14 work.
 15 I received my Ph.D. while doing a minor in
 16 applied mathematics. And my particular specialty in that was
 17 numerical analysis. And that's the solution of partial
 18 differential equations. That's where we use in groundwater
 19 we use Darcy's law and we use mass balance.
 20 And I also, in doing that, out of necessity I had
 21 to write the code. I've written code for finite difference
 22 models. I've written code for the solvers. I've written the
 23 code for finite elements. And I'm familiar with how they
 24 work on the inside, if you will.

1 area. The Lower White River Flow System hydrographic areas
 2 and the surrounding hydrographic areas are underlain by
 3 strongly broken-up arrangement of Paleozoic carbonate blocks.
 4 Kane Springs Valley is in a different structural
 5 block of Paleozoic carbonates. I used the term in my report,
 6 a labyrinth, a maze. I've tried to find terms. Corridors.
 7 I don't think they're tubes. These aren't -- I'm not making
 8 analogy of rivers. I'm just saying that the pieces are
 9 broken up.
 10 And if you look at -- I depend strongly on the
 11 work of Page and Rowley. I've seen very similar features in
 12 both of them. But it's critical to look at the structures in
 13 the area. So I'm saying that there are structural
 14 impediments of the blocks to groundwater flow. I'm not
 15 saying that all of them are impermeable. I would think that
 16 the East Mormon Mountains are where the actual underlain
 17 granite come to the surface, that might be pretty close. But
 18 there's no such thing as impermeable in my book. Tratzoky
 19 showed that concrete isn't even impermeable.
 20 So there are structural pieces between Kane
 21 Springs Valley and the MRSA. And that would include both of
 22 what you see today as well as what's in Page and Rowley.
 23 So conjectures about Kane Springs Valley being an
 24 effective important place to manage and so as to protect the

1 springs and associated surface flows of the Muddy River
2 Springs area are erroneous. And that's my summary.
3 MS. PETERSON: Thank you.
4 So I think we'll end right there. I don't know
5 how much time we have left. The rest of the pages of the
6 slides for Dr. Mock are contained in his report. And, again,
7 they are in evidence because this power point presentation
8 was already admitted in to evidence. So, if we can get back
9 to it, we will. Thank you.
10 HEARING OFFICER FAIRBANK: Ms. Peterson, you have
11 about five minutes left of the time that you reserved. So if
12 you have time for -- or if you wish after we have
13 cross-examination to come back for redirect, you'll have
14 about five minutes.
15 MS. PETERSON: For redirect?
16 HEARING OFFICER FAIRBANK: Yes.
17 MS. PETERSON: Okay. Thanks.
18 HEARING OFFICER FAIRBANK: Okay. We'll go ahead
19 and start with the cross-examination. And the participants
20 will have seven minutes for their cross. And we'll start
21 with Coyote Springs Investments.
22 CROSS-EXAMINATION
23 By Mr. Herrema:
24 ANSWERS BY MR. BUTLER:

1 A. I would have to look at them specifically.
2 There's some -- I would have to look -- I couldn't answer
3 that directly. I would have to go look at it independently.
4 I wasn't calculating the years. I was looking at the
5 carbonate water gross difference. But, yes, if there was
6 significant differences, it could.
7 Q. Okay. When you do this analysis do you have to
8 assume a flow path to -- for the age dating of the water?
9 A. There was -- In -- When I group the similarities
10 in water chemistry, there is no assumption of anything. It
11 was just similarities. So that was just like gradient
12 indicates potential, it's just similarities in percent modern
13 carbon. For them to be connected there would have to be a
14 flow path. But I did not provide any such evaluation.
15 Q. Okay. The 2006 Page preliminary report and the
16 July 2019 report, it states, even the current geochemical
17 models cannot really account for the relative amounts of
18 mixing with groundwater of the many different agents.
19 Given the wide range of ages, the different ages,
20 between alluvial and carbonate aquifers and the potential
21 different flow paths in the Coyote Springs Valley, does your
22 analysis using carbon-14 data represent a unique solution?
23 A. I was focused mainly on the difference between
24 Kane, which is quite a bit older, quite a bit less percent

1 Q. Thank you. Brad Herrema on behalf of CSI. I'd
2 like to start with a couple of questions for Mr. Butler.
3 Good afternoon.
4 A. Hello.
5 Q. Are you familiar with the wells in the Coyote
6 Spring Valley that were used in the carbon-14 analysis? And,
7 specifically, do you know if the analysis differentiated
8 between alluvial and carbonate wells?
9 A. I would have to go back and look specifically.
10 The data that I circled there was from that report, that 2006
11 report. I didn't create that. That graphic is showing the
12 carbon-14 data that was specifically from that 2006 report.
13 Q. You don't know sitting right now if it's
14 differentiated between alluvial or carbonate wells?
15 A. I'm sure they're a combination of both. If the
16 data were present, they were all plotted.
17 Q. Okay. For instance, the table on page one has
18 alluvial well CSV-3 which shows a water age of 28,000 years.
19 And the nearby carbonate well, CSVM-2, has an age of 30,500
20 years. Similarly, in northern Coyote Spring Valley, the
21 alluvial well, CSVM-7, has an age of 21,000 years. And the
22 nearby carbonate well, CSVM-3, has an age of 14,200 years.
23 Would the differences between alluvial and carbonate wells
24 affect your conclusions?

1 modern carbon than Coyote Springs. I was not focused on
2 Coyote Springs per se. It was the difference between Kane as
3 the component of flow coming in to Coyote Springs.
4 Q. Okay. Thank you.
5 ANSWERS BY MR. UMSTOT:
6 Q. Question for Mr. Umstot. One of the attorneys
7 earlier today asked Mr. Lazarus about his review of your work
8 regarding the effect of climate on water levels in the Lower
9 White River Flow System. Were you present for that?
10 A. Yes, I was.
11 Q. Do you agree with the hydrographs that
12 Mr. Lazarus presented in his assessment of climate?
13 A. I don't agree with his assessment. I see a
14 decline in groundwater elevations from climate.
15 Q. Okay.
16 ANSWERS BY MR. BUSHNER:
17 Q. And one question for Mr. Bushner. Although we
18 didn't hear your presentation, we do have your slides.
19 A. Yes.
20 Q. Were you able to determine a value of
21 transmissivity for the carbonate aquifer in Kane Spring
22 Valley from the pump test that you performed?
23 A. Yes. So the transmissivity value that we
24 calculated from our aquifer test for the region localized

1 there in Kane Springs Valley was about 50,000 gallons per day
2 per foot. It wasn't anywhere near the 300,000 number that
3 Mr. Lazarus had put up. And that's also in my report on page
4 5-5.

5 MR. HERREMA: All right. I have no further
6 questions at this time. Thank you.

7 HEARING OFFICER FAIRBANK: United States Fish and
8 Wildlife Service? Seeing no questions.
9 National Park Service.

10 CROSS-EXAMINATION

11 By Ms. Glasgow:

12 Q. Good afternoon. Karen Glasgow with the
13 Department of Interior Office of the Solicitor for the
14 National Park Service.

15 All of my questions, because I'm really kind of
16 stupid about all of this are -- anyone is welcome to answer
17 them, okay. So if I don't call a specific person, just chime
18 in by whomever has an answer, okay.

19 Earlier I think it was Mr. Carlson or
20 Dr. Carlson, whichever, you talked about the permeability and
21 your CSAMT data. Can you determine the permeability of the
22 carbonate rock from the CSAMT data?

23 MR. CARLSON: No, not directly. There's so many
24 different things that vary the resistivity results. So

1 MS. GLASGOW: Okay. Thank you.
2 Could I approach the witness? I would like to
3 give them a -- one of the chart -- one of the power point
4 graphs that came out.

5 HEARING OFFICER FAIRBANK: Certainly.

6 MS. GLASGOW: Thank you. And I have more than
7 one, but if you guys could share amongst yourselves. I have
8 for you guys too.

9 MS. PETERSON: How about for me?

10 MS. GLASGOW: Oh, I need one -- I do have one for
11 her too. Sorry about that. I forgot all about you. Do you
12 need more than one? There are two pages.

13 And a second one for you all so you don't have to
14 share as closely. And what I handed to you was -- So I want
15 you to look at on the first or the second page, so it's
16 Figure 5.6 or 5-6. And I want you to look at five down from
17 the top for CM -- CSV-5. Can you identify the climate
18 signals in this hydrograph?

19 ANSWERS BY MR. UMSTOT:

20 A. This is Todd Umstot. You see a large -- You see
21 a general increase in groundwater elevations following the
22 high recharge event in 2005. And then it generally goes up
23 after that. You don't see any variability from any climate
24 or pumping.

1 permeability is one of them. But we don't know what else is
2 influencing it.

3 ANSWERS BY MR. BUTLER:

4 Q. (By Ms. Glasgow) My next question is about
5 geochemistry, which really I know nothing about. What is the
6 source of the arsenic that had to be removed from the water
7 pump from MX-5 prior to release?

8 A. I don't --

9 (The court reporter interrupts)

10 A. Oh, I'm sorry. Tom Butler. The exact source I
11 don't know. But arsenic is very common in volcanic rocks.
12 It's also -- It's absorbed to iron oxide in subsurface which
13 then can be released under reduced conditions and/or acidic
14 conditions. So any one of a number of those conditions.
15 Being that it's hydrothermal, volcanic signature could be the
16 source.

17 Q. Do you have -- I'm wondering how much CSV-7
18 water is required to mix with the KPW-1 water in order to
19 produce the values that were observed in the central CSV and
20 MRSA, the percent amount of carbon?

21 A. Percent amount of carbon? CSV-7?

22 Q. Yes.

23 A. I would have to go back and look at the
24 calculation.

1 You do see, after the MX-5 pumping ended, which
2 was indicated by this vertical dash line, that there is a
3 drop and a change in slope in the CSV-5 hydrograph. When I
4 looked at the data, that change in slope is due, I believe,
5 to a measurement error. That's when they switched to using
6 the calibrated tape for doing the manual measurements. And
7 previous to that drop they used regular -- a regular tape, I
8 guess, for doing their measurements. So there's some --
9 there's some variation sloped here. But I believe that's due
10 to measurement error.

11 Q. So let me make sure I understand. So there's a
12 surrogate for change in the hydrographic signals, what you
13 just talked about? I'm trying to make sure I understand,
14 because I don't see the plotted signals, so I'm trying to
15 figure out --

16 A. Oh, you see a very strong climate signal. If you
17 look at the period from 2003 to 2005, the water level is
18 flat.

19 Q. Okay.

20 A. From the 2005 onward there's a general increase
21 that seems to have a relatively steady slope. That's from
22 the recharge event in very, very wet years. One in a
23 hundred-year, two in a hundred-year recharge event. So you
24 can see a lot of wells, I believe, in Nevada are still

1 responding to that really extreme event. And the way they
2 respond depends not only on climate but also on the
3 particular hydrogeologic characteristics around that well.
4 Q. So the recharge event that you're talking about
5 is the 2004-2005 bump that you can see in that same
6 hydrograph?
7 A. Yeah, it's the bump you see in 2005.
8 Q. Okay. And so -- And you just testified that you
9 think a lot of wells are -- were responding or still
10 responding to that recharge event as we speak?
11 A. It depends on hydrogeologic characteristics
12 around a particular well. Some wells, I think, are still
13 responding to that recharge event, as you see a continuous
14 increase in groundwater elevations. Some wells, depending on
15 particular characteristics around that well, kind of increase
16 and then I have a decrease following that recharge event. So
17 now I have a declining trend.
18 Q. Is this a good surrogate for effects of water
19 levels from climate?
20 MS. PETERSON: Clarification. Is what?
21 MS. GLASGOW: The -- This particular hydrograph.
22 MS. PETERSON: CSV-5?
23 MS. GLASGOW: Correct.
24 MR. UMSTOT: I don't believe it is, in that it

1 A. I don't know. I mean, Kane Springs water, I
2 don't have an opinion on it. It's got signatures of both.
3 It's in communication with carbonate rocks and in
4 communication hydrothermal activity. It could be all of the
5 above.
6 Q. And you saw that the chemistry indicated that the
7 carbonate aquifer water in Kane Springs was distinct from
8 what was going on closer to the Muddy River Springs area; is
9 that correct?
10 A. That's correct.
11 Q. Where do you see that the water in Kane Springs
12 is going, if anywhere?
13 A. I don't have an opinion. The -- My scope on this
14 project was to evaluate the chemistry data and see if there
15 was a chemical link. It is clear there is a chemical link
16 between CSV-4 -- CSV-4 in the northeastern Coyote Valley and
17 Kane Springs. I don't see it anywhere else. I don't see
18 it -- That could mean it's so greatly attenuated you don't
19 see it elsewhere or has some alternate flow path that I'm not
20 aware of.
21 Q. Did you see any indication that the carbonate
22 water in the Kane Springs was stagnant, that it stayed where
23 it was and didn't go on a flow path?
24 A. No opinion. I was just evaluating chemistry

1 doesn't -- it only responds to long-term climate signals. It
2 doesn't respond to short-term climate signals. So those only
3 give information on the long-term climate signal.
4 MS. GLASGOW: Okay. Thank you. I appreciate
5 your time.
6 HEARING OFFICER FAIRBANK: Next is the Moapa Band
7 of Paiutes.
8 CROSS-EXAMINATION
9 By Mr. Berley:
10 ANSWERS BY MR. BUTLER:
11 Q. Hello. Richard Berley for the record.
12 Mr. Butler, I just want to ask you a question or two about
13 chemistry.
14 A. Okay.
15 Q. You talked about fluoride as a chemical marker to
16 try to figure out, you know, how water from one place relates
17 to water from some place else. Where does fluoride come from
18 generally?
19 A. Mineral fluoride is quite common.
20 Q. Does it come from volcanic rocks?
21 A. It's common in volcanic rocks. It's common in
22 carbonate rocks. It's common in a whole sleet of rocks.
23 Q. Do you have any special opinion about where it
24 comes from in Kane Springs water?

1 dependent of other -- I mean, I did look at gradient. That
2 was all I looked at.
3 Q. You didn't see any other place other than -- You
4 didn't look to see where this water might go if it didn't go
5 to the Muddy Springs --
6 A. I was specifically looking at chemical
7 signatures. I wasn't looking at groundwater. I wasn't
8 looking at basin deposits. I wasn't looking at the
9 structure. I wasn't looking at groundwater flow paths
10 particularly, other than just a generalized gradient in the
11 Kane Springs Valley. And the chemical signatures are quite
12 different. I mean, it wasn't -- it's not like we were just
13 looking at one particular chemical signature. We're looking
14 at soluble chemistry, isotope data, everything pointing to
15 the same conclusion.
16 There is some dissimilarities there that can
17 maybe be explained by either the very small flux through
18 there or alternate flow path. I would be speculating if I
19 say I knew where that was because there's not enough data to
20 support it.
21 Q. Okay. So your analysis went to the point of
22 where you reached a conclusion that there was a dissimilarity
23 between the water in Kane Springs and in the springs area,
24 but you didn't go further and try to figure out where maybe

1 the water might have gone if it didn't go towards the
2 springs?
3 A. Well, if I had the data, I could make that
4 conclusion. But there's not the data to support it. Kane
5 Springs chemistry is unique. It's an N-member. So if it was
6 plotted between some other N-member then I might be able to
7 make a conclusion that there was some mixing or it was
8 traveling somewhere else. There just wasn't the data to
9 support that because it wasn't an N-member.
10 Q. Okay. Is that true for isotopic evidence as
11 well?
12 A. The isotopic data for southern Kane Springs is
13 lighter than -- lighter than most of the other samples in
14 Coyote Valley and most of the samples in the MRSA and also
15 lighter than most of the samples in northern Kane Valley.
16 And so that suggests possibly that it was recharged under an
17 even quarter climate, higher elevation, it could be any of
18 those, mixing with another source.
19 Q. Did you find any basins in the general vicinity
20 that had similar isotopic signatures?
21 A. I would say surrounding it, it was mostly
22 heavier, mostly -- more S-negative.
23 Q. And so what do you think that shows? Does that
24 tend to show stagnancy or does that tend to show --

1 Springs Valley.
2 Q. So you agree that there is a strong hydrologic
3 connection between Kane Springs and Coyote Springs Valley?
4 A. I guess I would attenuate that a little bit. I
5 think with the evidence that we have provided today --
6 Q. Mr. Bushner, do you agree with the statement or
7 not?
8 A. I guess I don't agree with the strong connection.
9 But there is groundwater flow. We've never denied that that
10 groundwater flows from Kane Springs Valley in to Coyote
11 Springs Valley, just as it does from Pahrnagat Valley in to
12 Coyote Springs Valley, just as it does from --
13 Q. Thank you, sir. Thank you, sir. I have very
14 limited time.
15 So you disagree with the statement that there's a
16 strong hydrologic connection; is that fair?
17 A. Fair.
18 Q. And is that the same answer for everyone on the
19 panel?
20 MR. UMSTOT: Todd Umstot. Yes.
21 MR. MOCK: Peter Mock. Yes.
22 MR. BUTLER: Tom Butler. Yes.
23 MR. CARLSON: And Norman Carlson. Yes.
24 Q. (By Mr. Taggart)

1 A. I wouldn't make a conclusion on stagnancy. I
2 wouldn't have the data to support that.
3 MR. BERLEY: Okay. Thanks very much.
4 HEARING OFFICER FAIRBANK: Las Vegas Valley Water
5 District, Southern Nevada Water Authority.
6 CROSS-EXAMINATION
7 By Mr. Taggart:
8 ANSWERS BY MR. BUSHNER:
9 Q. Good afternoon. My name is Paul Taggart. I
10 represent the Southern Nevada Water Authority and the Las
11 Vegas Valley Water District. Good afternoon, Gentlemen.
12 I'm going to read to you a statement from Lincoln
13 County Exhibit Number 13, page 21. This is Ruling 5712. The
14 State Engineer issued this ruling and then the State Engineer
15 made this finding. The State Engineer finds the evidence
16 indicates a strong hydrologic connection between Kane Springs
17 Valley and Coyote Spring Valley, specifically that
18 groundwater flows from Kane Spring Valley in to Coyote Spring
19 Valley. And I want to ask each one of you, each one of you
20 disagree with that statement; is that true?
21 A. This is Greg Bushner for Vidler Water Company.
22 I'm going to answer for all of the experts. No, we don't
23 disagree with that statement. There is a connection.
24 Groundwater does flow from the Kane Springs in to the Coyote

1 ANSWERS BY MR. UMSTOT:
2 Q. Okay. Now I have a question for Mr. Todd -- what
3 was your last name?
4 A. Umstot.
5 Q. Umstot, thank you. Mr. Umstot, do you have an
6 opinion that thousands of acre-feet of water can be pumped
7 for a permanent subdivision without impacting the Moapa case
8 in the Muddy River Springs if that water is pumped south of
9 the Lower White River Flow System down the fault?
10 A. I haven't evaluated pumping effects.
11 Q. Okay. So do you believe thousands of acre-feet
12 can be pumped south of the Lower White River Flow System down
13 the fault without impacting the Muddy River Springs?
14 A. That's not something I've evaluated.
15 Q. Okay. So you don't have an opinion on that?
16 A. I don't have an opinion.
17 Q. What about anybody else on the panel? Mr. Mock?
18 I'm sorry. Doctor.
19 MR. MOCK: I haven't evaluated I and I don't have
20 an opinion on it to the question as stated.
21 Q. (By Mr. Taggart)
22 ANSWERS BY MR. BUSHNER:
23 Q. Mr. Bushner, does Lincoln County own the water
24 rights in Kane Spring Valley?

1 A. I believe so, yes.
2 Q. You're not aware of it?
3 A. I'm --
4 Q. You're not aware the State Engineer granted
5 applications for groundwater to Vidler and Lincoln County in
6 Kane Spring Valley?
7 A. Yes, I am aware.
8 Q. Okay. Would you agree with me that it was a
9 thousand acre-feet that were granted?
10 A. Yes.
11 Q. And if the proposal that is offered by Vidler and
12 Lincoln County in this proceeding where a boundary is
13 established at the Dorothy fault or the Lower White River
14 Flow System boundary fault, if a boundary is located there
15 then is it true that Vidler and Lincoln County could develop
16 that water in northern Coyote Spring Valley as long as it's
17 north of that boundary fault?
18 A. No. We would develop the water in Kane Springs
19 Valley.
20 Q. Okay. So you have no intention of trying to
21 develop that water in northern Kane Springs Valley?
22 A. No. We do have an intention of developing that
23 water in Kane Springs Valley.
24 Q. I'm sorry. You have no intention of developing

1 existing water right permits that Vidler and Lincoln County
2 own can be developed north of the boundary fault without
3 impacting the Muddy River Springs?
4 A. It's our position that we would develop those
5 water rights if awarded out of Kane Springs Valley. I think
6 the boundary fault that we identified is just more evidence
7 to support our assertion that we will have no impacts on
8 water rights or impacts in the Muddy River Springs area and
9 Coyote Springs Valley.
10 Q. No matter how much water is pumped north of the
11 fault?
12 A. We would evaluate that.
13 Q. Well, that's my question. Is there a -- Is it an
14 impermeable barrier, the boundary fault?
15 A. No.
16 Q. So there must be some maximum amount of water
17 that you can pump without impacting areas south of the fault;
18 right?
19 A. Mr. Taggart, we have -- we were on a trajectory
20 to go to hearing on our groundwater right applications until
21 this issue came up before us. And I have these gentlemen
22 here as professional scientists to evaluate that. And we
23 haven't evaluated that yet, so I don't have an answer for you
24 yet.

1 that water in northern Kane Springs Valley? I'm sorry.
2 Northern Coyote Spring Valley?
3 A. Correct.
4 Q. Okay. Now, you also have applications pending
5 before the State Engineer; correct?
6 A. Correct.
7 Q. And there may be another 5,000 acre-feet
8 requested in those additional applications in Kane Springs
9 Valley; is that true?
10 MS. PETERSON: I'm going to object based on
11 relevancy. I don't think our application in Kane Springs
12 Valley have anything to do with this proceeding and I thought
13 water rights were the next phase.
14 HEARING OFFICER FAIRBANK: I agree, Ms. Peterson.
15 Mr. Taggart, is this line of questioning related
16 to the five questions that were presented in Order 1303
17 relating to the geographic boundaries?
18 MR. TAGGART: Yes.
19 HEARING OFFICER FAIRBANK: And can you explain
20 that?
21 MR. TAGGART: Yes. I'll just ask the question.
22 Q. (By Mr. Taggart) Is it your position that the
23 water rights that are sought by Vidler and Lincoln County in
24 the applications that are before the State Engineer and the

1 Q. Mr. Bushner, are you familiar with the Muddy
2 River?
3 A. Not that familiar.
4 Q. And does Vidler or Lincoln County own water
5 rights in the Muddy Valley Irrigation Company?
6 A. I believe we do.
7 Q. Okay. So are you familiar with those water
8 rights?
9 A. No.
10 Q. Okay. Are you familiar with the fact that SNWA
11 owns water rights in the Muddy River?
12 A. I think I've heard that.
13 Q. Okay. And are you familiar with the opinion of
14 SNWA's hydrologist that pumping in the northern Kane Springs
15 area will impact the Muddy River Springs, that that's their
16 opinion?
17 A. I don't recall that.
18 Q. You don't recall --
19 A. But if that's their opinion, that's their
20 opinion.
21 Q. You filed a rebuttal report challenging that
22 opinion. So are you sure you don't recall it?
23 A. We filed a rebuttal report because SNWA said that
24 Kane Springs Valley should be included in the Lower White

1 River --
2 Q. Okay. Well, my question was, were you familiar
3 with the fact that a witness for SNWA has the opinion that
4 pumping in northern Kane Spring Valley can impact the Muddy
5 River Spring? That was my simple question.
6 MS. PETERSON: Objection. Asked and answered.
7 MR. TAGGART: No, it was not answered.
8 THE WITNESS: I do not recall a witness in this
9 case saying that.
10 HEARING OFFICER FAIRBANK: Mr. Taggart, you're
11 out of time.
12 MR. TAGGART: Thank you.
13 HEARING OFFICER FAIRBANK: We'll move on to the
14 City of North Las Vegas.
15 MR. MORRISON: Were we overlooked?
16 HEARING OFFICER FAIRBANK: Sorry. I checked the
17 wrong line on my little sticky note here. Mr. Morrison for
18 Moapa Valley Water District.
19 CROSS-EXAMINATION
20 By Mr. Morrison:
21 ANSWERS BY MR. BUSHNER:
22 Q. Good afternoon. Greg Morrison for the record for
23 the Moapa Valley Water District. Quickly, I would like to
24 start with Mr. Bushner. Page 2-2 of your report, you make

1 with high resolution.
2 Q. Yet you found the boundary fault using lines
3 parallel to that boundary fault?
4 A. Right. One is on one side and one is on the
5 other. So the difference between the two gives us the data
6 that it exists.
7 MR. MORRISON: Okay. Thanks. This question
8 might be for Mr. Bushner, might be for Mr. Carlson. We've
9 got a page out of your report here and I've got copies if you
10 would like to take a look at it.
11 May I approach the witness please?
12 HEARING OFFICER FAIRBANK: Yes, you may.
13 MR. MORRISON: Thanks.
14 Q. (By Mr. Morrison)
15 ANSWERS BY MR. BUSHNER:
16 Q. All right. First paragraph on the second page
17 there, first full paragraph. First sentence says that the
18 hydrographs for KMW-1 and CVSM-4 are plotted with the same
19 time and water level elevation scale for the combined period
20 of record. The difference in head between these wells is
21 explained due to presence of a fault between those wells. Am
22 I reading that accurately this?
23 A. This is Greg Bushner. Yes.
24 Q. Okay. And if you could turn to the next page,

1 the statement that groundwater management is on a
2 basin-by-basin basis and that including that Kane Springs
3 Valley would result in setting a dangerous precedent, kind of
4 a slippery slope argument, if I recall. Does that sound
5 right to you?
6 A. That does.
7 Q. All right. Is it your position that any
8 multi-basin management unit is improper in Nevada?
9 A. No.
10 Q. So is Kane Springs so unique that only its
11 inclusion would trigger that slippery slope to over
12 inclusion?
13 A. No. No.
14 Q. Okay. Let's go to Mr. Carlson.
15 ANSWERS BY MR. CARLSON:
16 Q. Did you say that you -- in slide 23 you said you
17 discovered the boundary fault based on analysis of 2019 lines
18 ten and 11?
19 A. Yes, that sounds right.
20 Q. All right. Did you state at the beginning of
21 your testimony that situating a CSAMT line parallel to a
22 fault is not an effective methodology?
23 A. Right. If you're running parallel to a fault or
24 a structure, a fracture zone, you're less likely to see it

1 I've got Figure 4-9, which is your location map showing the
2 northern boundary fault. Is the boundary fault as you've
3 illustrated it in this picture, is that in between those two
4 wells?
5 A. No.
6 Q. How is it situated in relation to those two
7 wells?
8 A. So, again, we're not sure exactly where this
9 boundary fault is, so we basically drew a line between the
10 transect, the physical transect line ten and geophysical
11 transect line 11 and said that there was a fault that occurs
12 in this area.
13 Q. But that fault finding was based on the
14 difference of head between the two wells. You have not
15 situated the fault between the two wells, did you?
16 A. You are correct on that.
17 Q. Okay. Thanks.
18 ANSWERS BY MR. BUTLER:
19 Q. (By Mr. Morrison) Let's see. How about
20 Mr. Butler. You had a quote from CH2M Hill on page 39 of
21 your report. Are you familiar with that quote?
22 A. You'll have to read it to me.
23 Q. I'm not going to read it to you. It's a pretty
24 expansive quote. So I guess we'll skip over that.

1 Do you also recall a statement in the CH2M Hill
 2 report that you relied upon that carbon-14 dates are
 3 particularly unreliable in carbonate settings?
 4 A. They can be, yes.
 5 Q. Okay. You stated that MRSA flows are not
 6 dominated by Kane Springs water but you didn't state that
 7 there was no Kane Springs water present, did you?
 8 A. No.
 9 MR. MORRISON: You know, I think we're going to
 10 leave it at that. Thanks.
 11 HEARING OFFICER FAIRBANK: Now it's the City of
 12 North Las Vegas.
 13 CROSS-EXAMINATION
 14 By Ms. Ure:
 15 Q. Good afternoon. Therese Ure for the City of
 16 North Las Vegas. And I think I have just a, more of a
 17 clarifying question. On your demonstrative slide number 30
 18 it is entitled stepwise linear regression shows only Garnet
 19 Valley pumping effects EH-4 water levels. Does an outcome
 20 from this analyses that the responses --
 21 MR. TAGGART: I'm going to object. This
 22 testimony was not offered during direct exam.
 23 MS. HARRISON: And --
 24 (The court reporter interrupts)

1 analysis. My opinion is not that Garnet Valley is the sole
 2 cause of fluctuations at EH-4. That does not make hydrologic
 3 sense. I think my point is that this whole analysis of
 4 linear regression as given by SNWA is not useful for any
 5 conclusions.
 6 MS. URE: Okay. Thank you.
 7 HEARING OFFICER FAIRBANK: Center for Biological
 8 Diversity? Not seeing any questions from the Center for
 9 Biological Diversity.
 10 Georgia Pacific and Republic?
 11 MS. HARRISON: We have no questions.
 12 HEARING OFFICER FAIRBANK: Seeing no questions.
 13 Nevada Cogeneration? Seeing no questions.
 14 Muddy Valley Irrigation Company?
 15 MR. KING: No questions.
 16 HEARING OFFICER FAIRBANK: Seeing no questions.
 17 Bedroc?
 18 MS. URE: No questions.
 19 HEARING OFFICER FAIRBANK: Seeing no questions.
 20 Nevada Energy?
 21 CROSS-EXAMINATION
 22 By Ms. Caviglia:
 23 Q. Justina Caviglia on behalf of NV Energy. And
 24 this is sort of a follow-up on some questions you've received

1 HEARING OFFICER FAIRBANK: Ms. Harris said she
 2 echoed Mr. Taggart's objection as well. And Mr. Taggart's
 3 objection was that this is beyond the scope of the direct
 4 examination.
 5 Ms. Ure, will you please repeat the question
 6 again because I think if this is relating to what the
 7 State -- what we decided the State Engineer would decide what
 8 if any weight or value to give to the testimony on these
 9 particular slides that were offered for demonstrative
 10 purposes in the subsequent analysis that wasn't included as
 11 part of the report or rebuttal reports.
 12 MS. URE: I don't think I ever got to the
 13 question. But the multiple linear regression analysis was in
 14 one of SNWA's reports and so this addresses it. I was just
 15 going to ask a question about it.
 16 HEARING OFFICER FAIRBANK: So to the extent that
 17 there was testimony with relation to this, we'll go ahead and
 18 permit the question. And, again, the State Engineer will
 19 decide what, if any, weight to assign to the responses.
 20 MS. URE: So my question is does an outcome from
 21 the linear regression analysis that all responses at EH-4 are
 22 from Garnet Valley make hydraulic sense?
 23 MR. UMSTOT: If you look at slide 22, which was
 24 accepted in to evidence from my presentation, I showed SNWA

1 so far. Where do you think the water from Kane Springs
 2 Valley goes?
 3 MR. BUTLER: For me.
 4 MS. CAVIGLIA: For any you.
 5 MR. MOCK: This is Peter Mock. Some of it goes
 6 in to northern Coyote Spring Valley. And some probably goes
 7 in to Lower Meadow Valley Wash. I haven't done a detailed
 8 analysis. But that seems reasonable to me.
 9 ANSWERS BY MR. MOCK:
 10 Q. And then what percentage of the water do you
 11 think goes to the Muddy River Springs?
 12 A. I haven't done that analysis.
 13 Q. But a portion would?
 14 A. You said would. You're saying in the future?
 15 Q. Or could.
 16 A. You're saying now?
 17 Q. Yeah.
 18 A. Actual water molecules?
 19 Q. Well, I'm just asking -- You stated that some of
 20 the water will discharge to Kane Spring, some to Lower Valley
 21 Meadow Wash. What do you think that percentage possibly can
 22 be?
 23 A. I haven't done that analysis and I want to answer
 24 your question. I'm saying that at the boundaries of Kane

1 Springs Valley it would appear that some flow can go to
2 Coyote Springs Valley and some flow currently, and this is
3 flow currently, could go to Lower Meadow Valley Wash because
4 there are carbonates on the southern boundary of Kane Springs
5 Valley. I don't know what the percentage is though. I
6 haven't done it.

7 MS. CAVIGLIA: Does anyone else have an opinion?
8 I have no further questions.

9 HEARING OFFICER FAIRBANK: Okay. So at this
10 point we'll go ahead and open up for questions to the State
11 Engineer and Division of Water Resources staff.

12 EXAMINATION

13 By Mr. Benedict:

14 ANSWERS BY MR. CARLSON:

15 Q. Jon Benedict for the record. Question for
16 Dr. Carlson. There were several other structures that had
17 been mapped across CSAMT line 12 by previous geologic offers
18 that were concealed and I think were shown on, let's see,
19 page 15. A couple of thrust faults, a couple of normal
20 faults. Did you see any of those in the CSAMT lines?

21 A. I believe the -- From memory here, I believe on
22 the strike slip fault that you see running through the center
23 of this by a dotted or dashed line, I can't quite see. But
24 it's got the arrows on each side as well that goes from the

1 Q. Right. Okay. You indicated that Kane Springs
2 Valley, the basin fill was relatively thick and then it
3 becomes thin from northeast to southwest. And I see that as
4 it shows in here. Did you interpret any structures on that
5 shallow in Kane Springs Valley, just out of curiosity?

6 A. Yes. I interpreted a fairly significant fault
7 there in the -- There's a label here for line two. That's
8 where one of the lines crossed and then line three across
9 there. I interpret this as a fault. I don't think this is
10 just a very uniformly slope in surface on top of that blue
11 carbonate.

12 I think in addition to a slope this appears to me
13 to be a fault. So this would be an upthrown side or this is
14 a downthrown side. I see a fault there. We're also seeing a
15 low resistivity layer here in the basin fill. That seems to
16 pinch out and disappear up against some higher resistivity
17 basin fill material. So it's probably dry and coarse
18 probably. It's possible there's another fault in that area.

19 But there's a lot of interesting changes,
20 especially when you look at it relative to the other
21 cross-lines. But many of those changes the hydrologists
22 don't seem to care about, so I don't get to talk about it.

23 Q. Okay. So that structure you described at, like,
24 3900 or 4700, right in there, is that comparable to the kind

1 southern part of the map, it runs up north and then bends and
2 then goes in to Kane Springs Valley. And it's right on the
3 upper west side of that knob. I believe we see that when
4 we -- I believe we saw that on line ten. I believe it's
5 difficult to distinguish on 11 and 12. It's possible that
6 that was truncated by the large -- the fault that we see
7 between that. But it's just -- it's not blatantly obvious to
8 us, no.

9 Q. So if we move to slide 21. Maybe this will help
10 better. So on this map a few faults aren't shown. Is that
11 because they weren't interpreted to exist including on the
12 previous slide there was a thrust of blue and then a
13 north-south structure that had normal faulting?

14 A. Right. Right.

15 Q. Signature?

16 A. Yeah, exactly. We didn't see clear evidence of
17 those faults on the lines. So we removed them from this
18 particular image.

19 Q. Okay. Thank you. Another question on
20 geophysics. On line, I think it was called, it was a long
21 line that went up Kane Springs Valley and I think you
22 showed -- or you called a CSAMT interpretation of that.

23 A. Yes. We call it the axis line because it runs
24 right up the axis of the valley.

1 of thing that you see on the other side going in to Coyote
2 Springs Valley? Is that analogous to that?

3 A. Right. If we had done the line parallel to this
4 or just continued this line on further southwest out of Kane
5 Springs Valley, I think we would have seen another big
6 feature like this but in the opposite direction.

7 Q. Okay. Thank you.

8 ANSWERS BY MR. BUSHNER:

9 Q. And I'm not sure who this question is for. But I
10 was curious about the seven-day aquifer test that was
11 mentioned previously that was done on the KPW well and I was
12 wondering if any analysis was done with that to see if that
13 test did or should have ID'd a barrier or two in the boundary
14 in the direction expected in the distance presumed?

15 A. So this is Greg Bushner with Vidler Water
16 Company. So we did do an analysis. Unfortunately, I didn't
17 put it in my report. I should have. We compared the water
18 levels at CSVM-4 because we had some data as far back as 2006
19 where that information with the test water levels from
20 moderate flow to KMW-1. And it -- you had to exaggerate the
21 scale for the water levels on CSVM-4 to even show any type of
22 change, otherwise it would have plotted as a flat line. But
23 it actually showed a decline in water levels before the test.
24 And then during the test it showed a rise that started to be

1 in -- Again, this is, like, two-tenths of a foot or
2 four-tenths of a foot change in CSVM-4, according to the
3 data. So virtually there was no effect from the pumping the
4 seven-day aquifer test at KPW-1 on CSVM-4.

5 The testimony that has been given last week and
6 some today, the response to the Order 1169 aquifer test was
7 pretty much immediate. You saw it immediate in the
8 hydrographs. This didn't show up at all. So, again, it's
9 indicative of not a really high transmissivity area as was
10 testified today. But a structure that would -- or an aquifer
11 system that would transmit up and down Kane Springs Valley
12 more than anything else?

13 Q. So do you think the test was long enough to have
14 seen that boundary or do you think that the data is just not
15 sufficient to be able to?

16 A. That's a great question. Probably as SNWA knows
17 and all the people sitting behind me know these tests are
18 extremely expensive things to conduct. A seven-day aquifer
19 test is very expensive. And so at the time what I was trying
20 to do is get through enough log cycles to have a good data
21 set, which I think I accomplished, but could have gone
22 longer. We didn't see any boundary effects again. Not to
23 mean that there's none there. We just didn't see them yet.
24 They just haven't appeared. You could have run it longer and

1 looked at KPW-1 and CSVM-4 you said that the data suggested
2 something like 26 to 74 percent kind of ratio. And you had
3 some errors of two and three up to 15 percent between the
4 model and the data. And I'm just curious if you have a 15
5 percent potential error in data mixing what could you not see
6 in those data? Does that make since?

7 A. Well, I point out that the largest area was the
8 temperature. So --

9 (The court reporter interrupts)

10 THE WITNESS: Most of the error occurs when
11 calibrating with TDS. And then we looked at other things in
12 the water that might -- to use to compare that comparison to
13 see if it held through. And fluoride, what was it -- I can't
14 read it. It was four or six percent. Temperature was the
15 biggest area of concern. Deuterium, point-nine. Water
16 isotopes are pretty conservative unless they're being
17 evaporated. And it is 14, 2.4. So it's pretty low error
18 overall I think between the two. But, I mean, it's complex.

19 Q. Can you give an opinion though I guess on the
20 extent to which you can take those measurements and talk
21 about mixing ratios? Is there some kind of a limit where you
22 talk about this being an N-member but you can dilute things
23 to a point where the data is insufficient to tell you whether
24 there's some mixing or not. So I'm trying to get a sense of

1 maybe would have seen something. But there were no -- If
2 there was going to be an effect because it was so highly
3 transmissive, you would have probably seen it immediately.

4 Peter, I don't know if you want to add anything.

5 MR. MOCK: This is Peter Mock. I agree with
6 Greg's assessment. I plotted the test and looked at it and I
7 see a standard response to a fissured aquifer, which is a
8 simplification. But there was nothing unusual in the change
9 of slope except compared to Theis it had a flatter response.
10 This might be what it's like to people thinking that there's
11 a very high transmissivity but there's not. That's just the
12 beginning of the S-curve, what happens with the fissured rock
13 test, so I didn't see a boundary and those two days.

14 Q. Okay. Thank you.

15 ANSWERS BY MR. BUTLER:

16 Q. (By Mr. Benedict) On the geochemistry, I'm just
17 curious and I sort of danced around this question a little
18 bit, I think. But curious if you have an opinion on what
19 kind of mixing ratio you could have such that the, I guess,
20 the error in the method would have secured the data. In
21 other words, I'm trying to get a sense of how far you can
22 take the data with respect to saying you can't see this as an
23 N-member. Would a ten-to-one mix make the data insufficient?
24 I know you talked about some when you did a model where you

1 where we are on that --

2 A. You really need more information because it
3 really is just those two data points in southern Kane and
4 northeastern Coyote Springs Valley, the CSVM-4, just those
5 two data points. And they are chemically unique to
6 everything else that's out there. So there's no other data
7 that shows that they're mixing with something else that would
8 look like MRSA water, so I guess it's hard to quantify it.

9 Q. Yeah.

10 A. It's the fuzzy science.

11 Q. Okay. Thanks.

12 ANSWERS BY MR. UMSTOT:

13 Q. In terms of the discussion of climate in response
14 to things like the 2005 wet year, it was suggested, I think,
15 that you expect to see an increase in water levels because of
16 this exceptionally wet year and then the corresponding
17 decline after that. And I'm curious about these kinds of
18 responses and what you really expect to see, whether you
19 expect to see a step-up or pulse-like configuration in
20 hydrographs and if that means anything. And I'm just curious
21 about your experience in terms of describing these responses
22 and I guess what kind of supporting data you have for an
23 expected response from climate?

24 A. You definitely would see a response of increase

1 in the hydrograph from the recharge in 2005. And then
2 depending on the local hydrogeologic conditions, you'll see
3 there a pulse response, I think, or you'll see a continued,
4 basically a very long pulse response that we're still seeing
5 maybe a rise from, that exception of a very wet year that was
6 maybe once or twice in a century.

7 So I think that's -- it depends on, you know,
8 there's a climate effect that kind of gave the pulse. But
9 how that thing was interpreted by the aquifer is going to
10 depend on the aquifer conditions. Where is the source of
11 recharges and where is the source of discharge and the
12 hydraulic connectivity and the storage pump and the aquifer
13 materials.

14 Q. So seeing responses suggest near source recharge
15 or a very permeable aquifer?

16 A. Right.

17 Q. Seeing similar responses on either side of a
18 structure, would that indicate communication or?

19 A. It's not evidence to know either way.

20 Q. But it would be supporting the evidence if you
21 did?

22 A. If you saw the same response to climate, that
23 wouldn't be enough evidence.

24 Q. I guess this is the last question. I think

1 for Dr. Carlson. And I'm looking at your slide 21 where
2 you're showing the northern Lower White River Flow System
3 boundary fault.

4 A. Yes.

5 Q. Well, actually maybe it's in the other slides.

6 So if we look at the sections that were produced for lines
7 ten and 11, what other possible explanation is there for
8 those changes across a two-mile distance other than a fault
9 with 2500 feet of displacement on it?

10 A. Well, I'm sure there's some really bizarre ones,
11 because if we were in, say, in the over thrust belt and we
12 actually had a high resistivity, high resistivity unit, that
13 has been moved on top of a low resistivity unit and then that
14 has in turn been tilted, what we may be seeing is a contact
15 between high resistivity and low resistivity. It would have
16 to be fairly steep. But it would be a contact between two
17 lithologies but not a fault between two lithologies. So
18 that's going to take some pretty serious over thrust stuff
19 from up in Wyoming and Utah that generally over thrust belt
20 or something.

21 But when we have a large area of high resistivity
22 material and a large area of low resistivity material then
23 where they meet is either going to be a contact, one was laid
24 down on top of the other and then that contact was rotated to

1 you've already answered it maybe, but if you can do it again
2 in a different way. I'm just curious if you could explain
3 the relative lack of correlation between the Palmer drought
4 varying index and other water level measurements and
5 hydrographs that have been provided in previous presentations
6 here that are near but outside of the basin. Were you here
7 for those presentations?

8 A. Yeah. I forget -- I think you're referring to
9 the National Park Service or Fish and Wildlife?

10 Q. I think National Park Service had a number, they
11 presented a number of hydrographs that were nearby but
12 outside the basin that didn't show anything similar. And I'm
13 just curious what your thoughts are on that.

14 A. From what I recall, some of the hydrographs were
15 increasing, some of the hydrographs were flat. And then
16 maybe one or two of them were decreasing. When I looked at
17 the decreasing hydrographs, they were not unsimilar to KMW-1
18 and CSVM-4. So it seems like it could be in the mix of the
19 types of hydrographs that you see in the basins to the north.

20 MR. BENEDICT: Okay. Thank you.

21 EXAMINATION

22 By Mr. Kryder:

23 ANSWERS BY MR. CARLSON:

24 Q. Levi Kryder for the record. My first question is

1 meet this requirement or there's a fault that's brought high
2 resistivity material in to contact or low resistivity
3 material. So, geologically, yes, you could come up with
4 something exotic that doesn't require a fault by definition.

5 Q. Okay. Thank you.

6 ANSWERS BY MR. UMSTOT:

7 Q. My next question is for Todd Umstot. What do you
8 think is the response time of the groundwater system here to
9 climate or drought?

10 A. I think there's different signals that some of
11 the wells see. So it looks like it's within a month or two
12 you start to see, especially after the 2005 wet year, you see
13 a fairly quick response to that in many of the wells. And
14 then in some of the drought signals again it's probably in an
15 order of a few months or less.

16 Q. So, in general, one to several months?

17 A. Yeah.

18 Q. For either recharge events or drying signals?

19 A. That's correct.

20 MR. KRYDER: Thank you.

21 EXAMINATION

22 By Mr. Sullivan:

23 ANSWERS BY MR. CARLSON:

24 Q. For Dr. Carlson. The resistivity is measuring

1 the property of the rock matrix; is that right?
 2 A. The matrix has whatever is in the pores. So
 3 it's -- I mean, it's literally how well does this bunch of
 4 rock or whatever it is conduct electricity. And the things
 5 that influence that to conduct electricity include the matrix
 6 and the pore space and the pore fluids and then also how well
 7 interconnected those pores are. So the resistivity, if we
 8 were doing this would be in, say, a salt water intrusion zone
 9 on the coast where we have fresh water in a nice uniform
 10 aquifer and salt water coming in because people are pumping
 11 out, everything there is uniform, say, the sandstone or
 12 whatever the aquifer is, that's all uniform. But we would
 13 see a difference in resistivity because fresh water conducts
 14 electricity less well than salt water. But in other
 15 environments we might have a uniform type of water but the
 16 matrix is changing resistivity in this area versus that area.
 17 Maybe the matrix is faulted, heavily faulted. And so
 18 electricity is conducted more easily because of all of the
 19 water in the pores is connected. So, yeah, a lot of
 20 variables.
 21 Q. Okay. What I'm getting at is with regard to this
 22 structure, that subsurface feature map, what is that -- how
 23 informative to us is that about the hydraulic properties?
 24 A. Well, in some environments that tells you a lot.

1 But I think you have to look at it all in
 2 totality. You can't look at one piece of information and
 3 separate it out. I hope that helps.
 4 MR. SULLIVAN: Yes. Thanks.
 5 ANSWERS BY MR. MOCK:
 6 Q. (By Mr. Sullivan) And, Dr. Mock, I realize you
 7 didn't get much opportunity to talk about your work. And
 8 thumbing through your power point, one of the slides you
 9 touch on some of the characterization of the tertiary
 10 calderas and the water budget for Kane Springs. Would you
 11 mind summarizing that?
 12 A. Yes. The statement has been made many times that
 13 the calderas are barriers or just impermeable to groundwater
 14 flow or very low flow because I think the thought process for
 15 the people is that you've got a magma that has come up and
 16 though it's exploded it stayed pretty much together in the
 17 subsurface and as it cools it becomes -- it is a just a mass
 18 that's very difficult for the water to flow through.
 19 Having worked with Vidler and some of their
 20 investigations of the geology of the area, the different
 21 calderas, it has been clear to me that the picture that -- I
 22 forgot who said it earlier in the week, but their explanation
 23 was very good. They said so the magma comes up and it's very
 24 solidific and it's very light and it's also encountering a

1 High resistivity rock often is resistive because it's very
 2 tight. Other times high resistivity rock may not be so tight
 3 that the matrix is a resister. Some types of rocks are
 4 better resisters than others. So we see a high resistivity
 5 rock and then it seems to be faulted down and then you have
 6 low resistivity material. Just that information all by
 7 itself does not tell us the hydraulic properties of either
 8 side.
 9 And maybe Greg is going to expand on that.
 10 MR. BUSHNER: Greg Bushner, Vidler Water Company.
 11 Yeah, I have a little bit to add to what Norm has just said
 12 in response to your question. I think that geophysics is an
 13 instructive. But you have to use it in combination with all
 14 the other data that you have available. And, again, that's
 15 why I tried to bring the robust nature of this panel and look
 16 at the geochemistry, look at the water level changes over
 17 time. Look at the differences in head between KMW-1 and
 18 CSVM-4 and wells to the south.
 19 I think we detected something was there back in
 20 2006 when we went to hearing on our first application for
 21 water rights. And here we have a justification for what we
 22 saw back in 2006 in the changes in heads. We have an
 23 explanation for it. We didn't know we would find this. We
 24 went out and collected this data.

1 lot of groundwater and it literally blows the top off and
 2 then everything comes settling back down. I, for one, am
 3 glad I wasn't around for it in Arizona or in Mexico. But
 4 that was a different process than a smooth expulsion of lava.
 5 And so you get -- Even though the materials are very hot and
 6 the particles are hot when they come down and they can
 7 re-welt. I've been taken on some tours and looked at it and
 8 discussed it.
 9 There's plenty of room for water to move in these
 10 calderas. And what I noticed and I put in as a quick
 11 statement as to why I don't and so just for these brief
 12 submittals is that Todd Umstot's work in -- where Vidler
 13 reflects water level -- I'm sorry. They collect transducer
 14 data in the femoral streams, they also then have weather
 15 stations they set up. And then Todd does the actual surface
 16 water modeling to look at the recharge.
 17 The highest recharge areas, the most intense
 18 precipitation areas, are focused on our calderas here in the
 19 Delamars and in the Clovers. And my thought is that from
 20 working in the general hydrology of the southwest is if that
 21 material was granite, I think you would probably have some
 22 drought streams on both of those mountains, that you would
 23 have intermittent or perennial flows all the time coming off
 24 that you would be able to see at the surface. But, instead,

1 the numbers are pretty large, thousands of acre-feet are
 2 going down in to the calderas and then out. And so that's my
 3 viewpoint and secondary reason why I don't think they are
 4 barriers to flow.
 5 So I think the Delamars are an important recharge
 6 area and groundwater flow area and I think the Clovers are as
 7 well.
 8 Q. And you really don't have any theories about
 9 where that water would discharge?
 10 A. The water discharge from the Delamars, the --
 11 Q. The recharge --
 12 (The court reporter interrupts)
 13 Q. The recharge that you just described.
 14 A. So I think it would join the flow that is
 15 generally moving through the area. So I think there could be
 16 flow from the north rejoining in the system with northward to
 17 southward flow. Flow coming down through Kane and could go
 18 through the calderas and the caldera recharge would join it.
 19 MR. SULLIVAN: Okay. Thanks.
 20 HEARING OFFICER FAIRBANK: All right. So we will
 21 go ahead and conclude today's hearing. It's 4:30, which is
 22 our quitting time. And then we will go ahead and commence --
 23 or reconvene the panel and Vidler and Lincoln County's
 24 presentation tomorrow morning for additional

1 STATE OF NEVADA)
)ss.
 2 COUNTY OF WASHOE)
 3
 4 I, CHRISTY Y. JOYCE, Official Certified Court
 5 Reporter for the State of Nevada, Department of Conservation
 6 and Natural Resources, Division of Water Resources, do hereby
 7 certify:
 8 That on Monday, the 30th day of September,
 9 2019, I was present at the Legislative Counsel Bureau, Carson
 10 City, Nevada, for the purpose of reporting in verbatim
 11 stenotype notes the within-entitled public hearing;
 12 That the foregoing transcript, consisting of
 13 pages 1231 through 1368, inclusive, includes a full, true and
 14 correct transcription of my stenotype notes of said public
 15 hearing.
 16
 17 Dated at Reno, Nevada, this 1st day of
 18 October, 2019.
 19
 20
 21 _____
 CHRISTY Y. JOYCE, CCR #625
 22
 23
 24

1 cross-examination. And then we will move -- Once we're
 2 concluded with Lincoln County and Vidler, we'll move to the
 3 City of North Las Vegas. So we will reconvene at 8:30
 4 tomorrow morning. Thank you.
 5 (Hearing concluded at 4:30 p.m.)
 6
 7
 8
 9
 10
 11
 12
 13
 14
 15
 16
 17
 18
 19
 20
 21
 22
 23
 24

#	1259:2;1263:20; 1264:2;1265:4;1267:3; 1269:11,20;1271:24; 1277:12;1280:20; 1282:8;1283:11,24; 1284:11;1319:15; 1320:10;1354:23; 1361:5,12	16;1285:2,13;1286:6, 20;1288:11,15; 1289:19,23;1290:9,23; 1292:23;1295:1; 1296:7;1297:17; 1299:2,10;1300:9,13; 1304:24;1306:21; 1308:9;1313:2,9; 1315:7;1317:12,20,23, 24;1318:3;1323:6; 1346:8;1348:6,18; 1355:1,8,22;1360:1; 1362:14;1364:14	1253:10 allowed (1) 1313:19 alluvial (11) 1241:7,13;1284:11; 1285:7,9;1324:8,14,18, 21,23;1325:20 alluvium (2) 1243:4;1246:21 almost (3) 1263:17;1266:14; 1272:6 alone (2) 1281:6;1289:7 along (12) 1256:7;1261:23; 1262:1;1263:3,4; 1271:11;1274:21; 1275:14,17;1285:4,11; 1286:17 alternate (2) 1333:19;1334:18 Although (2) 1268:22;1326:17 always (3) 1265:22;1273:1,1 ambiguous (1) 1262:6 Amherst (1) 1292:1 amongst (1) 1329:7 amount (14) 1238:11,12;1239:6; 1245:18;1268:10; 1284:24;1297:4,13,14, 15;1307:12;1328:20, 21;1341:16 amounts (2) 1294:19;1325:17 analogous (1) 1354:2 analogy (1) 1322:8 analyses (7) 1248:12;1296:21; 1302:12,13,15;1308:2; 1347:20 analysis (45) 1243:3;1245:6; 1249:23;1293:17; 1303:21;1304:6,15; 1305:3,4,6;1306:3; 1307:11,15;1309:4; 1311:17,20;1312:7,13, 14;1313:5,7,18; 1314:12,23;1315:1,13; 1316:6;1320:11,17; 1324:6,7;1325:7,22; 1334:21;1344:17; 1348:10,13,21;1349:1, 3;1350:8,12,23; 1354:12,16	analyze (1) 1315:3 and- (1) 1233:4.5 and/or (2) 1254:6;1328:13 Angeles (1) 1233:9.5 angles (3) 1261:4;1266:17; 1267:3 anions (2) 1282:17;1284:23 anomaly (5) 1274:7;1307:18,20; 1308:18;1310:12 answered (3) 1343:6,7;1360:1 antennas (3) 1275:18,21;1276:14 anyways (1) 1310:1 apart (2) 1310:10,23 apologize (3) 1312:4;1319:1; 1321:22 appear (3) 1280:17;1284:18; 1351:1 appeared (2) 1313:16;1355:24 appears (4) 1239:13;1285:9; 1315:1;1353:12 appendix (1) 1312:23 application (2) 1340:11;1364:20 applications (8) 1249:15,18,19; 1339:5;1340:4,8,24; 1341:20 applied (3) 1282:16;1304:8; 1320:16 apply (6) 1282:3,4,4;1304:8,9; 1305:5 appreciate (3) 1314:16;1315:19; 1332:4 approach (2) 1329:2;1345:11 appropriate (6) 1272:14;1304:15,17; 1309:3;1314:13; 1315:10 approved (1) 1248:19 approximate (2) 1277:19;1281:23 approximately (1)
#625 (2) 1231:22.5;1369:21.5	Adam (1) 1232:6 add (3) 1305:14;1356:4; 1364:11 added (3) 1269:2;1309:15,19 addition (3) 1310:7;1316:10; 1353:12 Additional (15) 1238:7,8,11; 1243:22,23;1245:11, 12,13;1252:18,22; 1253:5;1265:22; 1295:12;1340:8; 1367:24 address (1) 1321:5 addresses (1) 1348:14 adjudicated (1) 1242:2 adjusted (1) 1308:24 adjustment (1) 1308:23 ADMINISTRATION (2) 1231:6;1292:19 admitted (4) 1256:15,16;1257:2; 1323:8 advisor (1) 1321:4 advisory (1) 1321:5 aerial (4) 1259:9,12,20;1270:8 affect (3) 1246:15;1247:11; 1324:24 affects (2) 1305:14;1321:2 afternoon (12) 1239:21;1241:21; 1243:2;1248:4;1291:2; 1319:4;1324:3; 1327:12;1336:9,11; 1343:22;1347:15 again (54) 1239:1;1245:23; 1248:4,16;1253:2; 1258:1;1267:15,22; 1268:20;1271:5,9; 1276:21,23;1278:11,	against (1) 1353:16 age (5) 1324:18,19,21,22; 1325:8 agency (2) 1292:18,19 agents (1) 1325:18 age-related (1) 1266:3 ages (2) 1325:19,19 ago (1) 1241:9 agree (16) 1236:17;1240:17,21; 1241:1;1246:22; 1249:7;1273:2; 1301:17;1326:11,13; 1337:2,6,8;1339:8; 1340:14;1356:5 agreed (1) 1238:2 agreement (2) 1242:14;1278:10 ahead (23) 1236:3;1243:11; 1245:12,18;1253:9,11, 22;1254:12;1257:7,22; 1260:8;1269:11; 1277:12;1291:3,4; 1314:8;1316:1,8; 1323:18;1348:17; 1351:10;1367:21,22 aiming (1) 1259:11 air (2) 1292:17;1307:12 airplane (1) 1258:4 AKA (1) 1231:11.5 Alex (1) 1233:15 Allison (1) 1233:13 allotted (2) 1254:9;1314:6 allow (1)	analyze (1) 1315:3 and- (1) 1233:4.5 and/or (2) 1254:6;1328:13 Angeles (1) 1233:9.5 angles (3) 1261:4;1266:17; 1267:3 anions (2) 1282:17;1284:23 anomaly (5) 1274:7;1307:18,20; 1308:18;1310:12 answered (3) 1343:6,7;1360:1 antennas (3) 1275:18,21;1276:14 anyways (1) 1310:1 apart (2) 1310:10,23 apologize (3) 1312:4;1319:1; 1321:22 appear (3) 1280:17;1284:18; 1351:1 appeared (2) 1313:16;1355:24 appears (4) 1239:13;1285:9; 1315:1;1353:12 appendix (1) 1312:23 application (2) 1340:11;1364:20 applications (8) 1249:15,18,19; 1339:5;1340:4,8,24; 1341:20 applied (3) 1282:16;1304:8; 1320:16 apply (6) 1282:3,4,4;1304:8,9; 1305:5 appreciate (3) 1314:16;1315:19; 1332:4 approach (2) 1329:2;1345:11 appropriate (6) 1272:14;1304:15,17; 1309:3;1314:13; 1315:10 approved (1) 1248:19 approximate (2) 1277:19;1281:23 approximately (1)	
A				
A-1 (1) 1312:23				
abbreviated (1) 1311:11				
able (11) 1236:21;1251:3; 1280:21;1282:21,23; 1312:4;1318:8; 1326:20;1335:6; 1355:15;1366:24				
above (2) 1308:3;1333:5				
absence (2) 1250:24;1253:20				
absorbed (1) 1328:12				
accepted (1) 1348:24				
access (1) 1264:4				
accomplished (1) 1355:21				
according (1) 1355:2				
account (2) 1292:16;1325:17				
accurate (3) 1240:19;1242:17; 1307:3				
accurately (1) 1345:22				
achieved (1) 1237:12				
acidic (1) 1328:13				
acre-feet (6) 1238:24;1338:6,11; 1339:9;1340:7;1367:1				
across (5) 1258:7;1269:1; 1351:17;1353:8; 1361:8				
Act (1) 1321:16				
Acting (1) 1232:5				
activity (1) 1333:4				
actual (6) 1237:18;1241:11; 1282:19;1322:16; 1350:18;1366:15				
actually (23) 1237:16;1242:18; 1253:14;1257:23;				

1273:9 approximates (1) 1277:6 approximating (1) 1277:16 April (3) 1258:11;1295:13; 1302:2 aquifer (36) 1241:12,13;1246:20; 1250:4,5,10,19,24; 1251:4;1252:2; 1258:23;1295:5,12; 1297:2;1301:4;1303:2, 18;1304:18;1305:2; 1307:5;1309:3; 1326:21,24;1333:7; 1354:10;1355:4,6,10, 18;1356:7;1359:9,10, 12,15;1363:10,12 aquifers (2) 1241:8;1325:20 architecture (1) 1321:2 AREA (53) 1231:8.5,11;1240:6; 1243:5;1250:1; 1259:14;1260:22; 1261:2,5;1265:12; 1270:9;1279:23; 1283:10;1284:12; 1285:8;1288:14; 1290:3,23;1295:2,3,20; 1296:5;1303:6; 1305:20,23;1306:1,3,4, 6,7,20,20;1310:18; 1322:1,13;1323:2; 1333:8;1334:23; 1341:8;1342:15; 1346:12;1353:18; 1355:9;1357:7,15; 1361:21,22;1363:16, 16;1365:20;1367:6,6, 15 areas (13) 1254:24;1255:17; 1258:22;1280:18; 1286:24;1294:18,19; 1302:10;1322:1,2; 1341:17;1366:17,18 argument (1) 1344:4 Arizona (7) 1319:8,13,19; 1320:1,3,8;1366:3 around (22) 1268:2;1270:12; 1274:4,12;1297:21; 1306:17;1307:24; 1308:18,22;1310:16, 17;1316:12,16,23; 1317:2,10,18;1331:3, 12,15;1356:17;1366:3	arrangement (1) 1322:3 Arrow (2) 1249:8;1258:20 arrows (1) 1351:24 arroyo (1) 1294:16 arsenic (9) 1280:18;1287:7,9, 20;1288:2,5;1290:23; 1328:6,11 artificial (3) 1319:24;1321:14,18 aspect (2) 1267:2;1268:21 aspects (1) 1321:5 asserted (1) 1239:5 assertion (1) 1341:7 assessment (6) 1236:17;1279:19; 1280:2;1326:12,13; 1356:6 assign (2) 1315:9;1348:19 assistance (1) 1320:9 associate (1) 1263:16 associated (1) 1323:1 Associates (4) 1280:5;1291:18; 1292:3,5 assume (1) 1325:8 assumption (1) 1325:10 Atmospheric (1) 1292:19 attenuate (1) 1337:4 attenuated (1) 1333:18 attorney (1) 1237:22 attorneys (1) 1326:6 August (1) 1312:8 Authority (10) 1247:24;1248:5,9; 1302:13;1308:15; 1309:15;1311:9; 1316:17;1336:5,10 Authority's (3) 1305:10;1307:6; 1311:16 automated (1) 1311:13	Automatic (2) 1272:24;1273:1 available (4) 1250:23;1257:5; 1289:12;1364:14 average (6) 1244:11;1294:7; 1296:16,19;1297:17; 1307:16 awarded (2) 1242:20;1341:5 aware (5) 1241:24;1333:20; 1339:2,4,7 away (7) 1246:6;1251:6; 1267:17;1268:9; 1272:18;1276:18; 1294:14 axis (4) 1263:2;1264:20; 1352:23,24	B Bachelor's (3) 1291:23;1319:7,8 back (29) 1236:4;1237:1; 1243:16;1244:16; 1245:12;1250:3,14; 1251:12,15,19; 1253:12,14,23;1270:8; 1272:12;1297:1; 1299:3;1308:24; 1314:2;1320:5,6; 1323:8,13;1324:9; 1328:23;1354:18; 1364:19,22;1366:2 background (6) 1259:4,14;1260:13; 1262:24;1274:1; 1291:22 backward (1) 1284:9 backwards (1) 1264:3 bad (1) 1279:16 Baker (1) 1321:4 balance (2) 1292:16;1320:19 Band (3) 1233:16.5;1247:20; 1332:6 barely (1) 1259:19 Barnes (6) 1232:9;1234:9; 1244:8,8,14,17 barrier (5) 1310:7,8;1311:3;	1341:14;1354:13 barriers (3) 1309:6;1365:13; 1367:4 bars (3) 1292:12,13;1293:7 base (1) 1242:17 based (12) 1237:14;1240:14; 1251:6;1253:19; 1275:13;1281:2,22; 1304:18;1312:11; 1340:10;1344:17; 1346:13 basement (1) 1263:24 basically (6) 1260:10;1283:15; 1287:6;1288:23; 1346:9;1359:4 BASIN (51) 1231:8,9,9.5,10,10.5, 12;1232:15.5;1239:12, 13;1258:17;1260:13; 1261:8;1262:14,20; 1263:10,12;1265:18; 1266:15,20;1267:13; 1268:10,11,12;1270:3; 1271:2,4,5;1272:18; 1274:1,12,13,15; 1276:2,10,15,17,20; 1278:4,9;1281:16; 1285:24;1288:4; 1319:15;1320:11,13; 1334:8;1353:2,15,17; 1360:6,12 basin-by-basin (1) 1344:2 basins (4) 1245:4;1246:9; 1335:19;1360:19 basis (2) 1239:6;1344:2 bath tub (1) 1310:21 became (2) 1320:3,6 becomes (4) 1264:2,18;1353:3; 1365:17 Bedroc (5) 1233:20;1242:24; 1243:3;1252:20; 1349:17 bedrock (4) 1258:18,21;1260:13; 1261:9 began (4) 1295:6,10;1296:9; 1301:3 beginning (3) 1304:9;1344:20;	1356:12 beginnings (1) 1319:20 behalf (7) 1248:5;1257:15; 1279:9;1291:10; 1318:18;1324:1; 1349:23 behaves (1) 1251:21 behind (2) 1283:18;1355:17 Belaustegui (1) 1233:6 below (4) 1275:24;1276:3,20; 1289:16 belt (2) 1361:11,19 bends (1) 1352:1 Benedict (10) 1232:12;1234:8; 1235:12;1243:14,15; 1244:6;1351:13,15; 1356:16;1360:20 Berley (5) 1233:16.5;1235:7; 1332:9,11;1336:3 best (6) 1241:14;1261:17; 1262:3,21;1304:17; 1311:11 Beto (1) 1255:15 better (4) 1267:7;1303:23; 1352:10;1364:4 beyond (4) 1247:3;1295:13; 1311:4;1348:3 Big (21) 1240:4,11,19; 1259:1;1261:2;1265:1, 12;1267:17,17; 1271:14,21;1272:8,15, 15;1274:11,11; 1278:13;1296:22; 1309:11;1319:21; 1354:5 biggest (3) 1269:19;1282:9; 1357:15 Biologic (1) 1233:23 Biological (5) 1236:5,10;1252:10; 1349:7,9 bit (20) 1253:11;1256:24; 1262:24;1266:3; 1267:7;1269:23; 1273:14;1280:16,18;
---	--	--	--	--	--

1286:14;1291:21; 1292:23;1296:6; 1311:1;1319:9; 1325:24,24;1337:4; 1356:18;1364:11	boundaries (8) 1250:6,11,14,16; 1251:1,5;1340:17; 1350:24	1234:15,5;1254:17, 17;1255:1;1256:1,9,9; 1257:4;1326:16,17; 1336:8,21;1337:6; 1338:22,23;1342:1; 1343:21,24;1345:8,15, 23;1354:8,15;1364:10, 10	1274:6,22;1279:9; 1291:10;1318:18; 1352:20,22	1325:5,20;1326:21; 1327:22;1332:22; 1333:3,7,21;1347:3; 1353:11
bizarre (1) 1361:10	boundary (22) 1271:22,23,23; 1339:12,14,14,17; 1341:2,6,14;1344:17; 1345:2,3;1346:2,2,9; 1351:4;1354:13; 1355:14,22;1356:13; 1361:3	B-u-s-h-n-e-r (1) 1254:17	calls (1) 1316:18	carbonates (14) 1240:13;1263:17; 1264:11,12,23;1272:4; 1276:5,21;1277:10,21, 24;1278:13;1322:5; 1351:4
BLACK (14) 1231:8;1260:20; 1261:2;1262:15; 1283:3,5,20;1285:24; 1295:2;1305:20,23; 1306:4,6,19	Brad (3) 1245:23;1313:21; 1324:1	BUTLER (25) 1234:15,19;1254:20, 20,20;1255:9;1256:4,4, 12,12;1279:8,15; 1285:18;1323:24; 1324:2;1328:3,10; 1332:10,12;1337:22, 22;1346:18,20;1350:3; 1356:15	came (3) 1305:19;1329:4; 1341:21	care (1) 1353:22
blatantly (1) 1352:7	Bradley (1) 1233:9	B-u-t-l-e-r (1) 1254:20	Can (69) 1237:6;1240:24; 1246:17,24;1250:8; 1257:21,22;1259:14, 19,23;1260:21;1265:8; 1266:11;1267:3,7; 1268:13,18;1269:17; 1270:2;1272:15; 1273:18;1276:12,16, 24;1277:5;1279:3; 1284:1,13;1288:10; 1291:3;1293:6; 1298:18;1299:13; 1303:7,8,23;1304:2,8; 1305:12,12;1306:23; 1309:9;1311:13,22; 1316:15,19;1317:9; 1323:8;1327:21; 1328:13;1329:17; 1330:24;1331:5; 1334:16;1338:6,12; 1340:19;1341:2,17; 1343:4;1347:4; 1350:21;1351:1; 1356:21;1357:19,20, 22;1360:1;1366:6	CARLSON (32) 1234:15,17;1254:19, 19;1255:18;1256:3,3, 11,11;1257:8,8,14,21; 1259:23;1265:24; 1266:22;1272:11; 1275:9;1327:19,20,23; 1337:23,23;1344:14, 15;1345:8;1351:14,16; 1360:23;1361:1; 1362:23,24
Bliss (1) 1232:15	Braumiller's (1) 1240:3	bypass (1) 1248:6		C-a-r-l-s-o-n (1) 1254:19
blob (6) 1264:16,17;1265:2; 1269:19,21;1273:20	break (9) 1253:12,21;1268:22; 1291:2,2,4,5;1317:20; 1318:3	C		Carbon (5) 1231:23.5;1233:4, 14;1236:1;1369:9
blobs (3) 1264:23;1265:2; 1269:19	Bridget (1) 1232:15	calcite (5) 1288:23;1289:2,5,6, 11		case (11) 1240:21;1242:13; 1246:8;1256:24; 1260:10;1265:4; 1276:2;1287:16; 1309:2;1338:7;1343:9
block (3) 1264:5;1282:19; 1322:5	brief (3) 1236:10;1319:2; 1366:11	calculate (2) 1252:3;1282:7		cases (1) 1266:13
blocks (2) 1322:3,14	briefly (2) 1254:22;1291:20	calculated (2) 1251:24;1326:24		casing (2) 1310:14;1317:9
blow (1) 1286:9	bright (1) 1267:22	calculates (1) 1268:11		cations (2) 1282:16;1284:23
blows (1) 1366:1	bring (1) 1364:15	calculating (2) 1307:11;1325:4		Causation (2) 1303:20,20
blue (40) 1260:20;1261:3,3, 21;1262:16;1263:16, 20;1264:16,17,23; 1265:1;1266:12; 1267:15;1269:18,19; 1272:17;1273:20,24; 1276:4,21,24;1277:10, 21,22,23;1283:4,17; 1286:6;1289:5;1293:7; 1294:6;1296:19; 1297:14;1302:3,4; 1309:16,16;1316:12; 1352:12;1353:10	brings (2) 1283:1;1284:24	calculations (3) 1248:9;1305:1; 1307:17		cause (6) 1246:9;1295:8; 1297:22;1306:7,8; 1349:2
boldly (1) 1271:22	broken (8) 1264:24;1265:12; 1266:16;1267:4,12; 1270:23;1297:11; 1322:9	caldera (1) 1367:18		caused (2) 1292:7;1317:19
book (1) 1322:18	broken-up (1) 1322:3	calderas (7) 1365:10,13,21; 1366:10,18;1367:2,18		Cave (2) 1303:23;1304:2
booming (1) 1265:7	brought (1) 1362:1	calibrated (6) 1281:21;1316:14; 1317:15,15;1318:4; 1330:6		Caviglia (8) 1233:10.5;1235:11; 1243:9;1253:1; 1349:22,23;1350:4; 1351:7
both (11) 1267:12;1277:23; 1304:11;1309:14; 1319:19;1320:3; 1322:12,21;1324:15; 1333:2;1366:22	Brownstein (1) 1233:8.5	calibrating (1) 1357:11		CCR (3) 1231:22,22.5; 1369:21.5
bottom (10) 1267:6,21;1269:2, 10;1276:12;1277:2,17; 1297:16;1300:11; 1310:12	budget (1) 1365:10	calibrations (1) 1273:1		Cenozoic (2) 1276:9,15
	bulk (3) 1260:12;1269:1; 1273:24	CALIFORNIA (6) 1231:10.5;1233:9.5; 1319:19;1320:1,2,4		Cenozoics (1) 1276:2
	bulls (1) 1274:11	call (2) 1327:17;1352:23		Center (28)
	bump (3) 1300:14;1331:5,7	Called (13) 1257:15;1263:2; 1265:4,21;1271:22,24;		
	bump-ups (1) 1300:7			
	bunch (2) 1265:2;1363:3			
	Bureau (1) 1369:9			
	BUSHNER (25)			

1233:23;1236:4,9; 1246:5,13;1247:14; 1251:22;1252:10; 1258:16;1259:11,16, 19;1261:1,12;1262:12; 1264:15;1265:6; 1267:11;1268:16; 1271:17;1273:19; 1274:8,12,13;1283:13; 1349:7,8;1351:22	characteristic (2) 1300:14,21 characteristics (3) 1331:3,11,15 characterization (1) 1365:9 characterizes (1) 1239:9 chart (3) 1301:14;1312:22; 1329:3 charts (1) 1236:22 check (1) 1305:15 checked (1) 1343:16 checks (1) 1273:1 chemical (6) 1332:15;1333:15,15; 1334:6,11,13 chemically (2) 1284:17;1358:5 chemistry (14) 1282:6,17;1283:14; 1284:2,4;1285:13; 1290:16;1325:10; 1332:13;1333:6,14,24; 1334:14;1335:5 Chief (2) 1232:8,11 chime (1) 1327:17 choose (1) 1311:11 Christi (1) 1232:13.5 CHRISTY (3) 1231:22;1369:4,21.5 circle (5) 1283:10,17,17,18,20 circled (1) 1324:10 circles (1) 1283:22 cite (1) 1303:1 City (11) 1231:23.5;1233:4, 14,21;1236:1;1252:8; 1343:14;1347:11,15; 1368:3;1369:10 clarification (3) 1253:15;1285:23; 1331:20 clarify (1) 1275:9 clarifying (1) 1347:17 class (1) 1320:10 clay (1)	1265:14 clays (1) 1274:16 clear (5) 1276:18;1298:21; 1333:15;1352:16; 1365:21 clients (1) 1241:24 Climate (35) 1293:7,10,14,18; 1294:24;1295:1,2,3; 1296:4,6,7,18,18; 1297:17;1303:7; 1317:19;1318:5,11; 1326:8,12,14;1329:17, 23;1330:16;1331:2,19; 1332:1,2,3;1335:17; 1358:13,23;1359:8,22; 1362:9 climb (1) 1298:17 close (6) 1260:5;1264:6; 1271:17;1276:11; 1299:4;1322:17 closely (1) 1329:14 closer (3) 1246:6;1267:9; 1333:8 Clovers (2) 1366:19;1367:6 CM (1) 1329:17 coarse (1) 1353:17 coast (1) 1363:9 code (4) 1320:21,21,22,23 coefficient (4) 1305:13,18,22; 1306:2 Coefficients (1) 1305:13 Cogen (1) 1241:16 Cogeneration (2) 1252:15;1349:13 coincidence (1) 1277:21 cold (2) 1279:16;1281:12 collect (2) 1289:8;1366:13 collected (2) 1317:1;1364:24 color (2) 1260:3;1296:17 colorful (1) 1260:16 colors (3)	1258:19,21;1293:7 combination (3) 1294:12;1324:15; 1364:13 combined (1) 1345:19 coming (11) 1263:17,17;1264:6, 16;1281:17;1286:23; 1294:16;1326:3; 1363:10;1366:23; 1367:17 commence (1) 1367:22 comment (1) 1287:5 comments (3) 1272:2;1280:4; 1287:5 common (6) 1289:3;1328:11; 1332:19,21,21,22 communication (3) 1333:3,4;1359:18 Community (2) 1321:15,19 Company (15) 1233:13;1241:18,22, 24;1242:8,20;1249:6; 1252:16;1254:1,4; 1336:21;1342:5; 1349:14;1354:16; 1364:10 comparable (1) 1353:24 compare (4) 1282:8,21;1298:2; 1357:12 compared (5) 1281:15;1289:21; 1290:2;1354:17; 1356:9 comparison (5) 1259:15;1290:3; 1296:12,14;1357:12 comparisons (1) 1303:6 complete (3) 1284:2,4;1298:16 completed (2) 1251:8;1315:13 completely (1) 1315:1 complex (2) 1261:6;1357:18 complicated (1) 1302:19 component (8) 1279:22;1282:12,13; 1284:21;1285:14; 1286:21;1289:20; 1326:3 components (1)	1280:19 computational (1) 1255:7 computer (1) 1236:14 concealed (6) 1262:15,17;1268:18; 1273:3,4;1351:18 concentrate (1) 1288:19 concentration (5) 1287:20,24;1288:19; 1289:9;1290:18 concentrations (6) 1280:16;1288:3,10, 12,13,14 concept (1) 1246:14 concern (2) 1312:18;1357:15 concerned (1) 1254:8 conclude (2) 1253:9;1367:21 concluded (2) 1368:2,5 conclusion (9) 1250:6,11;1279:21; 1280:7;1334:15,22; 1335:4,7;1336:1 conclusions (4) 1290:11;1312:1; 1324:24;1349:5 concrete (1) 1322:19 condition (4) 1292:21,22,23,24 conditions (21) 1292:13,14,17; 1293:18,20,21,23; 1294:4;1295:7,10,14; 1296:8;1297:1,19; 1317:18;1318:11; 1328:13,14,14;1359:2, 10 conduct (3) 1355:18;1363:4,5 conducted (2) 1248:9;1363:18 conductive (1) 1264:17 conductivity (1) 1321:2 conducts (1) 1363:13 conduit (1) 1281:7 configuration (1) 1358:19 confined (1) 1289:24 confines (1) 1314:13
---	---	---	--	--

Confusing (2) 1277:19;1298:18	contours (3) 1274:3,7,17	court (12) 1237:20;1282:14; 1283:19;1284:8; 1286:11;1290:14; 1314:19;1328:9; 1347:24;1357:9; 1367:12;1369:4	1264:9;1353:21	1328:17,21
conjectures (1) 1322:23	contracted (1) 1257:24	covered (1) 1260:15	cross-section (4) 1263:19;1269:13,16; 1275:7	cumulative (1) 1246:8
connected (7) 1244:5;1298:11,23; 1299:14;1303:10; 1325:13;1363:19	contracting (1) 1319:22	covering (1) 1258:18	CS (1) 1276:15	curiosity (1) 1353:5
connection (10) 1302:14;1303:17; 1304:4;1318:9,14; 1336:16,23;1337:3,8, 16	contributed (1) 1240:18	covers (2) 1293:15,15	CSAMT (10) 1259:4;1272:21; 1273:9;1276:23; 1327:21,22;1344:21; 1351:17,20;1352:22	curious (10) 1243:22;1244:9; 1354:10;1356:17,18; 1357:4;1358:17,20; 1360:2,13
connectivity (1) 1359:12	contributes (1) 1316:5	COYOTE (56) 1231:7.5;1243:4,21; 1245:13;1251:9; 1258:15;1259:11; 1260:17;1261:15; 1262:20;1268:6; 1270:10,20;1277:2; 1278:13,18;1279:23; 1280:10;1281:1,4,18; 1282:13;1283:14; 1284:14;1285:3,5,10, 10;1286:14,23; 1288:15;1290:4; 1293:13;1303:10; 1323:21;1324:5,20; 1325:21;1326:1,2,3; 1333:16;1335:14; 1336:17,18,24;1337:3, 10,12;1339:16;1340:2; 1341:9;1350:6;1351:2; 1354:1;1358:4	CSI (10) 1233:6,8.5;1245:23; 1259:4;1273:15; 1300:10;1313:21,22, 24;1324:1	current (8) 1236:16;1237:11; 1238:4,10;1239:12; 1248:18;1268:8; 1325:16
CONSERVATION (2) 1231:2;1369:5	controlling (1) 1288:18	create (2) 1284:1;1324:11	CSI-1 (1) 1299:20	currently (3) 1292:6;1351:2,3
conservative (1) 1357:16	cools (1) 1365:17	crew (2) 1264:12;1267:15	CSI-4 (5) 1309:10,19;1310:11, 17;1311:2	curve (1) 1299:13
consider (1) 1275:4	Cooper (1) 1232:13.5	critical (1) 1322:12	CSV (4) 1283:11;1290:9,22; 1328:19	curving (1) 1274:4
consideration (2) 1315:9,20	copies (2) 1257:11;1345:9	cross (5) 1261:18;1266:9,10; 1271:19;1323:20	CSV-3 (1) 1324:18	cuts (1) 1293:11
considerations (1) 1314:5	corner (2) 1258:15;1283:8	crossed (3) 1270:9;1272:22; 1353:8	CSV-4 (3) 1282:7;1290:2; 1333:16	CVSM-4 (1) 1345:18
considered (2) 1272:19;1309:2	corrected (3) 1309:19,23;1311:22	Cross-Examination (32) 1234:4,5,6,7,11,12, 13;1235:5,6,7,8,9,10, 11;1236:6;1239:18; 1241:19;1243:1; 1245:20;1248:1; 1249:2;1257:6; 1323:13,19,22; 1327:10;1332:8; 1336:6;1343:19; 1347:13;1349:21; 1368:1	CSVM-1 (6) 1236:13,14;1251:11; 1300:11,24,24	cycles (1) 1355:20
consistent (3) 1243:20;1244:10; 1252:1	correction (1) 1265:24	create (2) 1284:1;1324:11	CSVM-2 (1) 1324:19	D
consistently (1) 1304:24	corrections (1) 1283:2	critic (1) 1264:12;1267:15	CSVM-3 (1) 1324:22	dace (1) 1249:8
CONSISTING (3) 1234:3,15;1369:12	correlate (1) 1303:23	critical (1) 1322:12	CSVM-4 (54) 1250:23;1251:17; 1252:4;1260:6; 1280:10;1281:14,22, 23;1282:18,19,24; 1283:15,18;1284:17; 1285:3,11;1286:13; 1287:17,17,21;1288:1, 12;1289:8;1290:8; 1296:21;1297:12,24; 1298:7,16,20;1299:4; 1300:24;1301:1,10; 1303:24;1304:3,5,23; 1307:3;1308:11,13; 1309:7;1316:10; 1317:13;1318:11; 1333:16;1354:18,21; 1355:2,4;1357:1; 1358:4;1360:18; 1364:18	damage (1) 1287:15
constituent (1) 1282:1	correlation (10) 1302:13,15;1303:19; 1304:2;1305:5,6; 1307:15;1308:2; 1309:4;1360:3	cross-examine (1) 1315:21	CSVM-5 (4) 1303:9;1329:17; 1330:3;1331:22	dampened (1) 1311:2
constituents (1) 1282:8	correlations (2) 1303:8,15	crossing (1) 1259:12	CSVM-6 (2) 1299:20;1300:6	dampening (1) 1311:4
consultant (1) 1321:9	corresponding (1) 1358:16	cross-lines (2)	CSVM-7 (4) 1281:21;1324:21;	Dan (1) 1292:3
contact (5) 1361:14,16,23,24; 1362:2	Corridors (1) 1322:6			danced (1) 1356:17
contained (6) 1312:7,15;1313:15, 19;1314:14;1323:6	cost (1) 1241:9			dangerous (1) 1344:3
context (1) 1281:12	Counsel (1) 1369:9			Daniel (2) 1291:18;1292:5
contingent (1) 1237:17	County (19) 1233:12;1248:24; 1249:5;1253:24; 1254:3;1255:22; 1256:15;1257:24; 1291:7;1336:13; 1338:23;1339:5,12,15; 1340:23;1341:1; 1342:4;1368:2;1369:2			Darcy (1) 1248:9
continuation (1) 1253:23	County/Vidler (4) 1257:16;1279:10; 1291:11;1318:19			Darcy's (1) 1320:19
continue (5) 1291:6;1297:7,24; 1307:15;1316:3	County's (1) 1367:23			dark (1) 1258:12
Continued (6) 1233:1.5;1235:1.5; 1298:17;1301:6; 1354:4;1359:3	couple (6) 1273:16;1283:2; 1314:4;1324:2; 1351:19,19			darker (1) 1296:17
continuous (2) 1236:19;1331:13	course (2) 1273:17;1317:4			dash (3) 1271:10;1289:6; 1330:2
contour (1) 1308:19				dashed (4) 1260:20;1262:15,16; 1351:23

1246:17;1250:23; 1262:6;1264:13; 1270:12;1272:16,23; 1273:2;1274:21; 1278:20;1279:19,24; 1280:3,15;1281:3,10; 1282:7,19;1283:1,2,3, 12;1284:3,6;1285:13; 1286:9,20;1289:12,12, 16,19;1290:7,7,17,19, 19;1292:17;1293:8; 1294:8,9;1307:3,8,8; 1308:11,12;1316:14, 16;1318:7;1324:10,12, 16;1325:22;1327:21, 22;1330:4;1333:14; 1334:14,19;1335:3,4,8, 12;1336:2;1345:5; 1354:18;1355:3,14,20; 1356:20,22,23;1357:1, 4,5,6,23;1358:3,5,6,22; 1364:14,24;1366:14	Decree (2) 1242:2,20 decreed (2) 1242:1,19 dedicated (1) 1242:13 deep (9) 1240:13;1244:4; 1263:17;1264:1; 1269:7,24;1276:17; 1278:4;1280:22 deeper (2) 1269:3,12 deepest (5) 1269:9,10;1274:14; 1278:5,9 define (2) 1287:7;1288:10 definitely (2) 1299:13;1358:24 definition (1) 1362:4 degree (4) 1291:23;1292:1; 1319:7,11 Delamars (3) 1366:19;1367:5,10 delay (1) 1304:20 demands (1) 1271:20 demonstrative (12) 1257:11;1273:10; 1306:9;1311:6,18; 1313:1,13;1316:3,8,9; 1347:17;1348:9 denied (2) 1249:17;1337:9 dense (2) 1274:21;1294:14 density (12) 1274:9,10,15,18,18; 1275:1,2,6;1276:21; 1278:1,23,24 DEPARTMENT (4) 1231:2;1319:13; 1327:13;1369:5 depend (4) 1247:13;1317:6; 1322:10;1359:10 dependent (6) 1246:4,13;1287:11, 12,13;1334:1 depending (4) 1294:12;1317:5; 1331:14;1359:2 depends (4) 1237:13;1331:2,11; 1359:7 depiction (1) 1259:24 depicts (2) 1283:10,11	depleted (1) 1290:5 depletions (1) 1246:9 deposits (1) 1334:8 depth (3) 1269:17;1272:7; 1317:2 Deputy (1) 1232:6.5 describe (1) 1283:6 described (5) 1307:5;1313:8; 1316:13;1353:23; 1367:13 describing (2) 1285:18;1358:21 description (1) 1283:12 desert (1) 1260:3 designation (3) 1255:8,11,16 desk (1) 1257:12 detail (3) 1267:7;1297:11; 1306:10 detailed (2) 1239:4;1350:7 details (1) 1311:7 detected (1) 1364:19 detecting (1) 1277:23 determination (1) 1314:12 determine (3) 1318:9;1326:20; 1327:21 Deuterium (1) 1357:15 develop (4) 1339:15,18,21; 1341:4 developed (1) 1341:2 developing (3) 1321:18;1339:22,24 diagnostic (1) 1298:22 diagram (7) 1283:1,9,13;1284:2, 5,22,23 diagrams (1) 1290:17 diamonds (1) 1283:12 differ (1) 1280:11	difference (12) 1270:21;1272:16; 1282:11;1290:1; 1320:21;1325:5,23; 1326:2;1345:5,20; 1346:14;1363:13 differences (3) 1324:23;1325:6; 1364:17 different (43) 1240:5,10;1260:23, 23,24;1266:17;1268:6, 23;1278:20,21,21; 1280:17;1282:7; 1290:8,10,12;1293:7,9; 1294:12,18,18,20,22; 1300:10;1301:8; 1304:16;1305:1; 1308:5,6;1313:18; 1315:12,15;1317:8; 1322:4;1325:18,19,21; 1327:24;1334:12; 1360:2;1362:10; 1365:20;1366:4 differential (1) 1320:18 differentiate (1) 1276:6 differentiated (2) 1324:7,14 differently (2) 1256:24;1278:19 difficult (3) 1287:4;1352:5; 1365:18 digital (1) 1258:2 dilute (1) 1357:22 Direct (10) 1234:18,20,22,24; 1257:19;1279:13; 1291:14;1318:22; 1347:22;1348:3 direction (6) 1256:8;1262:7; 1264:1;1310:3;1354:6, 14 directions (1) 1260:24 directly (4) 1262:5;1265:19; 1325:3;1327:23 disagree (3) 1336:20,23;1337:15 disappear (1) 1353:16 discern (3) 1298:18;1299:12; 1318:8 discharge (9) 1238:14;1246:4,12, 18;1247:2;1350:20;	1359:11;1367:9,10 discovered (1) 1344:17 discrepancy (1) 1282:9 discretion (1) 1314:9 discuss (2) 1268:16;1272:3 discussed (7) 1265:20;1268:14; 1312:20;1313:3,4,10; 1366:8 discussion (6) 1242:11,14;1263:9; 1271:24;1273:15; 1358:13 discussions (1) 1270:13 displacement (1) 1361:9 displayed (1) 1236:23 dissertation (1) 1321:1 dissimilarities (1) 1334:16 dissimilarity (1) 1334:22 distance (6) 1251:3;1278:24; 1279:2;1310:19; 1354:14;1361:8 distances (1) 1294:21 distant (1) 1321:24 distinct (2) 1317:16;1333:7 distinguish (1) 1352:5 distorted (1) 1262:6 District (24) 1233:18;1238:10,16; 1239:4;1240:23; 1241:2,6,9;1242:7,10, 12;1247:23;1248:5,8; 1249:5,15;1253:10; 1254:3;1313:17,18; 1336:5,11;1343:18,23 District/ (1) 1233:12.5 District's (1) 1237:22 diversion (1) 1241:10 diversions (1) 1248:17 Diversity (6) 1233:23.5;1236:5, 10;1252:10;1349:8,9 divided (2)
--	---	--	--	---

1275:16;1295:2 DIVISION (20) 1231:3;1243:11; 1293:8,10,14,18; 1294:24;1295:1,2,3; 1296:4,6,7,18,19; 1297:21,22;1317:19; 1351:11;1369:6 Divisions (1) 1297:18 Doctor (1) 1338:18 doctoral (1) 1321:1 doctorate (1) 1320:7 dolomite (6) 1259:18,20;1260:4; 1265:5;1273:21; 1276:6 dolomites (2) 1258:22;1260:17 dominated (5) 1264:11;1289:10; 1290:21,22;1347:6 done (16) 1249:23;1302:12; 1307:6;1311:23; 1317:8,9;1321:13,14, 14;1350:7,12,23; 1351:6;1354:3,11,12 Donnelly (8) 1233:23,5;1234:4; 1236:7,9;1237:24; 1238:1;1239:3,15 Dorothy (1) 1339:13 Dorothy's (2) 1272:1,19 dot (2) 1282:20,20 dots (5) 1258:13;1274:24; 1275:18,21;1276:14 dotted (1) 1351:23 down (28) 1236:13;1258:3,8, 20;1260:14;1262:19; 1263:1;1271:11; 1272:6;1276:10,18; 1277:2;1281:18; 1300:18;1308:24; 1316:15,20;1317:24; 1329:16;1338:9,12; 1355:11;1361:24; 1364:5;1366:2,6; 1367:2,17 downstream (2) 1246:21,23 dowthrown (1) 1353:14 downward (5)	1263:23;1268:4; 1272:8,13;1318:12 Dr (10) 1255:5;1269:5; 1318:24;1321:21; 1323:6;1327:20; 1351:16;1361:1; 1362:24;1365:6 draped (1) 1258:1 draw (2) 1280:7;1281:5 drawdown (13) 1250:15;1302:16,17; 1303:2,24;1305:2; 1307:10,10;1308:10, 13;1309:5;1317:13; 1318:8 drawdowns (1) 1303:18 drawn (7) 1260:19;1261:21; 1262:14,20;1271:10, 11;1285:22 draws (1) 1262:13 drew (2) 1236:24;1346:9 drier (1) 1296:6 drop (4) 1244:4;1309:11; 1330:3,7 drops (1) 1278:14 drought (35) 1291:18;1292:7,10, 12,13,15,22;1293:3,4, 8,18,20,20,22;1294:1, 1,6,9;1295:7,10,13,14, 24;1296:10,15;1297:4, 16,19;1298:19;1299:9, 12;1360:3;1362:9,14; 1366:22 droughts (1) 1293:2 dry (4) 1292:21,22,23; 1353:17 drying (2) 1299:8;1362:18 due (9) 1288:10;1297:19; 1298:10,13;1299:23; 1307:7;1330:4,9; 1345:21 duly (4) 1257:16;1279:10; 1291:11;1318:19 during (15) 1239:24;1250:15,21, 23;1295:15;1297:24; 1298:20,21;1300:5;	1301:4;1307:4,5,22; 1347:22;1354:24 Durov (3) 1280:15;1284:22; 1290:17 Dylan (2) 1249:5;1254:3 dynamics (1) 1320:11 dyslexia (1) 1266:4 E earlier (10) 1245:1;1246:16; 1260:12;1264:10; 1265:20;1269:4; 1287:16;1326:7; 1327:19;1365:22 easily (1) 1363:18 East (7) 1238:14;1239:7,13; 1309:17,24;1310:3; 1322:16 east/west (3) 1262:11,12,21 east-west (1) 1268:17 easy (1) 1317:2 echo (1) 1314:22 echoed (2) 1315:7;1348:2 edge (2) 1269:18;1273:19 effect (9) 1243:5;1296:8; 1305:23;1311:2; 1315:2;1326:8;1355:3; 1356:2;1359:8 effective (2) 1322:24;1344:22 effectively (1) 1287:14 effects (14) 1246:3,7,12; 1251:10,16,23; 1270:11;1299:11,12; 1311:5;1331:18; 1338:10;1347:19; 1355:22 EH-4 (8) 1303:14;1305:23; 1306:7,8;1316:6; 1347:19;1348:21; 1349:2 eight (3) 1260:9,10;1299:1 eighties (3) 1293:1,1,3	either (10) 1241:23;1254:6; 1284:14;1312:7; 1334:17;1359:17,19; 1361:23;1362:18; 1364:7 electrical (1) 1317:7 electricity (4) 1363:4,5,14,18 elements (1) 1320:23 elevated (1) 1288:19 elevation (12) 1258:2;1295:8; 1308:21,22;1310:14, 16,17;1316:14,24; 1318:2;1335:17; 1345:19 elevations (22) 1280:23;1292:8; 1294:11;1295:23; 1296:22;1297:6,12; 1304:1;1307:22; 1308:1,9,16,17;1309:2, 9,11;1316:13;1317:1; 1318:13;1326:14; 1329:21;1331:14 else (16) 1256:24;1260:14; 1283:15;1286:23; 1288:4,13;1315:12; 1328:1;1332:17; 1333:17;1335:8; 1338:17;1351:7; 1355:12;1358:6,7 elsewhere (2) 1289:22;1333:19 emanates (1) 1242:18 employed (1) 1292:6 enable (1) 1284:4 encountered (3) 1250:14,21;1265:18 encountering (1) 1365:24 end (22) 1238:15;1254:10; 1260:6;1263:6;1266:3, 9,11;1267:6,14; 1279:5;1283:21; 1294:22;1297:22; 1298:15,16;1301:5; 1302:1,5;1304:9; 1310:4;1317:18; 1323:4 ended (1) 1330:1 ends (1) 1301:7	Energy (5) 1233:10,5;1243:8; 1252:24;1349:20,23 Engineer (26) 1232:5,6,5,9,5,15,5; 1238:2;1243:12; 1253:3;1254:24; 1255:2,6,10,14,19,20; 1314:10,11;1315:8; 1336:14,14,15;1339:4; 1340:5,24;1348:7,18; 1351:11 engineering (1) 1319:9 Engineer's (7) 1237:15;1253:18; 1254:5;1257:1;1259:3; 1291:21;1319:1 enjoy (1) 1321:11 enough (7) 1269:7,24;1303:16; 1334:19;1355:13,20; 1359:23 entering (2) 1279:22;1285:14 entire (1) 1280:12 entirety (1) 1266:14 entitled (2) 1280:1;1347:18 Environmental (2) 1239:22;1291:23 environments (2) 1363:15,24 equal (1) 1288:14 equation (2) 1302:18,18 equations (2) 1304:18;1320:18 equilibrium (7) 1280:17;1288:24; 1289:5,6,13,16; 1290:18 equipment (1) 1272:24 erroneous (1) 1323:2 error (11) 1308:7;1316:12; 1317:12;1318:1,7; 1330:5,10;1356:20; 1357:5,10,17 errors (4) 1283:2;1308:8,11; 1357:3 especially (2) 1353:20;1362:12 Esq (11) 1233:3,5,5,7,9,10,5, 13,5,15,16,5,18,20,21
---	--	---	--	---

established (1) 1339:13	1348:24;1352:16; 1359:19,20,23	expensive (2) 1355:18,19	22;1253:2,8,22; 1254:12;1256:16;	1352:10,17
estimate (9) 1240:17;1241:9; 1302:15,17;1303:2; 1304:4;1305:1; 1308:10,12	exact (2) 1288:5;1328:10	experience (2) 1319:2;1358:21	1259:6;1291:3,6; 1312:6,10;1313:20; 1314:4,20;1315:5,18; 1323:10,16,18;1327:7; 1329:5;1332:6;1336:4; 1340:14,19;1343:10, 13,16;1345:12; 1347:11;1348:1,16; 1349:7,12,16,19; 1351:9;1367:20	feature (6) 1261:18;1268:7; 1272:20;1278:1; 1354:6;1363:22
estimated (3) 1304:19;1308:13; 1317:13	exactly (6) 1264:3;1269:8; 1271:19;1278:8; 1346:8;1352:16	expert (11) 1253:16;1255:2,6,8, 10,14,17,19;1301:12; 1311:21,23	featured (1) 1284:23	features (6) 1261:18;1265:16; 1266:17;1267:8; 1271:7;1322:11
estimates (4) 1250:18;1251:24; 1252:1,3	exaggerate (1) 1354:20	expertise (2) 1256:21;1321:11	fairly (5) 1303:12;1310:21; 1353:6;1361:16; 1362:13	feet (23) 1244:4;1251:6; 1265:18,18;1268:11, 12;1271:2,2,4;1272:7, 8,18;1273:9;1276:10, 17,18;1278:14;1308:4, 9,11;1310:18;1317:3; 1361:9
estimating (1) 1307:9	exam (1) 1347:22	experts (3) 1254:5,24;1336:22	fall (1) 1268:12	femoral (1) 1366:14
evaluate (7) 1250:19,24;1251:4, 13;1333:14;1341:12, 22	Examination (21) 1234:8,9,10,18,20, 22,24;1235:12,13,14; 1243:13;1244:7,18; 1257:19;1279:13; 1291:14;1318:22; 1348:4;1351:12; 1360:21;1362:21	explain (3) 1318:12;1340:19; 1360:2	familiar (11) 1248:8;1288:21; 1320:23;1324:5; 1342:1,3,7,10,13; 1343:2;1346:21	few (4) 1263:18;1269:2; 1352:10;1362:15
evaluated (7) 1241:6;1279:24; 1303:20;1338:10,14, 19;1341:23	examined (4) 1257:17;1279:11; 1291:12;1318:20	explained (3) 1312:20;1334:17; 1345:21	far (9) 1241:11;1260:22; 1263:19;1267:14; 1272:20;1315:12; 1350:1;1354:18; 1356:21	field (1) 1317:2
evaluating (2) 1280:19;1333:24	example (1) 1303:22	explanation (3) 1361:7;1364:23; 1365:22	Farber (1) 1233:8.5	figure (12) 1288:1;1304:20; 1307:23;1312:21,23, 24,24;1329:16; 1330:15;1332:16; 1334:24;1346:1
evaluation (1) 1325:14	examined (4) 1257:17;1279:11; 1291:12;1318:20	exploded (1) 1365:16	farther (1) 1303:9	figures (3) 1309:14;1313:12,15
evaporated (1) 1357:17	example (1) 1303:22	expulsion (1) 1366:4	faster (1) 1287:3	file (1) 1273:14
Evapotranspiration (1) 1247:6	Excel (1) 1311:14	extend (1) 1314:8	fault (56) 1251:7;1260:19,22; 1262:5,15,17;1264:21; 1265:21;1266:19; 1269:5,18,20,22; 1271:13;1272:1,4,7,9, 19;1273:6,8;1279:4; 1338:9,13;1339:13,14, 17;1341:2,6,11,14,17; 1344:17,22,23;1345:2, 3,21;1346:2,2,9,11,13, 15;1351:22;1352:6; 1353:6,9,13,14,18; 1361:3,8,17;1362:1,4	file (1) 1273:14
even (14) 1238:12;1244:2; 1278:4;1298:11; 1301:17;1310:1,15; 1313:12,13;1322:19; 1325:16;1335:17; 1354:21;1366:5	except (2) 1283:15;1356:9	extent (3) 1314:10;1348:16; 1357:20	Farber (1) 1233:8.5	file (1) 1273:14
Event (15) 1296:23,24;1297:2; 1299:4,7;1300:1,2; 1329:22;1330:22,23; 1331:1,4,10,13,16	exception (1) 1359:5	extreme (4) 1294:1;1296:24; 1303:22;1331:1	farther (1) 1303:9	file (1) 1273:14
events (1) 1362:18	exceptionally (1) 1358:16	extremely (3) 1287:10;1294:3; 1355:18	faster (1) 1287:3	file (1) 1273:14
eventually (1) 1246:9	excluded (1) 1288:7	eye (1) 1274:11	fault (56) 1251:7;1260:19,22; 1262:5,15,17;1264:21; 1265:21;1266:19; 1269:5,18,20,22; 1271:13;1272:1,4,7,9, 19;1273:6,8;1279:4; 1338:9,13;1339:13,14, 17;1341:2,6,11,14,17; 1344:17,22,23;1345:2, 3,21;1346:2,2,9,11,13, 15;1351:22;1352:6; 1353:6,9,13,14,18; 1361:3,8,17;1362:1,4	file (1) 1273:14
everybody (2) 1256:24;1259:5	Excuse (2) 1257:10;1301:23		faulted (4) 1261:24;1363:17,17; 1364:5	file (1) 1273:14
everyone (2) 1315:16;1337:18	exhibit (3) 1236:11,12;1336:13		faulted-up (1) 1260:22	file (1) 1273:14
everywhere (1) 1283:15	Exhibits (5) 1255:22;1257:3,11; 1273:10;1313:13		faulting (1) 1352:13	file (1) 1273:14
evidence (26) 1250:5,10;1256:15; 1264:16;1279:21; 1282:21;1303:16; 1304:4;1310:2; 1312:12,14,24; 1313:16;1314:7; 1318:14;1323:7,8; 1335:10;1336:15; 1337:5;1341:6;	exist (1) 1352:11	fact (5) 1268:9;1312:11; 1321:3;1342:10; 1343:3	faults (28) 1250:20;1260:14,19, 23,23;1261:2,3,3,8,20; 1262:1,2,4,7,9,13,19; 1264:24;1266:19; 1268:18;1273:3,4; 1310:1,3;1351:19,20;	fill (30) 1258:17;1260:13; 1261:8;1262:14,20; 1263:10,12;1265:18; 1266:15,20;1267:13; 1268:10,11;1270:3; 1271:2,4,5;1272:18; 1274:2,15;1276:2,10, 15,17,20;1278:4,9; 1353:2,15,17
	existing (2) 1239:3;1341:1	factors (1) 1321:18		finally (2) 1288:8;1301:5
	exists (1) 1345:6	failure (1) 1307:7		find (7) 1303:15;1314:11; 1316:4,7;1322:6; 1335:19;1364:23
	exotic (2) 1289:4;1362:4	faint (2) 1273:20,23		finding (5) 1238:3;1273:7; 1319:21;1336:15; 1346:13
	expand (1) 1364:9	faintly (1) 1294:5		findings (1) 1280:4
	expansive (2) 1251:8;1346:24	fair (3) 1312:15;1337:16,17		finds (2) 1314:10;1336:15
	expect (14) 1289:4,9;1295:8; 1296:24;1297:9,20; 1298:12;1299:5; 1302:4;1304:10; 1310:21;1358:15,18,19	FAIRBANK (58) 1231:4;1232:3; 1234:10;1236:3; 1239:16;1241:16; 1242:24;1243:8,10; 1244:19,21;1245:10, 17;1247:16,20,22; 1248:24;1252:8,14,18,		fine (3)
	expected (4) 1264:3;1319:10; 1354:14;1358:23			
		F		

1259:6;1265:8; 1267:23 finished (1) 1321:7 finite (2) 1320:21,23 firm (2) 1321:7,13 first (18) 1246:24;1257:16; 1263:3,22;1268:22; 1279:10;1281:10; 1291:11;1295:19; 1311:17;1318:19; 1319:8;1329:15; 1345:16,17,17; 1360:24;1364:20 Fish (7) 1239:24;1244:24; 1245:1;1247:16; 1306:13;1327:7; 1360:9 fissured (2) 1356:7,12 fit (1) 1314:17 five (14) 1245:19,24;1254:4, 14;1287:2,21;1296:4; 1305:16;1306:15; 1318:24;1323:11,14; 1329:16;1340:16 five-minute (1) 1253:12 Flangas (1) 1233:15 flat (5) 1238:14;1310:21; 1330:18;1354:22; 1360:15 Flatley (1) 1232:7.5 flatter (2) 1244:2;1356:9 FLOW (59) 1231:7;1240:18; 1244:5;1245:3; 1246:15,19,20;1247:3, 4,8,8;1248:7,9,10,10; 1262:11;1271:21; 1280:13,19;1281:6,7; 1284:16;1286:16,18; 1293:16;1302:20,21; 1318:10,15;1322:1,14; 1325:8,14,21;1326:3,9; 1333:19,23;1334:9,18; 1336:24;1337:9; 1338:9,12;1339:14; 1351:1,2,3;1354:20; 1361:2;1365:14,14,18; 1367:4,6,14,16,17,17 flowed (1) 1286:17	flows (6) 1239:14;1323:1; 1336:18;1337:10; 1347:5;1366:23 fluctuations (4) 1252:5;1298:13; 1299:22;1349:2 fluids (1) 1363:6 flumes (1) 1319:21 fluoride (21) 1280:15;1282:4; 1288:9,9,11,12,14,16, 16,24;1289:3,5,7,9,10, 15;1290:17;1332:15, 17,19;1357:13 flux (1) 1334:17 focus (1) 1299:17 focused (3) 1325:23;1326:1; 1366:18 folds (1) 1260:14 folks (1) 1280:24 follow (1) 1244:9 following (5) 1296:23;1297:1; 1313:6;1329:21; 1331:16 follows (4) 1257:17;1279:11; 1291:12;1318:20 follow-up (1) 1349:24 foot (13) 1305:2;1307:9,10; 1308:10;1316:12,20, 20,24;1317:11,13; 1327:2;1355:1,2 Force (1) 1319:17 foregoing (1) 1369:12 forget (1) 1360:8 forgot (2) 1329:11;1365:22 forms (3) 1246:18;1247:2,11 forth (2) 1250:6,11 found (1) 1345:2 four (7) 1293:24;1294:3; 1296:1,3;1300:11; 1313:6;1357:14 four-tenths (1)	1355:2 fracture (1) 1344:24 Framework (1) 1280:2 frankly (1) 1313:12 Frehner (8) 1234:13;1249:3,5, 21,23;1250:3;1252:7; 1254:3 fresh (2) 1363:9,13 front (1) 1313:13 full (3) 1254:16;1345:17; 1369:13 further (19) 1246:6;1247:22; 1248:22;1251:22; 1252:9,11,13,14; 1261:15;1264:18; 1265:10;1273:15; 1278:3;1294:14; 1306:23;1327:5; 1334:24;1351:8; 1354:4 future (1) 1350:14 fuzzy (1) 1358:10	Gentlemen (4) 1242:23;1255:21; 1336:11;1341:21 geochemical (5) 1279:19,21;1280:2; 1288:22;1325:16 geochemistry (5) 1255:11;1279:24; 1328:5;1356:16; 1364:16 geographic (1) 1340:17 geologic (5) 1272:13,15;1273:13; 1321:5;1351:17 geological (2) 1260:11;1261:22 geologically (1) 1362:3 geologist (5) 1255:6;1265:21; 1319:14;1320:2,3 geologists (1) 1319:15 geology (9) 1255:10;1261:6; 1273:23;1275:10,13; 1291:24;1319:10; 1321:3;1365:20 geophysical (2) 1258:8;1346:10 geophysics (6) 1255:19;1261:7,17; 1310:8;1352:20; 1364:12 Georgia (4) 1239:16,22;1252:12; 1349:10 geostatistical (1) 1255:15 gets (1) 1270:6 Gila (2) 1321:15,19 gist (1) 1266:17 given (10) 1238:19;1239:5,8; 1245:11,18;1304:7; 1306:3;1325:19; 1349:4;1355:5 gives (2) 1258:2;1345:5 giving (1) 1307:13 glad (1) 1366:3 Glasgow (12) 1233:22;1235:6; 1247:19;1327:11,12; 1328:4;1329:1,6,10; 1331:21,23;1332:4 goes (10)	1256:7;1272:20; 1306:4;1329:22; 1350:2,5,6,11;1351:24; 1352:2 Good (26) 1239:21;1240:15; 1241:21;1243:2; 1248:4;1261:10; 1262:13;1265:8,20,22; 1267:16;1271:5; 1275:7;1288:6;1291:1; 1292:4;1319:4;1324:3; 1327:12;1331:18; 1336:9,11;1343:22; 1347:15;1355:20; 1365:23 gradient (9) 1243:16;1244:2; 1281:2,6,18;1310:21; 1325:11;1334:1,10 gradients (5) 1243:20,23;1244:3, 10;1281:17 grain (1) 1267:23 grandiose (1) 1271:24 granite (2) 1322:17;1366:21 granites (1) 1274:9 granted (2) 1339:4,9 graph (1) 1286:2 graphic (2) 1271:16;1324:11 graphs (1) 1329:4 gravel (1) 1274:16 gravity (10) 1273:16;1275:1,2,4, 7,14,16;1277:6,8,17 gray (1) 1260:4 Great (4) 1272:12;1278:13; 1319:21;1355:16 greater (1) 1317:12 greatest (1) 1249:7 greatly (1) 1333:18 green (6) 1261:2;1263:7; 1273:24;1287:5; 1289:4;1316:11 greens (1) 1267:10 Greg (11) 1233:18;1234:15.5;
G				
gallons (1) 1327:1 game (1) 1312:16 GARNET (6) 1231:9;1307:1; 1316:4;1347:18; 1348:22;1349:1 gave (2) 1271:23;1359:8 General (17) 1290:13,16;1292:8; 1293:1;1294:8;1295:6, 7,22;1299:7,21; 1300:17;1318:12; 1329:21;1330:20; 1335:19;1362:16; 1366:20 generalized (1) 1334:10 generally (10) 1293:11;1295:23; 1296:6;1303:6;1309:7; 1321:10;1329:22; 1332:18;1361:19; 1367:15 Gentleman (1) 1254:15				

1237:21;1254:17; 1256:9;1336:21; 1343:22;1345:23; 1354:15;1364:9,10 Greg's (1) 1356:6 gross (2) 1271:7;1325:5 ground (11) 1260:5;1265:8,22; 1266:12;1267:16; 1270:14;1271:5; 1275:22;1276:13; 1278:22;1317:8 groundwater (66) 1236:22;1237:1,3,8; 1238:4,10;1255:7,15; 1280:22;1281:1,17,18; 1286:15,16,18; 1287:12,13;1289:24; 1291:19;1292:8; 1294:10,11;1295:8,22; 1296:22;1297:6,12; 1299:22;1302:19,21; 1304:1;1307:22; 1308:9,16;1309:1,8,11; 1310:14,16,17; 1316:14,23;1317:1; 1318:2,13;1319:16; 1320:7,18;1322:14; 1325:18;1326:14; 1329:21;1331:14; 1334:7,9;1336:18,24; 1337:9,10;1339:5; 1341:20;1344:1; 1362:8;1365:13; 1366:1;1367:6 group (2) 1321:10;1325:9 groups (1) 1278:21 guess (14) 1243:19;1244:14; 1247:13;1304:12; 1314:4;1330:8;1337:4, 8;1346:24;1356:19; 1357:19;1358:8,22; 1359:24 guy (1) 1281:13 guys (4) 1314:5,8;1329:7,8 GV-1 (1) 1236:14 gypsum (3) 1289:3,5,17	1301:7;1305:1; 1307:10;1308:10; 1317:12 hand (1) 1263:11 handed (1) 1329:14 happen (2) 1286:18;1295:21 happens (2) 1310:13;1356:12 hard (6) 1244:1;1279:17; 1286:8;1299:12; 1318:6;1358:8 Harris (1) 1348:1 Harrison (13) 1234:5;1239:19,21; 1241:15;1252:13; 1314:18,20,21,22; 1315:6,7;1347:23; 1349:11 head (4) 1310:18;1345:20; 1346:14;1364:17 heads (1) 1364:22 hear (2) 1259:17;1326:18 heard (4) 1246:19;1272:2; 1304:12;1342:12 HEARING (70) 1231:4,15,16; 1232:3,5,8;1234:10; 1236:3;1239:16; 1241:16;1242:24; 1243:8,10;1244:19; 1245:1,10,17;1247:16, 20,22;1248:24;1252:8, 14,18,22;1253:2,8,22, 24;1254:12;1256:16; 1259:6;1268:8; 1279:17;1291:3,6; 1312:6,10;1313:20; 1314:4,20;1315:5,18; 1323:10,16,18;1327:7; 1329:5;1332:6;1336:4; 1340:14,19;1341:20; 1343:10,13,16; 1345:12;1347:11; 1348:1,16;1349:7,12, 16,19;1351:9;1364:20; 1367:20,21;1368:5; 1369:11,15 heavier (1) 1335:22 heavily (2) 1260:22;1363:17 heavily-faulted (1) 1261:5 heavy (5)	1260:20,20,20; 1271:10;1300:2 held (1) 1357:13 Hello (2) 1324:4;1332:11 help (2) 1288:10;1352:9 helps (1) 1365:3 hereby (1) 1369:6 Herrema (13) 1233:9;1234:11; 1235:5;1245:15,21,23; 1247:15;1313:20,21, 21;1323:23;1324:1; 1327:5 Hersh (1) 1311:10 Hi (1) 1291:17 HIDDEN (2) 1231:9,5;1283:18 high (50) 1237:12;1262:13; 1263:15;1264:5,14,23; 1265:7,9,11,16; 1266:12,13,20; 1269:17;1270:22,23; 1272:17;1274:9,17,18; 1275:1,6;1276:21; 1277:22,24;1278:1,1, 23;1279:1;1282:11; 1288:3,10;1299:6; 1303:12;1306:18; 1307:6,7;1319:3; 1329:22;1345:1; 1355:9;1356:11; 1361:12,12,15,21; 1362:1;1364:1,2,4 higher (11) 1272:5;1286:15; 1292:13,13;1293:3,4; 1294:19;1304:2; 1308:17;1335:17; 1353:16 highest (3) 1288:11;1295:19; 1366:17 high-flying (1) 1258:4 highlighted (2) 1311:17,18 highly (1) 1356:2 highway (1) 1309:18 Hill (4) 1280:1;1319:18; 1346:20;1347:1 hired (2) 1279:18,20	hit (3) 1245:16;1251:23; 1319:2 hold (1) 1287:22 hole (1) 1310:13 hope (1) 1365:3 horizontal (1) 1268:3 horrible (2) 1287:9;1290:24 hot (2) 1366:5,6 hotter (1) 1240:12 huge (1) 1278:13 hundred (2) 1275:12;1295:19 hundred-year (2) 1330:23,23 hung (1) 1272:14 Hyatt (1) 1233:8,5 hydraulic (14) 1302:14;1303:16; 1304:4;1310:7,7; 1311:3,5;1318:9,14; 1321:2;1348:22; 1359:12;1363:23; 1364:7 hydrogeologic (3) 1331:3,11;1359:2 hydrogeology (3) 1255:2,14;1292:1 hydrograph (11) 1240:10;1296:21; 1310:15;1315:16; 1316:10;1317:16; 1329:18;1330:3; 1331:6,21;1359:1 HYDROGRAPHIC (9) 1231:7,5,8,5,9,5,10, 10,5,11,5;1322:1,2; 1330:12 hydrographs (21) 1236:13;1238:13; 1251:20;1294:23; 1298:3;1299:5,17; 1300:17,23;1303:5; 1310:9;1326:11; 1345:18;1355:8; 1358:20;1360:5,11,14, 15,17,19 Hydrologic (5) 1280:2;1336:16; 1337:2,16;1349:2 Hydrologist (5) 1232:12,5;1255:6; 1267:20;1319:12;	1342:14 hydrologists (1) 1353:21 Hydrology (7) 1232:11;1255:7; 1272:20;1319:7,11; 1320:7;1366:20 hydrothermal (2) 1328:15;1333:4 hypothesis (1) 1240:4
I				
ID'd (1) 1354:13 idea (1) 1281:12 identified (1) 1341:6 identify (2) 1276:5;1329:17 illustrated (1) 1346:3 image (13) 1260:10;1261:12; 1262:6,12;1269:13,16; 1275:20;1276:11,13; 1277:13,15,18;1352:18 immediate (3) 1288:13;1355:7,7 immediately (1) 1356:3 impact (4) 1249:24;1308:13; 1342:15;1343:4 impacting (4) 1338:7,13;1341:3,17 impacts (4) 1246:22;1304:5; 1341:7,8 impediments (1) 1322:14 impermeable (5) 1322:15,18,19; 1341:14;1365:13 implementation (1) 1321:17 implication (2) 1237:23;1238:3 implied (2) 1238:1,5 imply (2) 1237:8,11 important (9) 1241:1,4;1242:11; 1260:11;1268:8; 1270:13;1281:5; 1322:24;1367:5 importantly (1) 1281:8 improper (1) 1344:8				

improve (1) 1305:4	1310:6;1333:21	interrupts (11) 1237:20;1282:14; 1283:19;1284:8; 1286:11;1290:14; 1314:19;1328:9; 1347:24;1357:9; 1367:12	1268:2	1367:17
inaccurately (1) 1239:9	indicative (1) 1355:9	interval (2) 1307:4;1308:5	jive (1) 1286:24	Karen (4) 1233:13.5,22; 1254:2;1327:12
in-basin (1) 1284:15	indicator (1) 1287:10	into (1) 1251:8	join (2) 1367:14,18	keep (3) 1267:2;1268:21; 1289:17
include (4) 1288:3,5;1322:21; 1363:5	indicators (2) 1287:18;1290:12	intrusion (1) 1363:8	Jon (3) 1232:12;1243:15; 1351:15	Kent (1) 1233:7
included (6) 1249:12;1307:16; 1313:7;1321:17; 1342:24;1348:10	individual (1) 1236:20	investigating (1) 1240:22	Jones (2) 1242:11,17	key (2) 1263:5;1267:8
includes (1) 1369:13	influence (1) 1363:5	investigation (1) 1241:12	JOSEPH (3) 1234:3;1242:3,21	kind (26) 1265:11;1267:3; 1274:4;1285:4; 1292:21;1294:8,8; 1298:12,18;1303:6,8, 22;1309:4;1316:16; 1317:17,19,20; 1327:15;1331:15; 1344:3;1353:24; 1356:19;1357:2,21; 1358:22;1359:8
including (3) 1290:16;1344:2; 1352:11	influencing (1) 1328:2	investigations (1) 1365:20	JOYCE (3) 1231:22;1369:4,21.5	kinds (1) 1358:17
inclusion (4) 1245:2,7;1344:11,12	influx (1) 1286:19	Investment (1) 1277:2	July (3) 1280:6;1312:7; 1325:16	King (9) 1233:19;1234:6; 1241:20,22;1242:6,16, 22;1252:17;1349:15
inclusive (1) 1369:13	informative (1) 1363:23	Investments (2) 1245:13;1323:21	jump (1) 1296:22	KMV-1 (2) 1299:2,2
incorrectly (1) 1309:16	initial (3) 1254:6;1312:7; 1315:11	involved (2) 1281:13;1289:18	jumping (2) 1316:16;1317:10	KMW-1 (19) 1250:15;1252:4; 1299:11,15;1300:23; 1301:1,10,15;1303:12, 14;1304:22;1308:13; 1309:7;1317:24; 1318:11;1345:18; 1354:20;1360:17; 1364:17
increase (11) 1293:2;1295:7; 1297:21;1299:5; 1306:8;1329:21; 1330:20;1331:14,15; 1358:15,24	inside (1) 1320:24	involves (1) 1289:2	June (3) 1307:6,23;1308:14	King (9) 1233:19;1234:6; 1241:20,22;1242:6,16, 22;1252:17;1349:15
increased (3) 1248:19;1292:10; 1310:15	instance (1) 1324:17	iron (2) 1287:14;1328:12	justification (3) 1238:23;1304:7; 1364:21	knob (11) 1260:4,7;1264:10; 1265:5,6,9;1266:10,11; 1273:20,21;1352:3
increasing (4) 1295:23;1296:9; 1297:4;1360:15	instead (4) 1265:1;1266:18; 1302:22;1366:24	Irrigation (10) 1233:19;1241:18,22, 24;1242:8,19;1252:16; 1313:17;1342:5; 1349:14	Justina (2) 1233:10.5;1349:23	knowledge (2) 1241:14;1250:2
indeed (2) 1282:11;1288:18	instructive (1) 1364:13	island (1) 1259:22	K	known (1) 1272:22
independent (4) 1243:3;1282:5; 1290:20,20	insufficient (2) 1356:23;1357:23	isostatic (1) 1274:6	Kane (112) 1258:5,8,14; 1259:10,13,21; 1261:15,20;1263:1,3,3, 12,15,22;1264:4,7,9, 18,21;1265:15;1266:8, 9,18;1267:1,9,17,18; 1268:9;1270:19,24; 1272:16;1273:16,21; 1276:19;1278:12; 1279:22;1280:2,8,9,24; 1281:2,18;1282:12; 1283:11,22,23; 1284:17;1285:10,11, 13;1286:16,20;1288:3, 11;1289:19;1290:2,21; 1293:12;1301:1; 1321:23;1322:4,20,23; 1325:24;1326:2,21; 1327:1;1332:24; 1333:1,7,11,17,22; 1334:11,23;1335:4,12, 15;1336:16,18,24; 1337:3,10;1338:24; 1339:6,18,21,23; 1340:1,8,11;1341:5; 1342:14,24;1343:4; 1344:2,10;1347:6,7; 1350:1,20,24;1351:4; 1352:2,21;1353:1,5; 1354:4;1355:11; 1358:3;1365:10;	knew (2) 1272:23;1334:19
independently (1) 1325:3	intense (1) 1366:17	isotope (3) 1290:7,19;1334:14	KN	knows (1) 1355:16
Index (6) 1292:15;1293:21; 1296:15,16;1297:16; 1360:4	intention (3) 1339:20,22,24	isotopes (4) 1282:5;1289:23; 1290:1;1357:16	Kryder (5)	
Indian (2) 1321:15,19	interconnected (1) 1363:7	isotopic (4) 1290:2;1335:10,12, 20		
indicate (7) 1237:4;1254:23; 1284:19;1288:7; 1292:13,14;1359:18	inter-connected (1) 1246:9	isotopically (2) 1290:3,8		
indicated (6) 1243:20;1271:4; 1310:8;1330:2;1333:6; 1353:1	interest (2) 1242:1;1257:5	issue (2) 1307:2;1341:21		
indicates (5) 1262:15,17;1283:17; 1325:12;1336:16	interesting (6) 1267:19,20;1268:7; 1270:1,3;1353:19	issued (1) 1336:14		
indicating (2) 1263:7;1271:12	Interior (1) 1327:13	J		
indication (2)	intermittent (1) 1366:23	January (2) 1300:14;1302:2		
	interpret (4) 1266:14;1267:13; 1353:4,9	JAY (3) 1234:3;1242:4; 1245:22		
	interpretation (1) 1352:22	Jersey (1) 1292:4		
	interpreted (3) 1352:11;1353:6; 1359:9	jiggles (1)		
	interrupted (1) 1273:5			

1232:10.5;1235:13; 1360:22,24;1362:20 KSPW-1 (2) 1260:5;1265:17	1267:20;1268:24; 1269:1;1270:3 layers (2) 1269:3;1275:17 layout (1) 1259:8 LAZARUS (29) 1234:3;1236:10; 1237:22;1239:20,23, 23;1241:21;1242:4,4, 15;1243:6;1244:1,13, 16,20,21;1245:22,24; 1248:3,6;1249:4,7; 1250:8;1253:15,17; 1315:17;1326:7,12; 1327:3 LCV (1) 1257:3 least (2) 1309:1;1311:3 leave (1) 1347:10 left (9) 1245:19;1253:5; 1268:1;1287:3; 1293:19;1305:13; 1314:6;1323:5,11 left-hand (1) 1263:19 Legislative (1) 1369:9 less (11) 1258:12;1290:5; 1305:16,16;1307:9,12, 24;1325:24;1344:24; 1362:15;1363:14 level (20) 1246:15;1295:23; 1296:9,20;1302:1,3; 1303:2;1305:23; 1307:3,16;1308:16; 1312:18;1316:13,19; 1317:21;1330:17; 1345:19;1360:4; 1364:16;1366:13 levels (32) 1236:16,22;1237:1, 3,8;1238:4,22,22; 1239:7,12;1243:18; 1297:20,21;1299:22; 1301:6,14,16;1302:7; 1306:7,8;1307:24; 1316:6,11;1317:19; 1326:8;1331:19; 1347:19;1354:18,19, 21,23;1358:15 Levi (2) 1232:10.5;1360:24 light (6) 1258:16;1260:13; 1273:24;1276:4; 1290:3;1365:24 lighter (3)	1335:13,13,15 lightly (1) 1276:1 likely (8) 1263:10;1265:13; 1284:20;1286:23; 1287:17,18;1290:22; 1344:24 limestone (1) 1276:6 limestones (2) 1258:22;1260:17 limit (2) 1245:19;1357:21 limited (6) 1243:17;1247:7; 1253:19;1256:21; 1312:13;1337:14 Lincoln (23) 1233:12;1248:24; 1249:5;1253:24; 1254:3;1255:22; 1256:15;1257:16,24; 1279:10;1291:7,11; 1318:19;1336:12; 1338:23;1339:5,12,15; 1340:23;1341:1; 1342:4;1367:23; 1368:2 Lincoln-Vidler (1) 1251:7 line (118) 1236:17;1258:12; 1260:2,2,9;1261:11,12, 14,15;1262:4,11,16,21; 1263:2,2,6,6,19,21; 1264:4,10,15,20,22; 1265:4;1266:7,24,24; 1267:5,6,8,9,12,12; 1268:16,24;1269:1,17, 23;1270:2,9,10,19,22; 1271:3,3,10,15,15,18, 18,20,20;1272:5,6,8; 1273:16;1274:22,23; 1275:15,16,24;1276:4, 8,8,9,11,12,16;1277:2, 4,6,6,6,7,8,10,11,16,17, 18,19,22,23;1278:3,5, 7,8,9;1285:22,22; 1289:4,6,16;1294:6; 1295:3;1296:17,18,19; 1309:18;1330:2; 1340:15;1343:17; 1344:21;1346:9,10,11; 1351:17,23;1352:4,20, 21,23;1353:7,8;1354:3, 4,22 linear (19) 1302:15,16,23; 1303:1;1305:2,9,11; 1306:5;1307:11; 1308:2;1309:5; 1311:10;1312:19;	1313:8,9;1347:18; 1348:13,21;1349:4 lines (45) 1258:7,9,10,11; 1259:8,12,15;1260:20, 20;1261:11,14,16,21; 1262:3,8,9,15;1268:5, 6,14;1270:18,22; 1271:8,9,13,14,19; 1272:14;1273:9,16; 1274:3,4,22;1275:1,15; 1276:24;1277:1; 1278:18;1279:4; 1344:17;1345:2; 1351:20;1352:17; 1353:8;1361:6 link (2) 1333:15,15 listed (1) 1305:13 listening (2) 1244:23;1315:6 liter (1) 1287:21 literally (2) 1363:3;1366:1 lithologies (2) 1361:17,17 little (31) 1244:5;1253:10; 1256:24;1258:12; 1259:22;1262:24; 1264:9;1266:3;1267:7; 1269:3,23;1273:14; 1274:21,24;1275:18, 21;1278:19;1280:16, 18;1284:11;1291:21; 1292:23;1296:6; 1297:10;1300:7,8; 1311:1;1337:4; 1343:17;1356:17; 1364:11 loan (1) 1321:9 local (1) 1359:2 localized (1) 1326:24 locate (1) 1312:5 located (4) 1259:24;1260:6; 1283:21;1339:14 location (14) 1237:13,17;1247:13; 1288:19;1298:11,24; 1299:15;1304:5; 1309:19,23;1310:5; 1317:8;1318:11; 1346:1 locations (4) 1273:2;1302:4; 1309:12;1310:22	log (1) 1355:20 long (12) 1241:9;1251:10,16; 1258:8;1268:20; 1301:9;1304:21; 1319:21;1339:16; 1352:20;1355:13; 1359:4 longer (4) 1246:7;1251:22; 1355:22,24 long-term (2) 1332:1,3 look (79) 1236:11,18,20,21; 1237:2;1238:21; 1244:16;1251:12,15, 19;1262:22;1264:24; 1268:18;1269:12; 1275:6,18,21;1280:16; 1290:15;1292:20; 1293:17;1295:9,11; 1296:4;1299:16; 1300:13,16,23,24; 1301:19,24;1302:6,24; 1303:3,5,23,24;1304:1, 6;1305:15,19,24; 1306:2,12,12;1307:21, 21,22;1308:1,14; 1309:10;1310:9,15; 1311:15;1316:22; 1317:24;1322:10,12; 1324:9;1325:1,2,3; 1328:23;1329:15,16; 1330:17;1334:1,4; 1345:10;1348:23; 1353:20;1358:8; 1361:6;1364:15,16,17; 1365:1,2;1366:16 looked (17) 1244:10;1251:14; 1273:17;1282:2; 1290:11,17,19; 1301:13;1309:7,7; 1330:4;1334:2;1356:6; 1357:1,11;1360:16; 1366:7 looking (27) 1250:15;1258:1,3; 1265:7,8;1269:24; 1271:1;1272:13; 1300:9,10,11;1301:21; 1305:9;1307:2; 1308:10;1309:6; 1315:16;1316:22; 1325:4;1334:6,7,8,8,9, 13,13;1361:1 looks (6) 1264:22;1265:2; 1268:24;1301:11; 1316:23;1362:11 loose (1)
---	--	---	---	--

1274:16 Los (1) 1233:9.5 lot (14) 1258:6,22;1263:6; 1265:13;1268:24; 1275:13;1283:1; 1308:24;1330:24; 1331:9;1353:19; 1363:19,24;1366:1 Low (35) 1233:6.5;1263:8,8; 1265:12;1266:16,20; 1267:10;13,22,23; 1268:10,10;1269:1; 1270:7;1271:1; 1272:18;1274:10,15, 18,18;1275:2,5;1278:6, 24;1279:1;1282:10; 1286:13;1353:15; 1357:17;1361:13,15, 22;1362:2;1364:6; 1365:14 LOWER (41) 1231:6.5;1240:13; 1245:3,3,7;1246:19; 1247:3,8;1248:10; 1249:12,16,21,24; 1261:1;1267:14; 1268:4;1269:13,16; 1270:19;1276:11; 1280:12;1284:12,16; 1285:8;1290:22; 1292:14;1293:15,16; 1294:20;1318:10,14; 1322:1;1326:8;1338:9, 12;1339:13;1342:24; 1350:7,20;1351:3; 1361:2 lowers (1) 1265:14 LOWRFS (1) 1271:23 Ltd (1) 1233:3	1268:8;1280:22; 1325:23 maintain (1) 1248:17 major (4) 1272:4,20,20; 1282:16 majority (1) 1276:3 makes (1) 1261:24 making (2) 1294:22;1322:7 manage (1) 1322:24 MANAGEMENT (3) 1231:6.5;1344:1,8 manner (1) 1314:8 manual (6) 1316:12,14,18; 1317:10,12;1330:6 manually (2) 1311:15;1317:1 many (9) 1266:13;1289:21; 1321:13,18;1325:18; 1327:23;1353:21; 1362:13;1365:12 map (23) 1258:1,16;1259:19, 24;1260:1,11,12,19; 1267:24;1268:19; 1271:8;1272:14,15; 1273:22,23,24; 1274:24;1275:13; 1288:1;1346:1;1352:1, 10;1363:22 mapped (4) 1273:3,4,4;1351:17 maps (4) 1248:18;1251:7; 1261:22;1263:3 March (1) 1258:11 margin (1) 1286:24 marked (1) 1255:22 marker (1) 1332:15 mass (2) 1320:19;1365:17 Massachusetts (1) 1291:24 Master's (1) 1292:1 matched (1) 1272:23 material (22) 1263:10,12;1265:13; 1267:22,24;1269:18; 1270:3,6,23,23;1271:1,	5;1272:5;1274:13,15; 1353:17;1361:22,22; 1362:2,3;1364:6; 1366:21 materials (2) 1359:13;1366:5 mathematics (1) 1320:16 matrix (6) 1363:1,2,5,16,17; 1364:3 MATTER (2) 1231:6;1341:10 maximum (1) 1341:16 may (12) 1254:13;1265:13; 1267:23;1299:12; 1309:3;1318:4,5; 1340:7;1345:11,12; 1361:14;1364:2 maybe (20) 1240:24;1266:19; 1291:1;1298:12; 1301:9,11;1306:14; 1316:23;1319:2; 1334:17,24;1352:9; 1356:1;1359:5,6; 1360:1,16;1361:5; 1363:17;1364:9 maze (1) 1322:6 MD (1) 1261:2 Meadow (14) 1240:13;1245:3,7; 1249:12,16,21,24; 1258:20;1284:12; 1285:8;1290:23; 1350:7,21;1351:3 mean (15) 1243:22;1266:12; 1281:6,7;1292:21; 1300:22;1313:16; 1317:16;1333:1,18; 1334:1,12;1355:23; 1357:18;1363:3 means (4) 1244:4;1272:7; 1286:15;1358:20 meant (1) 1280:20 measured (2) 1236:23;1286:10 measurement (8) 1244:15;1275:23; 1317:6,7,8,21;1330:5, 10 measurements (14) 1236:19,20;1270:16; 1307:14,14;1316:19; 1317:10,12;1318:2,4; 1330:6,8;1357:20;	1360:4 measuring (2) 1278:21;1362:24 meet (2) 1361:23;1362:1 Melissa (1) 1232:7.5 memorandum (1) 1242:14 memory (4) 1240:9,15;1275:11; 1351:21 mentioned (5) 1259:12;1260:12; 1264:10;1269:5; 1354:11 meters (1) 1266:13 method (2) 1317:22;1356:20 methodology (1) 1344:22 Mexico (1) 1366:3 mic (1) 1319:5 MICHELINE (3) 1231:4;1232:3; 1244:21 Michelle (2) 1232:9;1244:8 micrograms (1) 1287:21 micromanaging (1) 1314:10 middle (11) 1263:5;1266:10; 1268:3;1274:10,11; 1276:16;1278:5,6,7,10; 1297:13 Mifflin (4) 1280:5;1287:5; 1288:9;1289:23 might (17) 1244:5;1246:22; 1279:17;1297:22; 1301:18;1306:8; 1310:6;1314:2; 1322:17;1334:4; 1335:1,6;1345:8,8; 1356:10;1357:12; 1363:15 miles (10) 1267:1,9;1270:20; 1272:17;1273:21; 1275:3,3;1310:10,23; 1319:21 mill (1) 1290:16 mind (2) 1243:17;1365:11 mineral (5) 1288:16,23,24;	1290:12;1332:19 minerals (2) 1289:3,14 minimum (2) 1271:4;1272:18 mining (2) 1290:12;1319:9 minor (1) 1320:15 minus (3) 1293:22;1306:15,15 minutes (10) 1245:19;1254:10; 1266:22;1272:11; 1287:2;1314:6; 1318:24;1323:11,14,20 mix (4) 1321:3;1328:18; 1356:23;1360:18 mixed (1) 1269:21 mixing (16) 1281:19,20;1284:14, 18,20;1285:8,15,19; 1325:18;1335:7,18; 1356:19;1357:5,21,24; 1358:7 mixture (1) 1282:2 MLR (2) 1311:11,11 MOAPA (17) 1231:11.5; 1233:16.5,17.5; 1237:21;1239:3; 1242:7,10,12,13; 1247:20;1249:8; 1253:9;1313:17; 1332:6;1338:7; 1343:18,23 MOCK (25) 1234:15.5,23; 1254:21,21;1255:5; 1256:5,5,13,13,17; 1318:17,24;1321:21; 1323:6;1337:21,21; 1338:17,19;1350:5,5,9; 1356:5,5;1365:5,6 M-o-c-k (1) 1254:21 model (18) 1258:2;1269:2,8,9, 10;1281:20,22;1282:7; 1288:23;1289:5,6; 1292:16;1302:20,21; 1311:11;1319:23; 1356:24;1357:4 modeling (7) 1255:7;1280:17; 1288:21,22;1304:19; 1319:16;1366:16 models (6) 1290:18;1319:16;
M				
ma'am (1) 1321:23 MacKenzie (1) 1233:13 Maddox (1) 1320:9 magma (2) 1365:15,23 magnitude (3) 1246:3,11,14 main (4) 1258:10;1259:9; 1263:5;1286:10 mainly (5) 1265:16;1267:11;				

1320:13,22;1321:13; 1325:17 moderate (1) 1354:20 moderately (4) 1263:8,8;1267:10,13 modern (4) 1286:10,12;1325:12; 1326:1 MODFLOW (3) 1320:10,10,12 moisture (1) 1292:17 molecules (1) 1350:18 MONDAY (7) 1231:18,5;1236:1; 1255:20;1259:4; 1263:9;1268:6;1369:8 monitoring (2) 1236:19;1238:19 month (8) 1316:24,24;1317:5, 11,11;1318:1,1; 1362:11 monthly (4) 1292:11;1294:5; 1296:19;1307:16 months (3) 1316:21;1362:15,16 more (29) 1245:19;1246:17; 1253:5;1264:19; 1269:11;1279:19; 1281:8;1286:9; 1289:16;1290:5,21; 1292:14;1294:14; 1297:10,22;1306:10; 1309:18;1310:3,20; 1311:14;1319:10; 1329:6,12;1335:22; 1341:6;1347:16; 1355:12;1358:2; 1363:18 Mormon (1) 1322:16 morning (2) 1367:24;1368:4 Morrison (18) 1233:18;1235:9; 1237:19,21,21;1239:1; 1247:21;1253:4,6; 1343:15,17,20,22; 1345:7,13,14;1346:19; 1347:9 most (15) 1261:16;1262:19; 1263:10;1273:7; 1282:10;1286:22; 1288:14;1290:4; 1296:20;1310:1; 1335:13,14,15; 1357:10;1366:17 mostly (4) 1261:23;1265:1; 1335:21,22 Mountain (7) 1283:3,5;1285:24; 1305:23;1306:4,6,19 MOUNTAINS (5) 1231:8,5;1294:20; 1305:20;1322:16; 1366:22 mouth (16) 1259:21;1261:14; 1263:14;1264:7,18; 1265:15;1266:8,18; 1267:1,9,18;1268:9; 1270:18;1272:16; 1276:18;1278:12 move (13) 1253:10;1256:14; 1264:18;1265:23; 1270:24;1276:18; 1278:12;1311:5; 1343:13;1352:9; 1366:9;1368:1,2 moved (6) 1268:9;1296:3; 1305:8;1309:23; 1311:17;1361:13 movement (1) 1246:1 Moving (7) 1299:1,10;1300:9, 16;1310:9;1311:6; 1367:15 MRA (1) 1284:7 MRSA (17) 1284:21;1285:6; 1286:6,14,16,22; 1287:7;1288:15; 1289:21;1290:5,9,21; 1322:21;1328:20; 1335:14;1347:5; 1358:8 MSRA (1) 1284:9 MSRAsic (1) 1285:15 much (18) 1237:17;1239:14; 1271:2;1286:19; 1287:11;1293:21; 1305:17;1308:17; 1310:22;1311:2; 1318:7;1323:5; 1328:17;1336:3; 1341:10;1355:7; 1365:7,16 MUDDY (43) 1231:11;1233:19; 1240:5,11,18,19; 1241:2,7,18,22,24; 1242:2,8,18,19;1243:5; 1246:10,20;1249:24; 1252:16;1279:23; 1284:6,15,15;1305:24; 1306:3,6,20;1321:24; 1323:1;1333:8;1334:5; 1338:8,13;1341:3,8; 1342:1,5,11,15;1343:4; 1349:14;1350:11 multi-basin (1) 1344:8 multi-linear (3) 1305:20;1313:3,4 multiple (11) 1244:10,11;1259:18; 1264:24;1272:2; 1287:18;1305:9,11; 1306:5;1311:10; 1348:13 must (2) 1261:9;1341:16 MVIC (1) 1242:5 MX (1) 1298:16 MX-4 (6) 1303:23;1307:21; 1308:2,17,23;1309:4 MX-5 (52) 1251:11,17;1252:5; 1292:9;1295:6,9,12; 1296:9,10;1297:8,15; 1298:3,4,6,11,13,15,22, 23;1299:14,19,20; 1300:5,6,13,15,20,22; 1301:1,3,4,5,5,10; 1302:1,3,5,9;1303:10; 1304:1,5,10,22;1305:2; 1307:4,22;1308:6; 1309:3;1316:22; 1318:8;1328:7;1330:1			nature (1) 1364:15 NCA (1) 1233:15 near (19) 1255:20;1259:18; 1265:15;1266:3; 1268:16;1270:9; 1271:3,3;1273:16; 1276:9;1299:20; 1300:13,24;1301:1; 1302:3;1310:5;1327:2; 1359:14;1360:6 nearby (3) 1324:19,22;1360:11 nearly (1) 1305:21 necessarily (1) 1281:7 necessity (1) 1320:20 need (5) 1253:6;1308:23; 1329:10,12;1358:2 needed (4) 1238:7,8,11;1265:24 needs (2) 1308:24;1309:23 negative (4) 1290:6;1293:24,24; 1306:4 neither (1) 1303:20 NEVADA (42) 1231:1,22,5,23,5; 1233:4,7,5,11,14,15,5; 1241:16;1243:8; 1247:24;1252:15,24; 1292:2;1293:7,10,11, 14,15,18;1294:24; 1295:3;1296:4; 1302:12;1305:10; 1307:6;1308:15; 1309:14;1311:9,16; 1316:17;1317:18; 1330:24;1336:5,10; 1344:8;1349:13,20; 1369:1,5,10,17 new (9) 1248:18;1249:18; 1285:4;1292:3; 1308:16;1311:20,23; 1314:23;1315:1 next (27) 1236:4;1242:6; 1253:24;1266:5; 1269:11;1272:21; 1275:8;1277:12; 1278:11,15;1281:10; 1282:23;1284:22; 1286:8;1288:8,17; 1294:16;1297:10; 1306:18;1313:5,6,14;	1328:4;1332:6; 1340:13;1345:24; 1362:7 nice (2) 1268:24;1363:9 nicely (2) 1265:9;1287:1 nine (2) 1262:23;1299:10 nine-month (1) 1301:13 nineties (3) 1292:4;1293:2,4 N-member (5) 1335:5,6,9;1356:23; 1357:22 N-members (2) 1281:21;1282:16 NOAA (3) 1292:18;1293:8; 1294:6 nobody (1) 1255:4 noise (1) 1294:9 none (2) 1250:21;1355:23 non-traditional (1) 1320:6 nor (2) 1303:20;1313:4 Norm (1) 1364:11 normal (5) 1293:21,22;1297:1; 1351:19;1352:13 NORMAN (7) 1234:15,17;1254:19; 1256:3,11;1257:14; 1337:23 North (25) 1233:21;1250:17; 1252:8;1258:3;1274:5; 1283:8;1293:12; 1295:4;1302:6,10; 1303:9;1310:8,11; 1311:4,5;1339:17; 1341:2,10;1343:14; 1347:12,16;1352:1; 1360:19;1367:16; 1368:3 north/south (1) 1262:20 northeast (9) 1258:15;1259:11; 1261:23;1263:6,11,23; 1264:1,9;1353:3 northeastern (5) 1280:10;1283:8; 1285:3;1333:16; 1358:4 northern (19) 1271:23,23;1274:22;
		N		
		N-1 (6) 1274:22;1275:16; 1276:8;1277:6,17,23 N-2 (4) 1274:23;1276:11; 1277:19;1278:8 name (7) 1254:16,16;1271:24; 1272:3;1291:17; 1336:9;1338:3 named (1) 1270:10 National (10) 1233:22;1247:18; 1273:12;1292:18; 1301:12;1306:14; 1327:9,14;1360:9,10 NATURAL (3) 1231:2;1241:11; 1369:6		

<p>1275:15;1276:8; 1281:3;1283:22; 1293:12;1324:20; 1335:15;1339:16,21; 1340:1,2;1342:14; 1343:4;1346:2;1350:6; 1361:2 north-south (3) 1274:5;1310:2; 1352:13 northward (1) 1367:16 northwest (2) 1261:13;1268:15 northwestern (2) 1267:5;1270:2 notably (1) 1240:12 note (3) 1259:17;1314:15; 1343:17 noted (1) 1315:20 notes (2) 1369:11,14 notice (4) 1260:18;1261:1; 1278:4;1307:20 noticed (2) 1307:18;1366:10 number (13) 1237:16,18,22; 1238:2;1239:2; 1243:16;1270:18; 1327:2;1328:14; 1336:13;1347:17; 1360:10,11 numbers (1) 1367:1 numerical (1) 1320:17 numerous (4) 1258:7;1260:19; 1262:14;1264:23 NV (2) 1233:10.5;1349:23 Nye (1) 1231:23</p>	<p>objections (1) 1315:9 observed (1) 1328:19 obvious (1) 1352:7 obviously (1) 1255:3 occur (3) 1246:6;1317:18,21 occurred (6) 1295:13,18,20,23; 1298:16;1300:3 occurrence (4) 1248:13;1292:10,12; 1293:2 occurring (5) 1281:8,8;1295:14, 15;1299:21 occurs (2) 1346:11;1357:10 Oceanic (1) 1292:18 O'Connor (1) 1233:5 October (1) 1369:18 odd (1) 1317:20 off (11) 1274:6;1278:14; 1286:2;1300:6,15,24; 1301:4;1307:9; 1308:21;1366:1,23 offered (4) 1255:1;1339:11; 1347:22;1348:9 offers (1) 1351:17 office (7) 1253:18;1254:6; 1256:19;1257:2; 1291:21;1319:1; 1327:13 OFFICER (58) 1231:4;1232:3.5,8; 1234:10;1236:3; 1239:16;1241:16; 1242:24;1243:8,10; 1244:19;1245:10,17; 1247:16,20,22; 1248:24;1252:8,14,18, 22;1253:2,8,22; 1254:12;1256:16; 1259:6;1291:3,6; 1312:6,10;1313:20; 1314:4,20;1315:5,18; 1323:10,16,18;1327:7; 1329:5;1332:6;1336:4; 1340:14,19;1343:10, 13,16;1345:12; 1347:11;1348:1,16; 1349:7,12,16,19;</p>	<p>1351:9;1367:20 Official (1) 1369:4 offset (6) 1308:3,4;1309:8,8; 1310:5,22 often (2) 1295:15;1364:1 ohm (1) 1266:13 old (1) 1285:1 older (2) 1286:17;1325:24 once (5) 1298:15;1317:14; 1318:3;1359:6;1368:1 one (69) 1236:14;1241:23; 1244:21;1245:15; 1253:14;1255:8; 1256:7;1258:7,8; 1260:2;1263:1,2; 1264:8;1265:1,4,20; 1267:3;1269:4,11,12, 20;1276:23;1277:12; 1281:11,24;1284:10; 1290:6,12,13;1293:10; 1297:2;1300:10; 1301:7;1305:13,14; 1306:17,24;1308:11; 1311:4;1314:5; 1319:12;1324:17; 1326:6,17;1328:1,14; 1329:3,3,7,10,10,12, 13;1330:22;1332:16; 1334:13;1336:19,19; 1345:4,4,4;1348:14; 1353:8;1360:16; 1361:23;1362:16; 1365:2,8;1366:2 ones (2) 1268:15;1361:10 one-to-one (1) 1267:2 one-year (3) 1295:9;1296:16; 1297:17 ongoing (2) 1237:5,7 only (15) 1250:5,10;1279:3; 1284:1;1289:11; 1300:20;1304:8; 1306:24;1310:22; 1316:4;1331:2;1332:1, 2;1344:10;1347:18 onward (1) 1330:20 oOo- (2) 1231:5;1236:2 open (6) 1243:11;1245:12;</p>	<p>1253:2;1273:13; 1283:22;1351:10 opinion (22) 1243:19;1245:7; 1248:13;1249:13; 1332:23;1333:2,13,24; 1338:6,15,16,20; 1342:13,16,19,20,22; 1343:3;1349:1;1351:7; 1356:18;1357:19 opportunity (4) 1312:16;1315:21; 1319:17;1365:7 opposite (3) 1264:1;1288:5; 1354:6 orange (1) 1296:18 ORDER (8) 1231:16;1237:16; 1238:3;1317:11; 1328:18;1340:16; 1355:6;1362:15 orient (2) 1261:16;1262:12 orientation (1) 1261:11 oriented (5) 1261:13;1262:10,21; 1268:17,17 others (5) 1302:12;1303:8; 1306:24;1310:20; 1364:4 otherwise (1) 1354:22 out (57) 1237:4;1243:18; 1246:17;1247:2,8; 1259:9,20;1260:4,16, 16;1261:7,9,11,15; 1262:14;1265:10; 1270:21,24,24;1271:3; 1272:22;1273:13; 1274:10;1278:3,7,12, 18,19;1281:17;1283:2; 1285:7;1294:9; 1297:12;1304:20; 1305:19;1306:19,20; 1308:14;1316:17; 1317:5;1320:20; 1329:4;1330:15; 1332:16;1334:24; 1341:5;1343:11; 1345:9;1353:5,16; 1354:4;1357:7;1358:6; 1363:11;1364:24; 1365:3;1367:2 outcome (2) 1347:19;1348:20 outcrop (11) 1259:18,20,22; 1260:16,18,21;</p>	<p>1264:13;1265:5; 1266:10;1267:16; 1272:23 outcrops (1) 1258:21 outflow (1) 1247:11 outpatient (1) 1281:3 outside (4) 1260:17;1321:24; 1360:6,12 oval (2) 1274:11,12 over (25) 1239:8;1257:12; 1259:5;1263:12; 1265:5,5,6;1266:15; 1278:24;1279:1; 1280:20;1295:1; 1296:6;1299:5; 1300:11;1304:1; 1310:18,18;1317:4; 1344:11;1346:24; 1361:11,18,19;1364:16 overall (4) 1295:22;1299:24; 1301:19;1357:18 overlaid (2) 1260:11;1276:23 overlap (1) 1321:10 overlooked (1) 1343:15 overview (3) 1257:23;1259:1; 1319:6 own (5) 1321:7,13;1338:23; 1341:2;1342:4 owns (1) 1342:11 oxide (1) 1328:12 oxyhydroxides (1) 1287:14</p>
O		P		
<p>object (6) 1237:19,23;1239:1; 1311:19;1340:10; 1347:21 objected (4) 1253:17;1255:4,8; 1256:20 objection (10) 1253:20;1255:16; 1312:11;1314:16,23; 1315:7,19;1343:6; 1348:2,3</p>				<p>Pacific (4) 1239:16,22;1252:12; 1349:10 packed (1) 1265:2 PAGE (18) 1234:2;1235:3; 1245:24;1275:11,13; 1322:11,22;1324:17; 1325:15;1327:3; 1329:15;1336:13; 1343:24;1345:9,16,24; 1346:20;1351:19 Pages (4)</p>

<p>1231:17.5;1323:5; 1329:12;1369:13 Pahrnagat (1) 1337:11 Paiute (1) 1236:14 Paiutes (3) 1233:16.5;1247:20; 1332:7 pale (2) 1276:15,20 Paleozoic (2) 1322:3,5 Paleozoics (1) 1276:4 Palmer (9) 1292:15;1293:8,20; 1294:6,9;1296:15; 1297:16;1299:9; 1360:3 PANEL (9) 1234:3,15;1235:4; 1254:4,8;1337:19; 1338:17;1364:15; 1367:23 paragraph (3) 1246:1;1345:16,17 parallel (9) 1261:14;1262:5; 1270:24;1271:13; 1274:4;1344:21,23; 1345:3;1354:3 parameter (3) 1290:13,20,20 parameters (1) 1290:15 parcel (1) 1248:18 Park (9) 1233:22;1247:18; 1273:12;1301:12; 1306:14;1327:9,14; 1360:9,10 parked (1) 1275:22 part (17) 1242:9;1243:21; 1246:24;1248:12; 1263:12,19;1264:19; 1266:1;1267:5;1277:4; 1278:5,9;1284:19; 1292:4;1293:13; 1348:11;1352:1 partial (1) 1320:17 participant (1) 1312:16 participants (1) 1323:19 particles (1) 1366:6 particular (8) 1320:16;1331:3,12,</p>	<p>15,21;1334:13;1348:9; 1352:18 particularly (3) 1306:11;1334:10; 1347:3 parties (1) 1319:22 party (1) 1256:20 past (3) 1272:2;1293:5; 1296:7 paternity (1) 1258:17 path (7) 1286:16,18;1325:8, 14;1333:19,23; 1334:18 paths (2) 1325:21;1334:9 Patrick (2) 1233:23.5;1236:9 pattern (4) 1297:23;1299:23; 1300:18;1301:2 patterns (1) 1303:7 Paul (3) 1233:3.5;1248:4; 1336:9 Pederson (8) 1238:13,14,23; 1239:7,13,13;1240:6,6 pending (3) 1249:18,20;1340:4 people (8) 1296:20;1301:8,17; 1302:16;1355:17; 1356:10;1363:10; 1365:15 per (4) 1287:21;1326:2; 1327:1,2 percent (26) 1240:18;1275:12; 1281:24,24;1282:10, 10,15;1286:10,12,24; 1287:18;1295:10,14; 1305:17,21,21;1306:1, 17;1325:12,24; 1328:20,21;1357:2,3,5, 14 percentage (4) 1281:23;1350:10,21; 1351:5 perennial (1) 1366:23 performed (2) 1312:13;1326:22 period (13) 1239:8;1295:9,9,11, 17;1296:10;1298:1,20, 21;1301:18;1308:6;</p>	<p>1330:17;1345:19 periodic (1) 1236:19 periods (1) 1298:4 permanent (1) 1338:7 permeability (3) 1327:20,21;1328:1 permeable (1) 1359:15 permission (1) 1259:3 permit (1) 1348:18 permits (1) 1341:1 perpendicular (5) 1261:3,18;1262:3,8; 1271:18 person (2) 1317:6;1327:17 personally (1) 1271:17 perspective (3) 1258:2;1272:13; 1278:16 PETER (10) 1234:15.5,23; 1254:21;1256:5,13; 1318:17;1337:21; 1350:5;1356:4,5 Peterson (37) 1233:13.5;1234:18, 20,22,24;1254:2,2,15, 22;1256:6,14,23; 1257:20;1259:23; 1279:6,14;1283:6; 1287:2;1291:1,15; 1312:6,9,19;1313:9; 1314:5;1315:24; 1318:23;1323:3,10,15, 17;1329:9;1331:20,22; 1340:10,14;1343:6 pH (2) 1285:1;1287:12 phase (1) 1340:13 PhD (1) 1320:15 Phoenix (1) 1319:18 PHREEQC (2) 1288:21,21 physical (2) 1278:21;1346:10 picture (2) 1346:3;1365:21 piece (1) 1365:2 pieces (2) 1322:8,20 pinch (1)</p>	<p>1353:16 pink (1) 1273:24 Piper (7) 1280:14;1282:19,24; 1283:9,13;1284:23; 1290:16 place (8) 1261:10;1271:19; 1272:8;1295:12; 1322:24;1332:16,17; 1334:3 placed (1) 1280:20 places (1) 1272:15 plate (1) 1276:23 Please (8) 1239:11;1247:1; 1250:8;1257:9; 1273:11;1319:5; 1345:11;1348:5 plenty (1) 1366:9 plot (38) 1263:12;1264:11; 1265:10;1267:5,6,14, 21;1268:4,20,23; 1269:2,24;1270:2,19; 1273:18,19;1274:8,8, 20;1275:2,19;1277:5, 13;1282:10,24;1283:5; 1285:4;1286:1,1; 1289:16,17;1297:13; 1302:8;1309:21,22,22; 1310:11,11 plots (5) 1267:2;1268:21; 1280:14,15;1292:12 plotted (10) 1290:16;1293:6; 1309:13,17;1324:16; 1330:14;1335:6; 1345:18;1354:22; 1356:6 plotting (1) 1296:16 plunges (1) 1268:4 PM (3) 1231:17.5;1236:1; 1368:5 point (20) 1257:1;1259:9; 1260:8;1261:10,11; 1270:21;1283:2,4,4; 1286:6,10;1287:16; 1323:7;1329:3; 1334:21;1349:3; 1351:10;1357:7,23; 1365:8 pointed (2)</p>	<p>1273:13;1316:17 pointing (8) 1283:7;1286:3; 1287:23,24;1309:21, 22;1316:21;1334:14 point-nine (1) 1357:15 points (9) 1260:9;1274:21,21, 23,23;1285:22;1319:3; 1358:3,5 polling (1) 1311:7 polygons (2) 1309:15,16 pore (2) 1363:6,6 pores (3) 1363:2,7,19 PORTION (7) 1231:8;1280:9; 1281:3;1283:13; 1285:3;1293:12; 1350:13 position (3) 1340:22;1341:4; 1344:7 positioning (1) 1291:19 positive (2) 1294:2;1306:5 possibility (1) 1241:6 possible (6) 1240:22;1243:23; 1244:2;1352:5; 1353:18;1361:7 possibly (3) 1240:13;1335:16; 1350:21 postulated (3) 1288:3;1298:9; 1301:8 potential (11) 1238:18;1240:12; 1281:9,19;1284:13; 1287:11;1298:19; 1319:22;1325:12,20; 1357:5 potentially (1) 1240:23 power (4) 1256:24;1323:7; 1329:3;1365:8 precedent (1) 1344:3 precipitation (5) 1292:16;1295:18,19; 1300:3;1366:18 predict (1) 1303:17 prediction (1) 1309:5</p>
---	--	--	--	---

preface (1) 1284:1	1267:19,23;1273:5, 7;1279:5;1286:22;	1303:20	1256:21;1304:13; 1369:10	1284:12;1285:7
preliminary (1) 1325:15	1288:21;1295:18; 1297:21;1299:23;	provide (5) 1237:22;1253:15; 1279:18;1282:21; 1325:14	purposes (3) 1256:18;1271:16; 1348:10	raise (1) 1312:18
preparation (1) 1312:17	1319:10;1350:6; 1353:17,18;1355:16;	provided (8) 1237:17;1280:4; 1305:10;1311:21; 1312:13;1313:23; 1337:5;1360:5	pursuing (1) 1321:6	ran (2) 1258:9;1262:2
prepared (3) 1255:21;1256:7; 1280:5	1356:3;1362:14; 1366:21	proximity (2) 1246:5,13	put (16) 1236:11,15;1257:12; 1262:4,4;1269:8,18; 1270:17;1271:16; 1272:1,19;1299:17; 1315:4;1327:3; 1354:17;1366:10	Ranch (1) 1321:16
presence (4) 1250:20,24;1251:4; 1345:21	problems (1) 1272:24	PUBLIC (3) 1231:15;1369:11,14	P-values (9) 1305:15,15,19; 1306:12,13,17,18,21; 1311:15	range (6) 1258:20,20;1293:22, 22;1309:1;1325:19
present (8) 1239:23;1244:23; 1254:7;1288:11; 1324:16;1326:9; 1347:7;1369:9	procedure (1) 1311:12	publish (1) 1293:9	PZ (1) 1276:4	rate (3) 1295:5;1307:7; 1316:12
presentation (14) 1238:17;1239:5,24; 1242:9;1253:9; 1254:11;1257:4; 1291:7;1314:7;1319:3; 1323:7;1326:18; 1348:24;1367:24	proceed (5) 1257:9,21;1273:11; 1314:17;1316:1	published (3) 1292:18;1306:13; 1307:23	Q	rather (1) 1319:17
presentations (3) 1257:1;1360:5,7	PROCEEDINGS (7) 1231:14;1253:16,19; 1255:10;1256:22; 1312:17;1314:14	publishes (1) 1293:8	qualification (3) 1253:19;1255:3; 1256:18	ratio (4) 1267:2;1268:21; 1356:19;1357:2
presented (5) 1256:23;1259:3; 1326:12;1340:16; 1360:11	process (2) 1365:14;1366:4	pulled (1) 1309:14	qualified (9) 1253:18;1254:23; 1255:2,5,9,13,18; 1256:19,21	ratios (1) 1357:21
presents (1) 1284:23	processes (3) 1255:15;1294:12,22	pulling (1) 1311:8	quantify (1) 1358:8	Ravie (1) 1292:3
pressure (2) 1304:21,22	produce (1) 1328:19	pulse (4) 1295:21;1359:3,4,8	quarter (1) 1335:17	reach (4) 1251:11,17;1294:15; 1304:21
presumed (3) 1281:2;1286:15; 1354:14	produced (1) 1361:6	pulse-like (1) 1358:19	quick (7) 1253:14;1268:13; 1277:9;1283:12; 1319:6;1362:13; 1366:10	reached (1) 1334:22
pretty (12) 1239:14;1286:24; 1293:21;1305:17; 1322:17;1346:23; 1355:7;1357:16,17; 1361:18;1365:16; 1367:1	producer (1) 1265:20	pulses (1) 1295:21	quicker (1) 1294:17	read (6) 1246:2;1287:6; 1336:12;1346:22,23; 1357:14
previous (8) 1255:10;1261:22; 1299:6;1314:24; 1330:7;1351:17; 1352:12;1360:5	Professional (2) 1232:9.5;1341:22	pump (4) 1326:22;1328:7; 1341:17;1359:12	quikly (2) 1273:12;1343:23	reading (1) 1345:22
Previously (4) 1244:22;1253:17; 1256:19;1354:11	proffered (3) 1253:16;1255:14; 1256:21	pumped (6) 1246:4;1295:13; 1338:6,8,12;1341:10	quite (12) 1264:14;1269:7; 1282:9;1286:13,14; 1296:17;1319:9; 1325:24,24;1332:19; 1334:11;1351:23	real (1) 1283:12
primarily (2) 1267:10;1302:13	proffering (1) 1256:20	pumping (84) 1237:11,14;1238:4, 5,11,15,16;1239:6,12; 1246:3,5,8,12,13,15, 22;1247:11,14; 1248:19;1249:8; 1250:15,16,22; 1251:10,17,22;1252:5; 1280:8;1295:6,10; 1296:9,11;1297:13,14, 15;1298:2,4,5,6,8,10, 14,16,19,19,23; 1299:11,12,19,20,21, 23;1300:5,15,18,22,22; 1301:3,5,7,10;1302:2, 4,5,9;1303:10;1304:5, 10;1305:22;1306:6,20, 21;1307:4;1311:1; 1318:10;1319:17; 1329:24;1330:1; 1338:10;1342:14; 1343:4;1347:19; 1355:3;1363:10	quitting (1) 1367:22	realistic (1) 1272:22
primary (1) 1319:19	program (2) 1288:22;1319:20	purpose (3) 1282:20;1283:18	quote (3) 1346:20,21,24	realize (1) 1365:6
prior (7) 1263:9,16;1292:8; 1299:19,20;1313:23; 1328:7	progression (1) 1306:19		quoted (1) 1237:15	really (16) 1253:14;1262:7; 1278:15;1279:16; 1286:8;1308:18; 1325:17;1327:15; 1328:5;1331:1;1355:9; 1358:2,3,18;1361:10; 1367:8
probability (2) 1282:11;1305:16	project (1) 1333:14		R	reason (2) 1261:6;1367:3
probably (18)	projects (1) 1321:18		radical (1) 1270:21	reasonable (2) 1312:11;1350:8
	proof (1) 1303:19		railroad (2)	rebuttal (13) 1236:12;1254:6; 1305:10;1312:22; 1313:10;1314:1; 1315:2,2,3;1319:3; 1342:21,23;1348:11
	proper (1) 1280:21			recall (11) 1240:3;1242:14; 1244:22;1245:1; 1342:17,18,22;1343:8; 1344:4;1347:1; 1360:14
	properties (4) 1278:22;1304:19; 1363:23;1364:7			
	property (1) 1363:1			
	proposal (1) 1339:11			
	prospect (1) 1321:16			
	protect (2) 1242:1;1322:24			
	proved (1)			

received (5) 1319:7,9;1320:7,15; 1349:24	1253:5;1254:11; 1323:13,15	relating (2) 1340:17;1348:6	1312:8,8,20,20,21,23; 1313:2,7,10,11,12,19, 24;1314:1;1316:17; 1322:5;1323:6;	resistivities (8) 1263:8,9;1265:7,11; 1267:10;1271:20; 1277:22;1278:6
recent (3) 1280:5;1292:11; 1293:4	REDOX (1) 1287:11	relation (2) 1346:6;1348:17	1324:10,11,12; 1325:15,16;1327:3; 1342:21,23;1343:24; 1345:9;1346:21; 1347:2;1348:11; 1354:17	resistivity (50) 1263:15;1264:5,14, 23;1265:9,12,14,16; 1266:12,16,20,21; 1267:13,22,24; 1268:10,11;1269:1; 1270:6,7,22,23;1271:1; 1272:5,17,18;1277:24; 1278:2;1279:1,1; 1327:24;1353:15,16; 1361:12,12,13,15,15, 21,22;1362:2,2,24; 1363:7,13,16;1364:1,2, 4,6
recently (1) 1279:18	reds (1) 1267:22	relationship (5) 1284:20;1285:5,9, 19;1287:21	REPORTED (2) 1231:21;1303:9	resolution (6) 1261:17;1262:4,13, 22;1275:5;1345:1
recharacterize (1) 1239:11	reduced (1) 1328:13	relationships (2) 1284:14,19	reporter (12) 1237:20;1282:14; 1283:19;1284:8; 1286:11;1290:14; 1314:19;1328:9; 1347:24;1357:9; 1367:12;1369:5	resolve (2) 1262:2,7
recharge (40) 1255:15;1284:15; 1286:5;1294:13,13,15, 18,19,19,20,21; 1295:21,21;1296:23; 1297:2;1299:3,7; 1300:1,2,2;1308:20; 1319:24;1321:14,18; 1329:22;1330:22,23; 1331:4,10,13,16; 1359:1,14;1362:18; 1366:16,17;1367:5,11, 13,18	reference (4) 1276:22;1277:1,3; 1311:8	relative (4) 1276:24;1325:17; 1353:20;1360:3	REPORTERS (2) 1231:21,21.5	resource (1) 1242:12
recharged (1) 1335:16	referring (1) 1360:8	relatively (7) 1238:22;1243:17,20; 1304:18;1310:19; 1330:21;1353:2	reporting (1) 1369:10	RESOURCES (8) 1231:2,3;1243:11; 1319:13;1320:8; 1351:11;1369:6,6
recharges (1) 1359:11	reflects (1) 1366:13	release (1) 1328:7	reports (18) 1242:10;1254:5,6,6; 1255:21;1256:7; 1269:6;1280:5; 1311:21,24;1312:1,4, 14,15;1313:4;1314:14; 1348:11,14	respect (2) 1243:18;1356:22
recollection (1) 1240:14	refresh (1) 1240:9	released (1) 1328:13	represent (5) 1258:21;1283:14; 1293:7;1325:22; 1336:10	respond (6) 1252:4;1300:20; 1312:2;1315:14; 1331:2;1332:2
recommendation (3) 1237:14,15;1245:2	refresher (2) 1268:14;1277:9	relevance (1) 1320:8	representative (1) 1300:12	responded (1) 1298:6
reconvene (2) 1367:23;1368:3	regard (1) 1363:21	relevancy (1) 1340:11	representing (2) 1243:3;1254:3	responding (9) 1300:1,18,19,21; 1303:7;1331:1,9,10,13
record (20) 1236:4;1242:7,16; 1243:15;1244:8; 1245:23;1246:2; 1248:4;1253:13,23; 1254:16;1255:24; 1299:3;1311:20; 1315:4;1332:11; 1343:22;1345:20; 1351:15;1360:24	regarding (4) 1240:4;1245:7; 1246:1;1326:8	relied (2) 1302:13;1347:2	represents (3) 1293:11,21;1305:17	responds (1) 1332:1
recognition (1) 1240:14	regardless (1) 1313:24	relying (2) 1302:22,22	Republic (4) 1239:17,21;1252:12; 1349:10	response (29) 1294:15,17;1298:3, 7,22;1299:18;1300:3, 21;1301:4,18,19; 1302:5,9;1307:2; 1313:11;1314:16; 1318:8;1355:6;1356:7, 9;1358:13,23,24; 1359:3,4,22;1362:8,13; 1364:12
recommendation (3) 1237:14,15;1245:2	regards (3) 1249:11;1250:4; 1314:12	remains (1) 1307:1	requested (1) 1340:8	responses (10) 1299:11;1300:8; 1320:13;1347:20; 1348:19,21;1358:18, 21;1359:14,17
reconvene (2) 1367:23;1368:3	region (6) 1299:17;1303:11; 1309:2,8,10;1326:24	remember (1) 1313:14	required (1) 1328:18	responsible (1) 1319:22
record (20) 1236:4;1242:7,16; 1243:15;1244:8; 1245:23;1246:2; 1248:4;1253:13,23; 1254:16;1255:24; 1299:3;1311:20; 1315:4;1332:11; 1343:22;1345:20; 1351:15;1360:24	regional (3) 1319:16,16;1321:13	remotely (1) 1315:6	requirement (1) 1362:1	rest (3) 1275:2;1293:15; 1323:5
recovering (1) 1279:16	regions (3) 1293:9,10;1297:17	remove (1) 1306:23	reserve (1) 1254:10	restate (1)
recovery (8) 1250:22;1298:17,21; 1299:11,14,17;1300:8; 1301:20	registered (4) 1319:14,15;1320:2,3	removed (2) 1328:6;1352:17	reserved (1) 1323:11	
rectangle (1) 1285:19	regression (30) 1302:15,17,23; 1303:1,11,13,21; 1305:3,9,11,20;1306:5, 21;1307:11;1308:2; 1309:5;1311:8,10; 1312:3,19;1313:3,4,8, 10;1316:4,5;1347:18; 1348:13,21;1349:4	rendition (1) 1314:24	resistant (1) 1264:16	
red (18) 1258:7,12;1259:12; 1263:2;1265:12; 1270:5;1271:10; 1275:17,21;1276:13; 1297:15;1302:6; 1309:15,15,18; 1311:18;1316:13; 1317:14	regular (2) 1330:7,7	Reno (5) 1233:7.5,11,15.5; 1292:2;1369:17	resister (1) 1364:3	
reddish (2) 1268:1,2	REICH (1) 1236:8	repeat (4) 1237:6;1247:1; 1250:8;1348:5	resisters (1) 1364:4	
redirect (4)	reiterate (1) 1315:8	replace (1) 1321:4	resistive (1) 1364:1	
	rejoining (1) 1367:16	replete (1) 1287:17		
	related (7) 1280:11;1282:12,24; 1290:2;1318:5,5; 1340:15	replicated (1) 1311:16		
	relates (1) 1332:16	report (60) 1236:12;1237:23; 1238:1,3,5;1245:24; 1248:17,20;1250:7,12, 13;1269:9;1272:2; 1273:13,14;1275:5; 1278:17;1280:1,3,6; 1284:3;1287:5; 1289:15;1302:24; 1305:11;1307:6,23; 1308:15;1311:9;		

1237:24 result (3) 1250:16;1275:14; 1344:3 results (5) 1266:21;1271:7,8; 1272:22;1327:24 review (2) 1312:16;1326:7 re-welt (1) 1366:7 Richard (2) 1233:16.5;1332:11 ridge (2) 1310:4,4 right (77) 1240:17;1242:17,18; 1244:6;1245:11; 1248:22;1253:3; 1258:6,15;1259:10,19, 21;1261:1,14;1262:11; 1263:4,11,18;1265:5, 15;1266:8,8,18; 1268:1;1269:8,22; 1270:18;1271:21; 1272:5,16;1273:10,19, 22;1274:8;1275:11,24; 1278:6;1283:5,13; 1284:10;1285:6; 1286:1,5;1289:9; 1294:16;1295:1; 1299:20;1300:24; 1309:13,21,22,22; 1312:24;1316:1; 1323:4;1324:13; 1327:5;1341:1,18,20; 1344:5,7,19,20,23; 1345:4,16;1352:2,14, 14,24;1353:1,24; 1354:3;1359:16; 1363:1;1367:20 right-hand (6) 1264:11,22;1267:14; 1269:21;1285:20; 1286:3 rights (18) 1238:10,24;1239:4; 1242:2,19;1243:4; 1246:1;1321:15,16; 1338:24;1340:13,23; 1341:5,8;1342:5,8,11; 1364:21 rise (3) 1302:3;1354:24; 1359:5 rising (1) 1302:5 RIVER (47) 1231:7,11;1240:18; 1241:3,7;1242:2,18; 1243:5;1245:3; 1246:10,19,20;1247:3, 8;1248:10;1249:24;	1279:23;1280:12; 1284:15;1293:16; 1306:1,3,6,20;1318:10, 14;1321:15,19,24; 1322:1;1323:1;1326:9; 1333:8;1338:8,9,12,13; 1339:13;1341:3,8; 1342:2,11,15;1343:1,5; 1350:11;1361:2 rivers (1) 1322:8 Robison (2) 1233:6,7 robust (1) 1364:15 rock (10) 1263:24;1264:6; 1274:16;1327:22; 1356:12;1363:1,4; 1364:1,2,5 rocks (10) 1260:16;1274:9,10; 1328:11;1332:20,21, 22,22;1333:3;1364:3 Rogers (3) 1283:3,4;1286:6 room (1) 1366:9 rotated (1) 1361:24 roughly (4) 1268:3;1271:13,16; 1314:6 Rowley (11) 1258:1;1260:11,19; 1261:22;1262:13; 1268:19;1271:8; 1273:4;1275:13; 1322:11,22 Rowley's (2) 1275:10,12 R-squared (4) 1303:12;1304:17; 1305:4,14 rule (1) 1311:24 ruling (3) 1315:11;1336:13,14 run (5) 1262:8;1271:18; 1295:5;1306:21; 1355:24 running (10) 1258:7,8;1260:23; 1262:5,8,19;1263:1,4; 1344:23;1351:22 runs (3) 1263:3;1352:1,23	same (17) 1244:15;1255:11; 1260:10;1269:2; 1277:20;1278:12,22; 1280:22;1282:2,15; 1290:10;1316:7; 1331:5;1334:15; 1337:18;1345:18; 1359:22 samples (8) 1284:1;1285:24; 1289:15,21;1290:4; 1335:13,14,15 sand (1) 1274:16 sandstone (1) 1363:11 saturated (2) 1265:13;1267:23 saves (1) 1259:7 saw (9) 1268:5;1278:8; 1296:5;1301:14; 1333:6;1352:4;1355:7; 1359:22;1364:22 saying (14) 1237:16;1270:7; 1274:7;1276:8;1287:6; 1288:6;1322:8,13,15; 1343:9;1350:14,16,24; 1356:22 scale (2) 1345:19;1354:21 school (1) 1320:5 Schreck (1) 1233:8.5 science (2) 1291:24;1358:10 scientist (1) 1292:6 scientists (1) 1341:22 scope (2) 1333:13;1348:3 S-curve (1) 1356:12 se (1) 1326:2 season (1) 1244:15 seasonal (3) 1299:22;1300:21; 1301:2 second (4) 1295:19;1329:13,15; 1345:16 secondary (1) 1367:3 Section (4) 1232:8,11;1245:24; 1278:5	sections (1) 1361:6 secured (1) 1356:20 sedimentary (1) 1321:1 Seeing (33) 1241:16;1243:10; 1247:17;1252:9,10,15; 1253:3;1263:11; 1264:4,19;1265:15; 1266:19;1267:17; 1268:23;1269:7; 1270:11;1276:17; 1277:20,21;1278:4,22; 1302:9;1327:8;1349:8, 12,13,16,19;1353:14; 1359:4,14,17;1361:14 seek (1) 1255:5 seem (1) 1353:22 seems (6) 1317:21;1330:21; 1350:8;1353:15; 1360:18;1364:5 selected (1) 1308:5 Sell (1) 1311:9 Senior (4) 1232:12.5;1242:1, 19;1292:6 sense (6) 1261:24;1311:14; 1348:22;1349:3; 1356:21;1357:24 sentence (1) 1345:17 separate (4) 1240:4;1266:19; 1304:14;1365:3 SEPTEMBER (4) 1231:18.5;1236:1; 1257:2;1369:8 series (3) 1236:12;1280:14; 1293:17 serious (1) 1361:18 Service (13) 1233:22;1239:24; 1244:24;1247:17,18; 1273:12;1301:12; 1306:14;1327:8,9,14; 1360:9,10 Service's (1) 1245:2 SESSION (2) 1231:17.5;1236:1 set (7) 1250:6,11;1279:24; 1281:11;1289:12;	1355:21;1366:15 sets (3) 1278:20;1280:3; 1288:24 setting (1) 1344:3 settings (1) 1347:3 Settlement (1) 1321:16 settling (1) 1366:2 seven (6) 1239:12;1243:16; 1246:8;1259:8; 1297:11;1323:20 seven-day (3) 1354:10;1355:4,18 seventies (1) 1292:24 several (7) 1239:14;1241:22; 1290:12,15;1319:15; 1351:16;1362:16 severe (1) 1294:1 severity (2) 1296:16;1297:16 shaded (3) 1258:16;1273:20; 1276:1 shading (3) 1263:7,7;1273:24 shallow (3) 1264:2,19;1353:5 share (2) 1329:7,14 shareholder (1) 1242:8 shareholders (1) 1242:5 Shariq (1) 1321:4 Sharp (1) 1233:6 shift (2) 1298:12,13 shifted (1) 1304:10 short (4) 1264:9;1278:24; 1279:1;1310:19 Shorthand (1) 1231:21.5 short-term (1) 1332:2 show (26) 1236:22;1242:7; 1243:23;1246:7; 1268:22;1269:6,9,23; 1276:20;1280:8; 1282:23;1288:17; 1294:8;1296:12;
	S			
	salt (3) 1363:8,10,14			

<p>1297:10;1298:5; 1299:10;1303:16; 1306:24;1313:14,15; 1335:24,24;1354:21; 1355:8;1360:12</p> <p>showed (12) 1238:13,14;1250:5, 11;1272:22;1280:22; 1287:16;1322:19; 1348:24;1352:22; 1354:23,24</p> <p>showing (14) 1236:16;1265:9; 1274:17;1292:11; 1294:24;1296:14; 1301:24;1302:2,8; 1309:13;1316:10; 1324:11;1346:1; 1361:2</p> <p>shown (8) 1265:17;1273:23; 1294:5,6;1297:12,13; 1351:18;1352:10</p> <p>shows (15) 1236:24;1276:23; 1280:21;1283:2; 1285:23;1293:19; 1297:11;1299:4; 1300:14;1308:8; 1324:18;1335:23; 1347:18;1353:4; 1358:7</p> <p>side (17) 1262:16;1264:11; 1265:10;1269:21; 1271:11;1274:6,8; 1285:20;1286:4; 1345:4;1351:24; 1352:3;1353:13,14; 1354:1;1359:17; 1364:8</p> <p>sides (2) 1258:19;1304:11</p> <p>signal (8) 1298:2,17;1299:14; 1301:9;1304:22; 1311:1;1330:16; 1332:3</p> <p>signals (10) 1298:19,20;1329:18; 1330:12,14;1332:1,2; 1362:10,14,18</p> <p>signature (4) 1290:1;1328:15; 1334:13;1352:15</p> <p>signatures (4) 1333:2;1334:7,11; 1335:20</p> <p>significant (15) 1240:23;1272:9; 1273:7,8;1279:4,22; 1281:9;1284:20; 1285:14;1286:19,21;</p>	<p>1289:20;1307:1; 1325:6;1353:6</p> <p>significantly (2) 1238:15;1240:10</p> <p>Similar (21) 1278:18;1281:15; 1282:18,22;1284:22; 1289:13,13,17;1290:6; 1293:5;1296:5,8; 1299:2,4;1303:7,13; 1317:23;1322:11; 1335:20;1359:17; 1360:12</p> <p>similarities (4) 1281:14;1325:9,11, 12</p> <p>similarly (2) 1305:24;1324:20</p> <p>simple (5) 1281:20;1288:22; 1302:23;1304:18; 1343:5</p> <p>simplification (1) 1356:8</p> <p>simplified (1) 1292:15</p> <p>simplify (1) 1240:24</p> <p>simply (2) 1303:19;1314:24</p> <p>simulate (2) 1281:22;1282:18</p> <p>simulation (3) 1282:20;1288:20; 1289:13</p> <p>single (1) 1290:20</p> <p>sitting (2) 1324:13;1355:17</p> <p>situated (3) 1253:11;1346:6,15</p> <p>situating (1) 1344:21</p> <p>six (3) 1296:13,14;1357:14</p> <p>sixties (1) 1292:24</p> <p>skinny (2) 1267:4;1268:21</p> <p>skip (4) 1259:5;1269:11; 1316:8;1346:24</p> <p>sleet (1) 1332:22</p> <p>slide (88) 1243:16,16;1244:9; 1257:12,23;1259:2,8; 1260:9;1261:10; 1262:23;1264:8; 1265:3,23;1266:2,5,7, 24;1267:4;1268:13; 1269:11,12,14,15,15; 1270:17;1271:6,7;</p>	<p>1272:21;1275:8,10,20; 1276:13,22;1277:9,11, 15,16,18;1278:11,15; 1280:20,21;1281:10; 1282:23;1284:22; 1285:20;1286:8; 1288:8,18;1296:1,3,3, 13,14;1297:10,11; 1299:1,10;1300:9,16; 1301:23,24;1303:4,5, 22;1305:7,8,8;1307:19, 20;1309:9;1310:10; 1311:18;1312:9; 1313:1,5,5,5,6;1316:9, 9;1321:20;1344:16; 1347:17;1348:23; 1352:9,12;1361:1</p> <p>slides (12) 1257:11;1259:3; 1266:1;1290:13; 1311:6;1313:6,14; 1323:6;1326:18; 1348:9;1361:5;1365:8</p> <p>slight (1) 1310:2</p> <p>slightly (3) 1268:23;1290:5,5</p> <p>slip (2) 1310:3;1351:22</p> <p>slippery (2) 1344:4,11</p> <p>slope (8) 1330:3,4,21;1344:4, 11;1353:10,12;1356:9</p> <p>sloped (1) 1330:9</p> <p>slopes (2) 1263:23;1264:1</p> <p>slower (1) 1244:5</p> <p>small (3) 1271:11;1306:12; 1334:17</p> <p>Smaller (1) 1295:21</p> <p>smooth (2) 1294:9;1366:4</p> <p>snapshot (2) 1244:11,13</p> <p>S-negative (1) 1335:22</p> <p>SNWA (11) 1233:3;1236:15; 1301:11;1312:22; 1317:13;1342:10,23; 1343:3;1348:24; 1349:4;1355:16</p> <p>SNWA's (5) 1236:12;1313:11,15; 1342:14;1348:14</p> <p>software (1) 1311:13</p> <p>soil (1)</p>	<p>1292:16</p> <p>sole (1) 1349:1</p> <p>Solicitor (1) 1327:13</p> <p>solid (8) 1258:7;1261:21; 1263:2;1267:15; 1272:17;1277:10,23; 1283:17</p> <p>solidific (1) 1365:24</p> <p>soluble (2) 1282:5;1334:14</p> <p>solution (2) 1320:17;1325:22</p> <p>solvers (1) 1320:22</p> <p>someone (2) 1236:24;1315:15</p> <p>sometimes (2) 1275:3;1317:11</p> <p>somewhere (2) 1286:23;1335:8</p> <p>sooner (1) 1246:6</p> <p>Sorry (21) 1257:10,10;1266:6; 1269:15,15;1275:20; 1277:15;1279:16; 1283:4;1284:7; 1285:17;1291:20; 1314:22;1319:6; 1328:10;1329:11; 1338:18;1339:24; 1340:1;1343:16; 1366:13</p> <p>sort (15) 1250:14;1258:16; 1259:21;1260:3; 1261:1;1264:19; 1268:2;1271:6,7; 1274:5;1310:7; 1317:23;1321:12; 1349:24;1356:17</p> <p>sought (1) 1340:23</p> <p>sound (3) 1240:14,19;1344:4</p> <p>sounds (1) 1344:19</p> <p>source (15) 1240:4,6,7,13,22; 1285:9;1286:22; 1308:19;1328:6,10,16; 1335:18;1359:10,11,14</p> <p>sourced (2) 1294:13,14</p> <p>sources (5) 1241:2,7,11,13; 1294:21</p> <p>south (12) 1250:17;1267:5;</p>	<p>1273:15;1274:5; 1281:4;1309:9,18; 1310:12;1338:8,12; 1341:17;1364:18</p> <p>southeast (5) 1261:13;1266:3,5; 1268:15;1281:4</p> <p>southeastern (4) 1267:6;1269:16; 1277:5,7</p> <p>Southern (27) 1247:23;1274:23; 1277:16,17,18;1280:9; 1283:21;1293:14; 1295:2;1296:5; 1302:12;1305:10; 1307:5;1308:15; 1309:14;1311:9,16; 1316:16;1318:10,14; 1320:1;1335:12; 1336:5,10;1351:4; 1352:1;1358:3</p> <p>southward (1) 1367:17</p> <p>southwest (13) 1260:6;1261:23; 1263:14,24;1264:2; 1266:4,6,9,11;1281:3; 1353:3;1354:4; 1366:20</p> <p>southwestern (1) 1271:11</p> <p>space (1) 1363:6</p> <p>spaced (1) 1275:15</p> <p>speak (1) 1331:10</p> <p>special (2) 1301:22;1332:23</p> <p>specialty (2) 1255:7;1320:16</p> <p>specific (4) 1273:2;1312:9,21; 1327:17</p> <p>specifically (9) 1251:6;1279:19; 1313:11;1324:7,9,12; 1325:1;1334:6; 1336:17</p> <p>speculating (1) 1334:18</p> <p>spell (1) 1254:16</p> <p>SPRING (50) 1231:7.5;1240:6,22; 1242:11,17;1243:21; 1245:13;1246:4,12,13, 15;1247:3;1258:15; 1259:11;1260:17; 1261:15,21;1262:20; 1263:3;1270:10,11; 1273:16;1280:10;</p>
---	--	---	---	--

1281:4;1283:4,14,21, 21;1284:14;1285:4,6, 10;1286:14;1288:15; 1290:4;1321:23; 1324:6,20;1326:21; 1336:17,18,18; 1338:24;1339:6,16; 1340:2;1343:4,5; 1350:6,20	star (2) 1283:24;1284:6 stars (1) 1283:24 start (12) 1257:7,23;1294:1; 1297:6,21;1305:12; 1317:14;1323:19,20; 1324:2;1343:24; 1362:12 started (4) 1295:16;1301:14; 1321:7;1354:24 STATE (43) 1231:1;1232:5,6,5; 1237:4,9,12,15;1238:2; 1243:12;1253:3,18; 1254:5,16,24;1255:2,5, 9,13,18,20,23;1257:1; 1259:3;1287:9; 1291:21;1314:10,11; 1315:8;1319:1; 1336:14,14,15;1339:4; 1340:5,24;1344:20; 1347:6;1348:7,7,18; 1351:10;1369:1,5 stated (8) 1239:2;1244:23; 1248:17;1275:5; 1288:9;1338:20; 1347:5;1350:19 statement (10) 1239:7;1336:12,20, 23;1337:6,15;1344:1; 1347:1;1365:12; 1366:11 States (7) 1244:24;1247:16; 1250:13;1289:24; 1293:9;1325:16; 1327:7 static (2) 1238:22,22 station (2) 1270:4;1275:4 stations (5) 1258:13;1263:18; 1275:1,3;1366:15 statistical (1) 1315:13 status (1) 1308:22 stayed (2) 1333:22;1365:16 steady (4) 1237:4,9,12;1330:21 steep (2) 1267:3;1361:16 steeper (2) 1243:24;1244:3 steeply (1) 1268:4 stenotype (2)	1369:11,14 step (3) 1272:8;1278:13; 1306:18 step-by (1) 1306:19 Stephens (2) 1291:18;1292:5 step-up (1) 1358:19 stepwise (7) 1311:12;1312:3,19; 1313:8,9;1316:4; 1347:18 Steve (2) 1233:19;1241:22 sticking (1) 1259:22 sticks (1) 1260:4 sticky (1) 1343:17 still (8) 1281:6;1290:23; 1298:12;1302:6; 1330:24;1331:9,12; 1359:4 stone (1) 1260:19 stop (1) 1317:19 stopped (4) 1298:4,5,13;1301:5 storage (1) 1359:12 storativity (2) 1250:19;1252:2 story (1) 1299:2 straight (1) 1285:22 straightforward (1) 1251:21 stream (1) 1289:11 streams (2) 1366:14,22 stresses (1) 1250:16 stretched (1) 1317:4 stricken (1) 1314:3 strike (1) 1351:22 striking (1) 1314:1 strong (5) 1330:16;1336:16; 1337:2,8,16 strongly (2) 1322:3,10 struck (1)	1281:11 structural (3) 1322:4,13,20 structure (7) 1334:9;1344:24; 1352:13;1353:23; 1355:10;1359:18; 1363:22 structures (3) 1322:12;1351:16; 1353:4 student (1) 1320:7 students (1) 1320:13 stuff (1) 1361:18 stupid (1) 1327:16 subdivision (2) 1248:18;1338:7 submittal (1) 1311:23 submittals (1) 1366:12 submitted (4) 1251:7;1254:5; 1257:1;1312:12 subsequent (2) 1321:17;1348:10 substances (1) 1285:1 Subsurface (7) 1247:8;1261:17; 1266:15;1275:16; 1328:12;1363:22; 1365:17 sufficient (5) 1238:9;1303:17; 1304:3;1308:12; 1355:15 suggest (6) 1246:14;1285:13; 1289:19;1290:7,8; 1359:14 suggested (2) 1357:1;1358:14 suggesting (1) 1243:21 suggests (4) 1286:20;1289:23; 1290:20;1335:16 Suite (1) 1231:23 Sullivan (6) 1232:6;1235:14; 1362:22;1365:4,6; 1367:19 summarize (1) 1272:12 summarizes (1) 1272:21 summarizing (1)	1365:11 summary (5) 1271:7;1318:7; 1319:2;1321:23; 1323:2 super (1) 1239:13 superfund (1) 1319:20 Supervising (1) 1232:9.5 Supervisor (1) 1232:14 support (12) 1242:13;1248:13; 1279:21;1302:14; 1303:1;1304:4,15; 1334:20;1335:4,9; 1336:2;1341:7 supported (1) 1299:8 supporting (2) 1358:22;1359:20 supports (2) 1246:20;1316:3 Sure (14) 1241:1;1250:9; 1268:7;1275:12; 1308:4;1317:15; 1319:4;1324:15; 1330:11,13;1342:22; 1346:8;1354:9; 1361:10 surface (10) 1241:10;1263:18,20; 1264:6;1270:6,7; 1272:6;1275:22; 1276:13;1322:17; 1323:1;1353:10; 1366:15,24 surprised (1) 1302:20 surprising (2) 1263:21;1278:23 surrogate (2) 1330:12;1331:18 surrounding (2) 1322:2;1335:21 survey (4) 1259:8;1262:4,24; 1308:7 suss (1) 1246:17 sustainable (4) 1238:5,11,12;1239:6 swirling (1) 1274:4 switch (1) 1318:4 switched (1) 1330:5 sworn (6) 1254:13,14;1257:16;
---	---	--	---	---

1279:10;1291:11; 1318:19 Sylvia (2) 1239:21;1314:20 symbols (1) 1271:11 SYSTEM (38) 1231:7;1237:4,8; 1243:21;1245:3; 1246:19;1247:3,9; 1248:10;1251:20,21; 1280:12,13;1283:16; 1284:24;1288:7; 1289:2,10,18;1293:16; 1294:13;1297:3; 1299:24;1300:12,19; 1302:19;1318:10,15; 1320:12;1322:1; 1326:9;1338:9,12; 1339:14;1355:11; 1361:2;1362:8; 1367:16 systems (1) 1320:11	1319:17 TC (1) 1319:21 TDS (2) 1285:1;1357:11 teaches (1) 1320:11 teaching (2) 1320:9,12 teal (1) 1282:20 team (2) 1321:5,11 teams (1) 1321:8 techniques (1) 1255:16 Technologies (1) 1239:22 telling (1) 1268:7 tells (1) 1363:24 temperature (10) 1281:15;1282:4,9; 1288:18;1289:1,10,16; 1292:17;1357:8,14 temperature-controlled (1) 1288:17 temperatures (2) 1281:15;1307:7 temporarily (1) 1300:6 ten (36) 1258:11;1259:15; 1260:2;1261:12,14; 1262:9;1264:8;1266:7; 1267:8;1268:14; 1270:18,18;1271:8,10, 15,18,20;1272:5,8; 1273:9;1276:9;1277:1, 4,6,10,16,22;1279:4; 1306:1,14,15,15; 1344:18;1346:10; 1352:4;1361:7 tend (2) 1335:24,24 ten-minute (1) 1291:4 ten-month (2) 1301:14,15 ten-to-one (1) 1356:23 term (1) 1322:5 terminates (1) 1310:4 terms (3) 1322:6;1358:13,21 terribly (1) 1270:13 tertiary (1) 1365:9	test (47) 1238:15;1250:4,5, 10,16,19,22,24;1251:4; 1252:2;1295:12,15,16; 1297:5,7,8;1298:15; 1300:5,20;1301:3,4,6; 1303:2,18;1304:1,9; 1305:2;1307:5,22; 1308:6;1309:3,16; 1316:22;1318:8; 1326:22,24;1354:10, 13,19,23,24;1355:4,6, 13,19;1356:6,13 tested (1) 1305:5 testified (12) 1240:10,12;1255:19; 1257:17;1279:11; 1291:12;1301:13; 1310:20;1315:14; 1318:20;1331:8; 1355:10 testify (1) 1312:1 testimonies (1) 1269:4 testimony (16) 1239:10;1240:3; 1244:24;1250:4; 1304:12;1312:2,12; 1313:23;1315:1,2,10; 1344:21;1347:22; 1348:8,17;1355:5 testing (4) 1292:9;1295:6; 1297:8;1304:19 tests (1) 1355:17 TH-2 (1) 1236:14 Thanks (11) 1257:21;1272:12; 1323:17;1336:3; 1345:7,13;1346:17; 1347:10;1358:11; 1365:4;1367:19 Theis (3) 1302:18,18;1356:9 theories (1) 1367:8 Therese (4) 1233:20,21;1243:2; 1347:15 Thereto (1) 1278:11 thick (2) 1276:14;1353:2 thin (3) 1266:15;1276:9; 1353:3 thinking (1) 1356:10 third (3)	1269:20;1277:7,18 Thirties (1) 1292:22 THOMAS (5) 1234:15,19;1254:20; 1256:4;1279:8 though (7) 1274:1;1310:2; 1311:22;1351:5; 1357:19;1365:16; 1366:5 thought (8) 1240:11;1269:5; 1301:15;1311:24; 1313:23;1340:12; 1365:14;1366:19 thoughts (1) 1360:13 thousand (2) 1317:3;1339:9 thousands (4) 1266:13;1338:6,11; 1367:1 threat (1) 1249:8 three (9) 1249:19;1259:2; 1275:3;1293:24; 1294:3;1319:13,14; 1353:8;1357:3 three-month (3) 1301:12;1304:7,13 throughout (1) 1289:15 thrust (5) 1351:19;1352:12; 1361:11,18,19 thumbing (1) 1365:8 tight (2) 1364:2,2 tightly (1) 1275:15 tilted (1) 1361:14 Tim (2) 1232:4.5;1233:5 times (4) 1244:10;1259:18; 1364:2;1365:12 timing (1) 1246:3 title (2) 1266:2;1320:10 today (12) 1238:17;1255:1,4; 1257:5;1258:10; 1291:18;1314:7; 1322:22;1326:7; 1337:5;1355:6,10 today's (1) 1367:21 TODD (15)	1234:15.5,21; 1254:18;1256:2,10; 1291:9,16,17;1316:2; 1329:20;1337:20; 1338:2;1362:7; 1366:12,15 T-o-d-d (1) 1254:18 together (4) 1265:2;1280:7; 1282:6;1365:16 Tom (4) 1256:12;1320:9; 1328:10;1337:22 tomorrow (2) 1367:24;1368:4 took (3) 1263:22;1282:2; 1295:12 tool (2) 1280:19;1287:7 top (23) 1246:1;1262:5; 1266:1;1267:5;1270:1, 22;1273:19,22; 1275:15,17,19,20; 1277:13,15;1297:11, 13;1310:11;1317:9; 1329:17;1353:10; 1361:13,24;1366:1 topic (2) 1245:15;1258:10 topography (1) 1263:22 total (2) 1284:24;1297:14 totality (1) 1365:2 totally (1) 1313:18 touch (2) 1259:13;1365:9 touches (1) 1293:12 tours (1) 1366:7 towards (11) 1258:3;1259:11; 1261:13,23;1263:14, 23;1264:6,18;1274:8, 10;1335:1 trailing (3) 1294:7;1296:15; 1297:17 trajectory (2) 1285:12;1341:19 TRANSCRIPT (2) 1231:14;1369:12 transcription (1) 1369:14 transducer (8) 1307:4,8,13,13,14; 1316:11,16;1366:13
T				
table (1) 1324:17 Taggart (27) 1233:3,3,3,5; 1234:12;1235:8; 1248:2,5,22;1311:19; 1313:2,22;1315:11,19, 23;1336:7,9;1337:24; 1338:21;1340:15,18, 21,22;1341:19;1343:7, 10,12;1347:21 Taggart's (6) 1312:11;1314:15,23; 1315:7;1348:2,2 talk (14) 1248:6;1269:23; 1280:18,24;1287:3; 1288:9;1291:18; 1292:7;1301:11; 1302:11;1353:22; 1357:20,22;1365:7 talked (8) 1258:6;1269:6; 1273:14,20;1327:20; 1330:13;1332:15; 1356:24 talking (6) 1258:23;1259:1,17; 1285:19;1296:1; 1331:4 tan (3) 1258:17;1260:3,13 tape (5) 1317:3,7,15;1330:6, 7 Task (1)				

<p>transect (3) 1346:10,10,11</p> <p>transient (1) 1287:10</p> <p>transmissive (1) 1356:3</p> <p>transmissivity (7) 1250:18;1252:1; 1269:17;1326:21,23; 1355:9;1356:11</p> <p>transmit (1) 1355:11</p> <p>Tratzoky (1) 1322:18</p> <p>traveling (1) 1335:8</p> <p>travels (1) 1287:13</p> <p>trend (3) 1236:15,17;1331:17</p> <p>trending (3) 1258:14;1261:19,23</p> <p>trends (4) 1294:8;1299:8; 1318:12,12</p> <p>triangle (1) 1284:11</p> <p>triangles (1) 1262:16</p> <p>tried (3) 1304:16;1322:6; 1364:15</p> <p>trigger (1) 1344:11</p> <p>true (9) 1238:6,7;1249:15; 1287:22;1335:10; 1336:20;1339:15; 1340:9;1369:13</p> <p>truncated (1) 1352:6</p> <p>trust (1) 1262:17</p> <p>truth (5) 1265:8,22;1267:16; 1270:14;1271:5</p> <p>try (3) 1261:7;1332:16; 1334:24</p> <p>trying (9) 1262:2;1270:15; 1308:10;1330:13,14; 1339:20;1355:19; 1356:21;1357:24</p> <p>tubes (1) 1322:7</p> <p>turn (4) 1279:15;1319:5; 1345:24;1361:14</p> <p>turned (3) 1300:6,15;1301:4</p> <p>twice (2) 1295:15;1359:6</p>	<p>two (59) 1244:22;1257:23; 1261:14;1262:9; 1267:1,9;1269:19; 1270:20,21;1271:3,9, 13,14;1272:14,17; 1274:21;1275:3,17; 1277:8;1278:20,20,21; 1282:11,17;1293:7,22, 22;1298:4;1305:12; 1308:4,9,11;1309:11; 1310:5,10,22,23; 1319:8,12;1321:20; 1329:12;1330:23; 1332:12;1345:5; 1346:3,6,14,15;1353:7; 1354:13;1356:13; 1357:3,18;1358:3,5; 1360:16;1361:16,17; 1362:11</p> <p>two-mile (1) 1361:8</p> <p>two-tenths (1) 1355:1</p> <p>type (6) 1282:18;1303:13,14; 1321:16;1354:21; 1363:15</p> <p>types (6) 1260:23;1261:17; 1282:17;1303:15; 1360:19;1364:3</p> <p>Typically (4) 1302:17;1305:12; 1308:19;1321:8</p>	<p>1248:7,14</p> <p>underlain (2) 1322:2,16</p> <p>underlying (1) 1263:24</p> <p>underneath (1) 1262:14</p> <p>undertaking (1) 1240:23</p> <p>unexpected (1) 1278:23</p> <p>Unfortunately (1) 1354:16</p> <p>uniform (4) 1363:9,11,12,15</p> <p>uniformly (1) 1353:10</p> <p>unique (7) 1284:18;1289:20; 1319:17;1325:22; 1335:5;1344:10; 1358:5</p> <p>unit (3) 1344:8;1361:12,13</p> <p>United (4) 1244:24;1247:16; 1293:9;1327:7</p> <p>University (4) 1291:24;1292:2; 1319:8;1320:8</p> <p>unknown (1) 1310:6</p> <p>unless (3) 1286:18;1312:16; 1357:16</p> <p>unlike (1) 1267:8</p> <p>unreliable (1) 1347:3</p> <p>unsimilar (1) 1360:17</p> <p>unspooled (1) 1317:3</p> <p>unusual (3) 1278:20;1302:16; 1356:8</p> <p>up (75) 1236:4;1243:11; 1244:9;1245:12; 1250:14;1253:2,24; 1258:18;1259:5,18,22; 1260:15;1261:24; 1262:19;1263:1,17,17, 20;1264:6,12,16,24; 1265:9,12;1266:16; 1267:4,12,15;1268:22; 1269:6,23;1270:23; 1272:6;1273:18; 1274:4;1275:16; 1279:3,5;1281:1,23; 1283:24;1286:9; 1288:14;1294:22; 1297:20;1300:17;</p>	<p>1301:6,9,16;1302:6; 1303:12;1304:22; 1310:8;1311:4; 1315:15;1316:15,19; 1317:24;1322:9; 1327:3;1329:22; 1341:21;1351:10; 1352:1,21,24;1353:16; 1355:8,11;1357:3; 1361:19;1362:3; 1365:15,23;1366:15</p> <p>updated (1) 1250:18</p> <p>upon (4) 1253:19;1281:22; 1312:11;1347:2</p> <p>UPPER (9) 1231:11,5;1258:6, 15;1259:10,19; 1268:23;1274:20; 1277:4;1352:3</p> <p>upthrown (1) 1353:13</p> <p>Ure (15) 1233:20,21;1234:7; 1235:10;1243:2,2,7; 1252:21;1347:14,15; 1348:5,12,20;1349:6, 18</p> <p>URS (3) 1250:6,11,13</p> <p>use (22) 1238:16;1250:23; 1277:21,22;1288:2,5; 1290:24,24;1302:14, 16,17,19;1304:7,18,20; 1309:4;1311:12; 1320:18,19,19; 1357:12;1364:13</p> <p>used (18) 1275:11;1287:7; 1292:18;1303:17; 1304:24;1305:1; 1307:4,15,17;1308:1,6, 12;1311:8;1313:15; 1317:7;1322:5;1324:6; 1330:7</p> <p>useful (1) 1349:4</p> <p>USGS (6) 1258:1;1273:13; 1278:17;1288:22; 1302:24;1311:9</p> <p>using (13) 1296:15,20;1301:11; 1303:1,13,14;1311:14; 1317:14;1318:4; 1320:11;1325:22; 1330:5;1345:2</p> <p>usually (1) 1262:8</p> <p>Utah (1) 1361:19</p>	<p style="text-align: center;">V</p> <p>Vaguely (1) 1240:8</p> <p>VALLEY (149) 1231:7,5,9,10,11,5; 1233:17,5,19;1237:21; 1239:3;1240:13; 1241:18,22,24;1242:7, 8,10,12,19;1243:4,21; 1245:3,7;1247:23; 1249:12,16,21,24; 1251:9;1252:16; 1253:9;1258:3,5,15,19, 20;1259:10,21; 1261:16,21,24;1262:1; 1263:1,4,4,23;1264:5; 1270:10,19;1271:1; 1273:15;1274:13; 1275:6;1277:3;1278:7, 10;1280:9,11;1281:1,1, 2,4,19;1283:14,22,23; 1284:15,16;1285:4,6,8, 10,14;1286:14,21; 1288:15;1289:20,22; 1290:4;1293:13; 1294:20;1303:10,24; 1304:2;1307:1; 1313:17;1316:4; 1321:24;1322:4,21,23; 1324:6,20;1325:21; 1326:22;1327:1; 1333:16;1334:11; 1335:14,15;1336:4,11, 17,17,18,19;1337:1,3, 10,11,11,12;1338:24; 1339:6,16,19,21,23; 1340:1,2,9,12;1341:5, 9;1342:5,24;1343:4,18, 23;1344:3;1347:19; 1348:22;1349:1,14; 1350:2,6,7,20;1351:1, 2,3,5;1352:2,21,24; 1353:2,5;1354:2,5; 1355:11;1358:4</p> <p>valleys (2) 1278:3;1290:3</p> <p>valuable (1) 1280:19</p> <p>value (5) 1314:11,11;1326:20, 23;1348:8</p> <p>values (8) 1286:13,13;1294:2, 6;1306:11;1317:14; 1318:1;1328:19</p> <p>variability (1) 1329:23</p> <p>variable (2) 1285:1;1287:11</p> <p>variables (1) 1363:20</p>
--	---	---	---	---

variation (2) 1302:18;1330:9	1328:11,15;1332:20, 21	1354:15,17,19,21,23; 1357:12,15;1358:8,15; 1360:4;1363:8,9,10,13, 14,15,19;1364:10,16, 21;1365:10,18;1366:9, 13,16;1367:9,10; 1369:6	WHITE (17) 1231:7;1245:3; 1246:19;1247:3,8; 1248:10;1274:1; 1280:12;1293:16; 1318:14;1322:1; 1326:9;1338:9,12; 1339:13;1342:24; 1361:2	1320:12,13,14,24; 1321:8,9,10,11,12,14, 15;1322:11;1326:7; 1365:7;1366:12
variations (1) 1294:23	volcanics (1) 1258:24	Water's (1) 1291:7	whole (5) 1261:6;1280:3; 1297:24;1332:22; 1349:3	worked (12) 1272:24;1273:1,1, 17;1292:3,4;1319:12, 14,15,19;1320:1; 1365:19
various (4) 1243:18;1258:22; 1280:23;1304:16	VOLUME (2) 1231:17;1246:4	way (11) 1261:18;1262:10; 1268:17;1270:6; 1286:2;1288:5; 1301:21;1311:12; 1331:1;1359:19; 1360:2	whomever (1) 1327:18	working (4) 1302:21;1320:5; 1321:8;1366:20
vary (2) 1286:19;1327:24	volumes (1) 1248:18	ways (2) 1268:24;1305:12	wide (1) 1325:19	wraps (1) 1279:5
varying (1) 1360:4	W	weather (1) 1366:14	Wildlife (7) 1239:24;1244:24; 1245:2;1247:17; 1306:13;1327:8; 1360:9	write (1) 1320:21
vast (1) 1276:3	Waddell (2) 1269:5,22	week (3) 1240:1;1355:5; 1365:22	Willow (4) 1283:20,21;1285:4, 11	written (4) 1236:13;1320:21,22, 22
veers (1) 1274:6	WASH (17) 1231:10.5;1240:14; 1245:3.8;1249:12,16, 21,24;1264:21; 1267:18;1284:12,16; 1285:8;1290:23; 1350:7,21;1351:3	weight (3) 1315:10;1348:8,19	Wilson (1) 1232:4.5	wrong (3) 1311:21;1312:3; 1343:17
Vegas (9) 1233:21;1247:23; 1252:9;1336:4,11; 1343:14;1347:12,16; 1368:3	WASHOE (1) 1369:2	welcome (1) 1327:16	wish (2) 1278:17;1323:12	Wyoming (1) 1361:19
vegetated (1) 1270:9	WATER (187) 1231:3;1233:12.5, 13,18;1237:21; 1238:10,24;1239:4,4,7; 1240:11;1241:2,10; 1242:2,7,10,12;1243:4, 11,18;1246:1,4,19; 1247:23,24;1248:5,8,9; 1249:5,6;1253:9,24; 1254:3,4;1257:24; 1270:11;1279:22; 1281:21,23;1282:5,12, 13,17,18;1283:11,11, 14;1284:2,3,4,21; 1285:6,6,11,14; 1286:19,21;1287:19; 1289:23;1290:1,9,9,19, 21,22;1292:15; 1295:18;1296:20; 1297:20,21;1301:6,14, 16;1302:1,3,7,12; 1303:2;1305:10,23; 1306:7,8;1307:3,6,7, 16,24;1308:15,16,17; 1309:14;1311:9,11,16; 1313:17;1316:6,12,17, 19;1317:2,19,21; 1319:13;1321:14,16; 1324:18;1325:5,8,10; 1326:8;1328:6,18,18; 1330:17;1331:18; 1332:16,17,24;1333:1, 7,11,22;1334:4,23; 1335:1;1336:4,5,10,11, 21;1338:6,8,23; 1339:16,18,21,23; 1340:1,13,23;1341:1,5, 8,10,16;1342:4,7,11; 1343:18,23;1345:19; 1347:6,7,19;1350:1,10, 18,20;1351:11;	wells (45) 1236:16;1238:19; 1243:18;1244:15; 1249:9;1251:8;1252:4; 1271:3;1280:12,23; 1282:11;1284:5; 1294:21;1298:6; 1299:19;1300:10,10, 12,13,17,18;1301:1,10, 1302:3;1308:18,22; 1310:5,10;1324:5,8,14, 23;1330:24;1331:9,12, 14;1345:20,21;1346:4, 7,14,15;1362:11,13; 1364:18	without (5) 1303:14;1338:7,13; 1341:2,17	Y
vegetation (1) 1270:12		weren't (2) 1269:7;1352:11	WITNESS (20) 1234:2;1235:3; 1257:15;1259:7; 1279:9;1282:15; 1283:20;1284:9; 1286:12;1290:15; 1291:10;1313:16,22; 1318:18;1329:2; 1343:3,8,8;1345:11; 1357:10	Y-axis (1) 1293:19
veneer (1) 1266:15		west (3) 1265:10;1310:3; 1352:3	witnesses (8) 1254:7,13,14,23; 1311:24;1313:23,24; 1315:21	year (7) 1244:11;1295:16,18; 1358:14,16;1359:5; 1362:12
verbatim (1) 1369:10		wet (13) 1292:14;1293:20,23; 1294:3,3;1295:17; 1296:8;1317:17; 1330:22;1358:14,16; 1359:5;1362:12	within-entitled (1) 1369:11	years (17) 1239:14;1244:11; 1281:13;1295:20; 1299:6;1301:7; 1302:20;1319:8,14; 1320:6;1321:8; 1324:18,20,21,22; 1325:4;1330:22
version (1) 1268:23		wetter (3) 1292:21,23,24	WITNESS (20) 1234:2;1235:3; 1257:15;1259:7; 1279:9;1282:15; 1283:20;1284:9; 1286:12;1290:15; 1291:10;1313:16,22; 1318:18;1329:2; 1343:3,8,8;1345:11; 1357:10	yellow (4) 1263:7;1270:5; 1276:1,15
versus (3) 1289:10;1309:8; 1363:16		what's (6) 1261:7;1268:8; 1281:19;1301:17; 1308:22;1322:22	wondering (2) 1328:17;1354:12	yellows (2) 1267:11,21
vertical (2) 1265:1;1330:2		Whereas (2) 1270:24;1310:16	word (1) 1240:16	Yep (1) 1286:5
VI (1) 1231:17		whichever (1) 1327:20	words (1) 1356:21	younger (2) 1286:17,19
vicinity (2) 1302:9;1335:19			work (25) 1248:8;1263:16; 1266:7;1272:24; 1291:17;1311:23; 1317:2;1319:9,19,24;	zero (5) 1293:21;1305:18,22; 1306:2,15
Victor (1) 1321:4				zone (9) 1255:15;1264:17,22; 1265:21;1276:14; 1287:8;1288:10; 1344:24;1363:8
Vidler (24) 1233:13;1249:1,6; 1253:10,24;1254:4; 1255:22;1256:15; 1257:24;1279:18; 1291:7;1336:21; 1339:5,11,15;1340:23; 1341:1;1342:4; 1354:15;1364:10; 1365:19;1366:12; 1367:23;1368:2				zones (1) 1251:8
view (7) 1258:3;1259:9,12, 20;1270:8;1272:13; 1278:16				
viewpoint (1) 1367:3				
virtually (5) 1270:22;1271:12; 1272:5;1306:15; 1355:3				
volcanic (4)				

<p>0</p>	<p>1244 (2) 1234:9,10 1245 (1) 1234:11 1248 (1) 1234:12 1249 (1) 1234:13 1257 (1) 1234:18</p>	<p>18 (1) 1303:22 19 (2) 1269:15,15 1920s (1) 1292:21 1960 (1) 1293:18 1st (1) 1369:17</p>	<p>1231:18.5;1236:1; 1258:10;1260:2; 1266:7;1280:6; 1325:16;1344:17; 1369:9,18 21 (6) 1271:6;1305:7,8; 1336:13;1352:9; 1361:1 21,000 (1) 1324:21 210 (1) 1231:8 215 (1) 1231:9 216 (1) 1231:9.5 217 (1) 1231:10 218 (1) 1231:11 219 (1) 1231:12 22 (3) 1305:9;1321:8; 1348:23 2-2 (1) 1343:24 23 (1) 1344:16 24 (2) 1307:19,20 25 (3) 1272:11;1275:20; 1276:13 250 (1) 1265:18 2500 (9) 1268:11;1271:2,2; 1272:7,8,18;1273:9; 1278:14;1361:9 26 (3) 1276:22;1281:24; 1357:2 27 (2) 1277:9;1309:9 28 (2) 1277:11;1310:10 28,000 (1) 1324:18 29 (3) 1277:14,15,16 2-WITNESS (1) 1234:3</p>	<p>1276:17,18 30 (5) 1231:18.5;1236:1; 1310:18;1311:18; 1347:17 30,500 (1) 1324:19 300,000 (1) 1327:2 30-foot (1) 1244:4 30th (1) 1369:8 3-3 (1) 1236:12 34 (1) 1316:9 35 (1) 1287:22 39 (1) 1346:20 3900 (1) 1353:24 3rd (2) 1280:6;1312:8 3sic (1) 1296:6</p>
<p>1</p>	<p>1279 (1) 1234:20 1291 (1) 1234:22 12-month (2) 1294:7;1296:15 13 (3) 1266:24;1300:16; 1336:13 1303 (4) 1231:16;1237:16; 1238:3;1340:16 1318 (1) 1234:24 1323 (1) 1235:5 1327 (1) 1235:6 1332 (1) 1235:7 1336 (1) 1235:8 1343 (1) 1235:9 1347 (1) 1235:10 1349 (1) 1235:11 1351 (1) 1235:12 1360 (1) 1235:13 1362 (1) 1235:14 1368 (1) 1369:13 1369 (1) 1231:17.5 14 (2) 1267:4;1357:17 14,200 (1) 1324:22 143 (1) 1251:6 15 (10) 1240:18;1254:10; 1266:22;1268:13; 1282:10;1301:23,24; 1351:19;1357:3,4 1500 (1) 1271:4 17 (2) 1303:4,5</p>	<p>2</p>	<p>2 (2) 1255:22;1256:15 2.4 (1) 1357:17 20 (2) 1270:17;1314:6 200 (1) 1265:18 2000s (1) 1293:3 2002 (2) 1292:5;1311:10 2003 (1) 1330:17 2004 (1) 1321:17 2004-2005 (1) 1331:5 2005 (12) 1295:17,18,21; 1296:23;1300:3; 1329:22;1330:17,20; 1331:7;1358:14; 1359:1;1362:12 2006 (13) 1250:6,11,13; 1280:1;1284:3; 1289:15;1300:4; 1324:10,12;1325:15; 1354:18;1364:20,22 2010 (1) 1295:22 2011 (1) 1248:8 2012 (7) 1258:9;1259:13; 1260:2;1262:24; 1263:22;1265:4; 1300:14 2013 (6) 1295:13;1302:2; 1307:6,23;1316:17,23 2014 (3) 1297:22;1302:2; 1317:18 2015 (2) 1297:20,23 2016 (1) 1236:15 2019 (10)</p>	<p>210 (1) 1231:8 215 (1) 1231:9 216 (1) 1231:9.5 217 (1) 1231:10 218 (1) 1231:11 219 (1) 1231:12 22 (3) 1305:9;1321:8; 1348:23 2-2 (1) 1343:24 23 (1) 1344:16 24 (2) 1307:19,20 25 (3) 1272:11;1275:20; 1276:13 250 (1) 1265:18 2500 (9) 1268:11;1271:2,2; 1272:7,8,18;1273:9; 1278:14;1361:9 26 (3) 1276:22;1281:24; 1357:2 27 (2) 1277:9;1309:9 28 (2) 1277:11;1310:10 28,000 (1) 1324:18 29 (3) 1277:14,15,16 2-WITNESS (1) 1234:3</p>
<p>1 (2) 1255:22;1256:15 1,820 (2) 1307:24;1308:3 1,822 (1) 1310:17 1,856 (1) 1310:16 1:30 (1) 1253:13 10,000 (1) 1270:5 107 (1) 1231:23 11 (35) 1258:12;1259:15; 1261:12,15;1262:9; 1265:3;1266:1,2,4; 1267:9;1268:15,24; 1270:18,19;1271:3,9, 10,15,20;1272:6,9; 1273:9;1276:12; 1277:1,7,11,18;1278:3, 5;1279:4;1320:6; 1344:18;1346:11; 1352:5;1361:7 11,500 (1) 1270:5 1169 (6) 1250:15;1295:5,11; 1301:4;1307:5;1355:6 12 (16) 1257:3;1258:12; 1259:15;1262:11,21; 1265:23;1266:1,7; 1268:16;1269:23; 1271:3,9;1277:1; 1300:9;1351:17; 1352:5 123 (1) 1231:23 1231 (2) 1231:17.5;1369:13 1236 (1) 1234:4 1239 (1) 1234:5 1241 (1) 1234:6 1243 (2) 1234:7,8</p>	<p>1279 (1) 1234:20 1291 (1) 1234:22 12-month (2) 1294:7;1296:15 13 (3) 1266:24;1300:16; 1336:13 1303 (4) 1231:16;1237:16; 1238:3;1340:16 1318 (1) 1234:24 1323 (1) 1235:5 1327 (1) 1235:6 1332 (1) 1235:7 1336 (1) 1235:8 1343 (1) 1235:9 1347 (1) 1235:10 1349 (1) 1235:11 1351 (1) 1235:12 1360 (1) 1235:13 1362 (1) 1235:14 1368 (1) 1369:13 1369 (1) 1231:17.5 14 (2) 1267:4;1357:17 14,200 (1) 1324:22 143 (1) 1251:6 15 (10) 1240:18;1254:10; 1266:22;1268:13; 1282:10;1301:23,24; 1351:19;1357:3,4 1500 (1) 1271:4 17 (2) 1303:4,5</p>	<p>2</p>	<p>2 (2) 1255:22;1256:15 2.4 (1) 1357:17 20 (2) 1270:17;1314:6 200 (1) 1265:18 2000s (1) 1293:3 2002 (2) 1292:5;1311:10 2003 (1) 1330:17 2004 (1) 1321:17 2004-2005 (1) 1331:5 2005 (12) 1295:17,18,21; 1296:23;1300:3; 1329:22;1330:17,20; 1331:7;1358:14; 1359:1;1362:12 2006 (13) 1250:6,11,13; 1280:1;1284:3; 1289:15;1300:4; 1324:10,12;1325:15; 1354:18;1364:20,22 2010 (1) 1295:22 2011 (1) 1248:8 2012 (7) 1258:9;1259:13; 1260:2;1262:24; 1263:22;1265:4; 1300:14 2013 (6) 1295:13;1302:2; 1307:6,23;1316:17,23 2014 (3) 1297:22;1302:2; 1317:18 2015 (2) 1297:20,23 2016 (1) 1236:15 2019 (10)</p>	<p>210 (1) 1231:8 215 (1) 1231:9 216 (1) 1231:9.5 217 (1) 1231:10 218 (1) 1231:11 219 (1) 1231:12 22 (3) 1305:9;1321:8; 1348:23 2-2 (1) 1343:24 23 (1) 1344:16 24 (2) 1307:19,20 25 (3) 1272:11;1275:20; 1276:13 250 (1) 1265:18 2500 (9) 1268:11;1271:2,2; 1272:7,8,18;1273:9; 1278:14;1361:9 26 (3) 1276:22;1281:24; 1357:2 27 (2) 1277:9;1309:9 28 (2) 1277:11;1310:10 28,000 (1) 1324:18 29 (3) 1277:14,15,16 2-WITNESS (1) 1234:3</p>
<p>1 (2) 1255:22;1256:15 1,820 (2) 1307:24;1308:3 1,822 (1) 1310:17 1,856 (1) 1310:16 1:30 (1) 1253:13 10,000 (1) 1270:5 107 (1) 1231:23 11 (35) 1258:12;1259:15; 1261:12,15;1262:9; 1265:3;1266:1,2,4; 1267:9;1268:15,24; 1270:18,19;1271:3,9, 10,15,20;1272:6,9; 1273:9;1276:12; 1277:1,7,11,18;1278:3, 5;1279:4;1320:6; 1344:18;1346:11; 1352:5;1361:7 11,500 (1) 1270:5 1169 (6) 1250:15;1295:5,11; 1301:4;1307:5;1355:6 12 (16) 1257:3;1258:12; 1259:15;1262:11,21; 1265:23;1266:1,7; 1268:16;1269:23; 1271:3,9;1277:1; 1300:9;1351:17; 1352:5 123 (1) 1231:23 1231 (2) 1231:17.5;1369:13 1236 (1) 1234:4 1239 (1) 1234:5 1241 (1) 1234:6 1243 (2) 1234:7,8</p>	<p>1279 (1) 1234:20 1291 (1) 1234:22 12-month (2) 1294:7;1296:15 13 (3) 1266:24;1300:16; 1336:13 1303 (4) 1231:16;1237:16; 1238:3;1340:16 1318 (1) 1234:24 1323 (1) 1235:5 1327 (1) 1235:6 1332 (1) 1235:7 1336 (1) 1235:8 1343 (1) 1235:9 1347 (1) 1235:10 1349 (1) 1235:11 1351 (1) 1235:12 1360 (1) 1235:13 1362 (1) 1235:14 1368 (1) 1369:13 1369 (1) 1231:17.5 14 (2) 1267:4;1357:17 14,200 (1) 1324:22 143 (1) 1251:6 15 (10) 1240:18;1254:10; 1266:22;1268:13; 1282:10;1301:23,24; 1351:19;1357:3,4 1500 (1) 1271:4 17 (2) 1303:4,5</p>	<p>2</p>	<p>2 (2) 1255:22;1256:15 2.4 (1) 1357:17 20 (2) 1270:17;1314:6 200 (1) 1265:18 2000s (1) 1293:3 2002 (2) 1292:5;1311:10 2003 (1) 1330:17 2004 (1) 1321:17 2004-2005 (1) 1331:5 2005 (12) 1295:17,18,21; 1296:23;1300:3; 1329:22;1330:17,20; 1331:7;1358:14; 1359:1;1362:12 2006 (13) 1250:6,11,13; 1280:1;1284:3; 1289:15;1300:4; 1324:10,12;1325:15; 1354:18;1364:20,22 2010 (1) 1295:22 2011 (1) 1248:8 2012 (7) 1258:9;1259:13; 1260:2;1262:24; 1263:22;1265:4; 1300:14 2013 (6) 1295:13;1302:2; 1307:6,23;1316:17,23 2014 (3) 1297:22;1302:2; 1317:18 2015 (2) 1297:20,23 2016 (1) 1236:15 2019 (10)</p>	<p>210 (1) 1231:8 215 (1) 1231:9 216 (1) 1231:9.5 217 (1) 1231:10 218 (1) 1231:11 219 (1) 1231:12 22 (3) 1305:9;1321:8; 1348:23 2-2 (1) 1343:24 23 (1) 1344:16 24 (2) 1307:19,20 25 (3) 1272:11;1275:20; 1276:13 250 (1) 1265:18 2500 (9) 1268:11;1271:2,2; 1272:7,8,18;1273:9; 1278:14;1361:9 26 (3) 1276:22;1281:24; 1357:2 27 (2) 1277:9;1309:9 28 (2) 1277:11;1310:10 28,000 (1) 1324:18 29 (3) 1277:14,15,16 2-WITNESS (1) 1234:3</p>
<p>1 (2) 1255:22;1256:15 1,820 (2) 1307:24;1308:3 1,822 (1) 1310:17 1,856 (1) 1310:16 1:30 (1) 1253:13 10,000 (1) 1270:5 107 (1) 1231:23 11 (35) 1258:12;1259:15; 1261:12,15;1262:9; 1265:3;1266:1,2,4; 1267:9;1268:15,24; 1270:18,19;1271:3,9, 10,15,20;1272:6,9; 1273:9;1276:12; 1277:1,7,11,18;1278:3, 5;1279:4;1320:6; 1344:18;1346:11; 1352:5;1361:7 11,500 (1) 1270:5 1169 (6) 1250:15;1295:5,11; 1301:4;1307:5;1355:6 12 (16) 1257:3;1258:12; 1259:15;1262:11,21; 1265:23;1266:1,7; 1268:16;1269:23; 1271:3,9;1277:1; 1300:9;1351:17; 1352:5 123 (1) 1231:23 1231 (2) 1231:17.5;1369:13 1236 (1) 1234:4 1239 (1) 1234:5 1241 (1) 1234:6 1243 (2) 1234:7,8</p>	<p>1279 (1) 1234:20 1291 (1) 1234:22 12-month (2) 1294:7;1296:15 13 (3) 1266:24;1300:16; 1336:13 1303 (4) 1231:16;1237:16; 1238:3;1340:16 1318 (1) 1234:24 1323 (1) 1235:5 1327 (1) 1235:6 1332 (1) 1235:7 1336 (1) 1235:8 1343 (1) 1235:9 1347 (1) 1235:10 1349 (1) 1235:11 1351 (1) 1235:12 1360 (1) 1235:13 1362 (1) 1235:14 1368 (1) 1369:13 1369 (1) 1231:17.5 14 (2) 1267:4;1357:17 14,200 (1) 1324:22 143 (1) 1251:6 15 (10) 1240:18;1254:10; 1266:22;1268:13; 1282:10;1301:23,24; 1351:19;1357:3,4 1500 (1) 1271:4 17 (2) 1303:4,5</p>	<p>2</p>	<p>2 (2) 1255:22;1256:15 2.4 (1) 1357:17 20 (2) 1270:17;1314:6 200 (1) 1265:18 2000s (1) 1293:3 2002 (2) 1292:5;1311:10 2003 (1) 1330:17 2004 (1) 1321:17 2004-2005 (1) 1331:5 2005 (12) 1295:17,18,21; 1296:23;1300:3; 1329:22;1330:17,20; 1331:7;1358:14; 1359:1;1362:12 2006 (13) 1250:6,11,13; 1280:1;1284:3; 1289:15;1300:4; 1324:10,12;1325:15; 1354:18;1364:20,22 2010 (1) 1295:22 2011 (1) 1248:8 2012 (7) 1258:9;1259:13; 1260:2;1262:24; 1263:22;1265:4; 1300:14 2013 (6) 1295:13;1302:2; 1307:6,23;1316:17,23 2014 (3) 1297:22;1302:2; 1317:18 2015 (2) 1297:20,23 2016 (1) 1236:15 2019 (10)</p>	<p>210 (1) 1231:8 215 (1) 1231:9 216 (1) 1231:9.5 217 (1) 1231:10 218 (1) 1231:11 219 (1) 1231:12 22 (3) 1305:9;1321:8; 1348:23 2-2 (1) 1343:24 23 (1) 1344:16 24 (2) 1307:19,20 25 (3) 1272:11;1275:20; 1276:13 250 (1) 1265:18 2500 (9) 1268:11;1271:2,2; 1272:7,8,18;1273:9; 1278:14;1361:9 26 (3) 1276:22;1281:24; 1357:2 27 (2) 1277:9;1309:9 28 (2) 1277:11;1310:10 28,000 (1) 1324:18 29 (3) 1277:14,15,16 2-WITNESS (1) 1234:3</p>
<p>0</p>	<p>1244 (2) 1234:9,10 1245 (1) 1234:11 1248 (1) 1234:12 1249 (1) 1234:13 1257 (1) 1234:18</p>	<p>18 (1) 1303:22 19 (2) 1269:15,15 1920s (1) 1292:21 1960 (1) 1293:18 1st (1) 1369:17</p>	<p>1231:18.5;1236:1; 1258:10;1260:2; 1266:7;1280:6; 1325:16;1344:17; 1369:9,18 21 (6) 1271:6;1305:7,8; 1336:13;1352:9; 1361:1 21,000 (1) 1324:21 210 (1) 1231:8 215 (1) 1231:9 216 (1) 1231:9.5 217 (1) 1231:10 218 (1) 1231:11 219 (1) 1231:12 22 (3) 1</p>	

6				
6,000 (1) 1276:10				
6700 (1) 1238:23				
68 (1) 1303:12				
6th (1) 1257:2				
7				
70 (2) 1305:21,21				
7100 (1) 1270:4				
74 (2) 1281:24;1357:2				
75 (1) 1287:18				
76 (1) 1287:18				
775882-5322 (1) 1231:24				
8				
8:30 (1) 1368:3				
82 (1) 1295:13				
89706 (1) 1231:23.5				

In The Matter Of:

*DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER*

*Vol. VII
October 1, 2019*

*Capitol Reporters
123 W. Nye Lane, Ste 107

Carson City, Nevada 89706*

Original File 10-1-19volumeVIIFINALSE_1.txt
Min-U-Script® with Word Index

SE ROA 53553

JA_17950

1 STATE OF NEVADA
 2 DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
 3 DIVISION OF WATER RESOURCES
 4 BEFORE MICHELINE N. FAIRBANK, HEARING OFFICER
 5
 6
 7 IN THE MATTER OF THE ADMINISTRATION
 8 AND MANAGEMENT OF THE LOWER
 9 WHITE RIVER FLOW SYSTEM WITHIN
 10 COYOTE SPRING VALLEY HYDROGRAPHIC
 11 BASIN (210), A PORTION OF BLACK
 12 MOUNTAIN'S AREA HYDROGRAPHIC
 13 BASIN (215), GARNET VALLEY
 14 HYDROGRAPHIC BASIN (216), HIDDEN
 15 VALLEY HYDROGRAPHIC BASIN (217)
 16 CALIFORNIA WASH HYDROGRAPHIC BASIN
 17 (218), AND MUDDY RIVER SPRINGS AREA
 18 (AKA UPPER MOAPA VALLEY HYDROGRAPHIC
 19 BASIN (219)).
 20
 21
 22
 23
 24

15 TRANSCRIPT OF PROCEEDINGS
 16 PUBLIC HEARING
 17 HEARING ON ORDER 1303
 18 VOLUME VII
 19 (Pages 1370-1498)
 20 TUESDAY, OCTOBER 1, 2019
 21
 22
 23
 24 Reported by: Michel Loomis, RPR

1 APPEARANCES:
 2 For Lincoln County
 3 Water District
 4 -and-
 5 Vidler Water Company: Allison MacKenzie
 6 By: Karen Peterson, Esq.
 7 Carson City, Nevada
 8
 9 For Moapa Band of Paiutes: Richard Berley, Esq.
 10
 11 For Moapa Valley
 12 Water District: Greg Morrison, Esq.
 13
 14 For Bedroc:
 15 -and-
 16 For City of North Las Vegas: Schroeder Law
 17 By: Therese Ure, Esq.
 18
 19 For National Park Service: Karen Glasgow
 20
 21 For Center for Biologic
 22 Diversity: Patrick Donnelly
 23
 24

1 APPEARANCES:
 2 Micheline N. Fairbank,
 3 Hearing Officer
 4
 5 Tim Wilson,
 6 Acting State Engineer
 7 Adam Sullivan,
 8 Deputy State Engineer
 9
 10 Melissa Flatley,
 11 Chief of the Hearing Officer Section
 12 Michelle Barnes,
 13 Supervising Professional Engineer
 14
 15 Levi Kryder,
 16 Chief of the Hydrology Section
 17 Jon Benedict,
 18 Hydrologist
 19
 20 John Guillory,
 21 PE Supervisor
 22 Bridget Bliss,
 23 Basin Engineer
 24 For SNWA: Taggart & Taggart, Ltd.
 By: Paul G. Taggart, Esq.
 Carson City, Nevada
 -and-
 Tim O'Connor, Esq.
 For CSI: Robison, Belaustegui, Sharp
 & Low
 By: Kent R. Robison, Esq.
 Reno, Nevada
 For CSI: Brownstein Hyatt Farber Schreck
 By: Brad Herrema, Esq.
 Los Angeles, California
 For NV Energy: Justina Caviglia, Esq.

1 INDEX
 2 THE PANEL: DIRECT CROSS REDIRECT RECROSS
 3 By Ms. Glasgow: 1374 1395
 4 By Mr. Taggart: 1378 1398
 5 By Mr. Morrison: 1383
 6 By Mr. Flangas: 1388 1403
 7 EXAMINATION
 8 By Mr. Benedict: 1393
 9 By Ms. Peterson: 1405
 10
 11 DWIGHT SMITH: DIRECT CROSS REDIRECT RECROSS
 12 By Therese Ure: 1416
 13 By Mr. Herrema: 1467
 14 By Ms. Glasgow: 1470 1492
 15 By Mr. Taggart: 1474
 16 By Mr. Morrison: 1479
 17 By Ms. Petersen: 1481
 18 By Mr. Flangas: 1482
 19 EXAMINATION
 20 By Mr. Benedict: 1485, 1494
 21 By Mr. Sullivan: 1488
 22 By Ms. Barnes: 1490
 23 EXHIBITS: ADMITTED
 24 2-4, 7 1417

1 CARSON CITY, NEVADA, TUESDAY, OCTOBER 1, 2019, A.M. SESSION
2 -o0o-
3
4 HEARING OFFICER FAIRBANK: Good morning. So this
5 is the continuation of the hearing regarding the Lower White
6 River Flow System and Order 1303, and so we're going to go
7 ahead and continue this morning with cross-examination.
8 We have just under one hour left for
9 cross-examination, and so we'll go ahead and reopen the time
10 period to the participants to ask questions.
11 And at this point, we're going to go ahead and
12 limit that time frame to five minutes per participant for the
13 continuation of cross-examination, and so we'll start with
14 Coyote Springs Investments.
15 MR. HERREMA: We have no questions at this time.
16 HEARING OFFICER FAIRBANK: Okay. So seeing no
17 further questions from Coyote Springs Investments, United
18 States Fish and Wildlife Service.
19 Seeing no questions, National Park Service.
20 CROSS-EXAMINATION
21 BY MS. GLASGOW:
22 Q. Good morning. Karen Glasgow with the Solicitor's
23 Office, Department of Interior representing the National Park
24 Service.

1 MS. GLASGOW: Well, let me hand these to you.
2 That's just for you to look at, but that's what I'm handing
3 him.
4 HEARING OFFICER FAIRBANK: Sounds good. Thank
5 you.
6 BY MS. GLASGOW:
7 Q. Now, you testified that the MPS provided
8 hydrographs which included records with rising water levels,
9 declining water levels, and some showing the short-term
10 climatic effects.
11 Can you look through our Appendixes B and A or A
12 and B as I just handed to you and could you tell us which
13 hydrographs for wells in and near the Lower White River Flow
14 System and the USGS PowerPoint that shows many other
15 hydrographs and identify the wells that have a similar
16 hydrograph to the well that you identified as being actually
17 indicative of short-term climatic effects?
18 MS. PETERSON: I guess I have to ask for
19 clarification because I think he testified that he couldn't
20 remember which well that was.
21 BY MS. GLASGOW:
22 Q. Well, how about any well. Any well that you see
23 on any of our hydrographs or the USGS PowerPoint that show
24 short-term climatic effects.

1 Good morning, gentlemen. Can we see -- could you
2 put up Mr. Umstot's Slide Number 15. Mr. Umstot. Sorry.
3 Thank you. On this slide, you indicate that
4 CSVM-2 did not show a response to MX-5 pumping.
5 Is this why you stated that this well would be a
6 good well to use for seeing short-term climactic events for
7 separating out pumping effects?
8 ANSWERS BY MR. UMSTOT:
9 A. I don't recall testifying that you'd use CSVM-2
10 for that purpose.
11 Q. Do you recall what well you did identify as being
12 one that would be good for showing short-term climatic
13 effects?
14 A. At the moment, I don't recall which well I used
15 for it.
16 Q. Do you recall that you identified a well as being
17 one that would be good for seeing short-term climatic effects
18 for separating out pumping effects?
19 A. I don't recall.
20 Q. I'd like to show you -- I don't know if you have
21 them. I've got their Appendix A and Appendix B from our
22 rebuttal report.
23 MS. GLASGOW: Do you have copies there with you?
24 MR. UMSTOT: No.

1 ANSWERS BY MR. UMSTOT:
2 A. I haven't analyzed all of the wells shown in
3 these appendices. I would need to spend some time to go
4 through and look at these hydrographs and do some analysis to
5 determine which ones have a -- short-term responses to
6 climatic effects.
7 Q. Okay. Well, unfortunately, they gave me five
8 minutes, so I can't let you do that. Let's move along, then.
9 Isn't it true that well CSVM-5 does not show
10 effects of the short-term climatic changes that you testified
11 about?
12 A. Yes, at the scale that is plotted on here, I
13 don't discern any short-term effects.
14 Q. Isn't it also true that CSVM-5 does not exhibit
15 declining water levels, which is a common characteristic of
16 nearly all of the other hydrographs in the Lower White River
17 Flow System?
18 A. Yes, CSVM-5 does not show a declining water
19 level.
20 Q. Are your answers the same for the hydrograph for
21 BMONCO-2, which is located in the Black Mountain area, I
22 think?
23 A. I haven't analyzed this hydrograph before. It
24 looks a little odd to me, and that is a completely straight

1 line, but -- so I'm not sure about that.
2 Q. I want to ask you whether or not --
3 HEARING OFFICER FAIRBANK: Miss Glasgow, your
4 time is up. We will probably get back to you --
5 MS. GLASGOW: Okay. Thank you.
6 HEARING OFFICER FAIRBANK: -- on a second -- a
7 third round.
8 MS. GLASGOW: Thank you very much.
9 HEARING OFFICER FAIRBANK: Next is the Moapa Band
10 of Paiutes.
11 MR. BERLEY: No further questions.
12 HEARING OFFICER FAIRBANK: Seeing no additional
13 questions, Las Vegas Water District and Southern Nevada Water
14 Authority.
15 MR. TAGGART: Would you mind bringing up on the
16 screen the first page of the demonstratives from yesterday,
17 please?
18 MS. PETERSON: Which ones?
19 MR. TAGGART: The first page of the
20 demonstratives that were handed out.
21 CROSS-EXAMINATION
22 BY MR. TAGGART:
23 Q. All right. Good morning.
24 First, I want to ask Mr. Umstot: In your

1 A. No, I have not.
2 Q. 25 times?
3 A. No.
4 Q. Okay. The website also says that you developed a
5 watershed model that has been successfully used in water
6 rights hearings to estimate the quantity of recharge available
7 for groundwater procreation. The model has been applied in
8 numerous basins in New Mexico, Nevada, and California.
9 So my question is: What basins has your
10 groundwater model been successfully used in Nevada?
11 A. The Tule Desert Basin.
12 Q. And the State Engineer relied on that model in
13 that case?
14 A. Yes.
15 Q. Okay. And they didn't modify any of the
16 conclusions that you arrived at based on the model?
17 A. They -- I can't recall the ruling precisely.
18 They relied on the model and they also relied on other
19 evidence.
20 Q. Okay. Okay.
21 Dr. Mock, with this up on the screen, I just
22 wanted to ask you. So there's a fault that you've identified
23 that you believe exists in between line 10 and 11 of your
24 resistivity data; correct?

1 opinion, is there a well, a monitor well in Coyote Spring
2 Valley that can be properly be used to monitor the impacts
3 from 1169 pumping at MX-5?
4 ANSWERS BY MR. UMSTOT:
5 A. Yes. The EH-4 well and the MX-4 wells show a
6 response to the MX-5 pumping.
7 Q. Okay. Yesterday, you testified about the MX-4
8 well and some concerns about the data gathering at the MX-4
9 well. You -- despite that, you agree that the MX-4 well is a
10 well that can measure that impact?
11 A. Yeah, if you look at the data that was presented
12 in the SNWA 2013 report, the MX-4 well showed a response to
13 the MX-5 well pumping.
14 Q. Now, Mr. Umstot, on your website, it indicates
15 that you're a technical expert for environmental litigation;
16 is that true?
17 A. I haven't looked at the website in a while. That
18 seems kind of an odd phrase.
19 Q. Okay. Well, when you click on technical expert
20 under the environmental litigation tab, your name comes up,
21 doesn't it?
22 A. Yeah. I do a lot of different litigation.
23 Q. Okay. So you testified as -- my count, at least
24 50 times in front of a tribunal like this; right?

1 MS. PETERSON: Is that for Dr. Mock?
2 MR. TAGGART: I'm sorry. Mr. Carlson. I'm
3 sorry. Thank you.
4 ANSWERS BY MR. CARLSON:
5 A. What was the question?
6 BY MR. TAGGART:
7 Q. Okay. I have two minutes.
8 ANSWERS BY MR. CARLSON:
9 A. I'm sorry.
10 Q. So the fault that you identified, the boundary
11 fault, the Dorothy fault, whatever we call it --
12 A. Right.
13 Q. -- that fault is not on the Rowley map; correct?
14 A. Correct.
15 Q. It's also not on the Page map; correct?
16 A. Correct.
17 Q. It's also not on the Phelps Gravity work;
18 correct?
19 A. It's --
20 Q. The fault that you identified is not shown on
21 this gravity map; isn't that correct?
22 A. It's shown in the contours.
23 Q. Sir, I'm not asking you to interpret it.
24 A. Okay.

1 Q. I'm asking you if it's marked there on there as a
2 fault.
3 A. It's not marked on the Phelps map.
4 Q. Okay. And on your line 10, you did not see the
5 fault; correct?
6 A. Correct.
7 Q. And your line 11, you did not see the fault;
8 correct?
9 A. Correct.
10 Q. And -- and do you know how much displacement the
11 carbonate rocks show between line 10 and line 11? Would you
12 agree with me it's about 900 feet?
13 A. No, I think --
14 Q. -- okay --
15 A. -- the -- is two across --
16 Q. All right. Maybe you don't know, so just say you
17 don't know, and then I can move on.
18 MS. PETERSON: I don't think that was his
19 testimony.
20 MR. TAGGART: So on this contour map -- I only
21 have a few minutes, please.
22 BY MR. TAGGART:
23 Q. And so on this contour map, isn't it true that
24 this shows the interface between the alluvial aquifer and the

1 Do you recall that?
2 ANSWERS BY MR. BUSHNER:
3 A. Yes, I do.
4 Q. And I think the quote -- and perhaps it's
5 paraphrase. I think it's a quote. You said: "The
6 transmissivity is not as high as was testified to today", and
7 you were referring to Mr. Lazarus's testimony, I believe?
8 A. Correct.
9 Q. So I'm looking at a Slide 11 from our
10 presentation yesterday, and it's got Mr. Lazarus's statements
11 regarding his conclusions from the seven-day pump test results
12 summary.
13 One of his conclusions was, quote, "The carbonate
14 aquifer behaves as a porous media and can be analyzed as
15 such?"
16 Is that the statement that you disagreed with?
17 A. Nope.
18 Q. Do you remember who wrote that statement?
19 A. Yes.
20 Q. Was that you?
21 A. Yes.
22 Q. Okay. So what about Mr. Lazarus's testimony do
23 you disagree with?
24 A. Well, I don't believe that the transmissivity

1 carbonate aquifer. That's what the contours show; correct?
2 A. The contours show the isostatic and gravity
3 anomaly.
4 Q. But the intent of the document is to show the
5 interface between the alluvial aquifer and the underlying
6 aquifer; isn't that correct?
7 A. It's intended to show the change in gravity as
8 you go from over --
9 Q. All right.
10 A. -- high-density material to low-density.
11 Q. And isn't it true that this map shows a down
12 thrust in the southwest direction between line 10 and line 11?
13 A. Downturn in the southwest direction, yes.
14 MR. TAGGART: Okay. Thank you.
15 HEARING OFFICER FAIRBANK: Moapa Valley Water
16 District.
17 CROSS-EXAMINATION
18 BY MR. MORRISON:
19 Q. Good morning. Greg Morrison for Moapa Valley
20 Water District.
21 I want to start with Mr. Bushner. Now,
22 yesterday, at the end of the testimony, you were asked about
23 the transmissivity that was revealed by the seven-day KPW pump
24 test.

1 values are as high as 300- or 400,000 gallons per day per foot
2 as Mr. Lazarus presented. They might that high in a fault
3 zone, but that's a very limited storage. So that's going to
4 be drawn down very, very quickly.
5 What I was talking about from our test was a
6 localized or very local regionalized area of Kane Springs
7 Wash.
8 As you can see in this diagram, this area over
9 here, here's our well. Here's the Willow Springs fault that
10 has a slight inclination to the -- I guess it would be to
11 the --
12 Q. This one we're looking at here, any kind of
13 hydrologic data?
14 A. No.
15 Q. So it's kind of irrelevant to the question I
16 asked you, so we'll just move on.
17 I want to talk about in the rebuttal to the Moapa
18 Valley Water District report, referencing page 1, whoever
19 wrote this section -- I'm not sure who it was -- wrote that
20 "there is no direct connection that can be drawn between the
21 change in water levels in KMW-1 and the Order 1169 aquifer
22 test."
23 They also wrote that the Moapa Valley Water
24 District offers no data analysis or credible science to

1 support statements made that there was a response seen in well
2 KMW-1 from the 1169 aquifer test.
3 Do you have a copy of Figure 3-9 from your
4 original report handy, by chance? If not, I've got one here.
5 A. Let me find it. Yes.
6 Q. All right. Looking at that Figure 3-9, I think
7 the average water level decline rate there is based on a
8 comparison of the first and last points here that you referred
9 to in your report.
10 A. There's two graphs on this. I don't know what
11 you're referring to.
12 Q. The KMW-1, so the top blue line.
13 A. Okay.
14 Q. All right. Is that water level decline rate,
15 which I think you calculated as .1 feet per year, has that
16 been constant since the well was drilled?
17 A. Well, you can see from the hydrograph that it's
18 highly variable, and we've had a lot of testimony --
19 Q. Okay. Thanks.
20 A. -- that --
21 Q. Was the highest rate of water level decline from
22 2011 to 2014?
23 A. Yes.
24 Q. All right. And does that time frame include the

1 MR. MOORE: Okay. Thanks. My time is up.
2 HEARING OFFICER FAIRBANK: City of North
3 Las Vegas.
4 MS. URE: No questions.
5 HEARING OFFICER FAIRBANK: Seeing no further
6 questions, Center for Biological Diversity.
7 Seeing no further questions, Georgia
8 Pacific-Republic.
9 MS. HARRISON: No questions.
10 HEARING OFFICER FAIRBANK: Seeing no further
11 questions, Nevada Cogeneration.
12 CROSS-EXAMINATION
13 BY MR. FLANGAS:
14 Q. Good morning.
15 This is for the panel. I'm not really sure --
16 HEARING OFFICER FAIRBANK: Mr. Flangas, will you
17 make sure your mic is on.
18 BY MR. FLANGAS:
19 Q. This is for the panel. I'm not really sure who
20 it will be.
21 In the rebuttal report at page 2, paragraph 2,
22 the statement is made: There is no local recharge from KSV,
23 Kane Springs Valley, to the Lower White River Flow System.
24 And on page 7, there's a statement that Lincoln and Vidler

1 entire period of the Order 1169 pumping test?
2 A. I don't believe so. I think it's from 2010.
3 Q. 2011 and 2014 wasn't -- the 1169 pumping test
4 wasn't within that time frame?
5 A. Oh, yes.
6 Q. So the greatest declines were coincidental with
7 the 1169 pumping test?
8 A. Coincidental.
9 Q. Okay. And finally, Dr. Carlson, I believe -- I
10 think you said you determined your boundary fault line as
11 parallel to lines 10 and 11 from your 2019 analysis?
12 A. Yes.
13 Mr. Carlson.
14 Q. Mr. Carlson?
15 A. I don't want to take too much credit.
16 Q. I notice you have a line 12 that transected both
17 lines 10 and 11. Why didn't you rely on line 12 to
18 demonstrate that fault line since it would have crossed it?
19 A. Line 12 would have intersected -- it should have
20 crossed that fault, yes. And it would intersect it at a 40-
21 to 45-degree angle, and when we're running at a shallow angle
22 like that to a linear feature, the resolution becomes poorer,
23 so we don't resolve it as well.
24 We do see it in the deep data.

1 agree there is interbasin flow from the Kane Springs Valley to
2 Coyote Springs Valley.
3 Are those two statements consistent?
4 ANSWERS BY MR. BUSHNER:
5 A. So this is Greg Bushner, Vidler Water Company.
6 And, no, they're not inconsistent in my mind. There is much
7 local recharge in Kane Springs Valley. We have been measuring
8 that since probably around 2007 or '8.
9 We collect precipitation data, runoff data,
10 temperature, groundwater -- or soils temperature data,
11 chloride data. We submit all of this information to the State
12 on a quarterly basis, and we -- our intent is to document what
13 recharge occurs in Kane Springs Valley.
14 There is underflow that comes -- groundwater flow
15 from Kane Springs Valley into the northern Coyote Springs
16 Valley.
17 Q. So you don't consider the underflow to be local
18 recharge? That's the distinction?
19 A. Not in Coyote Springs Valley.
20 Q. Okay. So what you're -- what your contention is
21 is that whatever is flowing into Kane Springs Valley that's
22 local recharge, when it hits underflow, it goes from Kane
23 Springs Valley to Coyote Springs. That's not local recharge?
24 A. The local recharge that we're documenting relates

1 to the perennial yield of Kane Springs Valley.
2 Q. Okay. So you do agree that there is interbasin
3 flow, and that interbasin flow goes from Kane Springs Valley
4 to Coyote Springs Valley?
5 A. Yes, just like it is from Pahranaagat Valley.
6 Just like it is from Delamar Valley. It can go all the way up
7 the flow system.
8 Q. All right.
9 And you're familiar with the CH2M Hill report
10 from 2006, the framework report where it reported
11 16,000 acre-feet of flow; correct?
12 A. I -- I don't recall that number, but I am
13 familiar with the report, yes.
14 Q. At page 12 and 13 of that report, it was done for
15 Lincoln County. It actually states "Local groundwater
16 discharge into Coyote Spring Valley" -- top of page 13 --
17 "16000 acre-feet a year based on analysis by Walker."
18 Is that consistent with the position that Lincoln
19 County would have today?
20 A. Probably not. I think from our data that we've
21 collected in-basin that there's probably less groundwater
22 recharge that occurs than 16,000 acre-feet in Kane Springs
23 Valley.
24 However, we're going to analyze that and look at

1 Q. Thank you.
2 What month and year, do you know, was KMW-1
3 completed? Was it October 2005?
4 A. That -- that --
5 Q. Sound about right?
6 A. -- sounds right or it might be -- it was sometime
7 late fall of 2005.
8 Q. And then water level measurements began for that
9 in April of 2007; is that right, KMW-1?
10 A. Yes.
11 Q. How did Lincoln determine the impacts of the
12 extraordinary precipitation event of 2005 if groundwater level
13 monitoring began in 2007?
14 A. Do you want --
15 HEARING OFFICER FAIRBANK: Go ahead and answer
16 the question.
17 MR. BUSHNER: So if you go back to that figure --
18 what is it you asked me earlier -- I have it right here.
19 That's why it's so important.
20 So if you go back to the Figure 3 line of my
21 report that we submitted, and everybody wants to compare the
22 water levels between CSVN-4 and KMW-1, and so that's what we
23 did.
24 And CSVN-4 was constructed, I guess, prior --

1 that, and hopefully, Mr. Umstot will run his recharge model on
2 that.
3 Q. But we do have the CH2M Hill report from 2006
4 that talks about 16,000 acre-feet, and if that -- if that
5 inflow is coming in, it would be coming in through the
6 carbonate aquifer; isn't that right?
7 A. Most likely through the carbonate.
8 Q. Sir, I'm curious. There's another statement that
9 was made in the report: "The effects of pumping from Kane
10 Springs Valley would not be felt for over a hundred years
11 outside of Kane Springs Valley."
12 What's the basis of that statement?
13 A. So several years ago, I think SNWA developed a
14 model -- I think the author of it was Dagnisi. I had Dr. Mock
15 evaluate that and look at pumping from Kane Springs Valley of
16 our water rights to give us an idea of what the potential
17 effects would be on the Muddy River Springs area based on that
18 analysis, and he can speak to that, if you would like.
19 Q. It's based on a different report, not an analysis
20 done at this particular valley?
21 A. Correct.
22 Q. So a different report, a different valley?
23 A. No. A different model that was available several
24 years ago. It was Southern Nevada Water Authority's model.

1 obviously, prior to 2003, and so you have a hydrograph from
2 that well that you can compare with the well -- with KMW-1.
3 You have to look at those together. That's what we did.
4 MR. FLANGAS: Thank you.
5 HEARING OFFICER FAIRBANK: Muddy Valley
6 Irrigation Company.
7 MR. KING: No questions.
8 HEARING OFFICER FAIRBANK: Seeing no further
9 questions, Bedroc.
10 MS. URE: No questions.
11 HEARING OFFICER FAIRBANK: Seeing no questions,
12 Nevada Energy.
13 MS. CAVIGLIA: No questions.
14 HEARING OFFICER FAIRBANK: Seeing no further
15 questions, we'll go ahead and open it up to the State Engineer
16 and Division of Water Resources staff.
17 EXAMINATION
18 MR. BENEDICT: Jon Benedict for the record.
19 A question about hydrographs, and I think maybe the best way
20 to do this is to go to Slide Number 6 of Mr. Umstot's
21 presentation.
22 Okay. Great. So this is -- this is CSVN-4 hydrograph;
23 correct?
24 MR. UMSTOT: This is Todd Umstot. That's

1 correct.
2 BY MR. BENEDICT:
3 Q. Okay. So there was a question about what -- what
4 hydrograph might represent the best hydrograph for climate. I
5 mean, would -- you've kind of used this one to demonstrate a
6 relationship with climate.
7 Would you say that this is the best hydrograph to
8 represent and show climate responses based on their uses and
9 such?
10 A. Yeah, this would be a good one for looking at
11 climatic effects. There are errors in the water level
12 measurement collections that show probably more variation than
13 is actually occurring, but this does show the response to the
14 2005 recharge and then a decline as things dry up.
15 Q. And you've also concluded that it doesn't -- in
16 your opinion, it doesn't show response to the MX-5 test?
17 A. That's right. There's no discernible response in
18 this hydrograph.
19 Q. Okay. Another question:
20 Do you -- you've stated that you see water level
21 declines that continue for about a year and a half after the
22 test period in this one -- I think KMW-1 as well; correct?
23 A. That's correct.
24 Q. Do you also see in those two hydrographs declines

1 to determine the degree of connection between these wells and
2 the Muddy River Springs area?
3 ANSWERS BY MR. BUSHNER:
4 A. No, I don't. The State Engineer has already
5 granted water rights in this area, and they qualified that.
6 They allowed 500 acre-feet to be pumped from the southern part
7 of the valley, and we have another 500 acre-feet that can be
8 pumped further into the valley.
9 And I think we have provided data evidence here
10 today -- geophysical data, an analysis of water levels,
11 climate -- that shows that there's no reason to conduct
12 another long-term aquifer test in this area.
13 And we've also been collecting in-basin recharge
14 data that we use to support the perennial yield value of Kane
15 Springs Valley.
16 Q. So was that another long-term or just a
17 short-term test?
18 A. Was what?
19 Q. That you were just discussing, that you just
20 explained that you had done to show here.
21 A. So if you're referring to our tests in 2005 and
22 '06, that was a seven-day aquifer test.
23 Q. Have you done any tests longer than the seven
24 days that you've described?

1 from 2016 to present, as others have suggested in other
2 hydrographs?
3 A. Yeah, I see a decline. It's hard to see from
4 here, but it looks like it starts around 2016.
5 MR. BENEDICT: Okay. Thank you. Those are my
6 questions.
7 HEARING OFFICER FAIRBANK: Okay. We'll go ahead
8 and open it back up for questions for cross-examination. And
9 we will go ahead and give you -- you have four minutes.
10 So Coyote Springs Investments. Seeing none,
11 United States Fish and Wildlife Service.
12 Seeing none, National Park Service.
13 MS. GLASGOW: Yes.
14 CROSS-EXAMINATION
15 BY MS. GLASGOW:
16 Q. It's still morning. Good morning. Karen Glasgow
17 with the Department of Interior Solicitor's Office
18 representing the National Park Service. Hello again.
19 So I had just a couple of questions. Let's start
20 with Mr. Bushner.
21 Given the differing opinions about the response
22 of KMW-1 and CSV-4 to MX-5 pumping, do you agree that prior
23 to granting water rights in Kane Spring Valley, the State
24 Engineer should require a long-term aquifer test in this area

1 A. No, we have not.
2 Q. Can you use the CSV-4 hydrograph as an index
3 well for climate and use the same hydrograph to determine that
4 there is no pumping effect from MX-5 pumping?
5 A. I'm not sure I understand the question. If
6 CSV -- oh, use the CSV-5 well?
7 Q. I'm sorry. CSV-4.
8 A. So you would use CSV-4, which -- if you assume
9 it's all climatic effects and it has no effect of pumping to
10 see if there was a pumping effect, then, in KMW-1?
11 Q. No, in CSV-4.
12 A. Well, CSV-4, if you assume it's all due to
13 climatic effects, then you can't -- I don't think you would
14 discern any pumping effects.
15 Q. Thank you.
16 I think I have one more question. It's about...
17 With respect to the use of the -- forgive me --
18 Dagnisi model by Mock, the 100-year delay for pumping effect,
19 was the SNWA model run by Dr. Mock calibrated to the Order
20 1169 test?
21 DR. MOCK: This is Peter Mock. I don't recall.
22 I don't think so.
23 MS. GLASGOW: Thank you.
24 No further questions.

1 HEARING OFFICER FAIRBANK: Moapa Band of Paiutes.
2 Seeing no additional questions, Las Vegas Valley
3 Water District, Southern Nevada Water Authority.
4 CROSS-EXAMINATION
5 BY MR. TAGGART:
6 Q. Dr. Mock, just real quickly, you don't recall
7 whether it was calibrated -- well, the pump tests came after
8 the model was completed, so it couldn't have been calibrated
9 to the pump test; right?
10 ANSWER BY DR. MOCK:
11 A. That makes sense to me.
12 Q. Okay. Bushner, so in your opinion, a new fault
13 should be -- or this new fault that's been identified by
14 Mr. Carlson's work should be the boundary between Coyote
15 Springs Valley and Kane Spring Valley; right?
16 A. I think it provides a good --
17 Q. Okay. Should it be the boundary or not?
18 A. Sure, yes.
19 Q. And so CSI would not be able to file a change
20 application to move points of diversion for its permits that
21 it owns in Coyote Springs Valley to the area in Coyote Springs
22 Valley that's northeast of that fault under your proposal;
23 correct?
24 ANSWERS BY MR. BUSHNER:

1 to waste any more time on this.
2 Under your proposal, a hydrographic boundary
3 would be established at the fault; correct?
4 A. No, I don't think you'd change the hydrographic
5 boundary. The issue is the administrative unit.
6 Q. Okay. Thank you.
7 Now, is it also true that CSI has a contract with
8 Lincoln County Water District to acquire the water rights that
9 Lincoln County has in Kane Springs Valley?
10 MR. HERREMA: I'm going to object again. I don't
11 think this is within the scope of their reports for water
12 rights, water right contracts, or within in the scope of this
13 hearing.
14 MS. PETERSON: We would join in that also.
15 HEARING OFFICER FAIRBANK: So the objection is
16 that you believe it's beyond the scope?
17 MR. HERREMA: The scope of the hearing --
18 MR. TAGGART: Excuse me, is it my turn to
19 respond?
20 MR. HERREMA: -- beyond the scope of the
21 testimony.
22 HEARING OFFICER FAIRBANK: Mr. Taggart.
23 MR. TAGGART: It's certainly relevant to the
24 question of subdivision maps and the coordination between CSI

1 A. Well --
2 MR. HERREMA: Can I object to this? I don't
3 believe there's been any testimony in the reports or the
4 rebuttal about CSI change applications.
5 MR. TAGGART: It's a simple question.
6 MR. HERREMA: It's beyond the scope of the
7 salient conclusions that they either reported about or
8 testified about.
9 MS. PETERSON: I join in that.
10 HEARING OFFICER FAIRBANK: I think to the extent
11 that the question is going to -- you know, boundaries and
12 changing of boundaries, that is within the scope. But as to
13 specific water rights and those particular issues, I don't
14 know that that is within the scope or within the particular
15 issues in which have been addressed here today.
16 So, Mr. Taggart, if you want to rephrase your
17 question in a manner that is within the original scope of
18 testimony and the issues that are subject to these
19 proceedings.
20 BY MR. TAGGART:
21 Q. Well, would the fault change the boundary of the
22 hydrographic basin and how could it not if it's not the
23 boundary that you propose, Mr. Bushner?
24 And I'll strike the question because I don't want

1 and Lincoln County. There's a contract that's public record.
2 It was put before the Lincoln County Commission
3 on September 16th, so I think it's important for the State
4 Engineer to understand that there's a contract between these
5 two parties in this proceeding for the water that's being
6 sought.
7 HEARING OFFICER FAIRBANK: But, Mr. Taggart, how
8 does it relate to the geographic boundaries, the movement of
9 water rights, the amount of water that may be developed on a
10 sustainable basis within that geographic area that has been
11 designated as the Lower White River Flow System?
12 MR. TAGGART: I think it goes to credibility
13 about the whether the boundary really is a hydrologic boundary
14 or whether it's a place that can be drawn so that applications
15 can be developed in Kane Springs Valley and then water sold to
16 CSI from there.
17 HEARING OFFICER FAIRBANK: I'm going to go ahead
18 and sustain the objections on the basis that it's beyond the
19 scope of these proceedings.
20 MR. TAGGART: Okay. Do I have any time left?
21 HEARING OFFICER FAIRBANK: I'll give you -- I'll
22 give you another 15 seconds. You can ask one more question.
23
24 BY MR. TAGGART:

1 Q. It will be the last question. All right.
2 I'm not going to ask Mr. Umstot about the
3 Patriots.
4 So, Mr. Mock -- or Dr. Mock -- or actually, I'll
5 ask Mr. Carlson.
6 So the deep data that you talked about, none of
7 that deep data was presented in the presentation you shared
8 with the State Engineer yesterday; correct?
9 ANSWERS BY MR. CARLSON:
10 A. No. I think it was on a demonstrative slide --
11 Q. Okay.
12 A. -- but I'm not sure.
13 MR. TAGGART: Thank you.
14 HEARING OFFICER FAIRBANK: Moapa Valley Water
15 District.
16 Seeing no further questions, City of North
17 Las Vegas.
18 MS. URE: No additional questions.
19 HEARING OFFICER FAIRBANK: Center for Biological
20 Diversity. Seeing no further questions.
21 Georgia Pacific-Republic. Seeing no questions,
22 Nevada Cogeneration.
23 MR. FLANGAS: Thank you.
24

1 seemed to be suggesting that the discharge was really limited
2 to the Muddy River Springs area but that Vidler and Lincoln
3 County were saying, no, there's additional recharge, really,
4 into the carbonate from other areas, and there's additional
5 discharge from the carbonate system that occurs beyond just
6 the Muddy River Springs area that's not being accounted for.
7 A. I don't recall saying that I thought there was
8 additional recharge. I'm not aware of additional recharge
9 compared to what others have brought to the table.
10 But I will say that Lincoln and Vidler, as I
11 said, has Mr. Umstot and his firm collecting data and running
12 what I call a land surface model and calculating discharge in
13 some areas, and I'm not sure if that will lead to larger
14 numbers than people have seen before.
15 But I have agreed in my rebuttal report that I
16 think there's flow out to the Las Vegas Valley just based on
17 the structure, and the residual of what many people put
18 together for a water budget makes that reasonable as well.
19 Q. Is that based on geology, sir, and things?
20 A. Quite a bit of this is based on the framework of
21 the geology, there being large carbonate corridors that are
22 pointed toward Las Vegas.
23 Q. Do your colleagues at the panel agree with you on
24 that basis?

1 CROSS-EXAMINATION
2 BY MR. FLANGAS:
3 Q. I have just -- I have just one question for
4 Dr. Mock.
5 Generally, sir, is it a correct statement that
6 you don't agree with the contention that the -- that the
7 majority or, really, all of the discharge occurs in the Muddy
8 River Springs area from the carbonate but that, in fact, there
9 are other areas where the carbonate discharges water here.
10 Is that a generally correct statement when I read
11 all of these reports? I think that's what I'm understanding
12 you to say, that there's additional discharge occurring from
13 the carbonate system beyond just the Muddy River Springs area?
14 ANSWERS BY DR. MOCK:
15 A. In my rebuttal report, I said that I thought the
16 flow to the Las Vegas Valley was -- was a reasonable discharge
17 point for the Lower White River Flow System.
18 Is that what you're asking?
19 Q. I'm just trying understand generally that
20 concept. It seems like the two things that I understood from
21 all of the reports generally, but especially from yours, was
22 that there was additional recharge to the carbonate and
23 additional discharge from the carbonate beyond what many of
24 the other parties were saying occurred, that everybody else

1 Generally, I don't know if everybody has to nod
2 their head. I don't --
3 MR. BUSHNER: This is Greg Bushner. I do -- I
4 agree with Dr. Mock on that.
5 MR. CARLSON: This is Norman Carlson. Yes, based
6 on my understanding of things, yes.
7 MR. FLANGAS: Okay. Thank you. No further
8 questions.
9 HEARING OFFICER FAIRBANK: Muddy Valley
10 Irrigation Company?
11 Seeing no questions, Bedroc.
12 MS. URE: No questions.
13 HEARING OFFICER FAIRBANK: No questions.
14 Nevada Energy.
15 MS. CAVIGLIA: No questions.
16 HEARING OFFICER FAIRBANK: No further questions,
17 so we'll go ahead and open it up to the Division of Water
18 Resources staff and the State Engineer.
19 Okay. So at this time, we'll go ahead and open
20 it up to Lincoln County and Vidler for redirect, and I will go
21 ahead and -- we'll give you ten minutes.
22 REDIRECT EXAMINATION
23 BY MS. PETERSON:
24 Q. Thank you. Karen Peterson.

1 Mr. Bushner, what did Lincoln County and Vidler
2 do in response to Interim Order 1303?
3 ANSWERS BY MR. BUSHNER:
4 A. So in response to the State Engineer's request on
5 this interim order, we went out and collected new data. We
6 collected new geophysical data that has reviewed and presented
7 in this hearing and also discussed in our reports.
8 Also, it's been stated that we should do
9 additional pump tests or aquifer test analysis on additional
10 wells.
11 Well, the people that have stated that haven't
12 even reviewed the tests from our 2006 test of well KSW-1, and
13 that data has been publicly available since our hearing in
14 2006.
15 Also, we've analyzed geochemistry data throughout
16 the whole Lower White River Flow System for your benefit, and
17 we've brought new scientists here to look at that and to
18 reanalyze and provide opinions on it.
19 And so all of this information has been provided
20 to you previously, including the new information, the new
21 geophysical data that we collected.
22 Coyote Springs Investment, Lincoln County Water
23 District, and Vidler Water Company are the only ones, I think,
24 in this hearing that have been responsive to collecting new

1 We don't think that Kane Springs Valley should
2 be -- it's not in Order 1169. It's not one of the Lower White
3 River Flow System basins, and we don't think it should be
4 included.
5 But thank you. That's all I have to say.
6 BY MS. PETERSON:
7 Q. Thank you, Mr. Bushner.
8 Dr. Mock, could you please explain the difference
9 between flow paths and impacts.
10 ANSWERS BY DR. MOCK:
11 A. Just briefly -- yes. Just briefly, the --
12 there's been a lot of discussion about flow paths through the
13 system, and I think that is valuable in understanding how
14 water interacts with the structural geology of the area.
15 And certainly, that's important, and we'll
16 continue to learn from that. But the impacts as I understand
17 it are to the springs and the surface water features of the
18 Muddy River Springs area is the focus of this.
19 And what causes impacts, I think, is -- are
20 drawdowns, and I haven't seen anyone bring to the table their
21 estimates of drawdowns based on recent information at Muddy
22 River Springs due to pumping at the Kane Springs Wash that
23 would cause the engineer -- the State Engineer to reconsider
24 what they're doing.

1 information and providing it to the State Engineer to help him
2 address the four questions that are outlined in Interim Order
3 1303.
4 The Moapa Band of Paiutes have provided a new
5 analysis, a peat flow model. However, that's not based on any
6 new data as near as I can tell, but that is a new way of
7 looking at the flow system.
8 The other thing that CSI and Lincoln County Water
9 District and Vidler Water Company have done is contributed to
10 the Fish and Wildlife Service for the Moapa Dace habitat
11 restoration.
12 We've contributed a significant amount of money
13 of which we don't know how that has been spent. We don't know
14 what has come of that. We've not received any information on
15 what habitat has been restored for the monies we have agreed
16 to give them. So -- and we have given them.
17 Finally, I just want to say we've been very
18 responsive -- we've tried to be very responsive to your
19 requests in this Interim Order 1303.
20 We've focused our analysis on the issue most
21 germane to Lincoln County Water District and Vidler Water
22 Company, which is the boundary of the Lower White River Flow
23 System, the administrative boundary. And that's our new
24 geophysical evidence that we've brought to the terrible.

1 So how is that different? And if you read my
2 rebuttal report, you'll see my specific responses to these
3 specific comments where I think this happens.
4 But a drawdown from a well does not only go
5 focused running downstream to the -- down the flow path, and
6 it is allowed by the porous mediad or the fracture system to
7 go off in all variations until it encounters variations in
8 permeability that cause it to be modified. But it has a lot
9 of other places to go besides capture, the downstream capture
10 zone or the current steady flow.
11 Q. And then one last question, Dr. Mock. You've
12 listened to the evidence. I think you've been here since the
13 start of the proceedings.
14 And in your professional opinion, is there any
15 basis for the State Engineer to change his previous
16 determination that Kane Springs Valley should be excluded from
17 the Lower White River Flow System or the Order 1169
18 proceedings?
19 A. Well, just to correct you, I arrived at 1 o'clock
20 on Monday, but I don't think I've missed anything else.
21 I don't think there has been evidence that would
22 cause the State Engineer to change the boundaries that have
23 been set and -- and put into place for the Lower White River
24 Flow System as an administrative unit. And let me explain why

1 I think that.
2 I think the most prominent assertion that I have
3 heard is that the 1169 test led to us seeing a drawdown
4 response in response to that specific pumping at CSVM-4 and
5 KMW-1, and you certainly know what I'm talking about. You've
6 seen this over and over and over again.
7 And I don't think that that is a reliable basis
8 for the State Engineer to make his decisions about the
9 boundaries. I love aquifer tests. I teach aquifer tests and
10 practical analysis at seminars. And I think it's a great way
11 to characterize aquifer parameters in the vicinity of the
12 well. The closer the better, and I can go into that in more
13 detail.
14 When you're working at the edges, I think it can
15 give you unreliable information. In this specific case, let
16 me line up what I think makes this an unreliable measure of
17 what the boundaries should be.
18 First of all, let's just realize what we're
19 talking about. We're measuring waterways that are a thousand
20 feet below land surface. I personally have never done that.
21 My deepest water level is 750, and it was quite a physical
22 exertion. So I'm quite impressed with everyone's work here in
23 taking water levels at a thousand feet and working with them.
24 We're talking about what people have projected or

1 the testimony yesterday -- that there's a one-foot
2 variability, approximately, in some of their data for various
3 reasons, and they've answered for that.
4 Finally, in another group, there are no seasonal
5 signals that I see, not the clear seasonal signals of pumping
6 in the KMW-1 and CSVM-4 hydrographs that we see further south.
7 I don't see the multi-marked substantial recovery
8 and renewed decline in approximately January 2012. The MX-5
9 pumping was shut down for a while, but that signal is a
10 beautiful aquifer test signal farther south into the system.
11 And finally, this is the most important thing to
12 me is that you can't have a very short response time between
13 the start of the pumping and the start of the aquifer
14 response, say a few months at the beginning and then have more
15 than a year for it to respond with the cessation of the
16 pumping.
17 The way the physics of well response is of a
18 sharp, clear, focused impulse on the system is that when you
19 make a change, the timing of those responses as they go out is
20 the same.
21 So you can't have a few months going out of the
22 pumping response and over a year's response to a recovery
23 response because the pump has been shut off. And shutting off
24 a pump is just as powerful as turning it on.

1 seem to be looking at and thinking they see a half a foot or a
2 foot and a half of drawdown due to pumping caused by the 1169
3 test. So we're measuring one foot at the bottom of what is
4 essentially a hundred-story building in depth.
5 There are notes of the sounders sticking to the
6 side of the casing. Certainly, this is going to happen, and
7 you have to give them a jerk to keep it loose and moving
8 around, and people are doing the best they can. And I think
9 that's fine. But, again, I'm talking about the reliability of
10 being able to see drawdowns in this measure.
11 Near the end of the pumping, we have three kinds
12 of data. There were transducer data that were averaged, and
13 there were sounder data and there were calibrated sounder
14 data. And I'm not casting aspersions on this. I'm just
15 saying that there were changes that were going on, and we're
16 looking at different pieces of data. And we're again talking
17 about a foot of change -- approximately -- people are talking
18 about.
19 There were sudden one-foot swings that Mr. Umstot
20 showed near the end of the test in the data, and you see
21 swings when he compares the transducer data to the sounder
22 data. And we must wonder what would cause these sudden swings
23 at such a great depth, you know, in support of the aquifer.
24 And finally, SNWA says -- and we've seen this in

1 Finally, I think there's a reasonable inference
2 of a decadal scale decline. We've heard all the arguments
3 here today, but if you look at SNWA's many -- almost every
4 graph, they have a nice plot at the bottom of the percentage
5 above precipitation above and percentage below.
6 If you look at the last 20, 21 years, 14 of them
7 are less than. Seven of them are higher than, and that's all
8 I want to go into with that.
9 And I think the drought continues declining that
10 I have been associated with elsewhere in the southwest.
11 There's a stronger opinion that there is a decadal spin on it,
12 set of drought persistence since 1999 or 2000.
13 And, finally, I think there's a reasonable
14 inference that there's a multiyear recession from a rise due
15 to the big recharge event of 2005. I think those are two
16 reasonable things people can say about what happened during
17 this test.
18 I would say from being a person who runs aquifer
19 tests I want some long ones. I avoid long ones because these
20 things can happen. You can have a recharge event. You can
21 have people turn wells off during your time of your test. All
22 these things happen. So I understand it completely. But this
23 is not the sum total.
24 This is not a reasonable -- this is not a strong

1 foundation for the State Engineer to make changes to his
2 decisions that are based on a bigger set of data. So I do not
3 think the 1169 test helps you with the far edges of response.

4 And in fact, I think the data, especially that
5 timing issue, indicates that it did not make it into the
6 CSVN-4 KMW-1 winter.

7 So if I'm so tough on sounders and aquifer
8 testing, I tell you why I like those things. But what is
9 reliable here? And what I see that is reliable and what I
10 think is the core of the boundary delineation.

11 There is a catch from water level elevations of
12 about 1800 to 1820 that we first saw in the CH2M Hill report
13 from 2006, and I've seen persistently since then. It's this
14 patch of water levels. It's plus or minus five feet that is
15 remarkable, and I think that's something that's reproducible.
16 I think it is reliable.

17 I think you can go out with a sounder and a drill
18 rig and a survey crew any time you want. My only suggestion
19 is you have one surveyor go and do all of these well heads
20 because this is not much a change, but this is the core of the
21 five and a half or six or seven -- six and a half -- six-basin
22 selection.

23 The selection engineers make of core depth, I
24 think, is just plus or minus five feet or 10 feet between 1800

1 So, next, we will go ahead and move to City of North Las Vegas
2 and to allow some time for everyone to move around and shift.
3 We'll go ahead and take a quick ten-minute break.

4 (Recess.)

5 HEARING OFFICER FAIRBANK: Okay. We'll go ahead
6 and go back on the record and start with the City of North Las
7 Vegas, Ms. Ure.

8 MS. URE: Good morning, Tracy Ure appearing for
9 the City of North Las Vegas. And today Dwight Smith is going
10 to be testifying on behalf of the City, so if we could have
11 him sworn in.

12 DWIGHT SMITH,
13 called as a witness in this matter,
14 having been first duly sworn,
15 testified as follows:

16 DIRECT EXAMINATION
17 BY MS. URE:

18 Q. Thank you, Mr. Smith. Do you have a copy of the
19 City's exhibits in front of you have?

20 A. Yes.

21 Q. Can you briefly describe your background which is
22 presented in your CV at Exhibit 1?

23 A. I'm the principal hydrogeologist with the
24 interflow hydrology. I have been practicing for a little over

1 and 1820. That's where something is -- very interesting is
2 going on in the system, and it makes a lot of sense that
3 that's the core of this. And I would say that is reliable,
4 and I would stick with that. And that's something you can
5 work with.

6 Now, we know that the water levels go up over
7 20 feet as you head into northern Coyote Springs Valley, and
8 if you head up another seven or eight feet as you go up to
9 Kane, and I'm convinced by the geophysical data that's been
10 shown of that normal fault -- I think that's a basin and a
11 range fault that's -- that Mr. Carlson has found in his
12 fieldwork.

13 It's just an idea of why would there be a water
14 level drop? Well, there are these faults and these
15 juxtapositions that mature.

16 So if you were to make a change to this, you
17 might want to look at northern Coyote Springs Valley because
18 of that water level distance and that it doesn't quite fit
19 with this area of very uniform water levels.

20 But as it stands, the current basin
21 configuration, I think there's support for it. I haven't seen
22 reasonable evidence against it.

23 MS. PETERSON: Thank you. Thank you.

24 HEARING OFFICER FAIRBANK: Thank you. All right.

1 30 years. The majority of my work has been in Nevada
2 throughout my tenure.

3 And it's been my privilege to have testified
4 before the Nevada State Engineer on 15 prior occasions. So
5 this is my 16th -- 16th time to be here before you.

6 Q. And have you been previously qualified as an
7 expert in hydrogeology?

8 A. Yes, in those prior hearings.

9 Q. Okay. And did you submit reports in this case at
10 Exhibits -- or City of North Las Vegas Exhibits 2, 3, 4 and 7?

11 A. That's correct.

12 Q. And for Exhibit 5, did you assist in drafting of
13 this report letter as well?

14 A. I did assist Mr. Duval with that cover letter.

15 MS. URE: Okay. Mr. Smith is available for
16 cross-examination, we will go into his testimony, but we would
17 like to offer the City of North Las Vegas exhibits.

18 HEARING OFFICER FAIRBANK: And the exhibits are
19 so admitted.

20 (Exhibit 2 admitted into evidence.)

21 (Exhibit 3 admitted into evidence.)

22 (Exhibit 4 admitted into evidence.)

23 (Exhibit 7 admitted into evidence.)

24

1 BY MS. URE:
2 Q. Mr. Smith, did you prepare a presentation for
3 this hearing?
4 A. I have.
5 Q. And can you take us through that, please?
6 A. With pleasure. The presentation I've compiled
7 today is going to take us through just a few key aspects.
8 I'll have -- up front I just want to get all the key points
9 that we'd like to convey to the Nevada State Engineer and
10 staff this morning.
11 I would like to briefly present an overview on
12 the water supply strategy that the City of North Las Vegas has
13 for the Apex Industrial Center in Garnet Valley.
14 Our technical work has been in support of
15 advancing that water supply strategy. And then we'll use that
16 technical work to then provide some additional data,
17 additional interpretations from which the State Engineer can
18 address some of the questions posed in Interim Order 1303.
19 The -- the tables and figures in this
20 presentation are all from our Exhibits 3 and 4 unless
21 otherwise noted on the overview.
22 My key points for today. The -- the
23 administrative boundary as proposed by the State Engineer we
24 feel are appropriate. Our work has concentrated on just the

1 aquifer systems.
2 I'll touch briefly on my opinions regarding water
3 level trends. And we have not offered, because we have not
4 studied the entire system in my recent work here, I'm just
5 concentrating on the southern end.
6 I'm not going to offer an opinion on why a
7 perennial yield would be except for I would offer the advice
8 that we shift to a safe yield management scheme in the system
9 rather than perennial yield. And safe yield, I'll talk a
10 little more about that. Really what's safe, what can be
11 safely established as pumping in perhaps different geographic
12 areas.
13 And what is safe for the Muddy River Springs
14 area. I think that's the key here. The levels of drawdown
15 that we've been observing are long-term trends we've been
16 observing are not all that critical to anything except for the
17 high altitude springs that supports the Dace habitat. So
18 everything's got to be framed around that.
19 So that I would encourage moving forward that
20 this certainly needs to be tied more to a safe yield concept.
21 Just briefly now, I'd like to kind of encapsulate
22 the water supply strategy that's been brought forth by the
23 City of North Las Vegas. And that that is basically four
24 principal components.

1 southern part of the administrative area that's proposed.
2 Our technical analysis has not incorporated
3 northern aspects that have been discussed in detail in this
4 proceeding. So our work is really focused on the south.
5 I will point out a few uncertainties about the
6 southern boundary, but as a general position the City of North
7 Las Vegas supports the basic boundaries as defined in the
8 interim order.
9 One issue that we feel is critically important is
10 permitting the opportunities for transfer of water rights from
11 in between alluvial and carbonate aquifer systems.
12 And in particular, I'll convey how this relates
13 to the City's desire to lease or potentially acquire some of
14 the senior most water rights in this administrative area that
15 have historically been pumped from the alluvium, transfer
16 those down to Apex in Garnet Valley.
17 We think that's a prudent thing to propose and I
18 would also suggest that that opportunity needs to be left open
19 for others because I touch briefly on how there are examples
20 that transfer water rights between those two aquifer units
21 could have positive water management implications.
22 So every application needs to stand on its own
23 merits, I think it would be premature to draw any limitations
24 or conclusions about potential transfers between the two

1 The first component is to complete a water supply
2 pipeline from Las Vegas Valley up to Garnet Valley into the
3 Apex area.
4 As planned, it's currently a six-phase project to
5 build the pipeline, 36-inch diameter pipeline, it's a large
6 pipeline project.
7 Phase 1 is under construction, it's bringing the
8 pipeline up along the I-15 corridor. It's scheduled to be
9 completed in April of 2021 under construction currently.
10 The second phase of the pipeline extends another
11 three, three and a half miles and gets into Garnet Valley and
12 into the southernmost portion of the Apex Industrial Center.
13 That's not planned to be completed until April of 2022.
14 So this will enable delivery of Colorado River
15 source water from the greater Las Vegas area water system to
16 be brought up into the Apex area and provide water service for
17 the City of North Las Vegas and their municipal service area.
18 Now, pipeline construction takes time and a lot
19 of financing. In the interim the City owns two municipal
20 wells, the Playa Well, the very north end, and I'll have a few
21 maps to look at the locations here, and the Kapex Well, both
22 of these are in northern Apex area. Currently there is a
23 lease agreement with SNWA to utilize some of their water
24 rights that have been granted in Garnet Valley at these wells

1 leading into the future.
2 But as I will express, the City is interested in
3 giving senior water rights down to these wells to be utilized
4 into the future. Temporary water right transfers of a junior
5 status water right are not the optimal situation that a water
6 municipality wants to be in. And I think the reasons are
7 clear for that.
8 Then the other two components here, the City is
9 interested in pursuing an AR concept, artificial recharge.
10 That could be implemented as soon as the phase 2 pipeline is
11 completed. And I haven't -- I won't be discussing that in
12 detail, but I certainly can discuss that in more detail if the
13 State Engineer and staff would like. We've done some
14 conceptual testing on that. It appears to be a reasonable
15 proposal to bring forward.
16 This could have some -- some great -- or
17 facilitate some wise water management in the southern part of
18 the basin, it could facilitate pumping and support pumping in
19 the northern part of Apex for an interim period if needed. It
20 might become a long-term strategy if needed.
21 And also I would suggest that, you know, we've
22 talked about having the stress and test aquifer systems, quite
23 difficult to do to put a large pumping stress on if you don't
24 have anywhere the water can be used or place of use.

1 boundary and the red line is the phase 2 pipeline. Just about
2 right in the center just at the lower center part of the
3 overuse at blue point. That blue point is the approximate
4 location of a proposed artificial recharge well.
5 Q. And, Mr. Smith, when you referred to the basin
6 boundary are you talking about the black dotted line and
7 that's the basin boundary between Las Vegas Valley and Garnet
8 Valley; is that correct?
9 A. Yeah, that's the approximate hydrographic basin
10 boundary.
11 Then as the pipeline -- you'll see it continues
12 on north in different phase and segments to the northern end
13 of Apex. This next overview shows the loop system for the
14 pipeline around the northern end of Apex end.
15 So you'll notice the two wells that I've
16 referenced, Playa and Kapex. Kapex is at the southern part of
17 that loop, the blue point inside that loop. And then up on
18 the northern edge of the loop there's a blue point that's
19 labeled the Playa Well. So that's where those two existing
20 wells are today.
21 Just to give some geographic context here, on the
22 right-hand figure it shows in pink shading the Apex area,
23 extends from the east, northeasternmost edge of Las Vegas
24 Valley and then on up into Garnet Valley and into the central

1 But let's flip this around, do a long-term
2 injection test of a high rate, we can do that fairly easily.
3 If we get the pipeline up and into the valley and we have an
4 artificial recharge well, injection well or several wells,
5 whatever is required, you can do long-term testing at large
6 magnitudes. And we can do that, technically it's synonymous
7 to doing a pumping test.
8 So I think there's a lot of advantages to
9 pursuing that and advancing that concept.
10 And then the final component is just the wise
11 utilization of reclaimed water in the basin, the centralized
12 wastewater treatment plant is planned, it's not present today,
13 but how do we utilize those resources to conserve water and
14 conserve the amount of water that needs to be brought into the
15 valley or pumped.
16 So that's the -- that's the strategy for water
17 supply that the City has for Apex.
18 And just briefly how -- how this looks and
19 planned, the dashed black line along the bottom of the
20 overview is the approximate basin boundary between Las Vegas
21 Valley and Garnet Valley. You see at the very bottom of that,
22 this overhead, there's a green line that comes up, that's the
23 tail end of the phase 1 pipeline.
24 And then advancing on up across the basin

1 south part of Garnet Valley.
2 And above to the north is Hidden Valley and above
3 that to the north is Coyote Springs Valley, Muddy River
4 Springs area northeast and directly to the east of Garnet
5 Valley is California Wash. To the south is Black Mountains.
6 This may not be shown up too well on the
7 overview, but it should show up on your figures. The green
8 shaded area, I think we need to take note of that. That is
9 the Desert National Wildlife Refuge. So that the constitutes
10 a large amount of area and incorporates the westernmost arm of
11 Garnet Valley.
12 I think there are obvious limitations to any
13 disturbance of any type or development of water resources over
14 in that arm of Garnet Valley because of its land use
15 designation. Apex is otherwise surrounded by mostly public
16 lands, BLM, with some utility corridors cutting through it and
17 I-15 forming the southern boundary and U.S. 93 forming the
18 northern boundary.
19 So the geologic context that we're in, this is
20 just an overview of the regional geology and of some of the
21 primary fault zones. The blue shading are the carbonate
22 rocks. The yellow is the alluvial -- alluvial materials. And
23 you can see the band of bluer rocks that stem from north --
24 northward up from the Las Vegas shear zone through Garnet

1 Valley.
2 So we certainly do agree with the interpretations
3 of Garnet Valley being incorporated in this regionally
4 connected carbonate system.
5 The one thing I would like to point out is that
6 hydrologically and from a modeling perspective, we use the Las
7 Vegas -- we -- I should say most scientists have used the Las
8 Vegas sheer zone as a southern boundary, so that then results
9 in incorporation of that northern tip of the Black Mountains
10 area.
11 One thing that I have not heard discussed at all
12 is there is that part of Las Vegas Valley on that edge above
13 the Las Vegas sheer zone that possibly should be considered
14 for inclusion, but I don't suggest that we do that now,
15 because as you'll see as we go through this presentation
16 there's a lot of uncertainty there about the boundary between
17 Garnet and Las Vegas Valley. But we certainly need to keep in
18 mind for the future what the actual hydrologic boundary might
19 be for the flow system.
20 Q. And, Mr. Smith, so you're on slide 8, and I just
21 want to make it clear for the record that the Las Vegas Valley
22 sheer zone is labeled on your side and it's on the bottom
23 left-hand corner of your demonstrative exhibit; is that
24 correct?

1 A. So you can see the bluish shades or the
2 principally carbonate rock types and the greener shades are
3 the plastic rock types and a major discontinuity across the
4 Muddy River Fault.
5 You'll notice in the bottom cross section there's
6 a little derrick symbol, it's labeled Grace Petroleum, Arrow
7 Canyon number 1. So right in the Apex area there was a deep
8 petroleum exploration well drilled in 1982. It's over
9 17,000 feet deep.
10 So the only geologic real subsurface -- deep
11 subsurface lithologic control we have in these sections is
12 that one petroleum exploration well. But there it is, it has
13 defined a substantial thickness of carbonate rocks exceeding
14 17,000 interpreted to be on the order of 20 to 25,000 thick in
15 Garnet Valley.
16 Just as a quick note, there's some testimony by
17 Rick Waddell from the National Park Service about concerns
18 over potentially impacting flows of Rogers and Blue Point
19 Spring.
20 The concerns are duly noted, but you can see
21 through these cross sections, on the upper cross section
22 you'll see Blue Point Springs labeled. And the considerable
23 geologic discontinuities in the carbonate aquifer would have
24 to exist for that to be the regional source of water to those

1 A. Yes, that's correct. Just a couple other
2 regional faults I'll touch briefly on. On the -- running
3 through the eastern side of Garnet Valley is the Dry Lake
4 Thrust, but also a number of normal faults that are run
5 generally parallel to that fault feature. So we have a series
6 of faults along the east side of Garnet Valley.
7 It is possible that those are somewhat of an
8 impediment to the eastern flow. We're lacking any data to
9 from which to interpret that. So any data that will be
10 further east, it's just not available.
11 Until we get all the way over near the Muddy
12 Mountains Thrusts, which I think most people recognize as a
13 major geologic continuity for the carbonate aquifer.
14 So for now I guess I would also pose the question
15 is that part of California Wash in the southernmost part is
16 really part of the system.
17 I think for now we have to say yes because of the
18 interpreted geology and presence of substantial carbonate
19 rocks extending through that. I will note these are two --
20 these are zoom-ins on two of the geologic cross sections by
21 page numbers --
22 Q. And you're on slide 9 -- sorry, slide number 9?
23 A. Slide number 9.
24 Q. Okay. Thank you.

1 springs. Not that we shouldn't still acknowledge those
2 concerns, but from a geologic perspective it's rather
3 difficult to conceptualize that flow system.
4 So, regarding flows to and from Garnet Valley,
5 and what we understand based on the data we have, and I will
6 note that there are certain areas where we really don't have
7 any data from which to make interpretations, but as we
8 understand it, and this has been the -- really the conceptual
9 flow system.
10 Q. And you are on slide 10?
11 A. I've advanced to slide 10.
12 Q. Thank you.
13 A. So, since the earlier studies, all the way back
14 to Rush 1968, it's been interpreted that there's a southern
15 component of flow down through Hidden Valley and down into at
16 least the northern portion of Garnet Valley. And then from
17 there out to California Wash. That's been a conceptual flow
18 path that's been -- that has existed for many decades based on
19 the available data.
20 So water levels in Garnet Valley are all lower
21 than water levels in the Muddy River Springs area and are all
22 lower than water levels in Coyote Spring Valley. So this is
23 supported by water level data that we have.
24 I believe I have an overview coming up that will

1 zoom in on water levels in Garnet Valley, but the lowest water
2 level in the basin occurs at the GB-1 well. And I think we'll
3 -- I'll save that section so we can zoom in a little more.
4 But water levels are relatively flat in that 1808
5 to 1814 altitude range, so consistent with -- with that band
6 of water levels that was discussed in just the prior
7 testimony.
8 Q. And, Mr. Smith, going back to slide number 10,
9 did you discuss why you had a question mark going from Las
10 Vegas Valley into Garnet?
11 A. Yeah, thank you very much. So, question mark
12 there, we've interpreted based on our data evaluation back
13 there is potential flow from Las Vegas Valley into Garnet
14 Valley. And I'll look into that, discuss that in more detail.
15 And also we have an arrow going out to the Black
16 Mountains based on that -- that really deserves a big question
17 mark there also because it depends on which water level you're
18 trying to tie that to, certainly the water levels are within a
19 few feet of each other, so...
20 But the highest water level, I just mentioned the
21 lowest water level tying in the northern arm of -- or the
22 northernmost part of Apex is the lowest occurring water level,
23 that's been the case for decades.
24 The highest water level over the decades that

1 And up in the northern tip of the diamond or
2 triangle for Apex that's shaded pink you'll see the upper tip
3 of that and right on the basin boundary we put in Hidden
4 Valley is well GB-1.
5 So using the well log data, we looked at a
6 variety of things including depths to water and depths to top
7 of limestone that's recorded, et cetera, most all the wells
8 are completed into the top of the carbonate aquifer. There
9 are a few that were completed -- reported to be completed only
10 in the alluvium.
11 Q. And you are on slide 12; is that correct?
12 A. Yes, correct, I advanced to slide 12.
13 So, using the specific capacity data, so that's
14 just the production data reported on the well log and the
15 drawdown associated with that production, we can apply some
16 simple equations to estimate aquifer transmissivity.
17 So for all the available logs that had this
18 information, I believe it's 17 logs, we have computed the
19 estimated transmissivity.
20 So one thing that becomes immediately apparent is
21 that the transmissivity of the majority of the wells in Garnet
22 Valley is about two orders of magnitude lower than the
23 transmissivity estimated for up in the MX-5 area and the Arrow
24 Canyon area.

1 we've monitored has occurred in that southernmost --
2 southernmost tip of that arrow is GB-2, that's consistently
3 been the highest elevation water level in Garnet Valley,
4 higher than the water levels of Seradep at Moapa down in
5 Paiutes area included. So why is that the highest water
6 level? That's going to lead us down the -- my path
7 investigation on this.
8 So advancing to slide 11. One thing that we do
9 have, you know, we're always finding sparsity of data in this
10 flow system in general, but we have -- we have about 50 well
11 logs on record for this southern central portion of Garnet
12 Valley along the I-15 corridor, some of the wells on record
13 are done in the logs, about a third of them.
14 So we have at least 30, 35 logs, plus or minus,
15 with geologic information, water level information, some
16 production information.
17 And on these two overviews I'm going to zoom in
18 on the right-hand side, the blue, dark blue points are logs of
19 production wells, red are abandonment logs and lights, light
20 green or light blue shade are logs for wells drilled for
21 monitoring purposes.
22 You'll see -- I mentioned the GB-2 well, you'll
23 see that that as a light green color point in the south
24 central part of Apex.

1 So, the transmissivity in general, we're not
2 privileged to have wells that can produce several thousand
3 gallon a minute with only a couple feet of drawdown, but those
4 type of wells do not exist.
5 For reference to Playa Well that the City owns
6 now was drilled to 2,000 feet. As a static water level it's
7 down around 800 or 850 feet in depth. It's been tested at
8 600 gallons a minute. And the Kapex Well to the south there
9 has a production capacity of about 200 gallons a minute. And
10 it's completed down to 1145 feet. That Kapex Well was drilled
11 in 1990. It was called the Krut (ph.) Well for a long time.
12 Kapex -- what the City calls the Playa Well has
13 also -- has also been called the Solar Well, it was drilled
14 recently in 2006 -- '16, excuse me, 2016.
15 So you will notice all of these points are scaled
16 based on the transmissivity, the calculate transmissivity
17 value. So in the southernmost part you will notice a fairly
18 large blue point with a value of exceeding 50,000 feet squared
19 per day.
20 So that is about one-third or, you know, it's
21 starting to approach the types of transmissivities that are --
22 that have been determined up north, it's not quite as high,
23 but it is getting high.
24 Now, that is the well owned by Georgia Pacific.

1 On the well log it's reported that it was pumped at
2 140 gallons a minute with ten inches of drawdown. So, we have
3 not done anything to confirm that that ten inches is not ten
4 feet or we're trusting that that information on the well log
5 is accurate. If it is, then that is a higher transmissivity
6 well. And there's one well up along the I-15 corridor in the
7 northern area there that GBR-1 also had a notably higher
8 transmissivity.

9 And those perhaps not coincidentally are located
10 along fault and structure that projects along the east side of
11 Garnet Valley.

12 Q. So, Mr. Smith, is it your opinion that the
13 transmissivity in Garnet Valley is modest or moderate besides
14 these two outliers?

15 A. Yes. The average transmissivity in Garnet Valley
16 is I would just say moderate. It's not extremely high.

17 Q. And you're moving to slide 13 now?

18 A. Yes. Thank you. So just a little more on
19 potentiometric water levels, I think I've touched on this
20 already. These are water level information, some -- there's a
21 number of wells being monitored in Garnet Valley, which is a
22 good thing, but a substantial number of them are actually
23 pumped wells.

24 So we have a mix of the static water levels from

1 there with a dashed line, one is labeled Diamond Construction,
2 the other is labeled Diamond Apex.

3 And I was hoping to gain some insight, but
4 looking at these two wells they're both drilled to
5 approximately 900 feet in depth. And they have water rights
6 so we can reasonably accurately determine where their location
7 is. This was all an office exercise. So I think for me to
8 understand water level elevations we have to understand the
9 land surface elevation and then use the log data for depth of
10 water, we can draw elevation for the water tables. So this
11 was strictly an office exercise.

12 But unfortunately what we got out of those two
13 wells was about a 60-foot difference of predicted water
14 elevations, one of them being higher than Garnet Valley and
15 one of them being lower. So generally answered the questions
16 is could groundwater be coming in from Las Vegas Valley and
17 the Garnet Valley?

18 So we then expanded our search further out into
19 Las Vegas Valley. And I should note that this geographic
20 region is still north of Las Vegas sheer zone.

21 But there's quite a few well logs, and like
22 domestic well logs, other logs, we tried to ferret through and
23 find well logs that are associated with water right points of
24 diversion. So we know it would be lance our elevation more

1 monitoring wells and then also wells that have both static and
2 pumping water levels. And that's fine and it's good to be
3 reflecting both types of data in the basin.

4 You'll see circled in black dashed lines on the
5 right-hand pane is the two wells that I've already discussed,
6 the GB-1 well to the north with water level elevation and
7 average water level elevation year 2015 of 1,808 feet as
8 contrasted to the water level at GB-2 at 1,114 feet. So about
9 six feet of water level difference between those two wells.
10 And again, GB-2 being the highest water level that's observed.

11 The reason I've presented 2015 ties into the test
12 boundary modeling that we did which will be coming up shortly
13 in my presentation.

14 Advancing to slide 14, so the fact that GB-1 --
15 GB-2, excuse me, has the highest observed water level and it's
16 down in the southern boundary of Garnet Valley kind led us to
17 want to inquire further about why this could be.

18 We began with looking at water levels just
19 outside the basin boundary in Las Vegas Valley. So in the
20 overview on slide 14 you'll see in the upper right-hand corner
21 there is a black line where the basin is labeled, that's the
22 Garnet Valley/Las Vegas Valley boundary, hydrographic
23 boundary.

24 And then you'll see two wells that I've circled

1 accurately. And deeper -- deeper well logs.

2 At the end of the day we compiled about 20 well
3 logs with estimates of water level elevation from the reported
4 depths to water. And the average of all of those values
5 places us a little lower in Las Vegas Valley than Garnet
6 Valley or GB-2. The median places us a little above, about
7 ten feet above.

8 So, my preliminary interpretation is I relied
9 more upon the median because we have a few outliers in this
10 dataset and the median probably more accurately represents
11 potential water level.

12 So, a very preliminary assessment is that there
13 appears to be a gradient between the two basins from Las Vegas
14 Valley and the Garnet Valley. This -- this really can only be
15 answered with a more accurate on the ground data. Ideally
16 water level measurements from monitoring wells, not pumped
17 wells. And completed into the carbonate aquifer.

18 So this is an area that I -- for now I can't
19 advance this any further just using office techniques, that is
20 something that we need to understand better, especially for
21 composing to try some AR just north of this boundary.

22 We need to understand artificial recharge water,
23 where it's going to go, is it going to stay in Garnet Valley
24 like we would hope or is it going to leak out in the Las Vegas

1 Valley? What are the gradients or how do we affect that
2 interaction that may exist in that inflow by doing -- by
3 proposed actions.

4 Now, advancing to my next slide, 15, I'm going to
5 touch briefly on a test model that we did. We put together
6 specifically to -- for me to try to gain a better
7 understanding and hopefully for the State Engineer staff to
8 gain just a better understanding on the magnitude of potential
9 fluxes through Garnet Valley.

10 So now that we have an idea on the
11 transmissivity, and the transmissivity is relatively moderate,
12 we have water level elevation data, we can start to assess
13 groundwater inflow and outflow from Garnet Valley.

14 So, this is really -- really I've turned this and
15 I want to be careful, this is a test modeling exercise, this
16 is not anything more than really just a modeling exercise is
17 what this was.

18 So we assigned eight different boundaries along
19 the periphery of Garnet Valley where we hypothesize there
20 there potentially could be inflows and outflows of the water.
21 And they're all assigned general head boundaries.

22 We then anchor that general head to water level
23 elevations at matching points outside the basin. And for
24 Garnet -- for the potential flow that we just spoke of, Las

1 that was collected. And we got reasonably good fit after
2 adjustments to the model boundaries and some adjustment to
3 hydraulic parameters. We got a pretty good fit to the water
4 level data that's available.

5 And the results -- let's see the results slide.
6 Just staying on slide 15 for a minute, the results of this, we
7 used PEST to calibrate the boundaries. So I wanted to find
8 the optimal with the boundary conductances that regulate flow
9 into or out of the model. We used PEST to calibrate them.
10 And we also attempt sensitivity of each of those boundaries.

11 And there's a summary table in our report that
12 goes through each of those boundaries, what are our assessment
13 on the sensitivity of that boundary is.

14 So a boundary that has low sensitivity, really
15 could be open to a number of different inflow, outflow
16 scenarios, conversely a models boundary with high
17 sensitivities probably does not have as much latitude to
18 adjust deviate beyond what we have established as the
19 calibrated inflow or outflow.

20 So -- oh, I'm sorry, this is maybe a little out
21 of sequence, I just -- no, no, this is fine. I advanced to
22 slide 16. To take up messages as our boundary's on the east
23 side of the model going into the southern part of California
24 Wash here have a higher sensitivity and suggest -- actually

1 Vegas Valley into Garnet Valley, I -- I used the median water
2 level. So I have a higher water level represented outside the
3 boundary there.

4 And then I'll go through the effort of wanting to
5 calibrate the models. So I want to have a transmissivity,
6 this is a two-dimensional model by the way, it's just a single
7 layer that represents the upper thousand saturated feet of the
8 carbonate aquifer, that's all that it represents in a
9 two-dimensional manner.

10 So we have our water level dataset, I used 2015
11 because the pumping for the decade prior to 2015 is fairly
12 constant in Garnet Valley at about 1500-acre-feet annually.

13 And years 2016 and 2017 water pumping increased
14 for construction activities, I'll touch on that a bit briefly,
15 but pumping was up around 2,000-acre-feet for those two years.
16 So I didn't want to pick a snapshot in time that may have more
17 dynamic influences than necessary. So 2015 was my -- my index
18 year for this test.

19 In the model you'll see the reporting on the
20 model in the -- in the document, I'm not going to dwell on
21 that, but it did calibrate reasonably well to the water level
22 date that we have.

23 It calibrated to both static water levels and
24 average pumping water levels, if that was the type of data

1 the model wanted to take no flow out of that boundary.

2 So minimal flow out to the east across that
3 boundary seems to result in the best fit to existing data.
4 Inflow from Las Vegas Valley around 700-acre-feet was derived
5 at a good model solution, a good match to the data.

6 Inflow into northern Garnet Valley and across the
7 Moapa Paiute area and then out to California Wash was
8 simulated, and that's the northern part of -- northwestern
9 part of California Wash for the outflow.

10 That model boundary has lower sensitivity. We
11 had modest amounts of flow coming in at about 500-acre-feet or
12 450-acre-feet. And with an outflow, also a modest outflow of
13 about 100-acre-feet. So -- but as noted a lower sensitivity
14 threshold on that boundary. So the fluxes could be higher or
15 lower, certainly that is the case.

16 One unexpected outcome is the inflow from
17 southern Hidden Valley into Garnet Valley into the Apex area,
18 I was thinking that that would be a source of inflow to the
19 model, but the model wanted to suggest that it didn't need or
20 necessarily want inflow coming in from Hidden Valley given
21 that GB-1 is the most opportune water right in the system.

22 So again, this was just an exercise, this was a
23 test and I don't want to convey this as being anything at all
24 definitive, but it was trying to help me assess through as an

1 assess what are the probable magnitudes of flow in that
2 uppermost carbonate aquifer that the wells are currently
3 developed in the uppermost thousand feet. And that was
4 basically the outcome.

5 Shifting to slide 17, part of the input we
6 mentioned was pumping on the right-hand pane as shown in the
7 distribution of 2015 pumping.

8 But on the left-hand bar -- bar hydrograph, bar
9 plot, you'll see the data from the State Engineer's pumping
10 inventories, which have been published for the time frame of
11 2001 through 2017, I did not find that 2018 has been published
12 yet.

13 And there are some notes, you know, this is -- by
14 the way, Exhibit 4 was an addendum to the original plot
15 presented because we had not noticed that in the year 2016
16 there was notes that added in pumping from Las -- Southern
17 Nevada Water Authority's permits in 2002 through 2005.

18 So I assume that my -- the interpretation on that
19 2006 pumping inventory was that that needed to be added back
20 in. I might ask the State Engineer's Office could possibly
21 amend those earlier pumping inventories to reflect that,
22 because I wasn't a hundred percent sure if those should be
23 added in, but it appeared to be that that was what the note
24 was referencing in 2006.

1 transferred to power facilities in Garnet Valley, primarily
2 power facilities. I think the -- well, there's several
3 different power facilities that are using this water, I
4 believe that Chuck Lindsey facility is using the most of those
5 water rights. But all the green is the newer leased at the
6 newer lease granted to SNWA in Garnet Valley.

7 So, water level pumping, pumped amounts in 2016,
8 2017 approached 2,000 plus or minus acre-feet. Prior to that,
9 for about ten years was a plus or minus around 15,000.

10 Prior to 2006, which we had additional power
11 generate facilities come online in that time frame. The
12 pumping was also plus or minus 1,000-acre-feet. And then the
13 older historical pumping, we'll take a look at the 2001
14 pumping inventory data.

15 I'm going to skip ahead to slide 19. And this is
16 just the state's 2001 pumping inventory, it's slide 19 and 20.
17 And you'll see the total is 911-acre-feet of permitted rights
18 being placed to use.

19 And then I have a number in the bottom,
20 805-acre-feet, that would be taking out chemical line and
21 western gypsum pumping, which I believe are some wells
22 completed on the alluvium, at least that's what my
23 understanding is.

24 So historically those older rights were being

1 So, the colors for the bars on this, the yellow
2 and the blue is -- yellow is industrial, blue is commercial.
3 And that's a history that predates the period we have for a
4 history of water use in Garnet Valley that predates the
5 pumping inventory start of 2001. It's -- as I'll discuss
6 coming up here, it's that industry has been present in Garnet
7 Valley really began in earnest in the 1980s, came into
8 presence in the early 1990s and persisted on -- has persisted
9 on through actually, you can tell current and you'll notice
10 that those water uses are very similar year to year.

11 In 2016, 2017, at the base of the bar plot you'll
12 see some orange bars, those are construction water supply for
13 the I-15 interchange construction and the widening of Highway
14 93 in the fairly huge super pad construction site, which is a
15 700-acre super pad.

16 All those construction activities are consuming
17 additional water. That was -- that water was done under
18 temporary transfers of SNWA's rights that were granted in
19 Garnet Valley in 2001.

20 The green bars on the top that we have stacked on
21 top of what I would say is the older historic usage in the
22 valley, that is the use of water rights that were granted to
23 SNWA in 2001 in Garnet Valley. 2,280-acre-feet.

24 And there's a history of those water rights being

1 placed to use at somewhere between 800 -- well, 900-acre-feet,
2 but from the carbonate aquifer source probably about
3 800-acre-feet.

4 And I'm going to skip back now to slide 18. This
5 is just a summary table of records on file from your office.
6 This was compiled from EWR's electronic database online. And
7 this shows the history of some of the permits issued to
8 facilities in Garnet Valley.

9 You'll see going all the way back to the permit
10 granted in 1959 the completion of work and beneficial use in
11 1961. That's for a small amount of water right,
12 three-acre-feet.

13 But you can gauge from this table the history of
14 water development and water use and the beginning of water use
15 and -- in Garnet Valley. And it spans back to the late '80s
16 -- well, some water -- additional water use came into play in
17 the 1960s. But then -- in the '70s. But then probably more
18 of the modern facilities still -- and so the water rights
19 being used today are for industrial water uses are -- stem
20 back to the late '80s, early '90s and most of them were being
21 placed to beneficial use by the mid-'90s.

22 Q. And, Mr. Smith, these are all from water rights
23 in Garnet Valley; is that correct?

24 A. Yes, that's correct. That's correct. Again,

1 from records of the State Engineer's Office.
2 So this is going to lead me to one particular
3 criticism that I have to offer today. It's to my colleagues
4 at SNWA, it's regarding the multiple linear regression
5 analysis that was submitted as a rebuttal analysis. And what
6 you'll see is that the input pumping for Garnet Valley is
7 quite different than the records we have for water rights and
8 water use in Garnet Valley.

9 The pumping input was -- the input values were
10 indicated to be from the NDWR pumping inventories. But
11 pumping inventories weren't published until 2001. So this
12 early history of pumping portrayed as being until 1996.

13 And then ramping up to approaching the 2001 NDWR
14 level, they're not quite there, but ramping up over that late
15 '90s time frame. That is not the history of pumping in Garnet
16 Valley that is known based on water rights and proof of
17 beneficial use filings in the basin. That is inaccurate.

18 So, unfortunately -- and just some other
19 inconsistencies, that is a big issue, that early history and
20 how that's been input into their multiple linear regression
21 model is a big issue and I'm going to discuss that in a
22 minute.

23 Also of note is all the values and input in are
24 not consistent within NDWR pumping inventories. And what I

1 you have an explanatory variable that has been incorrectly
2 input and it has an association that the process is going to
3 want to match with that corresponding water level decline.

4 So, what that leads to, and I think this has been
5 borne out by observations by others, is all a sudden there's a
6 high association of Garnet Valley pumping influence
7 coordinated with EH-4 water level. And what does that do to
8 the other variables? Unfortunately, it doesn't just affect
9 Garnet Valley relationship defined, it affects all the
10 relationships defined in that analysis.

11 Because if you shifted and placed a lot of the
12 explanatory -- a lot of the explanation for that observed
13 water level turned to one variable. Well, that affects the
14 assignment of the weighting for explanatory variable to the
15 other variables. And these are all inter-tied in the
16 analysis.

17 So at the end of the day the erroneous input of
18 historical Garnet Valley pumping basically invalidates this
19 method. Not the method, it invalidates the results of this
20 analysis for all the relationships defined.

21 Q. And that was your summary on slide 23; correct?

22 A. That's correct.

23 Q. Okay. And you're moving to slide 24?

24 A. Yes. Slide 24. Now, a couple other notes. Now,

1 believe has happened is I looked at the datasets that are
2 available from -- from reporting 1169 in agreements that they
3 have from the facilities, but I don't believe they've
4 accounted for everybody.

5 So you have two sets of data out there, so
6 scientists beware. There's two sets of informational data out
7 there, there's the NDWR pumping inventory data and then
8 there's datasets that are available on NDWR's website
9 reporting under 1169 that have different values. And I
10 believe the 1169 dataset is incomplete.

11 Q. And you're referring to slide 22 now?

12 A. Yes, I'm sorry; right. Slide -- is that slide
13 22? Thank you.

14 And of course the bottom value, 2018, we don't
15 have published inventory data yet, so that leads me to believe
16 it's all from the Order 1169 agreements from reporting our
17 pumping totals.

18 Where that leads us. Coincidentally,
19 unfortunately, coincidentally, with that input interpretation
20 of zero pumping in Garnet Valley ramping up in the late '90s
21 up to a significant amount, which is inaccurate, also
22 corresponds with the observed beginning of declines of water
23 levels at EH-4.

24 So what that does in this type of analysis, now

1 perhaps not to the level of invalidating a particular
2 analysis, but the inconsistency that's further propagated
3 through the analysis for the pumping inputs not being
4 consistent with NDWR inventory data, it is also an issue, but
5 another issue that I take exception to in particular is not
6 having a climate variable in that analysis.

7 I think it was entirely inappropriate to suggest
8 that that was the error or to presume that the error accounts
9 for an explanatory variable that you believe has some
10 relationship to the analysis.

11 And also you'll find -- I've just made some
12 citations from the reference that SNWA cited. And their
13 prejudgment of the outcome of the climate variable was also
14 not in keeping with the scientific methods for this type of
15 analysis.

16 If you have an explanatory variable that you
17 think or you suspect could be explained some of the
18 relationship, then you put it in and you -- you run through
19 the analysis and you look at the statistical parameters that
20 define whether it is an explanatory variable or has
21 significance or not, and then you leave it in there or you
22 take it out accordingly. That procedure was not reported to
23 have been followed in that analysis.

24 Okay. So I'll move on to maybe somewhat

1 constructive input to the State Engineer and staff.
2 One thing I would like to point out. Yes, we see
3 similar water level trends throughout Garnet Valley as we do
4 elsewhere in the Lower White River Flow System basins. We
5 have this decline in trend about 23 feet per year.
6 It is a concern obviously. I will note that
7 prior to the late '90s water levels at EH-4 were stable. And
8 that is the time frame that coincides with the beginning of
9 development in pumping in Garnet Valley. So there was
10 significant pumping throughout the '90s in Garnet Valley
11 through the time period where a lot of those are stable at
12 EH-4. I think we need to note that.
13 From my perspective I see that water levels are
14 stabilizing again at EH-4. There are different opinions on
15 that whether it could be declining or stabilizing, but from my
16 perspective I see that as stabilizing. I think there is
17 possibly a systematic explanation for that.
18 I'll elaborate a little more on a following
19 slide.
20 Q. And you're now moving to slide 26?
21 A. Yeah, slide 26, the base plot is borrowed from
22 Tim Mayer's presentation and his report. And I -- I still
23 believe that we have both a mixture of pumping and climbing in
24 our hydrologic records and our water level trends. I think at

1 And while I do believe it's a mix, I think we're
2 going to be debating this for a long time as scientists. And
3 I'm not necessarily sure that we need to absolutely answer
4 that for broader water management in Jackson Valley. The fact
5 remains is that water levels are declining at EH-4. And
6 that's associated with the high altitude spring discharge.
7 So regardless of how the weighting of climate
8 versus pumping dominates in -- in the record doesn't override
9 the fact that water levels are declining and we need to manage
10 accordingly. So yes, there's scientific value in trying to
11 continue to parse through this.
12 But at the end of the day maybe for some broader
13 water management directives we can move beyond this and just
14 focus on -- on the fact that what the water levels are and
15 what is within our abilities to do to help address that. So,
16 okay. One other issue here --
17 Q. Mr. Smith, we're moving to slide 27; correct?
18 A. Thank you. Advancing to slide 27. I've heard
19 quite a few professionals over the past week here trying to
20 draw some conclusion out of the seasonal water level trends.
21 And what they've inferred to be pumping signals, I believe
22 Dr. Waddell also mentioned that ET signals and pumping
23 signals, seasonal signals.
24 One thing that we definitely need to take note

1 this point we can't argue that there is a wet climate signal
2 when we have recharge.
3 But my position is pretty fundamentally that
4 there's an equal and offsetting dry response to the wet
5 response. If you don't have an equal and offsetting dry
6 response then you're not maintaining dynamic equilibrium in
7 any system.
8 So to suggest that there's only a wet response
9 doesn't set well with me. I think it's much easier to see the
10 wet responses because they're so dramatic in the record.
11 Because dry responses are more subtle and spread over multiple
12 years.
13 But one thing that I believe, and this was
14 climate -- Climate Drought Severity Index for climate zone
15 three, which is to the north, the northern part of the White
16 River Flow System that I see in this record that you have a
17 dominance of negative values. So moving into the dryer
18 regimes for the last two decades as contrasted to the decade
19 prior.
20 So I haven't -- I haven't expended a lot of time
21 trying to parse through this. And I have done work on this in
22 the past. You know, I've published along with authors at SNWA
23 examinations looking at climate variables and indices and
24 potential mix of pumping and climate signals.

1 of, all of us here, all of us scientists and engineers is that
2 there is a seasonal barometric pressure cycle and it's
3 significant, it's in Nevada.
4 So SNWA has been directing barometric pressure
5 data to a number of different margin points. And the -- and
6 the plot on the right is I've just picked one -- one that --
7 there wasn't any reason why I picked CSVM-1. I just picked
8 one where it was being recorded. And you can see that
9 fluctuation is over a foot, foot and a half of barometric
10 pressure change seasonally that reoccurs every year. Okay.
11 It's coincident with rising and falling water levels. So each
12 well out in the system has a unique barometric efficiency.
13 So what I mean by barometric efficiency, some of
14 the wells mentioned would be the ones that have the lower
15 storage coefficients more confined will respond greater to
16 barometric pressure change.
17 And how we define the barometric efficiency is by
18 looking at the daily or hourly barometric pressure --
19 pressures with water level responses. So you pick a window of
20 time that there's been a barometric change and you can go and
21 determine the barometric efficiency of each well in the
22 system. I've done this for a handful of wells. I believe
23 some are presented in the appendices for the Order 1169
24 testing.

1 But the barometric efficiencies range from near
2 zero, some wells do not show a barometric response, they tend
3 to be the ones that have a higher storage coefficient. But
4 some have sufficient barometric efficiencies. Some as high as
5 60 percent.
6 So 60 percent of the barometric -- seasonal
7 barometric trends is going to be reflected in a seasonal
8 variance in water levels.
9 So, before you can go anywhere with trying to
10 make a case that you do or do not see a pumping signal, first
11 we have to factor out what we know. And we've done this -- by
12 the way, this is commonly done when we're looking at trends in
13 water levels, it's been done for published water level studies
14 in Death Valley Regional Flow System. This is -- there's
15 public domain software available to filter out barometric and
16 earth tide responses.
17 And in an aquifer system where we're dealing with
18 very subtle, very small fluctuations in water levels from
19 wells that do have a barometric efficiency and do respond to
20 barometric pressure changes and earth-type changes, you need
21 to filter that out first.
22 You filter it out and then you're left with okay,
23 what -- what is the additional response in the system from
24 pumping, from ET, from recharge, whatever it may be.

1 I'll have a little more to say on that.
2 And again, my opinion is that we have been in a
3 dryer climate regime. There's been some attempts to contrast
4 with other geographic areas, but, you know, as the Death
5 Valley Regional Flow System is dominated by a much more arid
6 and southern weighted geographic area down the White River
7 Flow System far north in latitude.
8 As we understand the flow system to the desert
9 again is just a southern arid basin. So you have to be
10 careful when you're trying to contrast one basin to the next
11 because they all have their unique characteristics and their
12 unique geographic extent.
13 Q. And you were just reviewing your professional
14 opinions on slide 28; correct?
15 A. That's correct.
16 Q. Okay. And you're moving to slide 29?
17 A. Yeah. Just a brief observation here. Sometimes
18 the simplest explanations are the best. I think what SNWA's
19 work in both in their prior analysis and -- and in the current
20 analysis being brought forward.
21 It's pretty clearly demonstrated that pumping
22 right in proximity to the Muddy River Springs, so pumping from
23 the alluvium and the carbonate aquifer in the immediate
24 proximity of the springs has a pretty clear capture of Muddy

1 But I've seen quite a few people trying to make
2 arguments based off this absence of presence of a "pumping
3 signal" when they haven't first factored out the barometric
4 efficiency of the well and barometric response.
5 So anybody that has offered that opinion and has
6 not taken that step it's not a terribly difficult thing to
7 accomplish, needs to do so and then build their case from
8 there. Is there still a season of cycle or not.
9 In some cases you'll see that you will resolve
10 out all of that seasonal variation simply by filtering for
11 barometric pressure change.
12 So, that is just a note for the State Engineer
13 and for hopefully everybody that's working in the system.
14 So again, I think I've made these notes, but I'll
15 just briefly go through my bullet ones here. Pre-1998 water
16 levels at EH-4 were stable and there was a history of pumping
17 in Garnet Valley.
18 I believe this suggests that there is a
19 manageable amount of pumping in Garnet Valley that can occur
20 without detrimentally impacting the EH-4 water levels and
21 therefore, high altitude spring discharges.
22 EH-4 water levels appear to be leveling off in my
23 opinion. I believe this may be result of starting to
24 collaborate to pumping near the Muddy River Springs area. And

1 River Spring flows -- excuse me, Muddy River flows.
2 And I think -- you know, there's some attempt to
3 say that well, it's just a matter of how you stack the bars,
4 but let's not lose sight of just practical hydrology here.
5 You know, you're pumping some alluvial wells that
6 are within a hundred -- a few hundred feet of the river in
7 some cases. You're pumping from carbonate wells that are
8 likewise in pretty close proximity to the springs and the
9 headwaters of the river. Just fundamental hydrology here.
10 Those near a pumping center are going to have a more immediate
11 impact on the river system.
12 So I would suggest that the capture that we've
13 seen from the Muddy River to date has been overwhelmingly
14 dominated by pumping that has occurred proximal to the Muddy
15 River itself. And I think that's clearly shown in the data
16 and their analysis.
17 So where does that leave the regional pumping
18 that has occurred in those lighter blue bars stacked in Garnet
19 Valley. I don't think we felt much, if any, effect to
20 reduction of the Muddy River flows from those distant pumping
21 centers. Not to say that there isn't some small fraction and
22 over long periods of time that's going to increase. That
23 would be a traditional captured theory for wells that are say
24 25 miles away in Garnet Valley.

1 But let's not lose sight of just fundamental
2 hydrology in the proximity of pumping to the river it explains
3 a lot of a capture that's been presented.
4 Q. And now you're on slide 30?
5 A. Yes, slide 30. I think I've touched on that,
6 again, duration, location magnitude all factors into capture
7 of river flows. I will note that some of the alluvial pumping
8 has been in place, you know, water rights going back to the
9 1940s. So this has been seven decades worth of pumping that's
10 probably affected the flows of the river. It is some senior
11 most groundwater pumping rights that we're dealing with.
12 I believe that, you know, there's been a really
13 strong emphasis from SNWA about capture river flows. And
14 certainly it needs to be considered, we're grappling with this
15 issue up to the north in the Humboldt River system and
16 elsewhere.
17 There are appropriate approaches to this that the
18 State Engineer is implementing in other areas. We have a
19 screen flow capture issue here, but it's not just related to
20 the Lower White River Flow System.
21 There are wells pumping along the entire reach of
22 the Muddy River all the way down to its headwaters in the
23 Moapa area. And there are groundwater rights issued
24 throughout that area, I haven't examined them in detail, but

1 that's the driver for water granting decisions. Stream flow
2 capture does need to be addressed and we need to start moving
3 down that path. But again, it encompasses a broader
4 geographic area and it's going to have a different set of
5 management outcomes.
6 So I just want to emphasize that. So I mentioned
7 up front and thank you for your attention, I'm just about
8 through here.
9 But according to the City of Las Vegas, they have
10 what I think is a really great water supply strategy. You
11 know, it's injunctive use bringing in multiple sources, it's
12 redundancy, has the ability to adapt and manage. Having the
13 Colorado River source, groundwater AR, put all this into
14 action, really do something sustainable in Garnet Valley.
15 But, it's going to happen incrementally in steps,
16 that's just the way it has to happen. And for now, the City
17 of North Las Vegas wants to secure senior water rights on
18 their municipal water supply lists.
19 They need to depend on those at least for the
20 bridge period while development occurs and while the pipeline
21 is being completed up into the valley, maybe that's ten years,
22 maybe it's 15, I'm not sure, it depends on the -- you know,
23 how things get built out.
24 But there is I think a need to -- and there's a

1 this is not solely Lower White River Flow System basin issue.
2 This is an issue that needs to be carefully
3 worked through, you know, and the future for rivers in Nevada
4 and stream flow capture, we do have to really quantify, have a
5 mechanism to quantify how much capture is occurring today, how
6 much capture is occurring tomorrow, where are we headed with
7 this, how can we mitigate this, does this mean that impactors
8 have to buy and relinquish dedicated decreed water rights
9 possibly, is there financial compensations, does it mean we
10 need some curtailments in pumping? All of the above. You're
11 going to have approach this as a regional issue just like you
12 are on the Humboldt River flow system.
13 So, while there's been a lot of emphasis placed
14 by SNWA on this issue, I view it as being two issues here and
15 for stream flow capture, but it's a much broader area. It's
16 the Lower Meadow Valley Wash. It's the areas along the Moapa
17 and Gilbert's Park. And, you know, we've got to consider the
18 whole system and treat this appropriately.
19 Again, separate issue in my mind, right now what
20 we're trying to understand is should we combine the Lower
21 White River Flow System, if so, what might be some safe
22 yields.
23 The safe yield is really associated with water
24 levels at Pederson and EH-4 of the high altitude springs,

1 desire to transfer through lease or acquisition senior water
2 rights and get down to those rights.
3 Senior is important because the future and how
4 we're going to manage these basins is unclear. I mean, could
5 there be curtailments in water rights based on priorities, I'm
6 not asking you how to answer that question today.
7 But from a municipal water conveyor perspective
8 that gives them a little extra assurance that they're offering
9 them senior groundwater rights for the water supply rather
10 than certain transfers of junior most water rights, which is
11 kind of presently how they're situated.
12 So the merits of transferring I think really
13 needs to be assessed, we can't be prejudging with any of these
14 possibilities to transfer water rights in or out of -- and I
15 think they need to be considered on an individual basis by the
16 State Engineer and how the administrative policies are set up
17 for this Lower White River Flow System. You need -- you need
18 to keep that flexibility that we have in any other basin in
19 Nevada to make -- to have the opportunity to apply to transfer
20 water rights around and then judge the merits as they come
21 forth.
22 You know, I'm going to flip this around for just
23 a minute. What about transferring carbonate pumping into the
24 alluvial aquifer? I think you want to keep that option open.

1 Because, you know, if we have issues with water
2 levels at the springs and sustained high altitude springs,
3 boy, you know, the future may be we have to shift pumping out
4 of the carbonate aquifer, especially the local pumping
5 occurring near the springs and shift it into the alluvium.
6 At that point you accomplished a situation where
7 we relieve some of the burden on the carbonate aquifer local
8 to the springs. Now, we have the flip side issue, we have to
9 address the decreed water rights in the Muddy River, but that
10 can be addressed. You know, entities could buy the leased
11 water rights, whatever -- there's paths to look forward on
12 that.
13 From a modern maverick perspective, again, I
14 think you need to keep these options open to go either way on
15 these. I think you're prejudging potential beneficial
16 transfers of water rights at the end of the day.
17 So let's -- I would encourage you to -- to
18 administer this basin like you would any other, allow
19 transfers based on their individual merits as they're
20 considered and brought before you.
21 Q. And you were discussing your information on slide
22 31; was that correct?
23 A. Yes. Thank you.
24 Q. And you're now moving to slide 32?

1 again, how much that bears on -- on water, broader water
2 administration issues is that's not as necessary to define as
3 one would think.
4 Perennial yield, I would encourage the State to
5 shift to a safety overload approach. In fact, maybe, you
6 know, shift to a safety overload approach.
7 For Garnet Valley, that means let's do the
8 testing you want to do in Garnet Valley, let's pump additional
9 but also let's flip this around, let's do injection testing in
10 Garnet Valley.
11 Let's view these different types of stresses. We
12 can figure out, okay, what is -- what is causing effects to
13 water levels at EH-4, that's -- water level effects elsewhere
14 are just not relevant, EH-4, the high altitude springs.
15 Now, where can we find this threshold is that
16 really an amount of development 900-acre-feet, maybe that was
17 the sustainable amount, maybe that was the amount that was
18 captured some of the southern flow through the system.
19 I mean, capturing some of the Las Vegas Valley
20 inflow, maybe that was a balance that is really having minimal
21 effects propagating north to the spring area, maybe that was
22 it. Maybe it can be higher, maybe it has to be lower.
23 Certainly very stressing scenarios, complimented with
24 additional monitoring. I meant to touch on that, but we do

1 A. Okay. Conclusions. Again, it's our opinion and
2 again our focus has really been on the southern end of the
3 flow system that the boundaries as proposed for the Lower
4 White River Flow System are sufficient, are adequate.
5 We just discussed transfers from the alluvium
6 carbonate should not be generically limited, should be
7 considered on the merits on a case-by-case basis. And I think
8 the City of North Las Vegas is going to want to bring forward
9 an application for consideration at some point in the future,
10 it's part of their water supply strategy. And we think it has
11 merit. So we would like to have the opportunity to bring that
12 before the State Engineer.
13 Capture of the Muddy River flows needs to be
14 managed as a separate issue. Yeah, all the basins that are
15 involved, you know, there's going to be interactions of
16 management strategies, et cetera, but this is a broader issue
17 than just the Lower White River Flow System, this includes the
18 lower basins also all the way down to Lake Mead. There are
19 existing groundwater permits issued along the river corridor
20 and in these other basins.
21 So there's a need to be managed and you probably
22 need to initiate that process, but that's a separate issue.
23 Again, I've given you my opinion that I think
24 we're still dealing with the effects of the climate. But

1 need some additional monitoring in place.
2 We really have no good monitoring levels in
3 Hidden Valley that SHV-1 down in the north I believe is
4 completely alluvium. We need some additional monitoring.
5 There's Las Vegas Valley.
6 Perhaps an additional monitoring well on the east
7 of the Dry Lake Thrust, maybe on that western edge of Southern
8 California Wash to then further assess and address the
9 National Park Service questions that are all in this testing
10 that's needed also needs to be augmented -- needs to have
11 augmented monitoring.
12 Let's move forward with this and let's figure out
13 what is the safe amount to pump from Garnet Valley. It can be
14 done. And the City's water management strategy will
15 facilitate that happening. Thank you.
16 Q. And, Mr. Smith, it's your opinion -- or I guess
17 you didn't have an opinion as to the total quantity of
18 groundwater, your opinion was that we should just simply look
19 at it from a safe yield concept; correct?
20 A. That is correct. I have not offered an opinion
21 on the potential safe yield from the entire system, I've
22 really just focused on the south end.
23 MS. URE: Okay. Thank you. We would like to
24 reserve the remainder of our time for redirect. And I also

1 don't know if I was clear that Mr. Smith was being offered as
2 an expert witness and he was not objected to.

3 HEARING OFFICER FAIRBANK: Thank you. And Mr.
4 Smith has previously been qualified before our office. We
5 appreciate that.

6 Let's go ahead and take a quick ten-minute break
7 and then we'll go ahead and proceed with cross-examination.

8 (Recess.)

9 HEARING OFFICER FAIRBANK: Okay. Let's go. Take
10 two. All right. We're back on the record, and we will go
11 ahead and start with cross-examination.

12 And first is Coyote Spring Investments, and our
13 time allotment is seven minutes per participant. And as we've
14 been doing, if there's additional time, then we'll allow --
15 reopen that time up for continuation of questions if you
16 weren't able to get everything done in the first go-around.

17 CROSS-EXAMINATION

18 BY MR. HERREMA:

19 Q. Thank you. Brad Herrema on behalf of CSI.

20 Just a first question, and I don't know if this
21 is properly addressed to you, Mr. Smith, or to your counsel,
22 Ms. Ure.

23 But would it be possible for us to get a PDF
24 copy, an electronic copy of your presentation? The color from

1 coming in from the Las Vegas Valley.

2 There is some amount of outflow, we believe, from
3 the southern end. So the degree that we were pumping and
4 predominantly capturing those flows, we do not need a
5 compartmentalization theory to explain that.

6 Q. Okay. When you reviewed the transmissivity in
7 the Garnet Valley, did you find higher values of
8 transmissivity near fault zones and lower values farther away
9 from fault zones?

10 A. Not in general. However, you will note that on
11 the transmissivity slide, the two highest values were along
12 that projection of the faulting that runs along the east side
13 of Garnet Valley. You also note that there's some low
14 transmissivities in there too.

15 It didn't point out, but, you know, there's a lot
16 of faulting all through that portion of Garnet Valley, a lot
17 of it kind of north-south trending.

18 But those two examples I noted are potentially
19 along the fault zone that runs along the eastern side, but
20 other than that, I could not make that inference.

21 Q. In regard to Slide 10, the model results in your
22 written report discuss inflow to your model from northern
23 Hidden Valley along the Arrow Canyon Range.

24 Do these results suggest a preferred flow path

1 your slides doesn't show up on the copy. So if we could -- if
2 that would be possible, we would appreciate that.

3 And I'm not sure if the State Engineer is
4 thinking of putting a folder together with all these
5 presentations, but that would be a request that we have as
6 well.

7 HEARING OFFICER FAIRBANK: Thank you.

8 CROSS-EXAMINATION

9 BY MR. HERREMA:

10 Q. Mr. Smith, on Slide 25, during your testimony,
11 you suggested that there was no relationship between pumping
12 in Garnet Valley and groundwater levels at EH-4 during the
13 late 80's and early 90's.

14 Does that sound accurate?

15 ANSWERS BY MR. SMITH:

16 A. Yes. I will say that if there was an effect,
17 it's really not recognizable in that flat trend water levels.

18 Q. Is it possible that this would suggest
19 heterogeneities in the aquifer or compartmentalization that
20 might exist within the flow system due to faults or folds?

21 A. For -- for the southern end of the flow system, I
22 do not think that is the case. As I mentioned, there are --
23 there's a -- some amount of groundwater flow that's coming
24 down to the south end. I believe there's a flow of water

1 along the north trending normal faults parallel to the Arrow
2 Canyon Range?

3 A. I'm not certain I can make that association.

4 There is a general north to south flow, and at some point,
5 that flow system is interpreted to turn to the east.

6 Q. You suggest the Dry Lake Thrust Fault might act
7 as an impediment to eastward groundwater flow. Is that a
8 general comment regarding the impact of thrust faults on
9 groundwater flow or was that specific to Dry Lake Thrust
10 Fault?

11 A. Well, that was more specific to the Dry Lake.
12 And I should have noted, if I didn't, that there is an -- a
13 number of significant normal faults that are coincident with
14 that thrust fault.

15 So, again, the boundary testing suggests that
16 there is very little outflow there to explain the water levels
17 at least in that upper slice of carbonate aquifer, and whether
18 it's normal faulting or the thrust fault, I -- I can't go that
19 far to define that.

20 Q. Okay. Thank you.

21 MR. HERREMA: I have no further questions at this
22 time.

23 HEARING OFFICER FAIRBANK: United States Fish and
24 Wildlife Service.

1 Seeing no questions, National Park Service.
2 CROSS-EXAMINATION
3 BY MS. GLASGOW:
4 Q. Let's see. Good morning still. I'm Karen
5 Glasgow with the Department of Interior, Office of the
6 Solicitor representing the National Park Service. And good
7 morning to you, Mr. Smith. I just have a few questions.
8 Your Slide Number 10 shows an arrow heading
9 northwest or northward in southern Coyote Springs Valley based
10 on the measured water level in CSVM-2.
11 What does that imply about the movement of large
12 amounts of water moving southward from Coyote Springs Valley
13 into Hidden Valley and eventually, into Las Vegas Valley?
14 ANSWERS BY MR. SMITH:
15 A. Well, we do have a -- a higher than normal water
16 level there that defines a gradient to the north back to
17 Coyote Springs Valley. I don't think we have enough data over
18 there to really make broader interpretations.
19 I'm not precluding that there is north to south
20 movement of water, and I also have questioned in the past
21 whether there is some -- some fault influence on those --
22 those water levels as in the fault being between the --
23 probably north-south fault.
24 But between them and the -- the lower elevations

1 A. Yes, it could. Some.
2 Q. Okay. Do you have information to indicate that
3 water levels throughout Garnet Valley are at a steady state?
4 A. Well, until we're able to clearly parse out
5 climate versus pumping, you know, we do have a declining water
6 level trend.
7 Pumping can't occur without some storage
8 depletion, so I don't think the water level record is devoid
9 of pumping influence. I think it is embedded in it.
10 Does that answer your question?
11 Q. Thank you.
12 So another question. In his rebuttal report,
13 Dr. Mock disputes your characterization of the Las Vegas
14 Valley Shear Zone.
15 Do you agree with his inference that groundwater
16 in Garnet Valley flows largely south to an entrance of the
17 Las Vegas Valley at a rate of somewhere between thousands to
18 tens of thousands of acre-feet per year?
19 A. So that is a hypothesis that, in my opinion,
20 really is not based on any information. So, you know, to
21 answer that, we would need to have monitoring wells drilled,
22 defined water levels, but I have not represented that in the
23 model strictly because I don't have any data to really suggest
24 its presence or its magnitude.

1 of the valley floor in Coyote Springs Valley, some of these
2 more south-turning faults. So really, I don't have enough
3 data -- I don't have enough data to really offer an opinion of
4 whether that would, say, preclude southern flow. I think that
5 is still a possibility. We're really lacking data to define
6 that.
7 Q. Thank you.
8 So, with respect to your modeling, was it a
9 steady-state model?
10 A. That's correct.
11 Q. In a steady-state model, doesn't all the water
12 move into and out of the model through the boundary
13 conditions, and no water is derived by lowering water levels
14 in the model?
15 A. I didn't mention, but we also have some local
16 recharge applied as a specified flux on the western edge of
17 the model representing recharge in the Las Vegas Range.
18 So there is a recharge source, internal, and then
19 all the other water is derived from the boundary flows in and
20 out.
21 Q. And that's a boundary condition; correct?
22 A. That's correct.
23 Q. Would the steady-state assumption affect the
24 calculated boundary flow rates?

1 Q. Thank you.
2 So similarly, were you here for Dr. Johnson's
3 testimony?
4 A. I was not.
5 Q. Okay. Then I will -- if I -- if I told you that
6 Dr. Johnson stated that somewhere on the order
7 48,000 acre-feet of water flows into the Las Vegas Valley
8 across the Las Vegas Shear Zone, would you agree with that
9 assessment?
10 A. I would not have any data to really support that
11 assessment. I would be looking for water level data along
12 that shear zone in the carbonate rock.
13 You know, this is part of what happens when we're
14 not constrained by having much data or any data is, you know,
15 it's still open to all kinds of hypotheses. Those hypotheses
16 can certainly be tested if one is willing to expend the effort
17 to go and collect data and drill wells.
18 But --
19 Q. Thank you.
20 MS. GLASGOW: I appreciate your time.
21 HEARING OFFICER FAIRBANK: Moapa Band of Paiutes.
22 MR. BUSHNER: No questions.
23 HEARING OFFICER FAIRBANK: Seeing no questions,
24 Las Vegas Water District and Southern Nevada Water Authority.

1 CROSS-EXAMINATION
2 BY MR. TAGGART:
3 Q. Good morning, Mr. Smith.
4 A. Good morning.
5 Q. There are a couple preliminary questions.
6 First of all, the -- North Las Vegas is a member
7 agency of the Southern Nevada Water Authority; correct?
8 A. That's correct.
9 Q. Okay. Is it true that none of your presentation
10 or your expert reports were coordinated with the Southern
11 Nevada Water Authority and their presentation of information?
12 A. That's correct.
13 Q. You started your discussion indicating that the
14 water that is under a legal agreement with the Southern Nevada
15 Water Authority, you referred to it could be considered
16 junior; right?
17 A. That's correct.
18 Q. Would you agree that if the basins in the Lower
19 White River Flow System were managed on priority based on by
20 basin instead of all in one unit, if Garnet Valley was just
21 its own valley and it was managed on priority, the SNWA water
22 rights would actually be more senior?
23 A. The SNWA rights would still be junior in Garnet
24 Valley. They were basically the last, you know, appropriation

1 And so now, we've exceeded kind of the salient
2 conclusions of his reports and his testimony.
3 HEARING OFFICER FAIRBANK: So the objection was
4 whether it exceeded the salient conclusions of his report by
5 extending outside of the Garnet Valley region --
6 MR. HERREMA: Right.
7 HEARING OFFICER FAIRBANK: -- just to summarize
8 your objection?
9 MR. HERREMA: Yes. You did very well. Thank
10 you.
11 HEARING OFFICER FAIRBANK: Thank you.
12 BY MR. TAGGART:
13 Q. The testimony you gave regarding moving water
14 from one point of origin to another --
15 Do you recall that?
16 A. Yes.
17 Q. Okay. And first of all, do you understand that
18 when the five basins that are now considered the Lower White
19 River Flow System, when they were separate basins, alluvial
20 water rights in the Muddy River Springs area could not have
21 been moved to Garnet Valley; right?
22 A. That's my understanding.
23 Q. Okay. So it's really just a function of this new
24 Lower White River Flow System that's allowed for alluvial

1 granted in Garnet Valley. So all of the appropriations prior
2 to that would be senior.
3 Q. Okay. Now, in some of your testimony -- and
4 let's find a slide, Slide 30. You indicated that pumping in
5 the proximity -- immediate proximity of the springs is -- and
6 I think you said based on basic hydrologic principles, the
7 pumping more proximate to the springs is having more effect on
8 the springs.
9 A. I agree.
10 Q. And when you talked about the immediate
11 proximity, does that immediate proximity include Coyote Spring
12 Valley?
13 A. No, I was really referring to the pumping from,
14 for example, the Arrow Canyon wells.
15 Q. Okay. Do you believe that pumping in Coyote
16 Spring Valley effects EH-4?
17 A. Yes, I think we've demonstrated that in Order
18 1169.
19 Q. Okay.
20 MR. HERREMA: I'd like to object. I know he's
21 already answered the question, but he said at the beginning of
22 his testimony that his focus and the conclusions in his report
23 were all focused on what was happening in Garnet Valley, not
24 on Coyote Springs.

1 rights to be moved elsewhere; right?
2 A. Alluvial rights or any rights to be moved from
3 one hydrographic basin to the next.
4 Q. Right. And you agree that alluvial pumping in
5 the Muddy River Springs area does affect the Muddy River;
6 right?
7 A. I agree.
8 Q. Okay. And do you believe that any conflict
9 between that pumping of alluvial water in the Muddy River
10 Springs area and senior decree rights in the river should be
11 addressed before any of that alluvial water rights can be
12 moved?
13 A. No, I wouldn't agree with that. You know, the
14 structure and framework to address streamflow capture is going
15 to require a process of its own. But to the degree that we
16 can -- to transfer those water rights from the alluvium
17 elsewhere, as proposed by the City, down to Garnet Valley, I
18 think the merits of that will have to bring forward on its
19 application, maybe, for the State Engineer.
20 Q. Okay. Now -- now, in your recommendations
21 regarding safe yield, do you agree that maintaining a certain
22 flow at the Warm Springs West Gage should be a control that
23 the State Engineer maintains in determining how much
24 groundwater pumping should be allowed?

1 A. I do.
2 Q. Okay. And do you agree that the -- well -- well,
3 let me strike that, please.
4 You had some criticism of the MLR analysis at
5 SNWA; correct?
6 A. Yes.
7 Q. Okay. And you also are aware that SNWA did an
8 analysis of how much groundwater can be pumped from the
9 carbonate system while maintaining a 3.2 flow at the Warm
10 Springs West Gage; correct?
11 A. I recall that testimony.
12 Q. Okay. Do you recognize that that analysis and
13 the MLR analysis are two distinctly separate analyses?
14 A. Yes.
15 Q. Okay. So your critique of the MLR approach does
16 not apply to the approach that SNWA used to determine the
17 control in order to protect 3.2 CFS in the Warm Springs West
18 Gage; is that true?
19 A. That's true.
20 Q. Okay. And most -- your -- your testimony
21 indicated that the -- the conclusions and analysis that you
22 conclude -- that you prepared were based upon the idea that
23 additional carbonate pumping in Garnet Valley by the City of
24 North Las Vegas would be temporary until a pipeline is built

1 strategies was bringing in senior groundwater rights.
2 A. Correct.
3 Q. Does -- has the City identified or targeted any
4 specific senior water rights to date?
5 A. Yes. The senior -- excuse me. The City has
6 entered into a Memorandum of Understanding with the Church of
7 Jesus Christ of Latter-Day Saints, the LDS Church, to initiate
8 discussions on leasing with possible long-term option to
9 purchase water rights from -- that are utilized along the
10 alluvium in the Muddy River Springs area.
11 Q. And are those -- are those rights currently being
12 pumped?
13 A. Since the decommissioning of the Reid Gardner
14 Station power plant in 2017, these water rights were under
15 lease for the past few decades to the power company for -- to
16 Nevada Energy for that -- that facility.
17 So since the decommissioning in 2017, I do not
18 believe they've been pumped, or if they have been, they have
19 not been pumped to a great amount.
20 Q. Okay. And you said those were alluvial rights?
21 A. The -- they are water rights at wells that have
22 historically pumped from the alluvium.
23 Q. Okay. The City's Kapex and Playa wells, are
24 those alluvial rights or are those carbonate right -- or

1 to bring water to North Las Vegas from the Las Vegas Valley;
2 is that correct?
3 A. I would say initially. I think ultimately,
4 through additional stress testing, whether it's pumping or
5 injection testing, will arrive at the proper amount to
6 perpetuate from the carbonate aquifer from Garnet Valley. I
7 don't think we've established that yet.
8 Q. Is the City of North Las Vegas prepared to pay
9 for the costs of those types of stress testing that you have
10 described?
11 A. I can't answer that.
12 Q. Okay.
13 MR. TAGGART: Thank you.
14 HEARING OFFICER FAIRBANK: The Moapa Valley Water
15 District.
16 CROSS-EXAMINATION
17 BY MR. MORRISON:
18 Q. Greg Morrison for Moapa Valley Water District for
19 the record.
20 Good morning, Mr. Smith. How are you?
21 ANSWERS BY MR. SMITH:
22 A. Good morning.
23 Q. I just got a couple questions about you spoke
24 about the City's long-term strategy, and one of those

1 wells, excuse me?
2 A. The wells are completed in the carbonate aquifer.
3 Q. Okay. So would it be fair to say that the
4 movement of the senior permit rights that the City currently
5 has targeted for acquisition, beginning to pump those would
6 increase pumping in the carbonate aquifer?
7 A. That's correct.
8 MR. MOORE: Okay. Thanks.
9 HEARING OFFICER FAIRBANK: Lincoln County-Vidler
10 Water Company.
11 CROSS-EXAMINATION
12 BY MS. PETERSON:
13 Q. Hi, Mr. Smith. Karen Peterson --
14 ANSWERS BY MR. SMITH:
15 A. Good morning.
16 Q. -- representing Lincoln County Water District and
17 Vidler Water Company. I just had a couple questions for you.
18 Is there any recommendation by your client to
19 include Kane Springs Valley into the Lower White River Flow
20 System?
21 A. No. Again, we have not done any assessment on
22 the other regions of the flow system.
23 Q. But in this proceeding, there is no
24 recommendation by your client based on the work that they've

1 done to include Kane Springs Valley; that is correct?
2 A. Yes, that's correct. We support the basins as
3 delineated in the Order 1303.
4 Q. And that would include the northern basins also?
5 A. That's correct.
6 MS. PETERSON: Okay. Thank you.
7 HEARING OFFICER FAIRBANK: Center for Biological
8 Diversity? Seeing no questions, Georgia Pacific-Republic?
9 MS. HARRISON: We have no questions.
10 HEARING OFFICER FAIRBANK: Seeing no questions,
11 Nevada Cogeneration?
12 Seeing no questions -- oh, okay.
13 CROSS-EXAMINATION
14 BY MR. FLANGAS:
15 Q. Good morning, Mr. Smith.
16 I think it's your Slide Number 15 and 16.
17 HEARING OFFICER FAIRBANK: Mr. Flangas, will you
18 turn on your microphone.
19 MR. FLANGAS: Sorry.
20 BY MR. FLANGAS:
21 Q. I think it's your Slides 15 and 16. If you could
22 explain just a little bit your understanding of the -- kind of
23 the boundary condition and the -- really, the boundary at the
24 Black Mountains area a little bit better because I wasn't

1 preliminary area for the Lower White River Flow System.
2 But also, you would incorporate a similar sized
3 area that's bound by the Gas -- Gas Peak Thrust Fault on the
4 west, the Las Vegas Valley Shear Zone on the south, and then
5 extends over to the Black Mountains area.
6 So there would potentially be a small corner
7 geographically that should be included also.
8 Q. I'm sorry. A small corner that could be --
9 A. Small corner of Las Vegas Valley that should be
10 incorporated.
11 Q. And with regard to that shear zone, what is it
12 telling us as far as is it a corridor for water? Is it a
13 boundary fault or what?
14 A. The hypotheses are that that is a boundary, and I
15 believe in some of the prior modeling efforts, it's been
16 interpreted as a no-flow boundary.
17 Again, we really don't have sufficient data to
18 define that, but I would agree that conceptually, it is likely
19 some type of terminal boundary to the flow system.
20 Q. But we don't have enough data in that area to
21 verify one way or the other; right?
22 A. I don't think we can absolutely conclude that.
23 MR. FLANGAS: Okay. Thank you very much. That's
24 all we have.

1 clear on that during your direct testimony.
2 A. I'm going to refer to my exhibit, Exhibit 3. So
3 we did include that boundary as a separate segment, and I'm --
4 bear with me here. I'm just looking for the outcome.
5 So the model simulation shows a very small flux
6 of water across that boundary and was testing of about seven
7 and a half acre-feet.
8 The sensitivity -- if I recall correctly, the
9 sensitivity was not high on that model boundary. So that
10 would imply that -- let me just confirm, please.
11 Yeah, the sensitivity was low on that model
12 boundary, so that would imply that there certainly could be a
13 notably different flux of water back and forth along that
14 model boundary and still produce a satisfactory solution.
15 Q. The comment here on Slide 16 when you say the
16 Las Vegas Shear Zone as a physical boundary incorporates a
17 portion of Las Vegas Valley similarly to incorporating a
18 portion of the Black Mountains area, what exactly does that
19 mean?
20 A. Let me go to overhead. Let's see. Let's look at
21 Slide 8. So you'll notice that if that carbonate corridor
22 that's coming down to the south and butts up against the
23 Las Vegas Shear Zone, then it would incorporate that corner of
24 the Black Mountains area that has been included in the

1 HEARING OFFICER FAIRBANK: Muddy Valley
2 Irrigation Company.
3 MR. KING: No questions.
4 HEARING OFFICER FAIRBANK: Seeing no questions,
5 Bedroc.
6 MS. URE: No questions.
7 HEARING OFFICER FAIRBANK: Seeing no questions,
8 Nevada Energy.
9 MS. CAVIGLIA: No questions.
10 HEARING OFFICER FAIRBANK: Seeing no questions,
11 I'll go ahead and open it up to the State Engineer and
12 Division of Water Resources staff.
13 EXAMINATION
14 BY MR. BENEDICT:
15 Q. Jon Benedict for the record.
16 I have a question about the concept of capture in
17 Garnet Valley and the potential for additional sources of
18 capture there, and I guess that question is pretty general.
19 What do you see as being capturable commodities?
20 I mean, if there is water that flows, for example, from Las
21 Vegas to Garnet Valley, how is that captured?
22 I mean, is it really just a loss of storage in
23 Las Vegas Valley that's actually occurring there or is that a
24 physical capture of a -- of water, in other words, and

1 inducement of flow or a reduction of discharge?
2 A. Yeah, we -- you know, I -- first off, I think we
3 need to start with the defining is this flux real or not and
4 is it really occurring. And if it is, then we can perhaps
5 start to investigate further, is this the result of rising
6 water levels, artificial -- or aquifer recharge in Las Vegas
7 Valley? Was this fundamentally present throughout the
8 history? You know, has it always been a flow source in that
9 direction? We have to understand that further.
10 But as far as it relates to capture, yeah, I
11 think there are -- there's a certain amount of flow in Garnet
12 Valley that has bypassed -- I'll use the word bypass -- the
13 Muddy River Springs. There's a certain amount of flow just
14 based on gradients that continues south. We know that by the
15 gradients.
16 Now, based on the transmissivities that we're
17 able to find to date, it appears that that flow is fairly
18 modest. But to the degree it's present, we can begin to pump
19 and capture that with wells.
20 Now, can you do that without absolutely having
21 other effects that you're trying to avoid? Well, it's usually
22 not an absolute scenario, you know. You're going to pump and
23 you're going to capture maybe an inflow source that was then
24 continuing out on out to the east.

1 when I say early, the 1990s into the 2001 time frame before
2 the additional power facilities came on or were born out there
3 in that area. It sure looks like the pumping that it was
4 doing was not creating any difficulties with water levels
5 propagating the EH-4.
6 How far we can go beyond that, you know, we
7 pumped at 2,000 acre-feet in 2016 and 2017. It looks likes
8 EH-4 water levels, you know, had stabilized. Now, we can't
9 reach that far yet. We need to do more testing and
10 observations to figure out where we can land in Garnet Valley
11 and maintain the water levels we want to preserve at EH-4 and
12 at the springs.
13 MR. BENEDICT: I think that was my only question.
14 Thank you.
15 EXAMINATION
16 BY MR. SULLIVAN:
17 Q. Adam Sullivan for the record.
18 Your recommendation for safe yields, are you --
19 are you recommending a distinct safe yield concept for the
20 Garnet Valley area that would be separate from a safe yield
21 for the northern portion of the Lower White River Flow System?
22 A. Yeah, I think that's what should be considered.
23 You know, how accurate is the water budget and how accurate
24 can it ever be?

1 I think any eastern flow that makes it out, which
2 appears to my eye to be modest, but I know the regional flow
3 modeling authored by the National Park Service, you know, has
4 at least 1,500 acre-feet flowing by and out through to the
5 waters of Dupont Springs, but possibly deeper.
6 But, yeah, you can capture a part of that. Can
7 you do that absolutely without having other far-reaching
8 effects? Probably not. It's not an absolute scenario, but
9 the degree that we can be pumping and harvesting a few of
10 those sources of water that were not flowing out and flowing
11 upgradient, obviously, to the Muddy River Springs, that is
12 what we need to try to achieve in Garnet Valley.
13 And we need to do so with minimum -- you know, if
14 you end up in a scenario where you're pumping three, four
15 times that manageable amount of water, then you're going to
16 see a preponderance of drawdown propagating far beyond where
17 you are intending it to. So we've got to find that right --
18 that right amount.
19 And I think we can get there. It's going to take
20 time and effort. But we can find that. I don't think we
21 found it today. I think the evidence we have do have is that
22 that really, pumping doesn't appear to be affecting EH-4 water
23 levels.
24 So I would suggest that that early pumping --

1 You know, say, for example, the computations
2 where there's 10,000 acre-feet flowing through the system
3 somewhere, it's kind of irrelevant. You know, we need to
4 define how much we can safely pump in different geographic
5 areas and maintain levels at EH-4. That's what we need to
6 find.
7 It's going to be different for different
8 geographic areas. Some areas might be quite a bit more
9 sensitive. You may find compartments, you know, through
10 further testing to where you can sustain greater amounts of
11 flow. I don't want to preclude that as being a possibility.
12 But, yeah, so I think you need to be looking at
13 this for a perspective because this is a -- this is a large
14 area.
15 Yes, there are some connections and commingling
16 of effects that need to be considered, but I think we can boil
17 this down to the southern area, we have some amount of
18 southern flow in the system, some amount that we can pump and
19 harvest and not get be getting into trouble, not be getting
20 into trouble with EH-4.
21 And I think that philosophy could apply elsewhere
22 in the basin also. It's kind of irregardless of what the
23 perennial yield and the water budget is.
24 Q. Okay. Thanks.

1 And one clarification on Slide Number 14, which
2 is -- you might not even need to look at the slide. It was
3 where you showed various water levels at the north end of Las
4 Vegas Valley.

5 A. Yes.

6 Q. Did you say those are to the north of or to the
7 south of the Las Vegas Shear Zone?

8 A. Well, we know for certain that Diamond
9 Construction, Diamond Apex wells are north of the Las Vegas
10 Shear Zone.

11 Where that structure would cut through, I
12 believe, is also south of those wells that are plotted on that
13 figure or at least south of some of them, but we're certainly
14 getting right in the area of the shear zone in there.

15 MR. SULLIVAN: Okay. Thanks.

16 EXAMINATION

17 BY MS. BARNES:

18 Q. Michelle Barnes for the record.

19 Can we go to your Slide 27. If the groundwater
20 elevations are already corrected for barometric pressure,
21 would you still expect to see this barometric response that
22 you talked about?

23 A. So to be clear here, and you'll have to let me
24 know if I've answered your question. But quite commonly, we

1 CROSS-EXAMINATION

2 BY MS. GLASGOW:

3 Q. Karen Glasgow, Department of Interior for
4 National Park Service. Hello. Still morning, Mr. Smith.

5 A couple more questions. Your model has general
6 head boundary conditions along your reaches 4 and 6 between
7 Garnet Valley and the Black Mountain area leading to Rogers
8 and Blue Point Springs with a hydraulic conductivity of
9 approximately ten to the minus five feet per day. Isn't this
10 orders of magnitudes smaller than other boundary conductance
11 values?

12 A. It is, and I pointed out that the solution to the
13 calibration wants to make that a tight and practically a
14 no-flow boundary, and that's the reason the conductance is
15 calibrated to such a low value.

16 Q. Do you have data that supports these values?

17 A. Well, the model calibrated to match the water
18 levels in the basin.

19 And I'll add, though, you know, you have to keep
20 in mind this is the upper thousand feet that we've represented
21 of a very thick section of carbonate rock.

22 So that certainly -- and I would say this testing
23 is certainly not definitive by any means, and it doesn't
24 exclude deeper flow systems out.

1 have an instrumentation correction for barometric pressure,
2 and I believe mostly interpretation of this area are vented,
3 so we don't have to do that atmospheric correction. But
4 that's an equipment accuracy issue. If they're sealed, then
5 you have to then -- then have to process the data for
6 barometric correction to get a true water level.

7 So what I'm talking about is actually true water
8 level response, not an instrumentation type of correction or
9 adjustment. This is a true observed when the barometric
10 pressure rises, the water levels fall in the aquifer,
11 physical -- it's actually a physical process that takes place.

12 Does that clarify?

13 Q. That does answer my question, yes. Thank you.

14 HEARING OFFICER FAIRBANK: Okay. Seeing staff
15 has completed their questions, we'll go ahead and reopen it
16 for additional questions.

17 Coyote Springs Investments, do you have any
18 further questions?

19 MR. HERREMA: Not at this time.

20 HEARING OFFICER FAIRBANK: Seeing no further
21 questions, Fish and Wildlife Service?

22 Seeing no questions, National Park Service. I'll
23 go ahead and give you five minutes.

24 MS. GLASGOW: Thank you.

1 Q. But would this affect any model-based conclusions
2 on the amount of water flowing across this boundary to Rogers
3 and Blue Point Springs, making the discharge rate very small?

4 A. I don't think we can use this model in that
5 manner. It's really just judging internal to Garnet Valley.
6 I think you do need to stick to a regional platform such as
7 Dr. Waddell's model to start examining that regional sort of
8 question on detail.

9 MS. GLASGOW: Okay. Thank you.

10 HEARING OFFICER FAIRBANK: Moapa Band of Paiutes.
11 Seeing no questions, Southern Nevada Water
12 Authority, Las Vegas Valley Water District.

13 MR. TAGGART: No questions.

14 HEARING OFFICER FAIRBANK: Seeing no questions,
15 Moapa Valley Water District.

16 MR. MOORE: No questions.

17 HEARING OFFICER FAIRBANK: No questions.

18 Lincoln County-Vidler? No questions.

19 Center for Biological Diversity? No questions.

20 Georgia Pacific and Republic?

21 Seeing no questions, Nevada Cogeneration?

22 Seeing no further questions, Muddy Valley

23 Irrigation Company? No questions.

24 Bedroc?

1 MS. URE: No questions.
2 HEARING OFFICER FAIRBANK: No questions.
3 And Nevada Energy?
4 Seeing no questions, again, I'll open it up to
5 Division of Water Resources staff and the State Engineer. Are
6 there any questions?
7 FURTHER EXAMINATION
8 BY MR. BENEDICT:
9 Q. Jon Benedict. A really simple question. You
10 suggested again that there's been pumpage in Garnet Valley.
11 It's not in the record, and you alluded to the proof of
12 beneficial use.
13 Do you have any numbers on what you think the
14 pumpage had been in the 90's just out of curiosity? Do you
15 have those records yourself?
16 A. Yeah, from the records I have observed -- and,
17 again, this is just a criticism of the input values in the
18 model. I believe that that -- if you looked at the
19 hydrograph --
20 Let me see if I can pull that up. So the yellow
21 bars and the blue bars represent those older water rights,
22 predominantly, that, again, were similarly appropriated very
23 early, in the 60's and earlier that are fairly modest, and
24 those initial water rights were in the alluvium also.

1 agricultural, we can find old photography and things like
2 that, but that's not the case here. It's all industrial.
3 Certainly, you could go through and scrutinize
4 this carefully and really try to put a detailed reconstruction
5 of an earlier time. You might look at when the facilities
6 were actually built, things like that.
7 But, yeah, I think you can get a reasonable
8 approximation of that early history of pumping based on the
9 water rights data, and I've successfully done that in quite a
10 few basins that I've tried to reconstruct.
11 MR. BENEDICT: Okay. Thank you.
12 HEARING OFFICER FAIRBANK: All right. Well, it
13 looks as though we've concluded our proceedings today, so --
14 oh, I'm sorry, Ms. Ure. You've reserved time for redirect.
15 MS. URE: Yes. We have no redirect.
16 HEARING OFFICER FAIRBANK: Okay. Thank you.
17 All right. So now we've officially concluded our
18 proceedings for today.
19 So tomorrow, we will go ahead and start again at
20 8:30 in the morning commencing with the Center For Biological
21 Diversity and then in the afternoon or then once we're
22 concluded with the Center for Biological Diversity move on to
23 Georgia Pacific and Republic and Dry Lake.
24 Again, as a reminder, on Thursday, October 3rd,

1 But commencing in the 1980's, you started to see
2 the new appropriations, the new developments occurring in the
3 Apex area, and that -- the evidence we have based on the water
4 right records is those facilities were up and operating
5 through the 1990's.
6 You know, their proof of beneficial use filings,
7 if we just look at the table, you know, were occurring in the
8 early 90's time frame just in general. Some of them are
9 extended out longer like that -- the Assignment Company rights
10 down there, you see the file proof of beneficial use until
11 2001. But, yeah, in general, I think these facilities were
12 operating pretty much through the 1990's.
13 Now, the early 1990's, they may -- you know, it
14 would have been a -- possibly some type of introduction of
15 water pumping, but I think you could probably take your 2001
16 pumping inventory and project it back in time to the early
17 90's and look at when the proof of beneficial use filings were
18 made and proof of completion of where funds were made and then
19 integrate that pumping -- and reconstruct that pumping history
20 back to the 1980's.
21 Q. So you say the best data for that would then be
22 the water rights files, for example; correct?
23 A. Well, it's a source of information that I've used
24 in other basins to reconstruct pumping. Sometimes with

1 we will be starting later in the day, and depending on how
2 things go and how far along we'll be moving, we'll make a
3 determination as to whether or not we're going to start at 11
4 as noted or we may start a little bit later.
5 And then on Thursday, we will have the
6 continuation of Dry Lake, Georgia Pacific, and Republic, if
7 necessary, the Nevada Cogeneration and then Muddy Valley
8 Irrigation Company.
9 And then on the morning of October 4th, we'll
10 proceed with Bedroc and Nevada Energy and then conclude with
11 public comment.
12 So we will see everyone tomorrow morning, and
13 thank you very much.
14 (Proceedings concluded at 11:47 a.m.)
15
16
17
18
19
20
21
22
23
24

1 STATE OF NEVADA)

) ss.

2 CARSON CITY)

3

4 I, MICHEL LOOMIS, a Certified Court Reporter, do
5 hereby certify;

6 That on the 1st of October, 2019, in Carson City,
7 Nevada, I was present and took stenotype notes of the hearing
8 held before the Nevada Department of Conservation and Natural
9 Resources, Division of Water in the within entitled matter,
10 and thereafter transcribed the same into typewriting as herein
11 appears;

12 That the foregoing transcript, consisting of
13 pages 1370 through 1497 hereof, is a full, true and correct
14 transcription of my stenotype notes of said hearing to the
15 best of my ability.

16

17 Dated at Carson City, Nevada, this 1st day of
18 October, 2019.

19

20

21

MICHEL LOOMIS, RPR

22 NV CCR #228

23

24

#	1382:15;1423:24; 1428:3;1441:2,6; 1473:8;1483:6;1493:2	administrative (7) 1400:5;1407:23; 1409:24;1418:23; 1419:1,14;1461:16	agreements (2) 1447:2,16	1468:2;1479:5; 1480:19;1486:11,13; 1487:15,18;1489:17, 18;1493:2
#228 (1) 1498:22	act (1) 1469:6	ADMITTED (6) 1373:23;1417:19,20, 21,22,23	agricultural (1) 1496:1	amounts (4) 1441:11;1444:7; 1470:12;1489:10
A	Acting (1) 1371:4	advance (1) 1437:19	ahead (22) 1374:7,9,11; 1392:15;1393:15; 1395:7,9;1401:17; 1405:17,19,21;1416:1, 3,5;1444:15;1466:6,7, 11;1485:11;1491:15, 23;1496:19	analyses (1) 1478:13
abandonment (1) 1431:19	action (1) 1460:14	advanced (3) 1429:11;1432:12; 1440:21	allotment (1) 1466:13	analysis (33) 1377:4;1385:24; 1387:11;1390:17; 1391:18,19;1396:10; 1406:9;1407:5,20; 1410:10;1419:2; 1446:5,5;1447:24; 1448:10,16,20;1449:2, 3,6,10,15,19,23; 1456:19,20;1457:16; 1478:4,8,12,13,21
abilities (1) 1452:15	actions (1) 1438:3	advancing (7) 1418:15;1423:9,24; 1431:8;1435:14; 1438:4;1452:18	allow (3) 1416:2;1462:18; 1466:14	analyze (1) 1390:24
ability (2) 1460:12;1498:15	activities (2) 1439:14;1443:16	advantages (1) 1423:8	allowed (4) 1396:6;1409:6; 1476:24;1477:24	analyzed (4) 1377:2,23;1384:14; 1406:15
able (5) 1398:19;1411:10; 1466:16;1472:4; 1486:17	actual (1) 1426:18	advice (1) 1420:7	alluded (1) 1494:11	anchor (1) 1438:22
above (8) 1413:5,5;1425:2,2; 1426:12;1437:6,7; 1459:10	actually (12) 1376:16;1390:15; 1394:13;1402:4; 1434:22;1440:24; 1443:9;1474:22; 1485:23;1491:7,11; 1496:6	affect (5) 1438:1;1448:8; 1471:23;1477:5; 1493:1	alluvial (16) 1382:24;1383:5; 1419:11;1425:22,22; 1457:5;1458:7; 1461:24;1476:19,24; 1477:2,4,9,11;1480:20, 24	and- (1) 1372:3
absence (1) 1455:2	Adam (2) 1371:5;1488:17	affects (2) 1448:9,13	alluvium (11) 1419:15;1432:10; 1444:22;1456:23; 1462:5;1463:5;1465:4; 1477:16;1480:10,22; 1494:24	Anges (1) 1371:23
absolute (2) 1486:22;1487:8	adapt (1) 1460:12	affected (1) 1458:10	almost (1) 1413:3	angle (2) 1387:21,21
absolutely (4) 1452:3;1484:22; 1486:20;1487:7	add (1) 1492:19	affecting (1) 1487:22	along (24) 1377:8;1421:8; 1423:19;1427:6; 1431:12;1434:6,10,10; 1438:18;1451:22; 1458:21;1459:16; 1463:19;1468:11,12, 19,19,23;1469:1; 1473:11;1480:9; 1483:13;1492:6; 1497:2	annually (1) 1439:12
accomplish (1) 1455:7	added (3) 1442:16,19,23	affects (2) 1448:9,13	altitude (7) 1420:17;1430:5; 1452:6;1455:21; 1459:24;1462:2; 1464:14	anomaly (1) 1383:3
accomplished (1) 1462:6	addendum (1) 1442:14	afternoon (1) 1496:21	always (2) 1431:9;1486:8	answered (5) 1412:3;1436:15; 1437:15;1475:21; 1490:24
according (1) 1460:9	additional (29) 1378:12;1398:2; 1402:18;1403:12,22, 23;1404:3,4,8,8; 1406:9,9;1418:16,17; 1443:17;1444:10; 1445:16;1454:23; 1464:8,24;1465:1,4,6; 1466:14;1478:23; 1479:4;1485:17; 1488:2;1491:16	again (29) 1395:18;1400:10; 1410:6;1411:9,16; 1435:10;1441:22; 1445:24;1450:14; 1455:14;1456:2,9; 1458:6;1459:19; 1460:3;1462:13; 1463:1,2,23;1464:1; 1469:15;1481:21; 1484:17;1494:4,10,17, 22;1496:19,24	agency (1) 1474:7	Apex (20) 1418:13;1419:16; 1421:3,12,16,22; 1422:19;1423:17; 1424:13,14,22; 1425:15;1428:7; 1430:22;1431:24; 1432:2;1436:2; 1441:17;1490:9; 1495:3
accordingly (2) 1449:22;1452:10	address (6) 1407:2;1418:18; 1452:15;1462:9; 1465:8;1477:14	against (2) 1415:22;1483:22	ago (2) 1391:13,24	apparent (1) 1432:20
accounted (2) 1404:6;1447:4	addressed (5) 1399:15;1460:2; 1462:10;1466:21; 1477:11	agency (1) 1474:7	agree (19) 1379:9;1382:12; 1389:1;1390:2; 1395:22;1403:6; 1404:23;1405:4; 1426:2;1472:15; 1473:8;1474:18; 1475:9;1477:4,7,13,21; 1478:2;1484:18	appear (2) 1455:22;1487:22
accounts (1) 1449:8	adequate (1) 1463:4	ago (2) 1391:13,24	amend (1) 1442:21	APPEARANCES (2) 1371:1;1372:1
accuracy (1) 1491:4	adjust (1) 1440:18	ago (2) 1391:13,24	amount (22) 1401:9;1407:12; 1423:14;1425:10; 1445:11;1447:21; 1455:19;1464:16,17, 17;1465:13;1467:23;	appeared (1) 1442:23
accurate (5) 1434:5;1437:15; 1467:14;1488:23,23	adjustment (2) 1440:2;1491:9	agreed (2) 1404:15;1407:15		appearing (1) 1416:8
accurately (3) 1436:6;1437:1,10	adjustments (1) 1440:2	agreement (2) 1421:23;1474:14		appears (5) 1422:14;1437:13;
achieve (1) 1487:12	administer (1) 1462:18			
acknowledge (1) 1429:1	ADMINISTRATION (2) 1370:7;1464:2			
acquire (2) 1400:8;1419:13				
acquisition (2) 1461:1;1481:5				
acre-feet (13) 1390:11,17,22; 1391:4;1396:6,7; 1444:8;1472:18; 1473:7;1483:7;1487:4; 1488:7;1489:2				
across (8)				

<p>1486:17;1487:2; 1498:11 appendices (2) 1377:3;1453:23 Appendix (2) 1375:21,21 Appendixes (1) 1376:11 application (4) 1398:20;1419:22; 1463:9;1477:19 applications (2) 1399:4;1401:14 applied (2) 1380:7;1471:16 apply (4) 1432:15;1461:19; 1478:16;1489:21 appreciate (3) 1466:5;1467:2; 1473:20 approach (6) 1433:21;1459:11; 1464:5,6;1478:15,16 approached (1) 1444:8 approaches (1) 1458:17 approaching (1) 1446:13 appropriate (2) 1418:24;1458:17 appropriated (1) 1494:22 appropriately (1) 1459:18 appropriation (1) 1474:24 appropriations (2) 1475:1;1495:2 approximate (3) 1423:20;1424:3,9 approximately (5) 1411:17;1412:2,8; 1436:5;1492:9 approximation (1) 1496:8 April (3) 1392:9;1421:9,13 aquifer (44) 1382:24;1383:1,5,6; 1384:14;1385:21; 1386:2;1391:6; 1395:24;1396:12,22; 1406:9;1410:9,9,11; 1411:23;1412:10,13; 1413:18;1414:7; 1419:11,20;1420:1; 1422:22;1427:13; 1428:23;1432:8,16; 1437:17;1439:8; 1442:2;1445:2; 1454:17;1456:23;</p>	<p>1461:24;1462:4,7; 1467:19;1469:17; 1479:6;1481:2,6; 1486:6;1491:10 AR (3) 1422:9;1437:21; 1460:13 AREA (66) 1370:12;1377:21; 1385:6,8;1391:17; 1395:24;1396:2,5,12; 1398:21;1401:10; 1403:8,13;1404:2,6; 1408:14,18;1415:19; 1419:1,14;1420:14; 1421:3,15,16,17,22; 1424:22;1425:4,8,10; 1426:10;1428:7; 1429:21;1431:5; 1432:23,24;1434:7; 1437:18;1441:7,17; 1455:24;1456:6; 1458:23,24;1459:15; 1460:4;1464:21; 1476:20;1477:5,10; 1480:10;1482:24; 1483:18,24;1484:1,3,5, 20;1488:3,20;1489:14, 17;1490:14;1491:2; 1492:7;1495:3 areas (11) 1403:9;1404:4,13; 1420:12;1429:6; 1456:4;1458:18; 1459:16;1489:5,8,8 argue (1) 1451:1 arguments (2) 1413:2;1455:2 arid (2) 1456:5,9 arm (3) 1425:10,14;1430:21 around (14) 1389:8;1395:4; 1411:8;1416:2; 1420:18;1423:1; 1424:14;1433:7; 1439:15;1441:4; 1444:9;1461:20,22; 1464:9 arrive (1) 1479:5 arrived (2) 1380:16;1409:19 Arrow (8) 1428:6;1430:15; 1431:2;1432:23; 1468:23;1469:1; 1470:8;1475:14 artificial (5) 1422:9;1423:4; 1424:4;1437:22;</p>	<p>1486:6 aspects (2) 1418:7;1419:3 aspersions (1) 1411:14 assertion (1) 1410:2 assess (4) 1438:12;1441:24; 1442:1;1465:8 assessed (1) 1461:13 assessment (5) 1437:12;1440:12; 1473:9,11;1481:21 assigned (2) 1438:18,21 assignment (2) 1448:14;1495:9 assist (2) 1417:12,14 associated (5) 1413:10;1432:15; 1436:23;1452:6; 1459:23 association (3) 1448:2,6;1469:3 assume (3) 1397:8,12;1442:18 assumption (1) 1471:23 assurance (1) 1461:8 atmospheric (1) 1491:3 attempt (2) 1440:10;1457:2 attempts (1) 1456:3 attention (1) 1460:7 augmented (2) 1465:10,11 author (1) 1391:14 authored (1) 1487:3 Authority (7) 1378:14;1398:3; 1473:24;1474:7,11,15; 1493:12 Authority's (2) 1391:24;1442:17 authors (1) 1451:22 available (11) 1380:6;1391:23; 1406:13;1417:15; 1427:10;1429:19; 1432:17;1440:4; 1447:2,8;1454:15 average (5) 1386:7;1434:15;</p>	<p>1435:7;1437:4; 1439:24 averaged (1) 1411:12 avoid (2) 1413:19;1486:21 aware (2) 1404:8;1478:7 away (2) 1457:24;1468:8</p> <p style="text-align: center;">B</p> <p>back (19) 1378:4;1392:17,20; 1395:8;1416:6; 1429:13;1430:8,12; 1442:19;1445:4,9,15, 20;1458:8;1466:10; 1470:16;1483:13; 1495:16,20 background (1) 1416:21 balance (1) 1464:20 Band (7) 1378:9;1398:1; 1407:4;1425:23; 1430:5;1473:21; 1493:10 bar (4) 1442:8,8,8;1443:11 Barnes (4) 1371:8;1373:22; 1490:17,18 barometric (26) 1453:2,4,9,12,13,16, 17,18,20,21;1454:1,2, 4,6,7,15,19,20;1455:3, 4,11;1490:20,21; 1491:1,6,9 bars (7) 1443:1,12,20; 1457:3,18;1494:21,21 base (2) 1443:11;1450:21 based (32) 1380:16;1386:7; 1390:17;1391:17,19; 1394:8;1404:16,19,20; 1405:5;1407:5; 1408:21;1414:2; 1429:5,18;1430:12,16; 1433:16;1446:16; 1455:2;1461:5; 1462:19;1470:9; 1472:20;1474:19; 1475:6;1478:22; 1481:24;1486:14,16; 1495:3;1496:8 basic (2) 1419:7;1475:6 basically (4)</p>	<p>1420:23;1442:4; 1448:18;1474:24 BASIN (31) 1370:9,10,11,13; 1380:11;1399:22; 1415:10,20;1422:18; 1423:11,20,24;1424:5, 7,9;1430:2;1432:3; 1435:3,19,21;1438:23; 1446:17;1456:9,10; 1459:1;1461:18; 1462:18;1474:20; 1477:3;1489:22; 1492:18 basins (16) 1380:8,9;1408:3; 1437:13;1450:4; 1461:4;1463:14,18,20; 1474:18;1476:18,19; 1482:2,4;1495:24; 1496:10 basis (9) 1389:12;1391:12; 1401:10,18;1404:24; 1409:15;1410:7; 1461:15;1463:7 bear (1) 1483:4 bears (1) 1464:1 beautiful (1) 1412:10 become (1) 1422:20 becomes (2) 1387:22;1432:20 Bedroc (6) 1372:9;1393:9; 1405:11;1485:5; 1493:24;1497:10 began (4) 1392:8,13;1435:18; 1443:7 begin (1) 1486:18 beginning (6) 1412:14;1445:14; 1447:22;1450:8; 1475:21;1481:5 behalf (2) 1416:10;1466:19 behaves (1) 1384:14 Belaustegui (1) 1371:19 below (2) 1410:20;1413:5 Benedict (13) 1371:11;1373:8,20; 1393:18,18;1394:2; 1395:5;1485:14,15; 1488:13;1494:8,9; 1496:11</p>
---	--	--	--	---

beneficial (8) 1445:10,21;1446:17; 1462:15;1494:12; 1495:6,10,17	boil (1) 1489:16	bring (6) 1408:20;1422:15; 1463:8,11;1477:18; 1479:1	1492:13	1485:21
benefit (1) 1406:16	born (1) 1488:2	bringing (4) 1378:15;1421:7; 1460:11;1480:1	California (9) 1371:23;1380:8; 1425:5;1427:15; 1429:17;1440:23; 1441:7,9;1465:8	capturing (2) 1464:19;1468:4
BERLEY (1) 1378:11	borne (1) 1448:5	broader (7) 1452:4,12;1459:15; 1460:3;1463:16; 1464:1;1470:18	call (2) 1381:11;1404:12	carbonate (42) 1382:11;1383:1; 1384:13;1391:6,7; 1403:8,9,13,22,23; 1404:4,5,21;1419:11; 1425:21;1426:4; 1427:13,18;1428:2,13, 23;1432:8;1437:17; 1439:8;1442:2;1445:2; 1456:23;1457:7; 1461:23;1462:4,7; 1463:6;1469:17; 1473:12;1478:9,23; 1479:6;1480:24; 1481:2,6;1483:21; 1492:21
besides (2) 1409:9;1434:13	borrowed (1) 1450:21	brought (8) 1404:9;1406:17; 1407:24;1420:22; 1421:16;1423:14; 1456:20;1462:20	called (3) 1416:13;1433:11,13	careful (2) 1438:15;1456:10
best (8) 1393:19;1394:4,7; 1411:8;1441:3; 1456:18;1495:21; 1498:15	both (8) 1387:16;1421:21; 1435:1,3;1436:4; 1439:23;1450:23; 1456:19	Brownstein (1) 1371:22	calls (1) 1433:12	carefully (2) 1459:2;1496:4
better (5) 1410:12;1437:20; 1438:6,8;1482:24	bottom (8) 1411:3;1413:4; 1423:19,21;1426:22; 1428:5;1444:19; 1447:14	budget (3) 1404:18;1488:23; 1489:23	came (4) 1398:7;1443:7; 1445:16;1488:2	Carlson (11) 1381:2,4,8;1387:9, 13,14;1402:5,9;1405:5, 5;1415:11
beware (1) 1447:6	bound (1) 1484:3	build (2) 1421:5;1455:7	Can (86) 1375:1;1376:11; 1379:2,10;1382:17; 1384:14;1385:8,20; 1386:17;1390:6; 1391:18;1393:2; 1396:7;1397:2;1399:2; 1401:14,15,22;1407:6; 1410:12,14;1411:8; 1413:16,20,20,20; 1414:17;1415:4; 1416:21;1418:5,17; 1420:10;1422:12,24; 1423:2,5,6;1425:23; 1428:1,20;1430:3; 1432:15;1433:2; 1436:6,10;1437:14; 1438:12;1443:9; 1445:13;1452:13; 1453:8,20;1454:9; 1455:19;1459:7; 1462:10;1464:12,15, 22;1465:13;1469:3; 1473:16;1477:11,16; 1478:8;1484:22; 1486:4,18,20;1487:6,6, 9,19,20;1488:6,10,24; 1489:4,10,16,18; 1490:19;1493:4; 1494:20;1496:1,7	Carson's (1) 1398:14
beyond (11) 1399:6;1400:16,20; 1401:18;1403:13,23; 1404:5;1440:18; 1452:13;1487:16; 1488:6	boundaries (14) 1399:11,12;1401:8; 1409:22;1410:9,17; 1419:7;1438:18,21; 1440:2,7,10,12;1463:3	building (1) 1411:4	Carlson (5) 1371:17;1374:1; 1498:2,6,17	case (9) 1380:13;1410:15; 1417:9;1430:23; 1441:15;1454:10; 1455:7;1467:22; 1496:2
big (4) 1413:15;1430:16; 1446:19,21	boundary (62) 1381:10;1387:10; 1398:14,17;1399:21, 23;1400:2,5;1401:13, 13;1407:22,23; 1414:10;1418:23; 1419:6;1423:20; 1424:1,6,7,10;1425:17, 18;1426:8,16,18; 1432:3;1435:12,16,19, 22,23;1437:21;1439:3; 1440:8,13,14,16; 1441:1,3,10,14; 1469:15;1471:12,19, 21,24;1482:23,23; 1483:3,6,9,12,14,16; 1484:13,14,16,19; 1492:6,10,14;1493:2	bullet (1) 1455:15	case-by-case (1) 1463:7	cases (2) 1455:9;1457:7
bigger (1) 1414:2	burden (1) 1462:7	burden (1) 1462:7	case (9) 1380:13;1410:15; 1417:9;1430:23; 1441:15;1454:10; 1455:7;1467:22; 1496:2	casting (1) 1411:6
Biological (6) 1388:6;1402:19; 1482:7;1493:19; 1496:20,22	Bushner (16) 1383:21;1384:2; 1389:4,5;1392:17; 1395:20;1396:3; 1398:12,24;1399:23; 1405:3,3;1406:1,3; 1408:7;1473:22	bursts (1) 1483:22	catch (1) 1414:11	causing (1) 1464:12
bit (6) 1404:20;1439:14; 1482:22,24;1489:8; 1497:4	boundary's (1) 1440:22	buy (2) 1459:8;1462:10	cause (4) 1408:23;1409:8,22; 1411:22	caused (1) 1411:2
BLACK (14) 1370:9;1377:21; 1423:19;1424:6; 1425:5;1426:9; 1430:15;1435:4,21; 1482:24;1483:18,24; 1484:5;1492:7	boy (1) 1462:3	bypass (1) 1486:12	capacity (2) 1432:13;1433:9	causes (1) 1408:19
Bliss (1) 1371:14	Brad (1) 1466:19	bypassed (1) 1486:12	Canyon (5) 1428:7;1432:24; 1468:23;1469:2; 1475:14	causing (1) 1464:12
BLM (1) 1425:16	break (2) 1416:3;1466:6	calculate (1) 1433:16	captured (3) 1457:23;1464:18;	Caviglia (4) 1371:24;1393:13; 1405:15;1485:9
blue (18) 1386:12;1424:3,3, 17,18;1425:21; 1428:18,22;1431:18, 18,20;1433:18;1443:2, 2;1457:18;1492:8; 1493:3;1494:21	bridge (1) 1460:20	calculated (2) 1386:15;1471:24	center (1) 1487:6	CCR (1) 1498:22
bluer (1) 1425:23	Bridget (1) 1371:14	calculating (1) 1404:12	center (1) 1487:6	Center (11)
bluish (1) 1428:1	brief (1) 1456:17	calibrate (4) 1439:5,21;1440:7,9	center (1) 1487:6	
BMONCO-2 (1) 1377:21	briefly (12) 1408:11,11;1416:21; 1418:11;1419:19; 1420:2,21;1423:18; 1427:2;1438:5; 1439:14;1455:15	calibrated (8) 1397:19;1398:7,8; 1411:13;1439:23; 1440:19;1492:15,17		
		calibration (1)		
		C		

<p>1388:6;1402:19; 1418:13;1421:12; 1424:2,2;1457:10; 1482:7;1493:19; 1496:20,22 centers (1) 1457:21 central (3) 1424:24;1431:11,24 centralized (1) 1423:11 certain (7) 1429:6;1461:10; 1469:3;1477:21; 1486:11,13;1490:8 certainly (18) 1400:23;1408:15; 1410:5;1411:6; 1420:20;1422:12; 1426:2,17;1430:18; 1441:15;1458:14; 1464:23;1473:16; 1483:12;1490:13; 1492:22,23;1496:3 Certified (1) 1498:4 certify (1) 1498:5 cessation (1) 1412:15 cetera (2) 1432:7;1463:16 CFS (1) 1478:17 CH2M (3) 1390:9;1391:3; 1414:12 chance (1) 1386:4 change (16) 1383:7;1385:21; 1398:19;1399:4,21; 1400:4;1409:15,22; 1411:17;1412:19; 1414:20;1415:16; 1453:10,16,20;1455:11 changes (5) 1377:10;1411:15; 1414:1;1454:20,20 changing (1) 1399:12 characteristic (1) 1377:15 characteristics (1) 1456:11 characterization (1) 1472:13 characterize (1) 1410:11 chemical (1) 1444:20 Chief (2) 1371:7,10</p>	<p>chloride (1) 1389:11 Christ (1) 1480:7 Chuck (1) 1444:4 Church (2) 1480:6,7 circled (2) 1435:4,24 citations (1) 1449:12 cited (1) 1449:12 City (33) 1371:17;1372:10; 1374:1;1388:2; 1402:16;1416:1,6,9,10; 1417:10,17;1418:12; 1419:6;1420:23; 1421:17,19;1422:2,8; 1423:17;1433:5,12; 1460:9,16;1463:8; 1477:17;1478:23; 1479:8;1480:3,5; 1481:4;1498:2,6,17 City's (5) 1416:19;1419:13; 1465:14;1479:24; 1480:23 clarification (2) 1376:19;1490:1 clarify (1) 1491:12 clear (8) 1412:5,18;1422:7; 1426:21;1456:24; 1466:1;1483:1; 1490:23 clearly (3) 1456:21;1457:15; 1472:4 click (1) 1379:19 client (2) 1481:18,24 climactic (1) 1375:6 climate (17) 1394:4,6,8;1396:11; 1397:3;1449:6,13; 1451:1,14,14,14,23,24; 1452:7;1456:3; 1463:24;1472:5 climatic (10) 1375:12,17;1376:10, 17,24;1377:6,10; 1394:11;1397:9,13 climbing (1) 1450:23 close (1) 1457:8 closer (1)</p>	<p>1410:12 coefficient (1) 1454:3 coefficients (1) 1453:15 Cogeneration (5) 1388:11;1402:22; 1482:11;1493:21; 1497:7 coincident (2) 1453:11;1469:13 coincidental (2) 1387:6,8 coincidentally (3) 1434:9;1447:18,19 coincides (1) 1450:8 collaborate (1) 1455:24 colleagues (2) 1404:23;1446:3 collect (2) 1389:9;1473:17 collected (5) 1390:21;1406:5,6, 21;1440:1 collecting (3) 1396:13;1404:11; 1406:24 collections (1) 1394:12 color (2) 1431:23;1466:24 Colorado (2) 1421:14;1460:13 colors (1) 1443:1 combine (1) 1459:20 coming (11) 1391:5,5;1429:24; 1435:12;1436:16; 1441:11,20;1443:6; 1467:23;1468:1; 1483:22 commencing (2) 1495:1;1496:20 comment (3) 1469:8;1483:15; 1497:11 comments (1) 1409:3 commercial (1) 1443:2 commingling (1) 1489:15 Commission (1) 1401:2 commodities (1) 1485:19 common (1) 1377:15 commonly (2)</p>	<p>1454:12;1490:24 Company (13) 1389:5;1393:6; 1405:10;1406:23; 1407:9,22;1480:15; 1481:10,17;1485:2; 1493:23;1495:9; 1497:8 compare (2) 1392:21;1393:2 compared (1) 1404:9 compares (1) 1411:21 comparison (1) 1386:8 compartmentalization (2) 1467:19;1468:5 compartments (1) 1489:9 compensations (1) 1459:9 compiled (3) 1418:6;1437:2; 1445:6 complete (1) 1421:1 completed (14) 1392:3;1398:8; 1421:9,13;1422:11; 1432:8,9,9;1433:10; 1437:17;1444:22; 1460:21;1481:2; 1491:15 completely (3) 1377:24;1413:22; 1465:4 completion (2) 1445:10;1495:18 complimented (1) 1464:23 component (3) 1421:1;1423:10; 1429:15 components (2) 1420:24;1422:8 composing (1) 1437:21 computations (1) 1489:1 computed (1) 1432:18 concentrated (1) 1418:24 concentrating (1) 1420:5 concept (7) 1403:20;1420:20; 1422:9;1423:9; 1465:19;1485:16; 1488:19 conceptual (3) 1422:14;1429:8,17</p>	<p>conceptualize (1) 1429:3 conceptually (1) 1484:18 concern (1) 1450:6 concerns (4) 1379:8;1428:17,20; 1429:2 conclude (3) 1478:22;1484:22; 1497:10 concluded (5) 1394:15;1496:13,17, 22;1497:14 conclusion (1) 1452:20 conclusions (11) 1380:16;1384:11,13; 1399:7;1419:24; 1463:1;1475:22; 1476:2,4;1478:21; 1493:1 condition (2) 1471:21;1482:23 conditions (2) 1471:13;1492:6 conduct (1) 1396:11 conductance (2) 1492:10,14 conductances (1) 1440:8 conductivity (1) 1492:8 configuration (1) 1415:21 confined (1) 1453:15 confirm (2) 1434:3;1483:10 conflict (1) 1477:8 connected (1) 1426:4 connection (2) 1385:20;1396:1 connections (1) 1489:15 CONSERVATION (2) 1370:2;1498:8 conserve (2) 1423:13,14 consider (2) 1389:17;1459:17 considerable (1) 1428:22 consideration (1) 1463:9 considered (9) 1426:13;1458:14; 1461:15;1462:20; 1463:7;1474:15;</p>
--	--	--	---	--

<p>1476:18;1488:22; 1489:16 consistent (5) 1389:3;1390:18; 1430:5;1446:24; 1449:4 consistently (1) 1431:2 consisting (1) 1498:12 constant (2) 1386:16;1439:12 constitutes (1) 1425:9 constrained (1) 1473:14 constructed (1) 1392:24 construction (10) 1421:7,9,18;1436:1; 1439:14;1443:12,13, 14,16;1490:9 constructive (1) 1450:1 consuming (1) 1443:16 contention (2) 1389:20;1403:6 context (2) 1424:21;1425:19 continuation (4) 1374:5,13;1466:15; 1497:6 continue (4) 1374:7;1394:21; 1408:16;1452:11 continues (3) 1413:9;1424:11; 1486:14 continuing (1) 1486:24 continuity (1) 1427:13 contour (2) 1382:20,23 contours (3) 1381:22;1383:1,2 contract (3) 1400:7;1401:1,4 contracts (1) 1400:12 contrast (2) 1456:3,10 contrasted (2) 1435:8;1451:18 contributed (2) 1407:9,12 control (3) 1428:11;1477:22; 1478:17 conversely (1) 1440:16 convey (3)</p>	<p>1418:9;1419:12; 1441:23 conveyor (1) 1461:7 convinced (1) 1415:9 coordinated (2) 1448:7;1474:10 coordination (1) 1400:24 copies (1) 1375:23 copy (5) 1386:3;1416:18; 1466:24,24;1467:1 core (4) 1414:10,20,23; 1415:3 corner (6) 1426:23;1435:20; 1483:23;1484:6,8,9 corrected (1) 1490:20 correction (4) 1491:1,3,6,8 correctly (1) 1483:8 corresponding (1) 1448:3 corresponds (1) 1447:22 corridor (6) 1421:8;1431:12; 1434:6;1463:19; 1483:21;1484:12 corridors (2) 1404:21;1425:16 costs (1) 1479:9 counsel (1) 1466:21 count (1) 1379:23 County (14) 1372:2;1390:15,19; 1400:8,9;1401:1,2; 1404:3;1405:20; 1406:1,22;1407:8,21; 1481:16 County-Vidler (2) 1481:9;1493:18 couple (8) 1395:19;1427:1; 1433:3;1448:24; 1474:5;1479:23; 1481:17;1492:5 course (1) 1447:14 Court (1) 1498:4 cover (1) 1417:14 Coyote (27)</p>	<p>1374:14,17;1379:1; 1389:2,15,19,23; 1390:4,16;1395:10; 1398:14,21,21; 1406:22;1415:7,17; 1425:3;1429:22; 1466:12;1470:9,12,17; 1471:1;1475:11,15,24; 1491:17 creating (1) 1488:4 credibility (1) 1401:12 credible (1) 1385:24 credit (1) 1387:15 crew (1) 1414:18 critical (1) 1420:16 critically (1) 1419:9 criticism (3) 1446:3;1478:4; 1494:17 critique (1) 1478:15 CROSS (6) 1373:2,11;1427:20; 1428:5,21,21 crossed (2) 1387:18,20 cross-examination (22) 1374:7,9,13,20; 1378:21;1383:17; 1388:12;1395:8,14; 1398:4;1403:1; 1417:16;1466:7,11,17; 1467:8;1470:2;1474:1; 1479:16;1481:11; 1482:13;1492:1 CSI (9) 1371:19,22;1398:19; 1399:4;1400:7,24; 1401:16;1407:8; 1466:19 CSVM (1) 1397:6 CSVM-1 (1) 1453:7 CSVM-2 (3) 1375:4,9;1470:10 CSVM-4 (12) 1392:22,24;1393:22; 1395:22;1397:2,7,8,11, 12;1410:4;1412:6; 1414:6 CSVM-5 (4) 1377:9,14,18;1397:6 curiosity (1) 1494:14 curious (1)</p>	<p>1391:8 current (4) 1409:10;1415:20; 1443:9;1456:19 currently (6) 1421:4,9,22;1442:2; 1480:11;1481:4 curtailments (2) 1459:10;1461:5 cut (1) 1490:11 cutting (1) 1425:16 CV (1) 1416:22 cycle (2) 1453:2;1455:8</p>	<p>date (4) 1439:22;1457:13; 1480:4;1486:17 Dated (1) 1498:17 day (9) 1385:1;1433:19; 1437:2;1448:17; 1452:12;1462:16; 1492:9;1497:1; 1498:17 days (1) 1396:24 dealing (3) 1454:17;1458:11; 1463:24 Death (2) 1454:14;1456:4 debating (1) 1452:2 decadal (2) 1413:2,11 decade (2) 1439:11;1451:18 decades (6) 1429:18;1430:23,24; 1451:18;1458:9; 1480:15 decisions (3) 1410:8;1414:2; 1460:1 decline (9) 1386:7,14,21; 1394:14;1395:3; 1412:8;1413:2;1448:3; 1450:5 declines (4) 1387:6;1394:21,24; 1447:22 declining (8) 1376:9;1377:15,18; 1413:9;1450:15; 1452:5,9;1472:5 decommissioning (2) 1480:13,17 decree (1) 1477:10 decreed (2) 1459:8;1462:9 dedicated (1) 1459:8 deep (6) 1387:24;1402:6,7; 1428:7,9,10 deeper (4) 1437:1,1;1487:5; 1492:24 deepest (1) 1410:21 define (7) 1449:20;1453:17; 1464:2;1469:19; 1471:5;1484:18;</p>
D				
<p>Dace (2) 1407:10;1420:17 Dagnisi (2) 1391:14;1397:18 daily (1) 1453:18 dark (1) 1431:18 dashed (3) 1423:19;1435:4; 1436:1 data (80) 1379:8,11;1380:24; 1385:13,24;1387:24; 1389:9,9,10,11; 1390:20;1396:9,10,14; 1402:6,7;1404:11; 1406:5,6,13,15,21; 1407:6;1411:12,12,13, 14,16,20,21,22;1412:2; 1414:2,4;1415:9; 1418:16;1427:8,9; 1429:5,7,19,23; 1430:12;1431:9; 1432:5,13,14;1435:3; 1436:9;1437:15; 1438:12;1439:24; 1440:4;1441:3,5; 1442:9;1444:14; 1447:5,6,7,15;1449:4; 1453:5;1457:15; 1470:17;1471:3,3,5; 1472:23;1473:10,11, 14,14,17;1484:17,20; 1491:5;1492:16; 1495:21;1496:9 database (1) 1445:6 dataset (3) 1437:10;1439:10; 1447:10 datasets (2) 1447:1,8</p>				

1489:4 defined (6) 1419:7;1428:13; 1448:9,10,20;1472:22 defines (1) 1470:16 defining (1) 1486:3 definitely (1) 1452:24 definitive (2) 1441:24;1492:23 degree (5) 1396:1;1468:3; 1477:15;1486:18; 1487:9 Delamar (1) 1390:6 delay (1) 1397:18 delineated (1) 1482:3 delineation (1) 1414:10 delivery (1) 1421:14 demonstrate (2) 1387:18;1394:5 demonstrated (2) 1456:21;1475:17 demonstrative (2) 1402:10;1426:23 demonstratives (2) 1378:16,20 DEPARTMENT (6) 1370:2;1374:23; 1395:17;1470:5; 1492:3;1498:8 depend (1) 1460:19 depending (1) 1497:1 depends (2) 1430:17;1460:22 depletion (1) 1472:8 depth (6) 1411:4,23;1414:23; 1433:7;1436:5,9 depths (3) 1432:6,6;1437:4 derived (3) 1441:4;1471:13,19 derrick (1) 1428:6 describe (1) 1416:21 described (2) 1396:24;1479:10 Desert (3) 1380:11;1425:9; 1456:8 deserves (1)	1430:16 designated (1) 1401:11 designation (1) 1425:15 desire (2) 1419:13;1461:1 despite (1) 1379:9 detail (7) 1410:13;1419:3; 1422:12,12;1430:14; 1458:24;1493:8 detailed (1) 1496:4 determination (2) 1409:16;1497:3 determine (7) 1377:5;1392:11; 1396:1;1397:3;1436:6; 1453:21;1478:16 determined (2) 1387:10;1433:22 determining (1) 1477:23 detrimentally (1) 1455:20 developed (5) 1380:4;1391:13; 1401:9,15;1442:3 development (5) 1425:13;1445:14; 1450:9;1460:20; 1464:16 developments (1) 1495:2 deviate (1) 1440:18 devoid (1) 1472:8 diagram (1) 1385:8 diameter (1) 1421:5 diamond (5) 1432:1;1436:1,2; 1490:8,9 difference (3) 1408:8;1435:9; 1436:13 different (22) 1379:22;1391:19,22, 22,23;1409:1;1411:16; 1420:11;1424:12; 1438:18;1440:15; 1444:3;1446:7;1447:9; 1450:14;1453:5; 1460:4;1464:11; 1483:13;1489:4,7,7 differing (1) 1395:21 difficult (3) 1422:23;1429:3;	1455:6 difficulties (1) 1488:4 DIRECT (5) 1373:2,11;1385:20; 1416:16;1483:1 directing (1) 1453:4 direction (3) 1383:12,13;1486:9 directives (1) 1452:13 directly (1) 1425:4 disagree (1) 1384:23 disagreed (1) 1384:16 discern (2) 1377:13;1397:14 discernible (1) 1394:17 discharge (11) 1390:16;1403:7,12, 16,23;1404:1,5,12; 1452:6;1486:1;1493:3 discharges (2) 1403:9;1455:21 discontinuities (1) 1428:23 discontinuity (1) 1428:3 discuss (6) 1422:12;1430:9,14; 1443:5;1446:21; 1468:22 discussed (6) 1406:7;1419:3; 1426:11;1430:6; 1435:5;1463:5 discussing (3) 1396:19;1422:11; 1462:21 discussion (2) 1408:12;1474:13 discussions (1) 1480:8 displacement (1) 1382:10 disputes (1) 1472:13 distance (1) 1415:18 distant (1) 1457:20 distinct (1) 1488:19 distinction (1) 1389:18 distinctly (1) 1478:13 distribution (1) 1442:7	District (17) 1378:13;1383:16,20; 1385:18,24;1398:3; 1400:8;1402:15; 1406:23;1407:9,21; 1473:24;1479:15,18; 1481:16;1493:12,15 disturbance (1) 1425:13 diversion (2) 1398:20;1436:24 Diversity (7) 1372:13;1388:6; 1402:20;1482:8; 1493:19;1496:21,22 DIVISION (6) 1370:3;1393:16; 1405:17;1485:12; 1494:5;1498:9 document (3) 1383:4;1389:12; 1439:20 documenting (1) 1389:24 domain (1) 1454:15 domestic (1) 1436:22 dominance (1) 1451:17 dominated (2) 1456:5;1457:14 dominates (1) 1452:8 done (20) 1390:14;1391:20; 1396:20,23;1407:9; 1410:20;1422:13; 1431:13;1434:3; 1443:17;1451:21; 1453:22;1454:11,12, 13;1465:14;1466:16; 1481:21;1482:1; 1496:9 Donnelly (1) 1372:13 Dorothy (1) 1381:11 dotted (1) 1424:6 down (24) 1383:11;1385:4; 1409:5;1412:9; 1419:16;1422:3; 1429:15,15;1431:4,6; 1433:7,10;1435:16; 1456:6;1458:22; 1460:3;1461:2; 1463:18;1465:3; 1467:24;1477:17; 1483:22;1489:17; 1495:10 downstream (2)	1409:5,9 Downturn (1) 1383:13 Dr (20) 1380:21;1381:1; 1387:9;1391:14; 1397:19,21;1398:6,10; 1402:4;1403:4,14; 1405:4;1408:8,10; 1409:11;1452:22; 1472:13;1473:2,6; 1493:7 drafting (1) 1417:12 dramatic (1) 1451:10 draw (3) 1419:23;1436:10; 1452:20 drawdown (8) 1409:4;1410:3; 1411:2;1420:14; 1432:15;1433:3; 1434:2;1487:16 drawdowns (3) 1408:20,21;1411:10 drawn (3) 1385:4,20;1401:14 drill (2) 1414:17;1473:17 drilled (8) 1386:16;1428:8; 1431:20;1433:6,10,13; 1436:4;1472:21 driver (1) 1460:1 drop (1) 1415:14 drought (3) 1413:9,12;1451:14 dry (11) 1394:14;1427:3; 1451:4,5,11;1465:7; 1469:6,9,11;1496:23; 1497:6 dryer (2) 1451:17;1456:3 due (5) 1397:12;1408:22; 1411:2;1413:14; 1467:20 duly (2) 1416:14;1428:20 Dupont (1) 1487:5 duration (1) 1458:6 during (5) 1413:16,21;1467:10, 12;1483:1 Duval (1) 1417:14 dwell (1)
--	---	---	---	--

1439:20 DWIGHT (3) 1373:11;1416:9,12 dynamic (2) 1439:17;1451:6	1487:20 efforts (1) 1484:15 EH-4 (21) 1379:5;1447:23; 1448:7;1450:7,12,14; 1452:5;1455:16,20,22; 1459:24;1464:13,14; 1467:12;1475:16; 1487:22;1488:5,8,11; 1489:5,20 eight (2) 1415:8;1438:18 either (2) 1399:7;1462:14 elaborate (1) 1450:18 electronic (2) 1445:6;1466:24 elevation (8) 1431:3;1435:6,7; 1436:9,10,24;1437:3; 1438:12 elevations (6) 1414:11;1436:8,14; 1438:23;1470:24; 1490:20 else (2) 1403:24;1409:20 elsewhere (7) 1413:10;1450:4; 1458:16;1464:13; 1477:1,17;1489:21 embedded (1) 1472:9 emphasis (2) 1458:13;1459:13 emphasize (1) 1460:6 enable (1) 1421:14 encapsulate (1) 1420:21 encompasses (1) 1460:3 encounters (1) 1409:7 encourage (3) 1420:19;1462:17; 1464:4 end (20) 1383:22;1411:11,20; 1420:5;1421:20; 1423:23;1424:12,14, 14;1437:2;1448:17; 1452:12;1462:16; 1463:2;1465:22; 1467:21,24;1468:3; 1487:14;1490:3 Energy (7) 1371:24;1393:12; 1405:14;1480:16; 1485:8;1494:3;	1497:10 Engineer (31) 1371:4;1380:12; 1393:15;1395:24; 1396:4;1401:4;1402:8; 1405:18;1407:1; 1408:23,23;1409:15, 22;1410:8;1414:1; 1417:4;1418:9,17,23; 1422:13;1438:7; 1450:1;1455:12; 1458:18;1461:16; 1463:12;1467:3; 1477:19,23;1485:11; 1494:5 engineers (2) 1414:23;1453:1 Engineer's (4) 1406:4;1442:9,20; 1446:1 enough (4) 1470:17;1471:2,3; 1484:20 entered (1) 1480:6 entire (4) 1387:1;1420:4; 1458:21;1465:21 entirely (1) 1449:7 entities (1) 1462:10 entitled (1) 1498:9 entrance (1) 1472:16 environmental (2) 1379:15,20 equal (2) 1451:4,5 equations (1) 1432:16 equilibrium (1) 1451:6 equipment (1) 1491:4 erroneous (1) 1448:17 error (2) 1449:8,8 errors (1) 1394:11 especially (4) 1403:21;1414:4; 1437:20;1462:4 Esq (4) 1371:18,20,24; 1372:4 essentially (1) 1411:4 established (4) 1400:3;1420:11; 1440:18;1479:7	estimate (2) 1380:6;1432:16 estimated (2) 1432:19,23 estimates (2) 1408:21;1437:3 et (4) 1432:7;1452:22; 1454:24;1463:16 evaluate (1) 1391:15 evaluation (1) 1430:12 even (2) 1406:12;1490:2 event (3) 1392:12;1413:15,20 events (1) 1375:6 eventually (1) 1470:13 everybody (5) 1392:21;1403:24; 1405:1;1447:4; 1455:13 everyone (2) 1416:2;1497:12 everyone's (1) 1410:22 everything's (1) 1420:18 evidence (12) 1380:19;1396:9; 1407:24;1409:12,21; 1415:22;1417:20,21, 22,23;1487:21;1495:3 EWR's (1) 1445:6 exactly (1) 1483:18 EXAMINATION (9) 1373:7,19;1393:17; 1405:22;1416:16; 1485:13;1488:15; 1490:16;1494:7 examinations (1) 1451:23 examined (1) 1458:24 examining (1) 1493:7 example (4) 1475:14;1485:20; 1489:1;1495:22 examples (2) 1419:19;1468:18 exceeded (2) 1476:1,4 exceeding (2) 1428:13;1433:18 except (2) 1420:7,16 exception (1)	1449:5 exclude (1) 1492:24 excluded (1) 1409:16 Excuse (6) 1400:18;1433:14; 1435:15;1457:1; 1480:5;1481:1 exercise (5) 1436:7,11;1438:15, 16;1441:22 exertion (1) 1410:22 exhibit (11) 1377:14;1416:22; 1417:12,20,21,22,23; 1426:23;1442:14; 1483:2,2 EXHIBITS (7) 1373:23;1416:19; 1417:10,10,17,18; 1418:20 exist (4) 1428:24;1433:4; 1438:2;1467:20 existed (1) 1429:18 existing (3) 1424:19;1441:3; 1463:19 exists (1) 1380:23 expanded (1) 1436:18 expect (1) 1490:21 expend (1) 1473:16 expended (1) 1451:20 expert (5) 1379:15,19;1417:7; 1466:2;1474:10 explain (5) 1408:8;1409:24; 1468:5;1469:16; 1482:22 explained (2) 1396:20;1449:17 explains (1) 1458:2 explanation (2) 1448:12;1450:17 explanations (1) 1456:18 explanatory (6) 1448:1,12,14; 1449:9,16,20 exploration (2) 1428:8,12 express (1) 1422:2
---	---	--	--	---

extended (1) 1495:9	1486:17;1494:23	1480:15;1487:9; 1496:10	1414:14,21,24; 1476:18;1491:23; 1492:9	focus (4) 1408:18;1452:14; 1463:2;1475:22
extending (2) 1427:19;1476:5	1392:7;1491:10	fieldwork (1) 1415:12	Flangas (14) 1373:6,18;1388:13, 16,18;1393:4;1402:23; 1403:2;1405:7; 1482:14,17,19,20; 1484:23	focused (6) 1407:20;1409:5; 1412:18;1419:4; 1465:22;1475:23
extends (3) 1421:10;1424:23; 1484:5	falling (1) 1453:11	Figure (9) 1386:3,6;1392:17, 20;1424:22;1464:12; 1465:12;1488:10; 1490:13	flat (2) 1430:4;1467:17	folder (1) 1467:4
extent (2) 1399:10;1456:12	familiar (2) 1390:9,13	figures (2) 1418:19;1425:7	flexibility (1) 1461:18	folds (1) 1467:20
extra (1) 1461:8	far (9) 1414:3;1456:7; 1469:19;1484:12; 1486:10;1487:16; 1488:6,9;1497:2	file (3) 1398:19;1445:5; 1495:10	flip (4) 1423:1;1461:22; 1462:8;1464:9	followed (1) 1449:23
extraordinary (1) 1392:12	Farber (1) 1371:22	files (1) 1495:22	floor (1) 1471:1	following (1) 1450:18
extremely (1) 1434:16	far-reaching (1) 1487:7	filings (3) 1446:17;1495:6,17	FLOW (90) 1370:8;1374:6; 1376:13;1377:17; 1388:23;1389:1,14; 1390:3,3,7,11;1401:11; 1403:16,17;1404:16; 1406:16;1407:5,7,22; 1408:3,9,12;1409:5,10, 17,24;1426:19;1427:8; 1429:3,9,15,17; 1430:13;1431:10; 1438:24;1440:8; 1441:1,2,11;1442:1; 1450:4;1451:16; 1454:14;1456:5,7,8; 1458:19,20;1459:1,4, 12,15,21;1460:1; 1461:17;1463:3,4,17; 1464:18;1467:20,21, 23,24;1468:24;1469:4, 5,7,9;1471:4,24; 1474:19;1476:19,24; 1477:22;1478:9; 1481:19,22;1484:1,19; 1486:1,8,11,13,17; 1487:1,2;1488:21; 1489:11,18;1492:24	follows (1) 1416:15
eye (1) 1487:2	farther (2) 1412:10;1468:8	filter (3) 1454:15,21,22	forth (3) 1420:22;1461:21; 1483:13	foot (7) 1385:1;1411:1,2,3, 17;1453:9,9
F	fault (37) 1380:22;1381:10,11, 11,13,20;1382:2,5,7; 1385:2,9;1387:10,18, 20;1398:12,13,22; 1399:21;1400:3; 1415:10,11;1425:21; 1427:5;1428:4; 1434:10;1468:8,9,19; 1469:6,10,14,18; 1470:21,22,23;1484:3, 13	filtering (1) 1455:10	forward (7) 1420:19;1422:15; 1456:20;1462:11; 1463:8;1465:12; 1477:18	foregoing (1) 1498:12
facilitate (3) 1422:17,18;1465:15	faulting (3) 1468:12,16;1469:18	final (1) 1423:10	forming (2) 1425:17,17	forgive (1) 1397:17
facilities (11) 1444:1,2,3,11; 1445:8,18;1447:3; 1488:2;1495:4,11; 1496:5	faults (9) 1415:14;1427:2,4,6; 1467:20;1469:1,8,13; 1471:2	finally (7) 1387:9;1407:17; 1411:24;1412:4,11; 1413:1,13	forth (3) 1420:22;1461:21; 1483:13	forming (2) 1425:17,17
facility (2) 1444:4;1480:16	feature (2) 1387:22;1427:5	financial (1) 1459:9	found (2) 1415:11;1487:21	formation (1) 1414:1
fact (7) 1403:8;1414:4; 1435:14;1452:4,9,14; 1464:5	features (1) 1408:17	financing (1) 1421:19	four (4) 1395:9;1407:2; 1420:23;1487:14	fraction (1) 1457:21
factor (1) 1454:11	feel (2) 1418:24;1419:9	find (14) 1386:5;1436:23; 1440:7;1442:11; 1449:11;1464:15; 1468:7;1475:4; 1486:17;1487:17,20; 1489:6,9;1496:1	fracture (1) 1409:6	frame (9) 1374:12;1386:24; 1387:4;1442:10; 1444:11;1446:15; 1450:8;1488:1;1495:8
factored (1) 1455:3	feet (28) 1382:12;1386:15; 1410:20,23;1414:14, 24,24;1415:7,8; 1428:9;1430:19; 1433:3,6,7,10,18; 1434:4;1435:7,8,9; 1436:5;1437:7;1439:7; 1442:3;1450:5;1457:6; 1492:9,20	firm (1) 1404:11	framed (1) 1420:18	framework (3) 1390:10;1404:20; 1477:14
factors (1) 1458:6	felt (2) 1391:10;1457:19	first (17) 1378:16,19,24; 1386:8;1410:18; 1414:12;1416:14; 1421:1;1454:10,21; 1455:3;1466:12,16,20; 1474:6;1476:17; 1486:2	front (4) 1379:24;1416:19; 1418:8;1460:7	full (1) 1498:13
fair (1) 1481:3	ferret (1) 1436:22	fit (4) 1415:18;1440:1,3; 1441:3	flux (4) 1471:16;1483:5,13; 1486:3	function (1) 1476:23
FAIRBANK (61) 1370:4;1371:2; 1374:4,16;1376:4; 1378:3,6,9,12;1383:15; 1388:2,5,10,16; 1392:15;1393:5,8,11, 14;1395:7;1398:1; 1399:10;1400:15,22; 1401:7,17,21;1402:14, 19;1405:9,13,16; 1415:24;1416:5; 1417:18;1466:3,9; 1467:7;1469:23; 1473:21,23;1476:3,7, 11;1479:14;1481:9; 1482:7,10,17;1485:1,4, 7,10;1491:14,20; 1493:10,14,17;1494:2; 1496:12,16	few (17) 1382:21;1412:14,21; 1418:7;1419:5; 1421:20;1430:19; 1432:9;1436:21; 1437:9;1452:19; 1455:1;1457:6;1470:7;	Fish (5) 1374:18;1395:11; 1407:10;1469:23; 1491:21	fluxes (2) 1438:9;1441:14	fundamental (2)
fairly (6) 1423:2;1433:17; 1439:11;1443:14;				

<p>1457:9;1458:1 fundamentally (2) 1451:3;1486:7 funds (1) 1495:18 further (28) 1374:17;1378:11; 1388:5,7,10;1393:8,14; 1396:8;1397:24; 1402:16,20;1405:7,16; 1412:6;1427:10; 1435:17;1436:18; 1437:19;1449:2; 1465:8;1469:21; 1486:5,9;1489:10; 1491:18,20;1493:22; 1494:7 future (7) 1422:1,4;1426:18; 1459:3;1461:3;1462:3; 1463:9</p>	<p>Gas (2) 1484:3,3 gathering (1) 1379:8 gauge (1) 1445:13 gave (2) 1377:7;1476:13 GB-1 (5) 1430:2;1432:4; 1435:6,14;1441:21 GB-2 (6) 1431:2,22;1435:8, 10,15;1437:6 GBR-1 (1) 1434:7 general (12) 1419:6;1431:10; 1433:1;1438:21,22; 1468:10;1469:4,8; 1485:18;1492:5; 1495:8,11 Generally (7) 1403:5,10,19,21; 1405:1;1427:5; 1436:15 generate (1) 1444:11 generically (1) 1463:6 gentlemen (1) 1375:1 geochemistry (1) 1406:15 geographic (11) 1401:8,10;1420:11; 1424:21;1436:19; 1456:4,6,12;1460:4; 1489:4,8 geographically (1) 1484:7 geologic (7) 1425:19;1427:13,20; 1428:10,23;1429:2; 1431:15 geology (5) 1404:19,21;1408:14; 1425:20;1427:18 geophysical (5) 1396:10;1406:6,21; 1407:24;1415:9 Georgia (7) 1388:7;1402:21; 1433:24;1482:8; 1493:20;1496:23; 1497:6 germane (1) 1407:21 gets (1) 1421:11 Gilbert's (1) 1459:17 Given (4)</p>	<p>1395:21;1407:16; 1441:20;1463:23 gives (1) 1461:8 giving (1) 1422:3 Glasgow (22) 1373:3,14;1374:21, 22;1375:23;1376:1,6, 21;1378:3,5,8;1395:13, 15,16;1397:23;1470:3, 5;1473:20;1491:24; 1492:2,3;1493:9 go-around (1) 1466:16 goes (4) 1389:22;1390:3; 1401:12;1440:12 Good (29) 1374:4,22;1375:1,6, 12,17;1376:4;1378:23; 1383:19;1388:14; 1394:10;1395:16; 1398:16;1416:8; 1434:22;1435:2; 1440:1,3;1441:5,5; 1465:2;1470:4,6; 1474:3,4;1479:20,22; 1481:15;1482:15 Grace (1) 1428:6 gradient (2) 1437:13;1470:16 gradients (3) 1438:1;1486:14,15 granted (7) 1396:5;1421:24; 1443:18,22;1444:6; 1445:10;1475:1 granting (2) 1395:23;1460:1 graph (1) 1413:4 graphs (1) 1386:10 grappling (1) 1458:14 Gravity (4) 1381:17,21;1383:2,7 Great (6) 1393:22;1410:10; 1411:23;1422:16; 1460:10;1480:19 greater (3) 1421:15;1453:15; 1489:10 greatest (1) 1387:6 green (6) 1423:22;1425:7; 1431:20,23;1443:20; 1444:5 greener (1)</p>	<p>1428:2 Greg (4) 1383:19;1389:5; 1405:3;1479:18 ground (1) 1437:15 groundwater (24) 1380:7,10;1389:10, 14;1390:15,21; 1392:12;1436:16; 1438:13;1458:11,23; 1460:13;1461:9; 1463:19;1465:18; 1467:12,23;1469:7,9; 1472:15;1477:24; 1478:8;1480:1; 1490:19 group (1) 1412:4 guess (6) 1376:18;1385:10; 1392:24;1427:14; 1465:16;1485:18 gypsum (1) 1444:21</p>	<p>1438:21,22;1492:6 headed (1) 1459:6 heading (1) 1470:8 heads (1) 1414:19 headwaters (2) 1457:9;1458:22 heard (4) 1410:3;1413:2; 1426:11;1452:18 HEARING (70) 1370:4;1371:7; 1374:4,5,16;1376:4; 1378:3,6,9,12;1383:15; 1388:2,5,10,16; 1392:15;1393:5,8,11, 14;1395:7;1398:1; 1399:10;1400:13,15, 17,22;1401:7,17,21; 1402:14,19;1405:9,13, 16;1406:7,13,24; 1415:24;1416:5; 1417:18;1418:3; 1466:3,9;1467:7; 1469:23;1473:21,23; 1476:3,7,11;1479:14; 1481:9;1482:7,10,17; 1485:1,4,7,10;1491:14, 20;1493:10,14,17; 1494:2;1496:12,16; 1498:7,14 hearings (2) 1380:6;1417:8 held (1) 1498:8 Hello (2) 1395:18;1492:4 help (3) 1407:1;1441:24; 1452:15 helps (1) 1414:3 hereby (1) 1498:5 herein (1) 1498:10 hereof (1) 1498:13 here's (2) 1385:9,9 Herrema (15) 1373:13;1374:15; 1399:2,6;1400:10,17, 20;1466:18,19;1467:9; 1469:21;1475:20; 1476:6,9;1491:19 heterogeneities (1) 1467:19 Hi (1) 1481:13 Hidden (8)</p>
G				
<p>Gage (3) 1477:22;1478:10,18 gain (3) 1436:3;1438:6,8 gallon (1) 1433:3 gallons (4) 1385:1;1433:8,9; 1434:2 Gardner (1) 1480:13 GARNET (99) 1370:10;1418:13; 1419:16;1421:2,11,24; 1423:21;1424:7,24; 1425:1,4,11,14,24; 1426:3,17;1427:3,6; 1428:15;1429:4,16,20; 1430:1,10,13;1431:3, 11;1432:21;1434:11, 13,15,21;1435:16,22; 1436:14,17;1437:5,14, 23;1438:9,13,19,24; 1439:1,12;1441:6,17; 1443:4,6,19,23;1444:1, 6;1445:8,15,23;1446:6, 8,15;1447:20;1448:6,9, 18;1450:3,9,10; 1455:17,19;1457:18, 24;1460:14;1464:7,8, 10;1465:13;1467:12; 1468:7,13,16;1472:3, 16;1474:20,23;1475:1, 23;1476:5,21;1477:17; 1478:23;1479:6; 1485:17,21;1486:11; 1487:12;1488:10,20; 1492:7;1493:5; 1494:10</p>				
H				
<p>habitat (3) 1407:10,15;1420:17 half (8) 1394:21;1411:1,2; 1414:21,21;1421:11; 1453:9;1483:7 hand (1) 1376:1 handed (2) 1376:12;1378:20 handful (1) 1453:22 handing (1) 1376:2 handy (1) 1386:4 happen (5) 1411:6;1413:20,22; 1460:15,16 happened (2) 1413:16;1447:1 happening (2) 1465:15;1475:23 happens (2) 1409:3;1473:13 hard (1) 1395:3 HARRISON (2) 1388:9;1482:9 harvest (1) 1489:19 harvesting (1) 1487:9 head (6) 1405:2;1415:7,8;</p>				

<p>1425:2;1429:15; 1432:3;1441:17,20; 1465:3;1468:23; 1470:13 high (17) 1384:6;1385:1,2; 1420:17;1423:2; 1433:22,23;1434:16; 1440:16;1448:6; 1452:6;1454:4; 1455:21;1459:24; 1462:2;1464:14; 1483:9 high-density (1) 1383:10 higher (12) 1413:7;1431:4; 1434:5,7;1436:14; 1439:2;1440:24; 1441:14;1454:3; 1464:22;1468:7; 1470:15 highest (8) 1386:21;1430:20,24; 1431:3,5;1435:10,15; 1468:11 highly (1) 1386:18 Highway (1) 1443:13 Hill (3) 1390:9;1391:3; 1414:12 historic (1) 1443:21 historical (2) 1444:13;1448:18 historically (3) 1419:15;1444:24; 1480:22 history (12) 1443:3,4,24;1445:7, 13;1446:12,15,19; 1455:16;1486:8; 1495:19;1496:8 hits (1) 1389:22 hope (1) 1437:24 hopefully (3) 1391:1;1438:7; 1455:13 hoping (1) 1436:3 hour (1) 1374:8 hourly (1) 1453:18 huge (1) 1443:14 Humboldt (2) 1458:15;1459:12 hundred (4)</p>	<p>1391:10;1442:22; 1457:6,6 hundred-story (1) 1411:4 Hyatt (1) 1371:22 hydraulic (2) 1440:3;1492:8 hydrogeologist (1) 1416:23 hydrogeology (1) 1417:7 hydrograph (14) 1376:16;1377:20,23; 1386:17;1393:1,22; 1394:4,4,7,18;1397:2, 3;1442:8;1494:19 HYDROGRAPHIC (7) 1370:11;1399:22; 1400:2,4;1424:9; 1435:22;1477:3 hydrographs (10) 1376:8,13,15,23; 1377:4,16;1393:19; 1394:24;1395:2; 1412:6 hydrologic (5) 1385:13;1401:13; 1426:18;1450:24; 1475:6 hydrologically (1) 1426:6 Hydrology (5) 1371:10;1416:24; 1457:4,9;1458:2 hypotheses (3) 1473:15,15;1484:14 hypothesis (1) 1472:19 hypothesize (1) 1438:19</p>	<p>1432:20 impact (3) 1379:10;1457:11; 1469:8 impacting (2) 1428:18;1455:20 impactors (1) 1459:7 impacts (5) 1379:2;1392:11; 1408:9,16,19 impediment (2) 1427:8;1469:7 implemented (1) 1422:10 implementing (1) 1458:18 implications (1) 1419:21 imply (3) 1470:11;1483:10,12 important (6) 1392:19;1401:3; 1408:15;1412:11; 1419:9;1461:3 impressed (1) 1410:22 impulse (1) 1412:18 inaccurate (2) 1446:17;1447:21 inappropriate (1) 1449:7 in-basin (2) 1390:21;1396:13 inches (2) 1434:2,3 inclination (1) 1385:10 include (6) 1386:24;1475:11; 1481:19;1482:1,4; 1483:3 included (5) 1376:8;1408:4; 1431:5;1483:24; 1484:7 includes (1) 1463:17 including (2) 1406:20;1432:6 inclusion (1) 1426:14 incomplete (1) 1447:10 inconsistencies (1) 1446:19 inconsistency (1) 1449:2 inconsistent (1) 1389:6 incorporate (2) 1483:23;1484:2</p>	<p>incorporated (3) 1419:2;1426:3; 1484:10 incorporates (2) 1425:10;1483:16 incorporating (1) 1483:17 incorporation (1) 1426:9 incorrectly (1) 1448:1 increase (2) 1457:22;1481:6 increased (1) 1439:13 incrementally (1) 1460:15 INDEX (4) 1373:1;1397:2; 1439:17;1451:14 indicate (2) 1375:3;1472:2 indicated (3) 1446:10;1475:4; 1478:21 indicates (2) 1379:14;1414:5 indicating (1) 1474:13 indicative (1) 1376:17 indices (1) 1451:23 individual (2) 1461:15;1462:19 inducement (1) 1486:1 Industrial (5) 1418:13;1421:12; 1443:2;1445:19; 1496:2 industry (1) 1443:6 inference (4) 1413:1,14;1468:20; 1472:15 inferred (1) 1452:21 inflow (13) 1391:5;1438:2,13; 1440:15,19;1441:4,6, 16,18,20;1464:20; 1468:22;1486:23 inflows (1) 1438:20 influence (3) 1448:6;1470:21; 1472:9 influences (1) 1439:17 information (18) 1389:11;1406:19,20; 1407:1,14;1408:21;</p>	<p>1410:15;1431:15,15, 16;1432:18;1434:4,20; 1462:21;1472:2,20; 1474:11;1495:23 informational (1) 1447:6 initial (1) 1494:24 initially (1) 1479:3 initiate (2) 1463:22;1480:7 injection (4) 1423:2,4;1464:9; 1479:5 injunctive (1) 1460:11 input (11) 1442:5;1446:6,9,9, 20,23;1447:19;1448:2, 17;1450:1;1494:17 inputs (1) 1449:3 inquire (1) 1435:17 inside (1) 1424:17 insight (1) 1436:3 instead (1) 1474:20 instrumentation (2) 1491:1,8 integrate (1) 1495:19 intended (1) 1383:7 intending (1) 1487:17 intent (2) 1383:4;1389:12 interaction (1) 1438:2 interactions (1) 1463:15 interacts (1) 1408:14 interbasin (3) 1389:1;1390:2,3 interchange (1) 1443:13 interested (2) 1422:2,9 interesting (1) 1415:1 interface (2) 1382:24;1383:5 interflow (1) 1416:24 Interim (8) 1406:2,5;1407:2,19; 1418:18;1419:8; 1421:19;1422:19</p>
	I			
	<p>I-15 (5) 1421:8;1425:17; 1431:12;1434:6; 1443:13 idea (4) 1391:16;1415:13; 1438:10;1478:22 Ideally (1) 1437:15 identified (7) 1375:16;1376:16; 1380:22;1381:10,20; 1398:13;1480:3 identify (2) 1375:11;1376:15 immediate (5) 1456:23;1457:10; 1475:5,10,11 immediately (1)</p>			

<p>Interior (4) 1374:23;1395:17; 1470:5;1492:3 internal (2) 1471:18;1493:5 interpret (2) 1381:23;1427:9 interpretation (4) 1437:8;1442:18; 1447:19;1491:2 interpretations (4) 1418:17;1426:2; 1429:7;1470:18 interpreted (6) 1427:18;1428:14; 1429:14;1430:12; 1469:5;1484:16 intersect (1) 1387:20 intersected (1) 1387:19 inter-tied (1) 1448:15 into (59) 1389:15,21;1390:16; 1396:8;1404:4; 1409:23;1410:12; 1412:10;1413:8; 1414:5;1415:7; 1417:16,20,21,22,23; 1421:2,11,12,16; 1422:1,4;1423:3,14; 1424:24,24;1429:15; 1430:10,13,14;1432:8; 1435:11;1436:18; 1437:17;1439:1; 1440:9,23;1441:6,17, 17;1443:7;1445:16; 1446:20;1451:17; 1458:6;1460:13,21; 1461:23;1462:5; 1470:13,13;1471:12; 1473:7;1480:6; 1481:19;1488:1; 1489:19,20;1498:10 introduction (1) 1495:14 invalidates (2) 1448:18,19 invalidating (1) 1449:1 inventories (5) 1442:10,21;1446:10, 11,24 inventory (8) 1442:19;1443:5; 1444:14,16;1447:7,15; 1449:4;1495:16 investigate (1) 1486:5 investigation (1) 1431:7 Investment (1)</p>	<p>1406:22 Investments (5) 1374:14,17;1395:10; 1466:12;1491:17 involved (1) 1463:15 irregardless (1) 1489:22 irrelevant (2) 1385:15;1489:3 Irrigation (5) 1393:6;1405:10; 1485:2;1493:23; 1497:8 isostatic (1) 1383:2 issue (21) 1400:5;1407:20; 1414:5;1419:9; 1446:19,21;1449:4,5; 1452:16;1458:15,19; 1459:1,2,11,14,19; 1462:8;1463:14,16,22; 1491:4 issued (3) 1445:7;1458:23; 1463:19 issues (6) 1399:13,15,18; 1459:14;1462:1; 1464:2</p>	<p style="text-align: center;">K</p> <p>Kane (25) 1385:6;1388:23; 1389:1,7,13,15,21,22; 1390:1,3,22;1391:9,11, 15;1395:23;1396:14; 1398:15;1400:9; 1401:15;1408:1,22; 1409:16;1415:9; 1481:19;1482:1 Kapex (7) 1421:21;1424:16,16; 1433:8,10,12;1480:23 Karen (7) 1372:4;1374:22; 1395:16;1405:24; 1470:4;1481:13; 1492:3 keep (6) 1411:7;1426:17; 1461:18,24;1462:14; 1492:19 keeping (1) 1449:14 Kent (1) 1371:20 key (4) 1418:7,8,22;1420:14 kind (12) 1379:18;1385:12,15; 1394:5;1420:21; 1435:16;1461:11; 1468:17;1476:1; 1482:22;1489:3,22 kinds (2) 1411:11;1473:15 KING (2) 1393:7;1485:3 KMV-1 (1) 1392:9 KMW-1 (12) 1385:21;1386:2,12; 1392:2,22;1393:2; 1394:22;1395:22; 1397:10;1410:5; 1412:6;1414:6 known (1) 1446:16 KPW (1) 1383:23 Krut (1) 1433:11 KSV (1) 1388:22 KSW-1 (1) 1406:12</p>	<p>1428:6,22;1435:21; 1436:1,2 lacking (2) 1427:8;1471:5 Lake (8) 1427:3;1463:18; 1465:7;1469:6,9,11; 1496:23;1497:6 lance (1) 1436:24 land (5) 1404:12;1410:20; 1425:14;1436:9; 1488:10 lands (1) 1425:16 large (8) 1404:21;1421:5; 1422:23;1423:5; 1425:10;1433:18; 1470:11;1489:13 largely (1) 1472:16 larger (1) 1404:13 Las (71) 1372:10;1378:13; 1388:3;1398:2; 1402:17;1403:16; 1404:16,22;1416:1,6,9; 1417:10,17;1418:12; 1419:7;1420:23; 1421:2,15,17;1423:20; 1424:7,23;1425:24; 1426:6,7,12,13,17,21; 1430:9,13;1435:19; 1436:16,19,20;1437:5, 13,24;1438:24;1441:4; 1442:16;1460:9,17; 1463:8;1464:19; 1465:5;1468:1; 1470:13;1471:17; 1472:13,17;1473:7,8, 24;1474:6;1478:24; 1479:1,1,8;1483:16,17, 23;1484:4,9;1485:20, 23;1486:6;1490:3,7,9; 1493:12 last (6) 1386:8;1402:1; 1409:11;1413:6; 1451:18;1474:24 late (7) 1392:7;1445:15,20; 1446:14;1447:20; 1450:7;1467:13 later (2) 1497:1,4 latitude (2) 1440:17;1456:7 Latter-Day (1) 1480:7 Law (1)</p>	<p>1372:10 layer (1) 1439:7 Lazarus (1) 1385:2 Lazarus's (3) 1384:7,10,22 LDS (1) 1480:7 lead (3) 1404:13;1431:6; 1446:2 leading (2) 1422:1;1492:7 leads (3) 1447:15,18;1448:4 leak (1) 1437:24 learn (1) 1408:16 lease (5) 1419:13;1421:23; 1444:6;1461:1; 1480:15 leased (2) 1444:5;1462:10 leasing (1) 1480:8 least (8) 1379:23;1429:16; 1431:14;1444:22; 1460:19;1469:17; 1487:4;1490:13 leave (2) 1449:21;1457:17 led (2) 1410:3;1435:16 left (4) 1374:8;1401:20; 1419:18;1454:22 left-hand (2) 1426:23;1442:8 legal (1) 1474:14 less (2) 1390:21;1413:7 letter (2) 1417:13,14 level (61) 1377:19;1386:7,14, 21;1392:8,12;1394:11, 20;1410:21;1414:11; 1415:14,18;1420:3; 1429:23;1430:2,17,20, 21,22,24;1431:3,6,15; 1433:6;1434:20; 1435:6,7,8,9,10,15; 1436:8;1437:3,11,16; 1438:12,22;1439:2,2, 10,21;1440:4;1444:7; 1446:14;1448:3,7,13; 1449:1;1450:3,24; 1452:20;1453:19;</p>
	<p style="text-align: center;">J</p> <p>Jackson (1) 1452:4 January (1) 1412:8 jerk (1) 1411:7 Jesus (1) 1480:7 Johnson (1) 1473:6 Johnson's (1) 1473:2 join (2) 1399:9;1400:14 Jon (4) 1371:11;1393:18; 1485:15;1494:9 judge (1) 1461:20 judging (1) 1493:5 junior (4) 1422:4;1461:10; 1474:16,23 Justina (1) 1371:24 juxtapositions (1) 1415:15</p>	<p style="text-align: center;">L</p> <p>labeled (7) 1424:19;1426:22;</p>		

1454:13;1464:13; 1470:10,16;1472:6,8; 1473:11;1491:6,8 leveling (1) 1455:22 levels (58) 1376:8,9;1377:15; 1385:21;1392:22; 1396:10;1410:23; 1414:14;1415:6,19; 1420:14;1429:20,21, 22;1430:1,4,6,18; 1431:4;1434:19,24; 1435:2,18;1439:23,24; 1447:23;1450:7,13; 1452:5,9,14;1453:11; 1454:8,13,18;1455:16, 20,22;1459:24;1462:2; 1464:13;1465:2; 1467:12,17;1469:16; 1470:22;1471:13; 1472:3,22;1486:6; 1487:23;1488:4,8,11; 1489:5;1490:3; 1491:10;1492:18 light (3) 1431:19,20,23 lighter (1) 1457:18 lights (1) 1431:19 likely (2) 1391:7;1484:18 likes (1) 1488:7 likewise (1) 1457:8 limestone (1) 1432:7 limit (1) 1374:12 limitations (2) 1419:23;1425:12 limited (3) 1385:3;1404:1; 1463:6 Lincoln (19) 1372:2;1388:24; 1390:15,18;1392:11; 1400:8,9;1401:1,2; 1404:2,10;1405:20; 1406:1,22;1407:8,21; 1481:9,16;1493:18 Lindsey (1) 1444:4 line (23) 1378:1;1380:23; 1382:4,7,11,11; 1383:12,12;1386:12; 1387:10,16,17,18,19; 1392:20;1410:16; 1423:19,22;1424:1,6; 1435:21;1436:1;	1444:20 linear (3) 1387:22;1446:4,20 lines (3) 1387:11,17;1435:4 listened (1) 1409:12 lists (1) 1460:18 lithologic (1) 1428:11 litigation (3) 1379:15,20,22 little (16) 1377:24;1416:24; 1420:10;1428:6; 1430:3;1434:18; 1437:5,6;1440:20; 1450:18;1456:1; 1461:8;1469:16; 1482:22,24;1497:4 local (11) 1385:6;1388:22; 1389:7,17,22,23,24; 1390:15;1462:4,7; 1471:15 localized (1) 1385:6 located (2) 1377:21;1434:9 location (3) 1424:4;1436:6; 1458:6 locations (1) 1421:21 log (5) 1432:5,14;1434:1,4; 1436:9 logs (14) 1431:11,13,14,18,19, 20;1432:17,18; 1436:21,22,22,23; 1437:1,3 long (5) 1413:19,19;1433:11; 1452:2;1457:22 longer (2) 1396:23;1495:9 long-term (9) 1395:24;1396:12,16; 1420:15;1422:20; 1423:1,5;1479:24; 1480:8 look (22) 1376:2,11;1377:4; 1379:11;1390:24; 1391:15;1393:3; 1406:17;1413:3,6; 1415:17;1421:21; 1430:14;1444:13; 1449:19;1462:11; 1465:18;1483:20; 1490:2;1495:7,17;	1496:5 looked (4) 1379:17;1432:5; 1447:1;1494:18 looking (15) 1384:9;1385:12; 1386:6;1394:10; 1407:7;1411:1,16; 1435:18;1436:4; 1451:23;1453:18; 1454:12;1473:11; 1483:4;1489:12 looks (6) 1377:24;1395:4; 1423:18;1488:3,7; 1496:13 Loomis (2) 1370:24;1498:4 loop (4) 1424:13,17,17,18 loose (1) 1411:7 Los (1) 1371:23 lose (2) 1457:4;1458:1 loss (1) 1485:22 lot (16) 1379:22;1386:18; 1408:12;1409:8; 1415:2;1421:18; 1423:8;1426:16; 1448:11,12;1450:11; 1451:20;1458:3; 1459:13;1468:15,16 love (1) 1410:9 low (4) 1440:14;1468:13; 1483:11;1492:15 low-density (1) 1383:10 Lower (39) 1374:5;1376:13; 1377:16;1388:23; 1401:11;1403:17; 1406:16;1407:22; 1408:2;1409:17,23; 1424:2;1429:20,22; 1432:22;1436:15; 1437:5;1441:10,13,15; 1450:4;1453:14; 1458:20;1459:1,16,20; 1461:17;1463:3,17,18; 1464:22;1468:8; 1470:24;1474:18; 1476:18,24;1481:19; 1484:1;1488:21 lowering (1) 1471:13 lowest (3) 1430:1,21,22	Ltd (1) 1371:16 M magnitude (4) 1432:22;1438:8; 1458:6;1472:24 magnitudes (3) 1423:6;1442:1; 1492:10 maintain (2) 1488:11;1489:5 maintaining (3) 1451:6;1477:21; 1478:9 maintains (1) 1477:23 major (2) 1427:13;1428:3 majority (3) 1403:7;1417:1; 1432:21 makes (5) 1398:11;1404:18; 1410:16;1415:2; 1487:1 making (1) 1493:3 manage (3) 1452:9;1460:12; 1461:4 manageable (2) 1455:19;1487:15 managed (4) 1463:14,21;1474:19, 21 management (8) 1419:21;1420:8; 1422:17;1452:4,13; 1460:5;1463:16; 1465:14 manner (3) 1399:17;1439:9; 1493:5 many (5) 1376:14;1403:23; 1404:17;1413:3; 1429:18 map (7) 1381:13,15,21; 1382:3,20,23;1383:11 maps (2) 1400:24;1421:21 margin (1) 1453:5 mark (3) 1430:9,11,17 marked (2) 1382:1,3 match (3) 1441:5;1448:3; 1492:17	matching (1) 1438:23 material (1) 1383:10 materials (1) 1425:22 MATTER (4) 1370:7;1416:13; 1457:3;1498:9 mature (1) 1415:15 maverick (1) 1462:13 may (10) 1401:9;1425:6; 1438:2;1439:16; 1454:24;1455:23; 1462:3;1489:9; 1495:13;1497:4 Maybe (17) 1382:16;1393:19; 1440:20;1449:24; 1452:12;1460:21,22; 1464:5,16,17,20,21,22, 22;1465:7;1477:19; 1486:23 Mayer's (1) 1450:22 Mead (1) 1463:18 Meadow (1) 1459:16 mean (9) 1394:5;1453:13; 1459:7,9;1461:4; 1464:19;1483:19; 1485:20,22 means (2) 1464:7;1492:23 meant (1) 1464:24 measure (3) 1379:10;1410:16; 1411:10 measured (1) 1470:10 measurement (1) 1394:12 measurements (2) 1392:8;1437:16 measuring (3) 1389:7;1410:19; 1411:3 mechanism (1) 1459:5 media (1) 1384:14 mediad (1) 1409:6 median (4) 1437:6,9,10;1439:1 member (1) 1474:6
--	---	---	---	---

<p>Memorandum (1) 1480:6</p> <p>mention (1) 1471:15</p> <p>mentioned (7) 1430:20;1431:22; 1442:6;1452:22; 1453:14;1460:6; 1467:22</p> <p>merit (1) 1463:11</p> <p>merits (6) 1419:23;1461:12,20; 1462:19;1463:7; 1477:18</p> <p>messages (1) 1440:22</p> <p>method (2) 1448:19,19</p> <p>methods (1) 1449:14</p> <p>Mexico (1) 1380:8</p> <p>mic (1) 1388:17</p> <p>Michel (2) 1370:24;1498:4</p> <p>MICHELINE (2) 1370:4;1371:2</p> <p>Michelle (2) 1371:8;1490:18</p> <p>microphone (1) 1482:18</p> <p>mid-'90s (1) 1445:21</p> <p>might (13) 1385:2;1392:6; 1394:4;1415:17; 1422:20;1426:18; 1442:20;1459:21; 1467:20;1469:6; 1489:8;1490:2;1496:5</p> <p>miles (2) 1421:11;1457:24</p> <p>mind (5) 1378:15;1389:6; 1426:18;1459:19; 1492:20</p> <p>minimal (2) 1441:2;1464:20</p> <p>minimum (1) 1487:13</p> <p>minus (7) 1414:14,24;1431:14; 1444:8,9,12;1492:9</p> <p>minute (7) 1433:3,8,9;1434:2; 1440:6;1446:22; 1461:23</p> <p>minutes (8) 1374:12;1377:8; 1381:7;1382:21; 1395:9;1405:21;</p>	<p>1466:13;1491:23</p> <p>Miss (1) 1378:3</p> <p>missed (1) 1409:20</p> <p>mitigate (1) 1459:7</p> <p>mix (3) 1434:24;1451:24; 1452:1</p> <p>mixture (1) 1450:23</p> <p>MLR (3) 1478:4,13,15</p> <p>Moapa (19) 1372:7;1378:9; 1383:15,19;1385:17, 23;1398:1;1402:14; 1407:4,10;1431:4; 1441:7;1458:23; 1459:16;1473:21; 1479:14,18;1493:10,15</p> <p>Mock (18) 1380:21;1381:1; 1391:14;1397:18,19, 21,21;1398:6,10; 1402:4,4;1403:4,14; 1405:4;1408:8,10; 1409:11;1472:13</p> <p>model (45) 1380:5,7,10,12,16, 18;1391:1,14,23,24; 1397:18,19;1398:8; 1404:12;1407:5; 1438:5;1439:6,19,20; 1440:2,9,23;1441:1,5, 10,19,19;1446:21; 1468:21,22;1471:9,11, 12,14,17;1472:23; 1483:5,9,11,14;1492:5, 17;1493:4,7;1494:18</p> <p>model-based (1) 1493:1</p> <p>modeling (7) 1426:6;1435:12; 1438:15,16;1471:8; 1484:15;1487:3</p> <p>models (2) 1439:5;1440:16</p> <p>moderate (3) 1434:13,16;1438:11</p> <p>modern (2) 1445:18;1462:13</p> <p>modest (6) 1434:13;1441:11,12; 1486:18;1487:2; 1494:23</p> <p>modified (1) 1409:8</p> <p>modify (1) 1380:15</p> <p>moment (1) 1375:14</p>	<p>Monday (1) 1409:20</p> <p>money (1) 1407:12</p> <p>monies (1) 1407:15</p> <p>monitor (2) 1379:1,2</p> <p>monitored (2) 1431:1;1434:21</p> <p>monitoring (11) 1392:13;1431:21; 1435:1;1437:16; 1464:24;1465:1,2,4,6, 11;1472:21</p> <p>month (1) 1392:2</p> <p>months (2) 1412:14,21</p> <p>MOORE (3) 1388:1;1481:8; 1493:16</p> <p>more (33) 1394:12;1397:16; 1400:1;1401:22; 1410:12;1412:14; 1420:10,20;1422:12; 1430:3,14;1434:18; 1436:24;1437:9,10,15; 1438:16;1439:16; 1445:17;1450:18; 1451:11;1453:15; 1456:1,5;1457:10; 1469:11;1471:2; 1474:22;1475:7,7; 1488:9;1489:8;1492:5</p> <p>morning (23) 1374:4,7,22;1375:1; 1378:23;1383:19; 1388:14;1395:16,16; 1416:8;1418:10; 1470:4,7;1474:3,4; 1479:20,22;1481:15; 1482:15;1492:4; 1496:20;1497:9,12</p> <p>Morrison (6) 1373:5,16;1383:18, 19;1479:17,18</p> <p>Most (14) 1391:7;1407:20; 1410:2;1412:11; 1419:14;1426:7; 1427:12;1432:7; 1441:21;1444:4; 1445:20;1458:11; 1461:10;1478:20</p> <p>mostly (2) 1425:15;1491:2</p> <p>Mountain (2) 1377:21;1492:7</p> <p>Mountains (8) 1425:5;1426:9; 1427:12;1430:16;</p>	<p>1482:24;1483:18,24; 1484:5</p> <p>move (11) 1377:8;1382:17; 1385:16;1398:20; 1416:1,2;1449:24; 1452:13;1465:12; 1471:12;1496:22</p> <p>moved (4) 1476:21;1477:1,2,12</p> <p>movement (4) 1401:8;1470:11,20; 1481:4</p> <p>moving (13) 1411:7;1420:19; 1434:17;1448:23; 1450:20;1451:17; 1452:17;1456:16; 1460:2;1462:24; 1470:12;1476:13; 1497:2</p> <p>MPS (1) 1376:7</p> <p>much (21) 1378:8;1382:10; 1387:15;1389:6; 1414:20;1430:11; 1440:17;1451:9; 1456:5;1457:19; 1459:5,6,15;1464:1; 1473:14;1477:23; 1478:8;1484:23; 1489:4;1495:12; 1497:13</p> <p>MUDDY (36) 1370:12;1391:17; 1393:5;1396:2;1403:7, 13;1404:2,6;1405:9; 1408:18,21;1420:13; 1425:3;1427:11; 1428:4;1429:21; 1455:24;1456:22,24; 1457:1,13,14,20; 1458:22;1462:9; 1463:13;1476:20; 1477:5,5,9;1480:10; 1485:1;1486:13; 1487:11;1493:22; 1497:7</p> <p>multi-marked (1) 1412:7</p> <p>multiple (4) 1446:4,20;1451:11; 1460:11</p> <p>multiyear (1) 1413:14</p> <p>municipal (4) 1421:17,19;1460:18; 1461:7</p> <p>municipality (1) 1422:6</p> <p>must (1) 1411:22</p>	<p>MX-4 (5) 1379:5,7,8,9,12</p> <p>MX-5 (9) 1375:4;1379:3,6,13; 1394:16;1395:22; 1397:4;1412:8; 1432:23</p> <hr/> <p style="text-align: center;">N</p> <hr/> <p>name (1) 1379:20</p> <p>National (12) 1374:19,23;1395:12, 18;1425:9;1428:17; 1465:9;1470:1,6; 1487:3;1491:22; 1492:4</p> <p>NATURAL (2) 1370:2;1498:8</p> <p>NDWR (5) 1446:10,13,24; 1447:7;1449:4</p> <p>NDWR's (1) 1447:8</p> <p>near (10) 1376:13;1407:6; 1411:11,20;1427:11; 1454:1;1455:24; 1457:10;1462:5; 1468:8</p> <p>nearly (1) 1377:16</p> <p>necessarily (2) 1441:20;1452:3</p> <p>necessary (3) 1439:17;1464:2; 1497:7</p> <p>need (36) 1377:3;1425:8; 1426:17;1437:20,22; 1441:19;1450:12; 1452:3,9,24;1454:20; 1459:10;1460:2,2,19, 24;1461:15,17,17; 1462:14;1463:21,22; 1465:1,4;1468:4; 1472:21;1486:3; 1487:12,13;1488:9; 1489:3,5,12,16;1490:2; 1493:6</p> <p>needed (4) 1422:19,20;1442:19; 1465:10</p> <p>needs (11) 1419:18,22;1420:20; 1423:14;1455:7; 1458:14;1459:2; 1461:13;1463:13; 1465:10,10</p> <p>negative (1) 1451:17</p> <p>NEVADA (35)</p>
---	--	--	--	--

<p>1370:1;1371:17; 1374:1;1378:13; 1380:8,10;1388:11; 1391:24;1393:12; 1398:3;1402:22; 1405:14;1417:1,4; 1418:9;1442:17; 1453:3;1459:3; 1461:19;1473:24; 1474:7,11,14;1480:16; 1482:11;1485:8; 1493:11,21;1494:3; 1497:7,10;1498:1,7,8, 17 New (16) 1380:8;1398:12,13; 1406:5,6,17,20,20,24; 1407:4,6,6,23;1476:23; 1495:2,2 newer (2) 1444:5,6 Next (6) 1378:9;1416:1; 1424:13;1438:4; 1456:10;1477:3 nice (1) 1413:4 nod (1) 1405:1 no-flow (2) 1484:16;1492:14 none (4) 1395:10,12;1402:6; 1474:9 Nope (1) 1384:17 normal (6) 1415:10;1427:4; 1469:1,13,18;1470:15 Norman (1) 1405:5 North (39) 1372:10;1388:2; 1402:16;1416:1,6,9; 1417:10,17;1418:12; 1419:6;1420:23; 1421:17,20;1424:12; 1425:2,3,23;1433:22; 1435:6;1436:20; 1437:21;1451:15; 1456:7;1458:15; 1460:17;1463:8; 1464:21;1465:3; 1469:1,4;1470:16,19; 1474:6;1478:24; 1479:1,8;1490:3,6,9 northeast (2) 1398:22;1425:4 northeasternmost (1) 1424:23 northern (21) 1389:15;1415:7,17; 1419:3;1421:22;</p>	<p>1422:19;1424:12,14, 18;1425:18;1426:9; 1429:16;1430:21; 1432:1;1434:7;1441:6, 8;1451:15;1468:22; 1482:4;1488:21 northernmost (1) 1430:22 north-south (2) 1468:17;1470:23 northward (2) 1425:24;1470:9 northwest (1) 1470:9 northwestern (1) 1441:8 notably (2) 1434:7;1483:13 note (14) 1425:8;1427:19; 1428:16;1429:6; 1436:19;1442:23; 1446:23;1450:6,12; 1452:24;1455:12; 1458:7;1468:10,13 noted (6) 1418:21;1428:20; 1441:13;1468:18; 1469:12;1497:4 notes (7) 1411:5;1442:13,16; 1448:24;1455:14; 1498:7,14 notice (7) 1387:16;1424:15; 1428:5;1433:15,17; 1443:9;1483:21 noticed (1) 1442:15 Number (17) 1375:2;1390:12; 1393:20;1427:4,22,23; 1428:7;1430:8; 1434:21,22;1440:15; 1444:19;1453:5; 1469:13;1470:8; 1482:16;1490:1 numbers (3) 1404:14;1427:21; 1494:13 numerous (1) 1380:8 NV (2) 1371:24;1498:22</p>	<p>1466:2 objection (3) 1400:15;1476:3,8 objections (1) 1401:18 observation (1) 1456:17 observations (2) 1448:5;1488:10 observed (6) 1435:10,15;1447:22; 1448:12;1491:9; 1494:16 observing (2) 1420:15,16 obvious (1) 1425:12 obviously (3) 1393:1;1450:6; 1487:11 occasions (1) 1417:4 occur (2) 1455:19;1472:7 occurred (4) 1403:24;1431:1; 1457:14,18 occurring (10) 1394:13;1403:12; 1430:22;1459:5,6; 1462:5;1485:23; 1486:4;1495:2,7 occurs (6) 1389:13;1390:22; 1403:7;1404:5;1430:2; 1460:20 o'clock (1) 1409:19 O'Connor (1) 1371:18 OCTOBER (7) 1370:20;1374:1; 1392:3;1496:24; 1497:9;1498:6,18 odd (2) 1377:24;1379:18 off (7) 1409:7;1412:23,23; 1413:21;1455:2,22; 1486:2 offer (5) 1417:17;1420:6,7; 1446:3;1471:3 offered (4) 1420:3;1455:5; 1465:20;1466:1 offering (1) 1461:8 offers (1) 1385:24 Office (10) 1374:23;1395:17; 1436:7,11;1437:19;</p>	<p>1442:20;1445:5; 1446:1;1466:4;1470:5 OFFICER (61) 1370:4;1371:7; 1374:4,16;1376:4; 1378:3,6,9,12;1383:15; 1388:2,5,10,16; 1392:15;1393:5,8,11, 14;1395:7;1398:1; 1399:10;1400:15,22; 1401:7,17,21;1402:14, 19;1405:9,13,16; 1415:24;1416:5; 1417:18;1466:3,9; 1467:7;1469:23; 1473:21,23;1476:3,7, 11;1479:14;1481:9; 1482:7,10,17;1485:1,4, 7,10;1491:14,20; 1493:10,14,17;1494:2; 1496:12,16 officially (1) 1496:17 offsetting (2) 1451:4,5 old (1) 1496:1 older (4) 1443:21;1444:13,24; 1494:21 once (1) 1496:21 one (45) 1374:8;1375:12,17; 1384:13;1385:12; 1386:4;1394:5,10,22; 1397:16;1401:22; 1403:3;1408:2; 1409:11;1411:3; 1414:19;1419:9; 1426:5,11;1428:12; 1431:8;1432:20; 1434:6;1436:1,14,15; 1441:16;1446:2; 1448:13;1450:2; 1451:13;1452:16,24; 1453:6,6,8;1456:10; 1464:3;1473:16; 1474:20;1476:14; 1477:3;1479:24; 1484:21;1490:1 one-foot (2) 1411:19;1412:1 ones (8) 1377:5;1378:18; 1406:23;1413:19,19; 1453:14;1454:3; 1455:15 one-third (1) 1433:20 online (2) 1444:11;1445:6 only (10)</p>	<p>1382:20;1406:23; 1409:4;1414:18; 1428:10;1432:9; 1433:3;1437:14; 1451:8;1488:13 open (11) 1393:15;1395:8; 1405:17,19;1419:18; 1440:15;1461:24; 1462:14;1473:15; 1485:11;1494:4 operating (2) 1495:4,12 opinion (18) 1379:1;1394:16; 1398:12;1409:14; 1413:11;1420:6; 1434:12;1455:5,23; 1456:2;1463:1,2,3; 1465:16,17,18,20; 1471:3;1472:19 opinions (5) 1395:21;1406:18; 1420:2;1450:14; 1456:14 opportune (1) 1441:21 opportunities (1) 1419:10 opportunity (3) 1419:18;1461:19; 1463:11 optimal (2) 1422:5;1440:8 option (2) 1461:24;1480:8 options (1) 1462:14 orange (1) 1443:12 Order (19) 1374:6;1385:21; 1387:1;1397:19; 1406:2,5;1407:2,19; 1408:2;1409:17; 1418:18;1419:8; 1428:14;1447:16; 1453:23;1473:6; 1475:17;1478:17; 1482:3 orders (2) 1432:22;1492:10 origin (1) 1476:14 original (3) 1386:4;1399:17; 1442:14 others (4) 1395:1;1404:9; 1419:19;1448:5 otherwise (2) 1418:21;1425:15 out (54)</p>
O				
<p>o0o- (1) 1374:2 object (3) 1399:2;1400:10; 1475:20 objected (1)</p>				

1375:7,18;1378:20; 1404:16;1406:5; 1412:19,21;1414:17; 1419:5;1426:5; 1429:17;1430:15; 1436:12,18;1437:24; 1440:9,20;1441:1,2,7; 1444:20;1447:5,6; 1448:5;1449:22; 1450:2;1452:20; 1453:12;1454:11,15, 21,22;1455:3,10; 1460:23;1461:14; 1462:3;1464:12; 1465:12;1468:15; 1471:12,20;1472:4; 1486:24,24;1487:1,4, 10;1488:2,10;1492:12, 24;1494:14;1495:9 outcome (4) 1441:16;1442:4; 1449:13;1483:4 outcomes (1) 1460:5 outflow (8) 1438:13;1440:15,19; 1441:9,12,12;1468:2; 1469:16 outflows (1) 1438:20 outliers (2) 1434:14;1437:9 outlined (1) 1407:2 outside (5) 1391:11;1435:19; 1438:23;1439:2; 1476:5 over (21) 1383:8;1385:8; 1391:10;1410:6,6,6; 1412:22;1415:6; 1416:24;1425:13; 1427:11;1428:8,18; 1430:24;1446:14; 1451:11;1452:19; 1453:9;1457:22; 1470:17;1484:5 overhead (2) 1423:22;1483:20 overload (2) 1464:5,6 override (1) 1452:8 overuse (1) 1424:3 overview (8) 1418:11,21;1423:20; 1424:13;1425:7,20; 1429:24;1435:20 overviews (1) 1431:17 overwhelmingly (1)	1457:13 own (3) 1419:22;1474:21; 1477:15 owned (1) 1433:24 owns (3) 1398:21;1421:19; 1433:5 P Pacific (4) 1433:24;1493:20; 1496:23;1497:6 Pacific-Republic (3) 1388:8;1402:21; 1482:8 pad (2) 1443:14,15 page (9) 1378:16,19;1381:15; 1385:18;1388:21,24; 1390:14,16;1427:21 Pages (2) 1370:19;1498:13 Pahranagat (1) 1390:5 Paiute (1) 1441:7 Paiutes (6) 1378:10;1398:1; 1407:4;1431:5; 1473:21;1493:10 pane (2) 1435:5;1442:6 PANEL (4) 1373:2;1388:15,19; 1404:23 paragraph (1) 1388:21 parallel (3) 1387:11;1427:5; 1469:1 parameters (3) 1410:11;1440:3; 1449:19 paraphrase (1) 1384:5 Park (12) 1374:19,23;1395:12, 18;1428:17;1459:17; 1465:9;1470:1,6; 1487:3;1491:22; 1492:4 parse (3) 1451:21;1452:11; 1472:4 part (22) 1396:6;1419:1; 1422:17,19;1424:2,16; 1425:1;1426:12; 1427:15,15,16;	1430:22;1431:24; 1433:17;1440:23; 1441:8,9;1442:5; 1451:15;1463:10; 1473:13;1487:6 participant (2) 1374:12;1466:13 participants (1) 1374:10 particular (7) 1391:20;1399:13,14; 1419:12;1446:2; 1449:1,5 parties (2) 1401:5;1403:24 past (4) 1451:22;1452:19; 1470:20;1480:15 patch (1) 1414:14 path (5) 1409:5;1429:18; 1431:6;1460:3; 1468:24 paths (3) 1408:9,12;1462:11 Patrick (1) 1372:13 Patriots (1) 1402:3 pay (1) 1479:8 PDF (1) 1466:23 PE (1) 1371:13 Peak (1) 1484:3 peat (1) 1407:5 Pederson (1) 1459:24 people (10) 1404:14,17;1406:11; 1410:24;1411:8,17; 1413:16,21;1427:12; 1455:1 per (9) 1374:12;1385:1,1; 1386:15;1433:19; 1450:5;1466:13; 1472:18;1492:9 percent (3) 1442:22;1454:5,6 percentage (2) 1413:4,5 perennial (6) 1390:1;1396:14; 1420:7,9;1464:4; 1489:23 perhaps (6) 1384:4;1420:11; 1434:9;1449:1;1465:6;	1486:4 period (7) 1374:10;1387:1; 1394:22;1422:19; 1443:3;1450:11; 1460:20 periods (1) 1457:22 periphery (1) 1438:19 permeability (1) 1409:8 permit (2) 1445:9;1481:4 permits (4) 1398:20;1442:17; 1445:7;1463:19 permitted (1) 1444:17 permitting (1) 1419:10 perpetuate (1) 1479:6 persisted (2) 1443:8,8 persistence (1) 1413:12 persistently (1) 1414:13 person (1) 1413:18 personally (1) 1410:20 perspective (7) 1426:6;1429:2; 1450:13,16;1461:7; 1462:13;1489:13 PEST (2) 1440:7,9 Peter (1) 1397:21 Petersen (1) 1373:17 Peterson (15) 1372:4;1373:9; 1376:18;1378:18; 1381:1;1382:18; 1399:9;1400:14; 1405:23,24;1408:6; 1415:23;1481:12,13, 1482:6 Petroleum (3) 1428:6,8,12 ph (1) 1433:11 Phase (6) 1421:7,10;1422:10; 1423:23;1424:1,12 Phelps (2) 1381:17;1382:3 philosophy (1) 1489:21 photography (1)	1496:1 phrase (1) 1379:18 physical (5) 1410:21;1483:16; 1485:24;1491:11,11 physics (1) 1412:17 pick (2) 1439:16;1453:19 picked (3) 1453:6,7,7 pieces (1) 1411:16 pink (2) 1424:22;1432:2 pipeline (15) 1421:2,5,5,6,8,10,18; 1422:10;1423:3,23; 1424:1,11,14;1460:20; 1478:24 place (6) 1401:14;1409:23; 1422:24;1458:8; 1465:1;1491:11 placed (5) 1444:18;1445:1,21; 1448:11;1459:13 places (3) 1409:9;1437:5,6 planned (4) 1421:4,13;1423:12, 19 plant (2) 1423:12;1480:14 plastic (1) 1428:3 platform (1) 1493:6 play (1) 1445:16 Playa (6) 1421:20;1424:16,19; 1433:5,12;1480:23 please (6) 1378:17;1382:21; 1408:8;1418:5;1478:3; 1483:10 pleasure (1) 1418:6 plot (6) 1413:4;1442:9,14; 1443:11;1450:21; 1453:6 plotted (2) 1377:12;1490:12 plus (6) 1414:14,24;1431:14; 1444:8,9,12 point (21) 1374:11;1403:17; 1419:5;1424:3,3,17,18; 1426:5;1428:18,22;
--	---	---	---	---

<p>1431:23;1433:18; 1450:2;1451:1;1462:6; 1463:9;1468:15; 1469:4;1476:14; 1492:8;1493:3 pointed (2) 1404:22;1492:12 points (9) 1386:8;1398:20; 1418:8,22;1431:18; 1433:15;1436:23; 1438:23;1453:5 policies (1) 1461:16 poorer (1) 1387:22 porous (2) 1384:14;1409:6 PORTION (8) 1370:9;1421:12; 1429:16;1431:11; 1468:16;1483:17,18; 1488:21 portrayed (1) 1446:12 pose (1) 1427:14 posed (1) 1418:18 position (3) 1390:18;1419:6; 1451:3 positive (1) 1419:21 possibilities (1) 1461:14 possibility (2) 1471:5;1489:11 possible (5) 1427:7;1466:23; 1467:2,18;1480:8 possibly (6) 1426:13;1442:20; 1450:17;1459:9; 1487:5;1495:14 potential (10) 1391:16;1419:24; 1430:13;1437:11; 1438:8,24;1451:24; 1462:15;1465:21; 1485:17 potentially (5) 1419:13;1428:18; 1438:20;1468:18; 1484:6 potentiometric (1) 1434:19 power (7) 1444:1,2,3,10; 1480:14,15;1488:2 powerful (1) 1412:24 PowerPoint (2)</p>	<p>1376:14,23 practical (2) 1410:10;1457:4 practically (1) 1492:13 practicing (1) 1416:24 Pre-1998 (1) 1455:15 precipitation (3) 1389:9;1392:12; 1413:5 precisely (1) 1380:17 preclude (2) 1471:4;1489:11 precluding (1) 1470:19 predates (2) 1443:3,4 predicted (1) 1436:13 predominantly (2) 1468:4;1494:22 preferred (1) 1468:24 prejudging (2) 1461:13;1462:15 prejudgment (1) 1449:13 preliminary (4) 1437:8,12;1474:5; 1484:1 premature (1) 1419:23 prepare (1) 1418:2 prepared (2) 1478:22;1479:8 preponderance (1) 1487:16 presence (4) 1427:18;1443:8; 1455:2;1472:24 present (7) 1395:1;1418:11; 1423:12;1443:6; 1486:7,18;1498:7 presentation (12) 1384:10;1393:21; 1402:7;1418:2,6,20; 1426:15;1435:13; 1450:22;1466:24; 1474:9,11 presentations (1) 1467:5 presented (9) 1379:11;1385:2; 1402:7;1406:6; 1416:22;1435:11; 1442:15;1453:23; 1458:3 presently (1)</p>	<p>1461:11 preserve (1) 1488:11 pressure (10) 1453:2,4,10,16,18; 1454:20;1455:11; 1490:20;1491:1,10 pressures (1) 1453:19 presume (1) 1449:8 pretty (7) 1440:3;1451:3; 1456:21,24;1457:8; 1485:18;1495:12 previous (1) 1409:15 previously (3) 1406:20;1417:6; 1466:4 primarily (1) 1444:1 primary (1) 1425:21 principal (2) 1416:23;1420:24 principally (1) 1428:2 principles (1) 1475:6 prior (14) 1392:24;1393:1; 1395:22;1417:4,8; 1430:6;1439:11; 1444:8,10;1450:7; 1451:19;1456:19; 1475:1;1484:15 priorities (1) 1461:5 priority (2) 1474:19,21 privilege (1) 1417:3 privileged (1) 1433:2 probable (1) 1442:1 probably (14) 1378:4;1389:8; 1390:20,21;1394:12; 1437:10;1440:17; 1445:2,17;1458:10; 1463:21;1470:23; 1487:8;1495:15 procedure (1) 1449:22 proceed (2) 1466:7;1497:10 proceeding (3) 1401:5;1419:4; 1481:23 proceedings (7) 1399:19;1401:19;</p>	<p>1409:13,18;1496:13, 18;1497:14 process (5) 1448:2;1463:22; 1477:15;1491:5,11 procreation (1) 1380:7 produce (2) 1433:2;1483:14 production (5) 1431:16,19;1432:14, 15;1433:9 professional (2) 1409:14;1456:13 professionals (1) 1452:19 project (3) 1421:4,6;1495:16 projected (1) 1410:24 projection (1) 1468:12 projects (1) 1434:10 prominent (1) 1410:2 proof (6) 1446:16;1494:11; 1495:6,10,17,18 propagated (1) 1449:2 propagating (3) 1464:21;1487:16; 1488:5 proper (1) 1479:5 properly (2) 1379:2;1466:21 proposal (3) 1398:22;1400:2; 1422:15 propose (2) 1399:23;1419:17 proposed (6) 1418:23;1419:1; 1424:4;1438:3;1463:3; 1477:17 protect (1) 1478:17 provide (3) 1406:18;1418:16; 1421:16 provided (4) 1376:7;1396:9; 1406:19;1407:4 provides (1) 1398:16 providing (1) 1407:1 proximal (1) 1457:14 proximate (1) 1475:7</p>	<p>proximity (8) 1456:22,24;1457:8; 1458:2;1475:5,5,11,11 prudent (1) 1419:17 public (4) 1401:1;1425:15; 1454:15;1497:11 publicly (1) 1406:13 published (6) 1442:10,11;1446:11; 1447:15;1451:22; 1454:13 pull (1) 1494:20 pump (14) 1383:23;1384:11; 1398:7,9;1406:9; 1412:23,24;1464:8; 1465:13;1481:5; 1486:18,22;1489:4,18 pumpage (2) 1494:10,14 pumped (14) 1396:6,8;1419:15; 1423:15;1434:1,2,3; 1437:16;1444:7; 1478:8;1480:12,18,19, 22;1488:7 pumping (119) 1375:4,7,18;1379:3, 6,13;1387:1,3,7; 1391:9,15;1395:22; 1397:4,4,9,10,14,18; 1408:22;1410:4; 1411:2,11;1412:5,9,13, 16,22;1420:11; 1422:18,18,23;1423:7; 1435:2;1439:11,13,15, 24;1442:6,7,9,16,19, 21;1443:5;1444:7,12, 13,14,16,21;1446:6,9, 10,11,12,15,24;1447:7, 17,20;1448:6,18; 1449:3;1450:9,10,23; 1451:24;1452:8,21,22; 1454:10,24;1455:2,16, 19,24;1456:21,22; 1457:5,7,10,14,17,20; 1458:2,7,9,11,21; 1459:10;1461:23; 1462:3,4;1467:11; 1468:3;1472:5,7,9; 1475:4,7,13,15;1477:4, 9,24;1478:23;1479:4; 1481:6;1487:9,14,22, 24;1488:3;1495:15,16, 19,19,24;1496:8 purchase (1) 1480:9 purpose (1) 1375:10</p>
---	--	--	--	---

<p>purposes (1) 1431:21</p> <p>pursuing (2) 1422:9;1423:9</p> <p>put (10) 1375:2;1401:2; 1404:17;1409:23; 1422:23;1432:3; 1438:5;1449:18; 1460:13;1496:4</p> <p>putting (1) 1467:4</p>	<p>1398:6;1428:10; 1486:3</p> <p>realize (1) 1410:18</p> <p>really (47) 1388:15,19;1401:13; 1403:7;1404:1,3; 1419:4;1420:10; 1427:16;1429:6,8; 1430:16;1437:14; 1438:14,14,16; 1440:14;1443:7; 1458:12;1459:4,23; 1460:10,14;1461:12; 1463:2;1464:16,20; 1465:2,22;1467:17; 1470:18;1471:2,3,5; 1472:20,23;1473:10; 1475:13;1476:23; 1482:23;1484:17; 1485:22;1486:4; 1487:22;1493:5; 1494:9;1496:4</p> <p>reanalyze (1) 1406:18</p> <p>reason (4) 1396:11;1435:11; 1453:7;1492:14</p> <p>reasonable (9) 1403:16;1404:18; 1413:1,13,16,24; 1415:22;1422:14; 1496:7</p> <p>reasonably (3) 1436:6;1439:21; 1440:1</p> <p>reasons (2) 1412:3;1422:6</p> <p>rebuttal (9) 1375:22;1385:17; 1388:21;1399:4; 1403:15;1404:15; 1409:2;1446:5; 1472:12</p> <p>recall (14) 1375:9,11,14,16,19; 1380:17;1384:1; 1390:12;1397:21; 1398:6;1404:7; 1476:15;1478:11; 1483:8</p> <p>received (1) 1407:14</p> <p>recent (2) 1408:21;1420:4</p> <p>recently (1) 1433:14</p> <p>Recess (2) 1416:4;1466:8</p> <p>recession (1) 1413:14</p> <p>recharge (28) 1380:6;1388:22;</p>	<p>1389:7,13,18,22,23,24; 1390:22;1391:1; 1394:14;1396:13; 1403:22;1404:3,8,8; 1413:15,20;1422:9; 1423:4;1424:4; 1437:22;1451:2; 1454:24;1471:16,17, 18;1486:6</p> <p>reclaimed (1) 1423:11</p> <p>recognizable (1) 1467:17</p> <p>recognize (2) 1427:12;1478:12</p> <p>recommendation (3) 1481:18,24;1488:18</p> <p>recommendations (1) 1477:20</p> <p>recommending (1) 1488:19</p> <p>reconsider (1) 1408:23</p> <p>reconstruct (3) 1495:19,24;1496:10</p> <p>reconstruction (1) 1496:4</p> <p>record (16) 1393:18;1401:1; 1416:6;1426:21; 1431:11,12;1451:10, 16;1452:8;1466:10; 1472:8;1479:19; 1485:15;1488:17; 1490:18;1494:11</p> <p>recorded (2) 1432:7;1453:8</p> <p>records (8) 1376:8;1445:5; 1446:1,7;1450:24; 1494:15,16;1495:4</p> <p>recovery (2) 1412:7,22</p> <p>RECROSS (2) 1373:2,11</p> <p>red (2) 1424:1;1431:19</p> <p>REDIRECT (7) 1373:2,11;1405:20, 22;1465:24;1496:14, 15</p> <p>reduction (2) 1457:20;1486:1</p> <p>redundancy (1) 1460:12</p> <p>refer (1) 1483:2</p> <p>reference (2) 1433:5;1449:12</p> <p>referenced (1) 1424:16</p> <p>referencing (2) 1385:18;1442:24</p>	<p>referred (3) 1386:8;1424:5; 1474:15</p> <p>referring (5) 1384:7;1386:11; 1396:21;1447:11; 1475:13</p> <p>reflect (1) 1442:21</p> <p>reflected (1) 1454:7</p> <p>reflecting (1) 1435:3</p> <p>Refuge (1) 1425:9</p> <p>regard (2) 1468:21;1484:11</p> <p>regarding (8) 1374:5;1384:11; 1420:2;1429:4;1446:4; 1469:8;1476:13; 1477:21</p> <p>regardless (1) 1452:7</p> <p>regime (1) 1456:3</p> <p>regimes (1) 1451:18</p> <p>region (2) 1436:20;1476:5</p> <p>regional (10) 1425:20;1427:2; 1428:24;1454:14; 1456:5;1457:17; 1459:11;1487:2; 1493:6,7</p> <p>regionalized (1) 1385:6</p> <p>regionally (1) 1426:3</p> <p>regions (1) 1481:22</p> <p>regression (2) 1446:4,20</p> <p>regulate (1) 1440:8</p> <p>Reid (1) 1480:13</p> <p>relate (1) 1401:8</p> <p>related (1) 1458:19</p> <p>relates (3) 1389:24;1419:12; 1486:10</p> <p>relationship (5) 1394:6;1448:9; 1449:10,18;1467:11</p> <p>relationships (2) 1448:10,20</p> <p>relatively (2) 1430:4;1438:11</p> <p>relevant (2)</p>	<p>1400:23;1464:14</p> <p>reliability (1) 1411:9</p> <p>reliable (5) 1410:7;1414:9,9,16; 1415:3</p> <p>relied (4) 1380:12,18,18; 1437:8</p> <p>relieve (1) 1462:7</p> <p>relinquish (1) 1459:8</p> <p>rely (1) 1387:17</p> <p>remainder (1) 1465:24</p> <p>remains (1) 1452:5</p> <p>remarkable (1) 1414:15</p> <p>remember (2) 1376:20;1384:18</p> <p>reminder (1) 1496:24</p> <p>renewed (1) 1412:8</p> <p>reoccurs (1) 1453:10</p> <p>reopen (3) 1374:9;1466:15; 1491:15</p> <p>rephrase (1) 1399:16</p> <p>report (26) 1375:22;1379:12; 1385:18;1386:4,9; 1388:21;1390:9,10,13, 14;1391:3,9,19,22; 1392:21;1403:15; 1404:15;1409:2; 1414:12;1417:13; 1440:11;1450:22; 1468:22;1472:12; 1475:22;1476:4</p> <p>Reported (8) 1370:24;1390:10; 1399:7;1432:9,14; 1434:1;1437:3; 1449:22</p> <p>Reporter (1) 1498:4</p> <p>reporting (4) 1439:19;1447:2,9,16</p> <p>reports (8) 1399:3;1400:11; 1403:11,21;1406:7; 1417:9;1474:10; 1476:2</p> <p>represent (3) 1394:4,8;1494:21</p> <p>represented (3) 1439:2;1472:22;</p>
Q				
<p>qualified (3) 1396:5;1417:6; 1466:4</p> <p>quantify (2) 1459:4,5</p> <p>quantity (2) 1380:6;1465:17</p> <p>quarterly (1) 1389:12</p> <p>quick (3) 1416:3;1428:16; 1466:6</p> <p>quickly (2) 1385:4;1398:6</p> <p>Quite (14) 1404:20;1410:21,22; 1415:18;1422:22; 1433:22;1436:21; 1446:7,14;1452:19; 1455:1;1489:8; 1490:24;1496:9</p> <p>quote (3) 1384:4,5,13</p>				
R				
<p>ramping (3) 1446:13,14;1447:20</p> <p>range (6) 1415:11;1430:5; 1454:1;1468:23; 1469:2;1471:17</p> <p>rate (6) 1386:7,14,21; 1423:2;1472:17; 1493:3</p> <p>rates (1) 1471:24</p> <p>rather (3) 1420:9;1429:2; 1461:9</p> <p>reach (2) 1458:21;1488:9</p> <p>reaches (1) 1492:6</p> <p>read (2) 1403:10;1409:1</p> <p>real (3)</p>				

1492:20 representing (5) 1374:23;1395:18; 1470:6;1471:17; 1481:16 represents (3) 1437:10;1439:7,8 reproducible (1) 1414:15 Republic (3) 1493:20;1496:23; 1497:6 request (2) 1406:4;1467:5 requests (1) 1407:19 require (2) 1395:24;1477:15 required (1) 1423:5 reserve (1) 1465:24 reserved (1) 1496:14 residual (1) 1404:17 resistivity (1) 1380:24 resolution (1) 1387:22 resolve (2) 1387:23;1455:9 RESOURCES (9) 1370:2,3;1393:16; 1405:18;1423:13; 1425:13;1485:12; 1494:5;1498:9 respect (2) 1397:17;1471:8 respond (4) 1400:19;1412:15; 1453:15;1454:19 response (28) 1375:4;1379:6,12; 1386:1;1394:13,16,17; 1395:21;1406:2,4; 1410:4,4;1412:12,14, 17,22,22,23;1414:3; 1451:4,5,6,8;1454:2, 23;1455:4;1490:21; 1491:8 responses (8) 1377:5;1394:8; 1409:2;1412:19; 1451:10,11;1453:19; 1454:16 responsive (3) 1406:24;1407:18,18 restoration (1) 1407:11 restored (1) 1407:15 result (3)	1441:3;1455:23; 1486:5 results (8) 1384:11;1426:8; 1440:5,5,6;1448:19; 1468:21,24 revealed (1) 1383:23 reviewed (3) 1406:6,12;1468:6 reviewing (1) 1456:13 Rick (1) 1428:17 rig (1) 1414:18 right (47) 1378:23;1379:24; 1381:12;1382:16; 1383:9;1386:6,14,24; 1390:8;1391:6;1392:5, 6,9,18;1394:17;1398:9, 15;1400:12;1402:1; 1415:24;1422:4,5; 1424:2;1428:7;1432:3; 1436:23;1441:21; 1445:11;1447:12; 1453:6;1456:22; 1459:19;1466:10; 1474:16;1476:6,21; 1477:1,4,6;1480:24; 1484:21;1487:17,18; 1490:14;1495:4; 1496:12,17 right-hand (5) 1424:22;1431:18; 1435:5,20;1442:6 rights (62) 1380:6;1391:16; 1395:23;1396:5; 1399:13;1400:8,12; 1401:9;1419:10,14,20; 1421:24;1422:3; 1436:5;1443:18,22,24; 1444:5,17,24;1445:18, 22;1446:7,16;1458:8, 11,23;1459:8;1460:17; 1461:2,2,5,9,10,14,20; 1462:9,11,16;1474:22, 23;1476:20;1477:1,2,2, 10,11,16;1480:1,4,9, 11,14,20,21,24;1481:4; 1494:21,24;1495:9,22; 1496:9 rise (1) 1413:14 rises (1) 1491:10 rising (3) 1376:8;1453:11; 1486:5 RIVER (70) 1370:8,12;1374:6;	1376:13;1377:16; 1388:23;1391:17; 1396:2;1401:11; 1403:8,13,17;1404:2,6; 1406:16;1407:22; 1408:3,18,22;1409:17, 23;1420:13;1421:14; 1425:3;1428:4; 1429:21;1450:4; 1451:16;1455:24; 1456:6,22;1457:1,1,6, 9,11,13,15,20;1458:2, 7,10,13,15,20,22; 1459:1,12,21;1460:13; 1461:17;1462:9; 1463:4,13,17,19; 1474:19;1476:19,20, 24;1477:5,5,9,10; 1480:10;1481:19; 1484:1;1486:13; 1487:11;1488:21 rivers (1) 1459:3 Robison (2) 1371:19,20 rock (4) 1428:2,3;1473:12; 1492:21 rocks (5) 1382:11;1425:22,23; 1427:19;1428:13 Rogers (3) 1428:18;1492:7; 1493:2 round (1) 1378:7 Rowley (1) 1381:13 RPR (1) 1370:24 ruling (1) 1380:17 run (4) 1391:1;1397:19; 1427:4;1449:18 running (4) 1387:21;1404:11; 1409:5;1427:2 runoff (1) 1389:9 runs (3) 1413:18;1468:12,19 Rush (1) 1429:14	1420:11;1489:4 safety (2) 1464:5,6 Saints (1) 1480:7 salient (3) 1399:7;1476:1,4 same (4) 1377:20;1397:3; 1412:20;1498:10 satisfactory (1) 1483:14 saturated (1) 1439:7 save (1) 1430:3 saw (1) 1414:12 saying (4) 1403:24;1404:3,7; 1411:15 scale (2) 1377:12;1413:2 scaled (1) 1433:15 scenario (3) 1486:22;1487:8,14 scenarios (2) 1440:16;1464:23 scheduled (1) 1421:8 scheme (1) 1420:8 Schreck (1) 1371:22 Schroeder (1) 1372:10 science (1) 1385:24 scientific (2) 1449:14;1452:10 scientists (5) 1406:17;1426:7; 1447:6;1452:2;1453:1 scope (10) 1399:6,12,14,17; 1400:11,12,16,17,20; 1401:19 screen (3) 1378:16;1380:21; 1458:19 scrutinize (1) 1496:3 sealed (1) 1491:4 search (1) 1436:18 season (1) 1455:8 seasonal (8) 1412:4,5;1452:20, 23;1453:2;1454:6,7; 1455:10	seasonally (1) 1453:10 second (2) 1378:6;1421:10 seconds (1) 1401:22 Section (7) 1371:7,10;1385:19; 1428:5,21;1430:3; 1492:21 sections (3) 1427:20;1428:11,21 secure (1) 1460:17 seeing (35) 1374:16,19;1375:6, 17;1378:12;1388:5,7, 10;1393:8,11,14; 1395:10,12;1398:2; 1402:16,20,21; 1405:11;1410:3; 1470:1;1473:23; 1482:8,10,12;1485:4,7, 10;1491:14,20,22; 1493:11,14,21,22; 1494:4 seem (1) 1411:1 seeded (1) 1404:1 seems (3) 1379:18;1403:20; 1441:3 segment (1) 1483:3 segments (1) 1424:12 selection (2) 1414:22,23 seminars (1) 1410:10 senior (14) 1419:14;1422:3; 1458:10;1460:17; 1461:1,3,9;1474:22; 1475:2;1477:10; 1480:1,4,5;1481:4 sense (2) 1398:11;1415:2 sensitive (1) 1489:9 sensitivities (1) 1440:17 sensitivity (9) 1440:10,13,14,24; 1441:10,13;1483:8,9, 11 separate (7) 1459:19;1463:14,22; 1476:19;1478:13; 1483:3;1488:20 separating (2) 1375:7,18
S				
safe (14) 1420:8,9,10,13,20; 1459:21,23;1465:13, 19,21;1477:21; 1488:18,19,20 safety (2)				

September (1) 1401:3	Shifting (1) 1442:5	1399:5;1432:16; 1494:9	1445:22;1452:17; 1465:16;1466:1,4,21; 1467:10,15;1470:7,14; 1474:3;1479:20,21; 1481:13,14;1482:15; 1492:4	1414:17
sequence (1) 1440:21	short (1) 1412:12	simplest (1) 1456:18	1474:3;1479:20,21; 1481:13,14;1482:15; 1492:4	sounders (2) 1411:5;1414:7
Seradep (1) 1431:4	shortly (1) 1435:12	simply (2) 1455:10;1465:18		Sounds (2) 1376:4;1392:6
series (1) 1427:5	short-term (10) 1375:6,12,17; 1376:9,17,24;1377:5, 10,13;1396:17	simulated (1) 1441:8	snapshot (1) 1439:16	source (9) 1421:15;1428:24; 1441:18;1445:2; 1460:13;1471:18; 1486:8,23;1495:23
Service (18) 1374:18,19,24; 1395:11,12,18; 1407:10;1421:16,17; 1428:17;1465:9; 1469:24;1470:1,6; 1487:3;1491:21,22; 1492:4	show (19) 1375:4,20;1376:23; 1377:9,18;1379:5; 1382:11;1383:1,2,4,7; 1394:8,12,13,16; 1396:20;1425:7; 1454:2;1467:1	simulation (1) 1483:5	SNWA (19) 1371:16;1379:12; 1391:13;1397:19; 1411:24;1421:23; 1443:23;1444:6; 1446:4;1449:12; 1451:22;1453:4; 1458:13;1459:14; 1474:21,23;1478:5,7, 16	sources (3) 1460:11;1485:17; 1487:10
SESSION (1) 1374:1	showing (2) 1375:12;1376:9	single (1) 1439:6		south (18) 1412:6,10;1419:4; 1425:1,5;1431:23; 1433:8;1465:22; 1467:24;1469:4; 1470:19;1472:16; 1483:22;1484:4; 1486:14;1490:7,12,13
set (6) 1409:23;1413:12; 1414:2;1451:9;1460:4; 1461:16	shown (7) 1377:2;1381:20,22; 1415:10;1425:6; 1442:6;1457:15	sited (1) 1484:2	SNWA's (3) 1413:3;1443:18; 1456:18	Southern (33) 1378:13;1391:24; 1396:6;1398:3;1419:1, 6;1420:5;1422:17; 1424:16;1425:17; 1426:8;1429:14; 1431:11;1435:16; 1440:23;1441:17; 1442:16;1456:6,9; 1463:2;1464:18; 1465:7;1467:21; 1468:3;1470:9;1471:4; 1473:24;1474:7,10,14; 1489:17,18;1493:11
sets (2) 1447:5,6	shows (9) 1376:14;1382:24; 1383:11;1396:11; 1424:13,22;1445:7; 1470:8;1483:5	six (3) 1414:21,21;1435:9	software (1) 1454:15	soils (1) 1389:10
seven (7) 1396:23;1413:7; 1414:21;1415:8; 1458:9;1466:13; 1483:6	shut (2) 1412:9,23	six-basin (1) 1414:21	Solar (1) 1433:13	Solar (1) 1433:13
seven-day (3) 1383:23;1384:11; 1396:22	shutting (1) 1412:23	six-phase (1) 1421:4	soled (1) 1401:15	solely (1) 1459:1
several (5) 1391:13,23;1423:4; 1433:2;1444:2	SHV-1 (1) 1465:3	sized (1) 1484:2	Solicitor (1) 1470:6	Solicitor's (2) 1374:22;1395:17
Severity (1) 1451:14	side (10) 1411:6;1426:22; 1427:3,6;1431:18; 1434:10;1440:23; 1462:8;1468:12,19	skip (2) 1444:15;1445:4	solution (3) 1441:5;1483:14; 1492:12	sometime (1) 1392:6
shade (1) 1431:20	signal (5) 1412:9,10;1451:1; 1454:10;1455:3	slice (1) 1469:17	Sometimes (2) 1456:17;1495:24	somewhat (2) 1427:7;1449:24
shaded (2) 1425:8;1432:2	signals (7) 1412:5,5;1451:24; 1452:21,22,23,23	Slide (55) 1375:2,3;1384:9; 1393:20;1402:10; 1426:20;1427:22,22, 23;1429:10,11;1430:8; 1431:8;1432:11,12; 1434:17;1435:14,20; 1438:4;1440:5,6,22; 1442:5;1444:15,16; 1445:4;1447:11,12,12; 1448:21,23,24; 1450:19,20,21; 1452:17,18;1456:14, 16;1458:4,5;1462:21, 24;1467:10;1468:11, 21;1470:8;1475:4,4; 1482:16;1483:15,21; 1490:1,2,19	somewhere (4) 1445:1;1472:17; 1473:6;1489:3	
shades (2) 1428:1,2	significance (1) 1449:21	slides (2) 1467:1;1482:21	soon (1) 1422:10	Southwest (3) 1383:12,13;1413:10
shading (2) 1424:22;1425:21	significant (5) 1407:12;1447:21; 1450:10;1453:3; 1469:13	slight (1) 1385:10	Sorry (11) 1375:2;1381:2,3,9; 1397:7;1427:22; 1440:20;1447:12; 1482:19;1484:8; 1496:14	spans (1) 1445:15
shallow (1) 1387:21	similar (4) 1376:15;1443:10; 1450:3;1484:2	small (8) 1445:11;1454:18; 1457:21;1483:5; 1484:6,8,9;1493:3	sometime (1) 1392:6	sparsity (1) 1431:9
shared (1) 1402:7	similarly (3) 1473:2;1483:17; 1494:22	smaller (1) 1492:10	Sometimes (2) 1456:17;1495:24	speak (1) 1391:18
Sharp (2) 1371:19;1412:18	simply (3) 1473:2;1483:17; 1494:22	SMITH (27) 1373:11;1416:9,12, 18;1417:15;1418:2; 1424:5;1426:20; 1430:8;1434:12;	Somewhat (2) 1427:7;1449:24	specific (9) 1399:13;1409:2,3; 1410:4,15;1432:13; 1469:9,11;1480:4
Shear (10) 1472:14;1473:8,12; 1483:16,23;1484:4,11; 1490:7,10,14	simple (3)		Somewhere (4) 1445:1;1472:17; 1473:6;1489:3	specifically (1) 1438:6
sheer (5) 1425:24;1426:8,13, 22;1436:20			soon (1) 1422:10	specified (1) 1471:16
shift (6) 1416:2;1420:8; 1462:3,5;1464:5,6			Sought (1) 1401:6	spend (1) 1377:3
shifted (1) 1448:11			Sound (2) 1392:5;1467:14	spent (1) 1407:13
			sounder (4) 1411:13,13,21;	spin (1)

1413:11 spoke (2) 1438:24;1479:23 spread (1) 1451:11 Spring (13) 1379:1;1390:16; 1395:23;1398:15; 1428:19;1429:22; 1452:6;1455:21; 1457:1;1464:21; 1466:12;1475:11,16 SPRINGS (86) 1370:12;1374:14,17; 1385:6,9;1388:23; 1389:1,2,7,13,15,15,19, 21,23,23;1390:1,3,4, 22;1391:10,11,15,17; 1395:10;1396:2,15; 1398:15,21,21;1400:9; 1401:15;1403:8,13; 1404:2,6;1406:22; 1408:1,17,18,22,22; 1409:16;1415:7,17; 1420:13,17;1425:3,4; 1428:22;1429:1,21; 1455:24;1456:22,24; 1457:8;1459:24; 1462:2,2,5,8;1464:14; 1470:9,12,17;1471:1; 1475:5,7,8,24;1476:20; 1477:5,10,22;1478:10, 17;1480:10;1481:19; 1482:1;1486:13; 1487:5,11;1488:12; 1491:17;1492:8; 1493:3 squared (1) 1433:18 stabilized (1) 1488:8 stabilizing (3) 1450:14,15,16 stable (3) 1450:7,11;1455:16 stack (1) 1457:3 stacked (2) 1443:20;1457:18 staff (9) 1393:16;1405:18; 1418:10;1422:13; 1438:7;1450:1; 1485:12;1491:14; 1494:5 stand (1) 1419:22 stands (1) 1415:20 start (17) 1374:13;1383:21; 1395:19;1409:13; 1412:13,13;1416:6;	1438:12;1443:5; 1460:2;1466:11; 1486:3,5;1493:7; 1496:19;1497:3,4 started (2) 1474:13;1495:1 starting (3) 1433:21;1455:23; 1497:1 starts (1) 1395:4 STATE (39) 1370:1;1371:4; 1380:12;1389:11; 1393:15;1395:23; 1396:4;1401:3;1402:8; 1405:18;1406:4; 1407:1;1408:23; 1409:15,22;1410:8; 1414:1;1417:4;1418:9, 17,23;1422:13;1438:7; 1442:9,20;1446:1; 1450:1;1455:12; 1458:18;1461:16; 1463:12;1464:4; 1467:3;1472:3; 1477:19,23;1485:11; 1494:5;1498:1 stated (5) 1375:5;1394:20; 1406:8,11;1473:6 statement (8) 1384:16,18;1388:22, 24;1391:8,12;1403:5, 10 statements (3) 1384:10;1386:1; 1389:3 States (4) 1374:18;1390:15; 1395:11;1469:23 state's (1) 1444:16 static (4) 1433:6;1434:24; 1435:1;1439:23 Station (1) 1480:14 statistical (1) 1449:19 status (1) 1422:5 stay (1) 1437:23 staying (1) 1440:6 steady (2) 1409:10;1472:3 steady-state (3) 1471:9,11,23 stem (2) 1425:23;1445:19 stenotype (2)	1498:7,14 step (1) 1455:6 steps (1) 1460:15 stick (2) 1415:4;1493:6 sticking (1) 1411:5 still (14) 1395:16;1429:1; 1436:20;1445:18; 1450:22;1455:8; 1463:24;1470:4; 1471:5;1473:15; 1474:23;1483:14; 1490:21;1492:4 storage (5) 1385:3;1453:15; 1454:3;1472:7; 1485:22 straight (1) 1377:24 strategies (2) 1463:16;1480:1 strategy (9) 1418:12,15;1420:22; 1422:20;1423:16; 1460:10;1463:10; 1465:14;1479:24 stream (3) 1459:4,15;1460:1 streamflow (1) 1477:14 stress (4) 1422:22,23;1479:4,9 stresses (1) 1464:11 stressing (1) 1464:23 strictly (2) 1436:11;1472:23 strike (2) 1399:24;1478:3 strong (2) 1413:24;1458:13 stronger (1) 1413:11 structural (1) 1408:14 structure (4) 1404:17;1434:10; 1477:14;1490:11 studied (1) 1420:4 studies (2) 1429:13;1454:13 subdivision (1) 1400:24 subject (1) 1399:18 submit (2) 1389:11;1417:9	submitted (2) 1392:21;1446:5 substantial (4) 1412:7;1427:18; 1428:13;1434:22 subsurface (2) 1428:10,11 subtle (2) 1451:11;1454:18 successfully (3) 1380:5,10;1496:9 sudden (3) 1411:19,22;1448:5 sufficient (3) 1454:4;1463:4; 1484:17 suggest (13) 1419:18;1422:21; 1426:14;1440:24; 1441:19;1449:7; 1451:8;1457:12; 1467:18;1468:24; 1469:6;1472:23; 1487:24 suggested (3) 1395:1;1467:11; 1494:10 suggesting (1) 1404:1 suggestion (1) 1414:18 suggests (2) 1455:18;1469:15 Sullivan (5) 1371:5;1373:21; 1488:16,17;1490:15 sum (1) 1413:23 summarize (1) 1476:7 summary (4) 1384:12;1440:11; 1445:5;1448:21 super (2) 1443:14,15 Supervisor (1) 1371:13 supply (10) 1418:12,15;1420:22; 1421:1;1423:17; 1443:12;1460:10,18; 1461:9;1463:10 support (8) 1386:1;1396:14; 1411:23;1415:21; 1418:14;1422:18; 1473:10;1482:2 supported (1) 1429:23 supports (3) 1419:7;1420:17; 1492:16 sure (14)	1378:1;1385:19; 1388:15,17,19;1397:5; 1398:18;1402:12; 1404:13;1442:22; 1452:3;1460:22; 1467:3;1488:3 surface (4) 1404:12;1408:17; 1410:20;1436:9 surrounded (1) 1425:15 survey (1) 1414:18 surveyor (1) 1414:19 suspect (1) 1449:17 sustain (2) 1401:18;1489:10 sustainable (3) 1401:10;1460:14; 1464:17 sustained (1) 1462:2 swings (3) 1411:19,21,22 sworn (2) 1416:11,14 symbol (1) 1428:6 synonymous (1) 1423:6 SYSTEM (71) 1370:8;1374:6; 1376:14;1377:17; 1388:23;1390:7; 1401:11;1403:13,17; 1404:5;1406:16; 1407:7,23;1408:3,13; 1409:6,17,24;1412:10, 18;1415:2;1420:4,8; 1421:15;1424:13; 1426:4,19;1427:16; 1429:3,9;1431:10; 1441:21;1450:4; 1451:7,16;1453:12,22; 1454:14,17,23; 1455:13;1456:5,7,8; 1457:11;1458:15,20; 1459:1,12,18,21; 1461:17;1463:3,4,17; 1464:18;1465:21; 1467:20,21;1469:5; 1474:19;1476:19,24; 1478:9;1481:20,22; 1484:1,19;1488:21; 1489:2,18 systematic (1) 1450:17 systems (4) 1419:11;1420:1; 1422:22;1492:24
---	--	--	---	---

T	1417:2 terminal (1) 1484:19 terrible (1) 1407:24 terribly (1) 1455:6 test (33) 1383:24;1384:11; 1385:5,22;1386:2; 1387:1,3,7;1394:16,22; 1395:24;1396:12,17, 22;1397:20;1398:9; 1406:9,12;1410:3; 1411:3,20;1412:10; 1413:17,21;1414:3; 1422:22;1423:2,7; 1435:11;1438:5,15; 1439:18;1441:23 tested (2) 1433:7;1473:16 testified (9) 1376:7,19;1377:10; 1379:7,23;1384:6; 1399:8;1416:15; 1417:3 testifying (2) 1375:9;1416:10 testimony (21) 1382:19;1383:22; 1384:7,22;1386:18; 1399:3,18;1400:21; 1412:1;1417:16; 1428:16;1430:7; 1467:10;1473:3; 1475:3,22;1476:2,13; 1478:11,20;1483:1 testing (15) 1414:8;1422:14; 1423:5;1453:24; 1464:8,9;1465:9; 1469:15;1479:4,5,9; 1483:6;1488:9; 1489:10;1492:22 tests (8) 1396:21,23;1398:7; 1406:9,12;1410:9,9; 1413:19 Thanks (5) 1386:19;1388:1; 1481:8;1489:24; 1490:15 theory (2) 1457:23;1468:5 thereafter (1) 1498:10 therefore (1) 1455:21 Therese (1) 1373:12 thick (2) 1428:14;1492:21 thickness (1)	1428:13 thinking (3) 1411:1;1441:18; 1467:4 third (2) 1378:7;1431:13 though (2) 1492:19;1496:13 thought (2) 1403:15;1404:7 thousand (6) 1410:19,23;1433:2; 1439:7;1442:3; 1492:20 thousands (2) 1472:17,18 three (5) 1411:11;1421:11,11; 1451:15;1487:14 three-acre-feet (1) 1445:12 threshold (2) 1441:14;1464:15 throughout (7) 1406:15;1417:2; 1450:3,10;1458:24; 1472:3;1486:7 thrust (9) 1383:12;1427:4; 1465:7;1469:6,8,9,14, 18;1484:3 Thrusts (1) 1427:12 Thursday (2) 1496:24;1497:5 tide (1) 1454:16 tie (1) 1430:18 tied (1) 1420:20 ties (1) 1435:11 tight (1) 1492:13 Tim (2) 1371:18;1450:22 times (3) 1379:24;1380:2; 1487:15 timing (2) 1412:19;1414:5 tip (4) 1426:9;1431:2; 1432:1,2 today (17) 1384:6;1390:19; 1396:10;1399:15; 1413:3;1416:9;1418:7, 22;1423:12;1424:20; 1445:19;1446:3; 1459:5;1461:6; 1487:21;1496:13,18	Todd (1) 1393:24 together (4) 1393:3;1404:18; 1438:5;1467:4 told (1) 1473:5 tomorrow (3) 1459:6;1496:19; 1497:12 took (1) 1498:7 top (6) 1386:12;1390:16; 1432:6,8;1443:20,21 total (3) 1413:23;1444:17; 1465:17 totals (1) 1447:17 touch (6) 1419:19;1420:2; 1427:2;1438:5; 1439:14;1464:24 touched (2) 1434:19;1458:5 tough (1) 1414:7 toward (1) 1404:22 Tracy (1) 1416:8 traditional (1) 1457:23 transcribed (1) 1498:10 transcript (1) 1498:12 transcription (1) 1498:14 transducer (2) 1411:12,21 transected (1) 1387:16 transfer (7) 1419:10,15,20; 1461:1,14,19;1477:16 transferred (1) 1444:1 transferring (2) 1461:12,23 transfers (7) 1419:24;1422:4; 1443:18;1461:10; 1462:16,19;1463:5 transmissivities (3) 1433:21;1468:14; 1486:16 transmissivity (20) 1383:23;1384:6,24; 1432:16,19,21,23; 1433:1,16,16;1434:5,8, 13,15;1438:11,11;	1439:5;1468:6,8,11 treat (1) 1459:18 treatment (1) 1423:12 trend (3) 1450:5;1467:17; 1472:6 trending (2) 1468:17;1469:1 trends (7) 1420:3,15;1450:3, 24;1452:20;1454:7,12 triangle (1) 1432:2 tribunal (1) 1379:24 tried (3) 1407:18;1436:22; 1496:10 trouble (2) 1489:19,20 true (13) 1377:9,14;1379:16; 1382:23;1383:11; 1400:7;1474:9; 1478:18,19;1491:6,7,9; 1498:13 trusting (1) 1434:4 try (4) 1437:21;1438:6; 1487:12;1496:4 trying (11) 1403:19;1430:18; 1441:24;1451:21; 1452:10,19;1454:9; 1455:1;1456:10; 1459:20;1486:21 TUESDAY (2) 1370:20;1374:1 Tule (1) 1380:11 turn (4) 1400:18;1413:21; 1469:5;1482:18 turned (2) 1438:14;1448:13 turning (1) 1412:24 two (34) 1381:7;1382:15; 1386:10;1389:3; 1394:24;1401:5; 1403:20;1413:15; 1419:20,24;1421:19; 1422:8;1424:15,19; 1427:19,20;1431:17; 1432:22;1434:14; 1435:5,9,24;1436:4,12; 1437:13;1439:15; 1447:5,6;1451:18; 1459:14;1466:10;
----------	--	---	--	--

1468:11,18;1478:13 two-dimensional (2) 1439:6,9 tying (1) 1430:21 type (8) 1425:13;1433:4; 1439:24;1447:24; 1449:14;1484:19; 1491:8;1495:14 types (6) 1428:2,3;1433:21; 1435:3;1464:11; 1479:9 typewriting (1) 1498:10	units (1) 1419:20 unless (1) 1418:20 unreliable (2) 1410:15,16 up (53) 1375:2;1378:4,15; 1379:20;1380:21; 1388:1;1390:6; 1393:15;1394:14; 1395:8;1405:17,20; 1410:16;1415:6,8,8; 1418:8;1421:2,8,16; 1423:3,22,24;1424:17, 24;1425:6,7,24; 1429:24;1432:1,23; 1433:22;1434:6; 1435:12;1439:15; 1440:22;1443:6; 1446:13,14;1447:20, 21;1458:15;1460:7,21; 1461:16;1466:15; 1467:1;1483:22; 1485:11;1487:14; 1494:4,20;1495:4 upgradient (1) 1487:11 upon (2) 1437:9;1478:22 upper (6) 1428:21;1432:2; 1435:20;1439:7; 1469:17;1492:20 uppermost (2) 1442:2,3 Ure (17) 1373:12;1388:4; 1393:10;1402:18; 1405:12;1416:7,8,8,17; 1417:15;1418:1; 1465:23;1466:22; 1485:6;1494:1; 1496:14,15 usage (1) 1443:21 use (31) 1375:6,9;1396:14; 1397:2,3,6,8,17; 1418:15;1422:24; 1425:14;1426:6; 1436:9;1443:4,22; 1444:18;1445:1,10,14, 14,16,21;1446:8,17; 1460:11;1486:12; 1493:4;1494:12; 1495:6,10,17 used (14) 1375:14;1379:2; 1380:5,10;1394:5; 1422:24;1426:7; 1439:1,10;1440:7,9; 1445:19;1478:16;	1495:23 uses (3) 1394:8;1443:10; 1445:19 USGS (2) 1376:14,23 using (5) 1432:5,13;1437:19; 1444:3,4 usually (1) 1486:21 utility (1) 1425:16 utilization (1) 1423:11 utilize (2) 1421:23;1423:13 utilized (2) 1422:3;1480:9	16,17;1473:7;1474:20, 21,24;1475:1,12,16,23; 1476:5,21;1477:17; 1478:23;1479:1,6,14, 18;1481:19;1482:1; 1483:17;1484:4,9; 1485:1,17,21,23; 1486:7,12;1487:12; 1488:10,20;1490:4; 1492:7;1493:5,12,15, 22;1494:10;1497:7 Valley/Las (1) 1435:22 valuable (1) 1408:13 value (6) 1396:14;1433:17,18; 1447:14;1452:10; 1492:15 values (12) 1385:1;1437:4; 1446:9,23;1447:9; 1451:17;1468:7,8,11; 1492:11,16;1494:17 variability (1) 1412:2 variable (9) 1386:18;1448:1,13, 14;1449:6,9,13,16,20 variables (3) 1448:8,15;1451:23 variance (1) 1454:8 variation (2) 1394:12;1455:10 variations (2) 1409:7,7 variety (1) 1432:6 various (2) 1412:2;1490:3 Vegas (71) 1372:10;1378:13; 1388:3;1398:2; 1402:17;1403:16; 1404:16,22;1416:1,7,9; 1417:10,17;1418:12; 1419:7;1420:23; 1421:2,15,17;1423:20; 1424:7,23;1425:24; 1426:7,8,12,13,17,21; 1430:10,13;1435:19, 22;1436:16,19,20; 1437:5,13,24;1439:1; 1441:4;1460:9,17; 1463:8;1464:19; 1465:5;1468:1; 1470:13;1471:17; 1472:13,17;1473:7,8, 24;1474:6;1478:24; 1479:1,1,8;1483:16,17, 23;1484:4,9;1485:21, 23;1486:6;1490:4,7,9;	1493:12 vented (1) 1491:2 verify (1) 1484:21 versus (2) 1452:8;1472:5 vicinity (1) 1410:11 Vidler (10) 1388:24;1389:5; 1404:2,10;1405:20; 1406:1,23;1407:9,21; 1481:17 view (2) 1459:14;1464:11
U		V	W	
ultimately (1) 1479:3 Umstot (13) 1375:2,8,24;1377:1; 1378:24;1379:4,14; 1391:1;1393:24,24; 1402:2;1404:11; 1411:19 Umstot's (2) 1375:2;1393:20 uncertainties (1) 1419:5 uncertainty (1) 1426:16 unclear (1) 1461:4 under (10) 1374:8;1379:20; 1398:22;1400:2; 1421:7,9;1443:17; 1447:9;1474:14; 1480:14 underflow (3) 1389:14,17,22 underlying (1) 1383:5 understood (1) 1403:20 unexpected (1) 1441:16 unfortunately (5) 1377:7;1436:12; 1446:18;1447:19; 1448:8 uniform (1) 1415:19 unique (3) 1453:12;1456:11,12 unit (3) 1400:5;1409:24; 1474:20 United (3) 1374:17;1395:11; 1469:23		VALLEY (211) 1370:10,11;1372:7; 1379:2;1383:15,19; 1385:18,23;1388:23; 1389:1,2,7,13,15,16,19, 21,23;1390:1,3,4,5,6, 16,23;1391:10,11,15, 20,22;1393:5;1395:23; 1396:7,8,15;1398:2,15, 15,21,22;1400:9; 1401:15;1402:14; 1403:16;1404:16; 1405:9;1408:1; 1409:16;1415:7,17; 1418:13;1419:16; 1421:2,2,11,24;1423:3, 15,21,21;1424:7,8,24, 24;1425:1,2,3,5,11,14; 1426:1,3,12,17,21; 1427:3,6;1428:15; 1429:4,15,16,20,22; 1430:1,10,13,14; 1431:3,12;1432:4,22; 1434:11,13,15,21; 1435:16,19,22; 1436:14,16,17,19; 1437:5,6,14,14,23; 1438:1,9,13,19;1439:1, 1,12;1441:4,6,17,17, 20;1443:4,7,19,22,23; 1444:1,6;1445:8,15,23; 1446:6,8,16;1447:20; 1448:6,9,18;1450:3,9, 10;1452:4;1454:14; 1455:17,19;1456:5; 1457:19,24;1459:16; 1460:14,21;1464:7,8, 10,19;1465:3,5,13; 1467:12;1468:1,7,13, 16,23;1470:9,12,13,13, 17;1471:1,1;1472:3,14,	Walker (1) 1390:17 wants (4) 1392:21;1422:6; 1460:17;1492:13 Warm (3) 1477:22;1478:9,17 Wash (10) 1385:7;1408:22; 1425:5;1427:15; 1429:17;1440:24; 1441:7,9;1459:16; 1465:8 waste (1) 1400:1 wastewater (1) 1423:12 WATER (279) 1370:3;1376:8,9; 1377:15,18;1378:13, 13;1380:5;1383:15,20; 1385:18,21,23;1386:7, 14,21;1389:5;1391:16, 24;1392:8,22;1393:16; 1394:11,20;1395:23; 1396:5,10;1398:3,3; 1399:13;1400:8,8,11, 12;1401:5,9,9,15; 1402:14;1403:9; 1404:18;1405:17; 1406:22,23;1407:8,9, 21,21;1408:14,17; 1410:21,23;1414:11, 14;1415:6,13,18,19; 1418:12,15;1419:10, 14,20,21;1420:2,22; 1421:1,15,15,16,23; 1422:3,4,5,5,17,24; 1423:11,13,14,16; 1425:13;1428:24;	

1429:20,21,22,23; 1430:1,1,4,6,17,18,20, 21,22,24;1431:3,4,5, 15;1432:6;1433:6; 1434:19,20,24;1435:2, 6,7,8,9,10,15,18; 1436:5,8,10,10,13,23; 1437:3,4,11,16,22; 1438:12,20,22;1439:1, 2,10,13,21,23,24; 1440:3;1441:21; 1442:17;1443:4,10,12, 17,17,22,24;1444:3,5, 7;1445:11,14,14,14,16, 16,18,19,22;1446:7,8, 16;1447:22;1448:3,7, 13;1450:3,7,13,24; 1452:4,5,9,13,14,20; 1453:11,19;1454:8,13, 13,18;1455:15,20,22; 1458:8;1459:8,23; 1460:1,10,17,18; 1461:1,5,7,9,10,14,20; 1462:1,9,11,16; 1463:10;1464:1,1,13, 13;1465:14;1467:17, 24;1469:16;1470:10, 12,15,20,22;1471:11, 13,13,19;1472:3,5,8, 22;1473:7,11,24,24; 1474:7,11,14,15,21; 1476:13,20;1477:9,11, 16;1479:1,14,18; 1480:4,9,14,21; 1481:10,16,17;1483:6, 13;1484:12;1485:12, 20,24;1486:6;1487:10, 15,22;1488:4,8,11,23; 1489:23;1490:3; 1491:6,7,10;1492:17; 1493:2,11,12,15; 1494:5,21,24;1495:3, 15,22;1496:9;1498:9	weighted (1) 1456:6 weighting (2) 1448:14;1452:7 wells (51) 1376:13,15;1377:2; 1379:5;1396:1; 1406:10;1413:21; 1421:20,24;1422:3; 1423:4;1424:15,20; 1431:12,19,20;1432:7, 21;1433:2,4;1434:21, 23;1435:1,1,5,9,24; 1436:4,13;1437:16,17; 1442:2;1444:21; 1453:14,22;1454:2,19; 1457:5,7,23;1458:21; 1472:21;1473:17; 1475:14;1480:21,23; 1481:1,2;1486:19; 1490:9,12 weren't (2) 1446:11;1466:16 West (4) 1477:22;1478:10,17; 1484:4 western (3) 1444:21;1465:7; 1471:16 westernmost (1) 1425:10 wet (4) 1451:1,4,8,10 What's (2) 1391:12;1420:10 WHITE (27) 1370:8;1374:5; 1376:13;1377:16; 1388:23;1401:11; 1403:17;1406:16; 1407:22;1408:2; 1409:17,23;1450:4; 1451:15;1456:6; 1458:20;1459:1,21; 1461:17;1463:4,17; 1474:19;1476:18,24; 1481:19;1484:1; 1488:21 whole (2) 1406:16;1459:18 widening (1) 1443:13 Wildlife (6) 1374:18;1395:11; 1407:10;1425:9; 1469:24;1491:21 willing (1) 1473:16 Willow (1) 1385:9 window (1) 1453:19 winter (1)	1414:6 wise (2) 1422:17;1423:10 WITHIN (15) 1370:8;1387:4; 1399:12,14,14,17; 1400:11,12;1401:10; 1430:18;1446:24; 1452:15;1457:6; 1467:20;1498:9 without (4) 1455:20;1472:7; 1486:20;1487:7 witness (2) 1416:13;1466:2 wonder (1) 1411:22 word (1) 1486:12 words (1) 1485:24 work (14) 1381:17;1398:14; 1410:22;1415:5; 1417:1;1418:14,16,24; 1419:4;1420:4; 1445:10;1451:21; 1456:19;1481:24 worked (1) 1459:3 working (3) 1410:14,23;1455:13 worth (1) 1458:9 written (1) 1468:22 wrote (4) 1384:18;1385:19,19, 23	yield (15) 1390:1;1396:14; 1420:7,8,9,9,20; 1459:23;1464:4; 1465:19,21;1477:21; 1488:19,20;1489:23 yields (2) 1459:22;1488:18	1145 (1) 1433:10 1169 (18) 1379:3;1385:21; 1386:2;1387:1,3,7; 1397:20;1408:2; 1409:17;1410:3; 1411:2;1414:3;1447:2, 9,10,16;1453:23; 1475:18 12 (6) 1387:16,17,19; 1390:14;1432:11,12 13 (3) 1390:14,16;1434:17 1303 (6) 1374:6;1406:2; 1407:3,19;1418:18; 1482:3 1370 (1) 1498:13 1370-1498 (1) 1370:19 1374 (1) 1373:3 1378 (1) 1373:4 1383 (1) 1373:5 1388 (1) 1373:6 1393 (1) 1373:8 1395 (1) 1373:3 1398 (1) 1373:4 14 (4) 1413:6;1435:14,20; 1490:1 140 (1) 1434:2 1403 (1) 1373:6 1405 (1) 1373:9 1416 (1) 1373:12 1417 (1) 1373:24 1467 (1) 1373:13 1470 (1) 1373:14 1474 (1) 1373:15 1479 (1) 1373:16 1481 (1) 1373:17 1482 (1) 1373:18 1485 (1)
			Z	
			zero (2) 1447:20;1454:2 zone (19) 1385:3;1409:10; 1425:24;1426:8,13,22; 1436:20;1451:14; 1468:19;1472:14; 1473:8,12;1483:16,23; 1484:4,11;1490:7,10, 14 zones (3) 1425:21;1468:8,9 zoom (3) 1430:1,3;1431:17 zoom-ins (1) 1427:20	
			1	
			1 (9) 1370:20;1374:1; 1385:18;1386:15; 1409:19;1416:22; 1421:7;1423:23; 1428:7 1,000-acre-feet (1) 1444:12 1,114 (1) 1435:8 1,500 (1) 1487:4 1,808 (1) 1435:7 10 (12) 1380:23;1382:4,11; 1383:12;1387:11,17; 1414:24;1429:10,11; 1430:8;1468:21; 1470:8 10,000 (1) 1489:2 100-acre-feet (1) 1441:13 100-year (1) 1397:18 11 (9) 1380:23;1382:7,11; 1383:12;1384:9; 1387:11,17;1431:8; 1497:3 11:47 (1) 1497:14	
		Y		
		year (13) 1386:15;1390:17; 1392:2;1394:21; 1412:15;1435:7; 1439:18;1442:15; 1443:10,10;1450:5; 1453:10;1472:18 years (10) 1391:10,13,24; 1413:6;1417:1; 1439:13,15;1444:9; 1451:12;1460:21 year's (1) 1412:22 yellow (4) 1425:22;1443:1,2; 1494:20 yesterday (6) 1378:16;1379:7; 1383:22;1384:10; 1402:8;1412:1		

1373:20 1488 (1) 1373:21 1490 (1) 1373:22 1492 (1) 1373:14 1494 (1) 1373:20 1497 (1) 1498:13 15 (8) 1375:2;1401:22; 1417:4;1438:4;1440:6; 1460:22;1482:16,21 15,000 (1) 1444:9 1500-acre-feet (1) 1439:12 16 (5) 1433:14;1440:22; 1482:16,21;1483:15 16,000 (3) 1390:11,22;1391:4 16000 (1) 1390:17 16th (3) 1401:3;1417:5,5 17 (2) 1432:18;1442:5 17,000 (2) 1428:9,14 18 (1) 1445:4 1800 (2) 1414:12,24 1808 (1) 1430:4 1814 (1) 1430:5 1820 (2) 1414:12;1415:1 19 (2) 1444:15,16 1940s (1) 1458:9 1959 (1) 1445:10 1960s (1) 1445:17 1961 (1) 1445:11 1968 (1) 1429:14 1980s (1) 1443:7 1980's (2) 1495:1,20 1982 (1) 1428:8 1990 (1) 1433:11 1990s (2)	1443:8;1488:1 1990's (3) 1495:5,12,13 1996 (1) 1446:12 1999 (1) 1413:12 1st (2) 1498:6,17	2016 (8) 1395:1,4;1433:14; 1439:13;1442:15; 1443:11;1444:7; 1488:7 2017 (7) 1439:13;1442:11; 1443:11;1444:8; 1480:14,17;1488:7 2018 (2) 1442:11;1447:14 2019 (5) 1370:20;1374:1; 1387:11;1498:6,18 2021 (1) 1421:9 2022 (1) 1421:13 21 (1) 1413:6 210 (1) 1370:9 215 (1) 1370:10 217 (1) 1370:11 218 (1) 1370:12 219 (1) 1370:13 22 (2) 1447:11,13 23 (2) 1448:21;1450:5 24 (2) 1448:23,24 2-4 (1) 1373:24 25 (3) 1380:2;1457:24; 1467:10 25,000 (1) 1428:14 26 (2) 1450:20,21 27 (3) 1452:17,18;1490:19 28 (1) 1456:14 29 (1) 1456:16	1385:1 31 (1) 1462:22 32 (1) 1462:24 35 (1) 1431:14 36-inch (1) 1421:5 3-9 (2) 1386:3,6 3rd (1) 1496:24	1417:10,23 700-acre (1) 1443:15 700-acre-feet (1) 1441:4 70s (1) 1445:17 750 (1) 1410:21	
	2		4	8	
	2 (6) 1388:21,21;1417:10, 20;1422:10;1424:1 2,000 (3) 1433:6;1444:8; 1488:7 2,000-acre-feet (1) 1439:15 2,280-acre-feet (1) 1443:23 20 (5) 1413:6;1415:7; 1428:14;1437:2; 1444:16 200 (1) 1433:9 2000 (1) 1413:12 2001 (11) 1442:11;1443:5,19, 23;1444:13,16; 1446:11,13;1488:1; 1495:11,15 2002 (1) 1442:17 2003 (1) 1393:1 2005 (7) 1392:3,7,12; 1394:14;1396:21; 1413:15;1442:17 2006 (9) 1390:10;1391:3; 1406:12,14;1414:13; 1433:14;1442:19,24; 1444:10 2007 (3) 1389:8;1392:9,13 2010 (1) 1387:2 2011 (2) 1386:22;1387:3 2012 (1) 1412:8 2013 (1) 1379:12 2014 (2) 1386:22;1387:3 2015 (6) 1435:7,11;1439:10, 11,17;1442:7	2018 (2) 1442:11;1447:14 2019 (5) 1370:20;1374:1; 1387:11;1498:6,18 2021 (1) 1421:9 2022 (1) 1421:13 21 (1) 1413:6 210 (1) 1370:9 215 (1) 1370:10 217 (1) 1370:11 218 (1) 1370:12 219 (1) 1370:13 22 (2) 1447:11,13 23 (2) 1448:21;1450:5 24 (2) 1448:23,24 2-4 (1) 1373:24 25 (3) 1380:2;1457:24; 1467:10 25,000 (1) 1428:14 26 (2) 1450:20,21 27 (3) 1452:17,18;1490:19 28 (1) 1456:14 29 (1) 1456:16	5	4 (5) 1417:10,22;1418:20; 1442:14;1492:6 40- (1) 1387:20 400,000 (1) 1385:1 450-acre-feet (1) 1441:12 45-degree (1) 1387:21 48,000 (1) 1473:7 4th (1) 1497:9	8 (3) 1389:8;1426:20; 1483:21 8:30 (1) 1496:20 800 (2) 1433:7;1445:1 800-acre-feet (1) 1445:3 805-acre-feet (1) 1444:20 80s (2) 1445:15,20 80's (1) 1467:13 850 (1) 1433:7
			6	9	
		3	5 (1) 1417:12 50 (2) 1379:24;1431:10 50,000 (1) 1433:18 500 (2) 1396:6,7 500-acre-feet (1) 1441:11	9 (3) 1427:22,22,23 900 (2) 1382:12;1436:5 900-acre-feet (2) 1445:1;1464:16 90s (5) 1445:20;1446:15; 1447:20;1450:7,10 90's (4) 1467:13;1494:14; 1495:8,17 911-acre-feet (1) 1444:17 93 (2) 1425:17;1443:14	
		3 (5) 1392:20;1417:10,21; 1418:20;1483:2 3.2 (2) 1478:9,17 30 (5) 1417:1;1431:14; 1458:4,5;1475:4 300- (1)	7		
			6 (3) 1393:20;1396:22; 1492:6 60 (2) 1454:5,6 600 (1) 1433:8 60-foot (1) 1436:13 60's (1) 1494:23		
			7 (4) 1373:24;1388:24;		

In The Matter Of:

*DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES*

*Vol. VIII
October 02, 2019*

*Capitol Reporters
123 W. Nye Lane, Ste 107

Carson City, Nevada 89706*

Original File 100219amfinalWater.txt
Min-U-Script® with Word Index

SE ROA 53611

JA_18008

1 STATE OF NEVADA
 2 DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
 3 DIVISION OF WATER RESOURCES
 4 BEFORE MICHELINE FAIRBANK, HEARING OFFICER
 5 ---oOo---
 6 IN THE MATTER OF THE ADMINISTRATION
 AND MANAGEMENT OF THE LOWER
 7 WHITE RIVER FLOW SYSTEM WITHIN
 COYOTE SPRING VALLEY HYDROGRAPHIC
 8 BASIN (210), A PORTION OF BLACK
 MOUNTAIN'S AREA HYDROGRAPHIC
 9 BASIN (215), GARNET VALLEY
 HYDROGRAPHIC BASIN (216), HIDDEN
 10 VALLEY HYDROGRAPHIC BASIN (217),
 CALIFORNIA WASH HYDROGRAPHIC BASIN
 11 (218), AND MUDDY RIVER SPRINGS AREA
 (AKA UPPER MOAPA VALLEY HYDROGRAPHIC
 12 BASIN (219).

13 _____ /
 14 TRANSCRIPT OF PROCEEDINGS
 15 PUBLIC HEARING
 16 HEARING ON ORDER 1303
 17 VOLUME VIII
 (A.M. SESSION, Pages 1499 - 1596)

18 WEDNESDAY, OCTOBER 2, 2019

19
 20
 21 REPORTED BY: CAPITOL REPORTERS
 Certified Shorthand Reporters
 22 BY: CHRISTY Y. JOYCE, CCR
 Nevada CCR #625
 23 123 W. Nye Lane Suite 107
 Carson City, Nevada 89706
 24 (775)882-5322

1 A P P E A R A N C E S
 (Continued)
 2
 3 For SNWA: Taggart & Taggart, Ltd.
 By: Paul G. Taggart, Esq.
 4 Carson City, Nevada
 -and-
 5 Tim O'Connor, Esq.
 6 For CSI: Robison, Belaustegui, Sharp
 & Low
 7 By: Kent R. Robison, Esq.
 Reno, Nevada
 8
 9 For CSI: Brownstein Hyatt Farber Schreck
 By: Bradley J. Herrema, Esq.
 Los Angeles, California
 10
 11 For NV Energy: Justina Caviglia, Esq.
 Reno, Nevada
 12 For Lincoln County
 Water District/
 13 Vidler Water Company: Allison MacKenzie
 By: Karen Peterson, Esq.
 14 Carson City, Nevada
 15 For NCA: Alex Flangas, Esq.
 Reno, Nevada
 16
 17 For Moapa Band of Paiutes: Richard Berley, Esq.
 18 For Moapa Valley
 Water District: Greg Morrison, Esq.
 19 For Muddy Valley Irrigation: Steve King
 20 For Bedroc: Therese Ure, Esq.
 21 For City of North Las Vegas: Therese Ure, Esq.
 22 For National Park Service: Karen Glasgow
 23 For Center for Biologic
 Diversity: Patrick Donnelly
 24

1 A P P E A R A N C E S
 2
 3 Micheline N. Fairbank,
 Hearing Officer
 4
 5 Tim Wilson,
 Acting State Engineer
 6 Adam Sullivan,
 Deputy State Engineer
 7
 8 Melissa Flatley,
 Chief of the Hearing Officer Section
 9 Michelle Barnes,
 Supervising Professional Engineer
 10
 11 Levi Kryder,
 Chief of the Hydrology Section
 12 Jon Benedict,
 Senior Hydrologist
 13
 14 Christi Cooper,
 Well Supervisor
 15 Bridget Bliss,
 Basin Engineer
 16
 17
 18
 19
 20
 21
 22
 23
 24

1	I N D E X	
2	WITNESS	PAGE
3	TOM MYERS	
4	Direct Examination by Mr. Donnelly	1507
5	Cross-Examination by Mr. Herrema	1546
6	Cross-Examination by Mr. Taggart	1552
7	Cross-Examination by Mr. Morrison	1557
8	Cross-Examination by Ms. Peterson	1560
9	Cross-Examination by Mr. King	1566
10	Examination by Mr. Benedict	1569
11	Examination by Mr. Kryder	1571
12	Examination by Mr. Sullivan	1572
13	Examination by Ms. Barnes	1574
14	Cross-Examination by Mr. Taggart	1576
15	Cross-Examination by Ms. Peterson	1580
16	Redirect Examination by Mr. Donnelly	1586
17	JONATHAN BELL	
18	Direct Examination by Ms. Williams	1588
19	Cross-Examination by Mr. Herrema	1591
20	Examination by Mr. Benedict	1593
21		
22		
23		
24		

1 CARSON CITY, WEDNESDAY, OCTOBER 2, 2019, A.M. SESSION
2 ---oOo---
3 HEARING OFFICER FAIRBANK: This is a continuation
4 of the Order 1303 hearing regarding the Lower White River
5 Flow System and the administration of the basins as a joint
6 administrative unit.
7 And we will continue our presentations by the
8 participants starting today with Center for Biological
9 Diversity. And so we'll go ahead and kick it off with
10 Mr. Donnelly.
11 MR. DONNELLY: Thank you. Good morning. Patrick
12 Donnelly for the Center for Biological Diversity. And our
13 expert witness today is Dr. Tom Myers, a hydrologist, who has
14 appeared in front of the Nevada State Engineer in numerous
15 proceedings. His CV is available on CBD Exhibit 1.
16 We appreciate the opportunity to present today.
17 The Center for Biological Diversity was founded in 1989 and
18 our mission is very simple. It's to save life on earth. In
19 particular, we focus on the protection of endangered species
20 and the habitats upon which they rely.
21 And I just want to provide the briefest of
22 remarks about the context of Dr. Myers' presentation. We
23 have been advocating for the protection of the Moapa dace for
24 over a decade, focusing on securing a long-term permanent

1 scientific experts presenting and interpreting data, Order
2 1303 asks a subjective question. What is the amount that may
3 be pumped? And the question that's implicit there is that
4 may be pumped within what constraints.
5 Different parties have had different
6 conceptualizations about what the constraints on pumping are
7 and thus have reached very different conclusions.
8 We feel that the Endangered Species Act is the
9 primary limiting factor on the overall quantity of allowable
10 pumping within the Lower White River Flow System and thus we
11 geared our analysis toward that goal of protecting the dace.
12 However, other testimony has made it clear that
13 certain types and locations of pumping will also impact
14 senior surface water rights. As such, while our report
15 focuses on what actions are necessary to save the dace, our
16 report should not be considered exclusive of conclusions
17 raised by other parties as to requisite actions to protect
18 senior surface water rights.
19 The findings in our report and other reports
20 instead may compliment one another, which is, of course, up
21 to the State Engineer's office to determine.
22 Dr. Myers presents in his conclusion a number of
23 potentially allowable alluvial pumping. However, if the goal
24 of this proceeding's outcome is both to protect the dace and

1 water supply for the fish. And as parties in this room are
2 doubtless aware, we unsuccessfully litigated Fish and
3 Wildlife Services section seven consultation on the MOA some
4 ten years ago.
5 As we've been eliciting in cross-examination over
6 the past two weeks, we believe that withdrawals from the
7 carbonate aquifer that cause a reduction in habitat quantity
8 for the dace are a take under the Endangered Species Act and
9 thus prohibited.
10 And while that implies that individual pumpers
11 may be potentially violating the Act, we believe that
12 responsibility lies with the Division of Water Resources.
13 Rather than running to court to litigate this,
14 we're participating in this proceeding because we believe
15 that the State Engineer's office is taking the right approach
16 to addressing this matter. With almost 40,000 acre-feet of
17 groundwater rights and 37,000 acre-feet of surface water
18 rights, the basin is extremely over-allocated and the dace's
19 habitat is in danger of drying up, even at current pumping
20 levels, as Dr. Myers will demonstrate.
21 Order 1303, Section 6-2-C asks about the
22 long-term annual quantity of groundwater that may be pumped
23 from the Lower White River Flow System. While this is a
24 technical evidentiary proceeding we're involved in involving

1 to protect in-stream water rights, we all need to consider
2 that the idea that all pumping must cease or at least that
3 needs to be part of the evaluation.
4 We would respectfully request of the State
5 Engineer's office the opportunity to present a brief written
6 closing argument after the termination of this hearing.
7 I'd like to move to have our Exhibits 1 through 4
8 admitted for the record.
9 HEARING OFFICER FAIRBANK: Those exhibits will be
10 admitted.
11 MR. DONNELLY: Thank you. I want to note for
12 everyone that our presentation today differs slightly from
13 the presentation provided to the parties as CBD Exhibit 4.
14 We chose to highlight a couple of different elements from our
15 reports to ensure it's relevant to the ongoing discussions
16 we've had, but we haven't reached any new substantive
17 conclusions or anything in the presentation today.
18 Could we please swear in the witness?
19 (The witness was sworn in)
20
21 TOM MYERS
22 Called as a witness on behalf of the
23 Center for Biological Diversity, having been first duly sworn
24 Was examined and testified as follows:

1 DIRECT EXAMINATION

2 By Mr. Donnelly:

3 Q. Thank you. With that I will turn it over to
4 Dr. Myers to present the Center for Biological Diversity's
5 report and rebuttal.

6 A. Good morning, members of the panel and everyone
7 in the room. Thank you for this opportunity to present our
8 analysis and our conclusions.

9 My name is Tom Myers. That's M-y-e-r-s. I've
10 been working as a hydrologic consultant for about 25 years
11 now, and, as Patrick mentioned, working this is my sixth or
12 seventh time before the Nevada State Engineer. I've also
13 done this in three other states, Arizona, Montana, and New
14 Mexico. So I've got some background doing this.

15 The outline of my presentation is pretty simple.
16 I'm going to summarize the direct evidence report which is
17 submitted as technical memorandum, groundwater management in
18 the Muddy River Springs. And I'm also going to present a
19 summary of my rebuttal report, which was titled technical
20 memorandum groundwater management in the Muddy River Springs,
21 rebuttal and response to stakeholder reports filed with
22 respect to Nevada State Engineer Order 1303.

23 I also note I'll try to speak slowly enough. I
24 actually already realize I'm doing that. Sorry. Just throw

1 around January 2002. The highest was in 2005, as we've heard
2 many times. There was a slight upward trend beginning
3 somewhere around 2010. And, as we've seen in other graphs by
4 other presenters, 2017 and even the winter of 2018-19 also
5 had some reasonably high precipitation amounts. And that is
6 important as we go forward here.

7 As an aside, I realize both in listening last
8 week and reading lots of reports that, you know, what is best
9 to consider when we think of recharge in an arid region. Is
10 it precipitation or is it PDSI, the Palmer Drought Severity
11 Index. And I recently -- I thought a lot about this in both
12 listening to the data here and also in realizing I do a fair
13 amount back east and have recently moved back east. And I
14 realize that PDSI is more appropriate in areas that have a
15 lot of soil cover. The PDSI tracks evap precipitation and
16 evaporation and it simulates evaporation based on temperature
17 and a couple of other variables.

18 Precipitation, however, especially in arid
19 regions, drives the runoff and that is even during a dry
20 period. For example, I mean, runoff can occur in an arid
21 region before the moisture deficits as represented by Palmer
22 Drought Severity Index are even made up. I mean, recharge
23 can occur due to runoff on pervious outcrops like carbonate
24 rock. It occurs as mountain-front recharge. I think if you

1 something at me.

2 On my presentation there will be page numbers and
3 that is frequently is a reference to where in the report if
4 I'm referring -- if I'm in the first part of it is in the
5 direct evidence report or the second part the page numbers
6 are where I've addressed this. I mean, it's not a direct
7 quote, usually. It's often where I paraphrase something from
8 my reports.

9 The first section I'm going to go over is
10 analysis of the Order 1169 pump test and subsequent data and
11 I'm going to consider climate, water level changes by well,
12 water level changes over the area, and spring flows. While
13 some of this will, no doubt, be repetitious of what we've
14 already been seeing, you know, with some small variability
15 perhaps in interpretation, I'm going to try not to dwell on
16 this because we have seen this so many times going forward.

17 First, regarding climate -- And I've chosen to
18 consider precipitation trends primarily. This is the -- This
19 is data. We've already seen this a couple of times, but it's
20 from the Western Regional Climate Center and it's the extreme
21 southern division. This is a 12-month running average of the
22 precipitation for the southern zone in Nevada. It shows a
23 seasonal variation. I see no evidence of a 20-year drought
24 in this data. You'll see that it went the lowest right

1 looked at some research that has been done, it's been
2 referenced earlier by other people. For example, the
3 research Scott Tyler at DRI did in runoff in desert washes.
4 It's just one event that causes a recharge slug.

5 And so I think my point here is that for the type
6 of area that we're looking at here, rainfall, like in the
7 previous graph that I presented, is a better thing to
8 consider for climate trends and for recharge slugs,
9 considering recharge, than is the Palmer Drought Severity
10 Index. And at that may be especially true going forward as
11 temperatures warm.

12 And I guess the point is that any year, even a
13 very, very wet year, the soil moisture is dissipated by the
14 end of the water year. And so you start almost every year on
15 a -- at the beginning, if you will.

16 Now, to consider a few of the well trends here.
17 This is a graph of the Coyote Spring carbonate wells that
18 even back in Order 6254 the Nevada State Engineer found that
19 the reduced pumping completed during the aquifer test, but I
20 am repeating the fact that it wasn't the full amount that had
21 originally been ordered in Order 1164, satisfied the goals
22 and the pumping in Coyote Spring Valley cause impacts north
23 in Coyote Spring Valley and then -- And this is a quote -- at
24 least to Kane Springs Valley south to Hidden Valley and

1 Garnet Valley and southeast to the Muddy River Springs area
2 and California Wash.

3 The water levels in the carbonate monitoring
4 wells in central and southern Coyote Spring Valley have
5 varied in parallel since the early two 2000s. The trend has
6 been downward except for the brief increase that occurred
7 around 2005. And then all of the carbonate wells in central
8 and southern Coyote Spring Valley decreased at least two feet
9 during the pump test period and they have all recovered by
10 less than half that amount by 2016.

11 Most carbonate monitoring wells show a continued
12 lowering of water levels since 2016. And I think it's
13 important that that's even with the wet winters in 2017 to
14 2019. That's why I mentioned that was important on the
15 precipitation graph I showed before.

16 And this lack of recovery shows that -- it
17 indicates that, I mean, that an increase gradient caused by
18 the drawdown is that it has not drawn substantially more
19 water from beyond the boundaries of the higher transmissivity
20 zone, that the broad two-foot drawdown cone or -- I guess you
21 would call it a cone. The broad drawdown levels throughout
22 the five basins is reached up to the boundaries and thus it
23 doesn't pull -- it hasn't really begun to pull substantially
24 more water from beyond the boundaries, which is partly why

1 ten feet seasonally. And that could change the gradient
2 between the connection in the carbonate and basin fill wells
3 and that could allow the carbonate wells to go up and down,
4 the water levels to go up and down, by half a foot like we
5 see.

6 I 169 aquifer test accelerated the decline in the
7 monitoring wells with a decrease of as much as two and a half
8 feet.

9 And I want to go back -- Yesterday we heard that
10 the well EH-4 may have been, you know, was steady, had steady
11 water levels during the nineties and even the late eighties
12 when pumping had begun in Garnet Valley and the idea was that
13 Garnet Valley pumping may not affect it at all.

14 Well, if you -- there is a, I interpret, a slight
15 downward trend here in the late eighties and early nineties
16 until we get to the -- until we get to a wet period in '92
17 and '93. And I also interpret a slide down at least steady
18 if not slight downward trend in the late nineties. So I'm
19 not really sure that we can say that Garnet Valley pumping
20 has had no effect at all on the carbonate water levels in the
21 Muddy River Springs area.

22 And I want to show two of the same graphs that
23 I've already shown but up close and in a little more detail.
24 And that is just to show that from late 2016 from the EH-4,

1 we've seen so little recovery.

2 The basin fill groundwater levels in the southern
3 portion of Coyote Spring Valley have also trends downward
4 since the late 1990s, with the exception being during the wet
5 period around 2005. Well CSV3011M water levels increased
6 from its installation in 2008 until the aquifer test after
7 which it began to climb as well.

8 And then well DF-1, which is a basin fill well in
9 the middle of southern Coyote Spring Valley, not shown on
10 this particular graph, however, had water levels of about 200
11 feet higher than other wells in the area.

12 Carbonate monitoring wells in the Muddy River
13 Springs area also show long-term downward trend commencing in
14 the 1990s with the familiar uptick in 2005.

15 The report, the USDOJ 2013 report identified
16 several wet year responses. That's -- The graph at the
17 bottom is from that particular report. They identified
18 several wet year response in groundwater levels including
19 1992, '93, 2005 and to a lesser degree in 1998 and 2011.

20 I'm not sure I can prove this. But the small
21 seasonal fluctuation that we see in many of the carbonate
22 wells, and it was discussed a little bit yesterday, I could
23 see that it could relate to the pumping in the basin fill
24 aquifer, which is seasonal, and in cases varies by as much as

1 EH-5b, and UMVM wells, all of them show a slight downward
2 trend with time especially starting in late 2015 and added
3 that this time period where there is a slight upward trend in
4 the precipitation. So this is occurring, this downward trend
5 in the last several years occurs, even though there has been
6 a slight uptick in the precipitation.

7 And then basin fill wells in the Muddy River
8 Springs area, both of these graphs are from -- I mean, show
9 some basin fill wells, basin fill wells in the Lewis Field
10 portion of the Muddy River Springs area have, you know, have
11 been steady but with a slight decline more recently. And
12 this is where you actually see the almost ten-foot seasonal
13 variation. So if you go back to my previous statement about
14 potential seasonal variability in the carbonate aquifer
15 possibly being related to pumping that occurs in the alluvial
16 aquifer.

17 And I realize I may go back and forth and say
18 alluvial and basin fill interchangeably, and it probably
19 shouldn't. But I recognize that I refer to them
20 interchangeably. And these tend to be more alluvial than
21 basin fill in this area.

22 All wells in the Lewis Field portion of the Muddy
23 River Springs area exhibit a drawdown of several feet during
24 and then just after the pump test. Basin fill wells near the

1 springs, and that's in the bottom graph, have declined, other
2 than during the uptick in 2005 since the 1990s, far more than
3 the Lewis Field wells, that declined, it accelerated through
4 the aquifer test period. And although it is mostly
5 completely recovered, however, most of that recovery is
6 probably due to the very significant decrease in alluvial
7 pumping that I'll show in a slide or two here.

8 Now, overall, the groundwater levels at the end
9 of the pump test show the very flat potentiometric surface
10 from midway up Coyote Spring Valley through the Muddy River
11 Springs area. On this graph you can see almost all the way
12 from the middle of Coyote Spring Valley. And I realize that
13 you can't read the -- indeed these elevations are not
14 extremely readable. But there's only a several-foot
15 variability all through the 30-mile area or 30-mile distance
16 here. I mean, and during pumping, the water levels
17 responded. And, literally, it responded to the aquifer of
18 the pond. And you pull water at one end and it reduces
19 throughout the whole area very quickly.

20 Carbonate water levels in northern Coyote Spring
21 Valley they are several tens to almost 400 feet higher than
22 in the southeast portion of Coyote Spring Valley. But the
23 water levels at least at CSVM-4 did decline during the
24 aquifer test.

1 Basin fill water levels in the Coyote Spring
2 Valley are substantially higher than they are in the
3 carbonate. That's most apparent in well CE-VF-2, which is
4 about 50 feet higher than in the carbonate.

5 Basin fill well DF-1 exceeds 2,000 feet while the
6 underlying carbonate wells are a good 200 feet lower.
7 Now, I suggest that because of the aridity of the
8 area that this doesn't so much reflect a substantial recharge
9 from the basin fill to the carbonate but it suggests that
10 there could be a hydrologic disconnect due to a low
11 conductivity zone or something between the carbonate and the
12 basin fill in Coyote Spring Valley.

13 In the Muddy River Springs area, carbonate water
14 levels exceed those in the basin fill, which reflects the
15 upward movement of water from the carbonate to the -- in the
16 to alluvium, and that also helps to provide water to the
17 springs and to the alluvium in the Muddy River Springs area.

18 And then just as a note, in the Lower Meadow
19 Valley Wash area, which is outside of the pump test study
20 area, these three wells up here, I believe those are, like,
21 MW-1 or something like that, they demonstrate sort of an
22 upward gradient from depth in what's a very thick basin fill
23 aquifer.

24 And then this graph here is a profile of the

1 I just mentioned the groundwater level at CSVM-4,
2 which is near the southern end of Kane Springs Valley, it's
3 just four to five feet lower than well KMW-1, which is
4 further north in Kane Springs Valley. And that does suggest
5 that there's a connection of transmissivity, the high
6 transmissivity, of carbonate rock that extends in to that
7 valley. And I'll allude to this area and this several times.
8 And I'm not denying that there is a fault in -- there is
9 probably a fault between those two wells. But with only a
10 few feet of variability and the fact that KMW-1 did vary
11 during the pump test, the fault cannot be providing a huge
12 impedence. And I will probably come back and say that
13 several more times, probably in response to questions later
14 too.

15 Carbonate groundwater levels drop from the Muddy
16 River Springs area they -- down to the far to the southeast
17 here they drop almost 250 feet. These levels down in this
18 area here at very, you know, south and east of the Muddy
19 River Springs are about 200 feet lower than they are at the
20 springs themselves. And that observation -- I mean, the fact
21 that there's a fair drop in the carbonate aquifer at that
22 point reflects some impedence in the carbonate, which
23 probably is partly responsible for the location of the
24 springs.

1 water levels at different wells from Muddy River Springs in
2 EH-4 in the far right up to CSVM-4. And these are water
3 levels before and after the pump test period. And the
4 profile, first off, it demonstrates the flatness of the
5 potentiometric surface. You can see an almost 20-mile area
6 there where the water level varies from 1820 to about 1814 --
7 or 1813. And during the aquifer test, the level there
8 consistently dropped about two feet.

9 Further north of CSVM-4, the groundwater level
10 change was less than a foot. And further north, the
11 carbonate water levels are about 200 feet higher. This is
12 off of my graph. But carbonate water levels continue up for
13 about -- they're about 200 feet higher. And that definitely
14 reflects the fact that there is transmissivity in northern
15 Coyote Spring Valley is lower and as reflected by the steeper
16 gradient. And also inflow to Coyote Spring Valley from
17 Pahranaagat or Delamar Valley. It flows through the lower
18 transmissivity area -- It flows through this lower
19 transmissivity area to reach southern Coyote Spring Valley
20 and well MX-5 and of course then the Muddy River Springs
21 area. The point being that inflow to Coyote Spring Valley, I
22 mean, there may be a lower transmissivity in the north. It's
23 still passing all of the water needed for the Muddy River
24 Springs area.

1 And then if we consider discharge from Warm
2 Springs West, it decreased from the nineties, you know,
3 through the mid-2000s from about four to 3.4 CFS. It
4 upticked in 2006 and then during the wet period. And then
5 during the Order 1169 pump test it dropped to almost 3.2 CFS.
6 That was a decline of about nine percent during the period of
7 the pump test and it recovered just a little bit more than
8 3.4 CFS since 2012.

9 Since 2016, it has decreased a little bit and
10 become steady at -- steady or slightly decreasing at less
11 than 3.4 CFS since a brief increase that occurred during the
12 wet 2017.

13 I would point out that although the data is
14 provisional, yesterday morning the flow at Warm Springs West
15 is 3.23 CFS. I checked it. Very close to that 3.2 CFS. I
16 mean, obviously it's provisional and I don't know how much
17 they've changed over the years until they go finalize them.
18 But it's been 3.23 CFS for over a week. So it's pretty
19 steady right now.

20 At the Pederson Springs, the flow is about half
21 of what it was in the mid-2000s right now there from this
22 first part of the graph to the second part. Much of the
23 decrease occurred during the pump test. There was some minor
24 recovery especially in the Pederson Springs, especially at

1 And then, also, whatever groundwater flow
2 originates in Kane Springs Valley probably is limited to
3 local recharge, but it does come in to Coyote Spring Valley
4 at some point. It has to come in to it. And so there's
5 evidence that pumping in Coyote Spring Valley will draw flow
6 from Kane Spring Valley, there's no limit to -- there's no
7 reason to not consider it, quite honestly.

8 And I also mention here no reason to separate out
9 northern Coyote Spring Valley. I can't remember which report
10 I read that suggested that maybe Coyote Spring Valley should
11 be considered differently. But the fact that all of the flow
12 in Pahranaagat Valley and Delamar Valley has to flow through
13 that area, there's really -- and intercepted, it's going to
14 have effects in southern Coyote Spring Valley, you know,
15 similar to pumping down there. There's really no reason to
16 separate out northern Coyote Spring Valley from the flow --
17 the Lower White River Flow System.

18 Here's the conclusion that I think stems from
19 this. And I'll come back to it several times in the
20 remainder of my presentation. But going forward in to the
21 future there can be no carbonate pumping if the objective is
22 to keep flows at Warm Springs West and at all of the springs
23 at the level that is necessary to support the Moapa dace and
24 quite honestly the water rights to further downstream.

1 Pederson Springs. At Pederson Springs the flows had declined
2 about 63 percent. And at Pederson East Spring about 45
3 percent during the test. And the USDOJ 2013 report they
4 found that had the rate of drawdown continued, Pederson
5 Spring would have gone dry in about a year and a half. And
6 that Pederson Spring East would have gone dry in another two
7 and a half to three years had the pumping as observed during
8 the pump test had continued.

9 Kane Springs Valley should be added to the Lower
10 White River Flow System for management purposes. That's
11 based on there being high or at least relatively high
12 transmissivity up through Coyote Spring Valley to at least
13 CSVM-4.

14 The fact that the groundwater level in KMW-1 is
15 just four to five feet higher than at KMW -- than at CSVM-4.
16 I apologize. That looks like a minor typo. That second
17 KMW-1 should say CSVM-4. And that is on slide 16.

18 The groundwater level lowering that occurred
19 during the pump test did propagate in to Kane Spring Valley.
20 It's pretty obvious from the water level data that it did.
21 There are large expansions of carbonate rock with no
22 structure hydrogeologic barriers. I'm not saying there's not
23 a structural -- that there's not a fault there, but it
24 doesn't appear to be having much of a hydrogeologic impact.

1 The figure I have here is actually I think was
2 prepared by the State Engineer for one of the Lower White
3 River Flow System meetings last summer or two summers ago and
4 it kind of shows, you know, the different trigger points for
5 consultations and things that occur as a part of the MOA.

6 But, you know, Warm Springs flows almost 3.2 CFS
7 during the aquifer test. And at the current much, much
8 reduced levels, they're at 3.23 CFS, and for reasons I will
9 go in to will probably continue to go down.

10 The Muddy River Decree, the 1920 Muddy River
11 Decree, has a total water rights of about 37,000 acre-feet
12 per year. The Muddy River near Moapa is downstream of all
13 the area springs and downstream of some irrigation
14 diversions. Based on the gage that this discharge from Eakin
15 in 1964 estimated discharge from the Lower White River Flow
16 System to be about 36,000 acre-feet per year from all of the
17 springs that supply the Muddy River Springs area.

18 From about 1943 to 1960, the recorded flow was
19 just less than 34,000 acre-feet per year. After 1960, it
20 decreased to less than 24,000 acre-feet per year. And after
21 the wet year in 2005, it began to increase and reached a
22 little over 30,000 acre-feet per year. And it's been
23 relatively steady just above 30,000 since then.

24 The trends there are likely due to groundwater

1 and surface water development upstream from the gage. That
2 would include a diversion of 9.2 CFS to the Reed-Gardner
3 electrical generating station.

4 Carbonate pumping which began in the 1990s and an
5 increase -- the increase began in 2005 due to the high
6 precipitation year. It also should be noted that in 2010
7 there was a fire somewhere in that vicinity that Southern
8 Nevada Water Authority identified as increasing, you know,
9 eliminating about a thousand acre-feet of a
10 evapotranspiration. So that would have had some effect on
11 this rising limb at the gage. And then -- But it's important
12 to realize that the flow hasn't met the requirements of the
13 decree, almost it's entire -- almost since 1940.

14 The pumpage shown -- Now I'm going to talk a
15 little bit about pumpage. This graph shows pumpage in the
16 both total pumping and total carbonate pumping both on a
17 monthly and on a 12-month average basis. And this is for the
18 entire Lower White River Flow System not -- as defined by the
19 State Engineer. It has -- It has been -- There have been
20 variable sources. Monthly pumpage, you know, it varied a
21 fair amount between 2000 and 2010 from around 9600 to 12,000
22 acre-feet per year. A total carbonate pumping varied from
23 about 4800 to 7200 acre-feet per year. And that, of course,
24 increased a lot during the 1169 aquifer test. After the

1 It generally -- You know, until -- until the pumping
2 captures, you know, until pumping equals captured discharge,
3 it's going to continue removing water from storage. And
4 that's evidenced by the general downward trend in water
5 levels even since 2016 around the aquifer. Drawdown will
6 only stop when the pumpage equals captured discharge and
7 induced recharge or inflow.

8 The carbonate system has not yet reached any
9 semblance of an equilibrium for any rate of pumping. And
10 with carbonate pumping it's only a matter of time before the
11 spring flow decreases significantly or is completely lost.
12 And that is due to pumping in the carbonate capturing --
13 capturing the discharge.

14 And I circle back to my recommendation a few
15 slides ago. The Nevada State Engineer should not allow
16 carbonate pumping in the Lower White River Flow System to
17 prevent those further decreases.

18 One of the questions we were asked to consider is
19 the conjunctive use of alluvial wells. And I did have a
20 couple of statements here. I think the carbonate water
21 discharges in to the basin fill and supports the basin fill
22 aquifer. Secondary recharge, which is once the water
23 discharges from the carbonate springs, it does support
24 alluvial water levels. So that secondary recharge, which

1 test, it has dropped to just over 8,000 acre-feet per year.

2 Since 2015, alluvial pumping has dropped to close
3 to zero, as can be seen in the far right side of this
4 particular graph. And it's the gray. The gray line
5 represents Muddy River Spring area alluvial pumping. The
6 blue represents Coyote Spring Valley carbonate. And the
7 reddish is Muddy River Spring area carbonate pumping.

8 Carbonate pumping in Coyote Spring Valley began
9 in 2005. So the flow in the carbonate system upstream from
10 the springs has only been pumped for 14 years. I think that
11 when considering the trends at EH-4 and considering the
12 trends in the springs, it's important to realize that pumping
13 hasn't been going on for all that long.

14 Muddy River Spring area carbonate pumping has
15 been steady or slightly decreasing at a range from 100 to 400
16 acre-feet per month. And, of course, the production is
17 mostly from Arrow Canyon wells. And during the aquifer test,
18 Coyote Spring Valley carbonate pumping dominated pumping from
19 the carbonate aquifer. But since then it's been about half
20 that in the Muddy River Spring area.

21 Then carbonate pumping mostly removes water
22 storage as evidenced by the general downward trend around the
23 carbonate aquifer. That can be seen in this graph, which
24 I -- which is the source of the graph is USDO I report 2013.

1 probably includes both direct spring flow and maybe even some
2 irrigation recharge, supports the basin fill water levels.

3 Some basin fill pumping could be acceptable in
4 the Muddy River Springs area because as secondary recharge
5 the water has already been used in the spring channels that
6 support the dace.

7 I've also suggested, and I don't have a
8 recommendation for the amount, but it's possible there could
9 be some basin fill pumping in Coyote Spring Valley that could
10 be sustainable. I think there's very little there now.
11 There's two wells in the far north end. I say that because
12 basin fill and carbonate water may be separated, like I
13 suggested before, by potential disconnect.

14 But before any water really starts being pumped
15 from that area, there needs to be some study. I'm
16 recommending more -- we have a better understanding of that
17 potential connectivity so that you're not actually reducing
18 water that would otherwise flow in to the carbonate. And I
19 think there's a good possibility it doesn't. But if it does
20 ultimately support carbonate groundwater, I don't think it
21 could be pumped. I mean, it shouldn't be pumped. But that
22 is subject to a recommendation for additional study.

23 And then in conclusion for my direct evidence,
24 there is a broad highly transmissive carbonate aquifer

1 underlying Coyote Spring Valley, Muddy River Springs area,
2 Garnet Valley, Hidden Valley, California Wash. The aquifer
3 is interconnected so much among basins that it's necessary to
4 manage groundwater through all basins as if they were part of
5 a whole basin.

6 And then jumping down to my third conclusion
7 here. Kane Springs Valley should be added to that or be
8 managed as part of the Lower White River Flow System based
9 upon the observed relative flat carbonate water level
10 extending in to that valley and the response of Kane Spring
11 Valley wells to pumping.

12 There seems a high likelihood that water pumped
13 from Kane Springs Valley would quickly contribute to the
14 depletion of carbonate aquifer in Coyote Springs Valley and
15 Muddy River Springs. But, of course, there's not been any
16 pumping and so that is -- I mean, that's sort of applying
17 reverse logic. If you're affecting Kane Springs by pumping
18 in Coyote Springs, it makes sense that the effect would go
19 the other way.

20 Back up to conclusion number two. The Nevada
21 State Engineer should not allow any pumping of the carbonate
22 aquifer to avoid continued decrease in spring flow in the
23 Muddy River Spring area. Again, this conclusion results from
24 the direct correlation of carbonate pumping and carbonate

1 what I meant to say. No, I'm just kidding.

2 I've outlined the rebuttal section of my
3 presentation by stakeholder. Detailed reference should be
4 made to my rebuttal report, which is one of the exhibits
5 we've provided. And because I have no chance at all of
6 covering all of the rebuttal that I've written about in this
7 presentation and I would also note that there's an overlap in
8 rebuttals for the various -- for the various stakeholders
9 because it all -- we're all interpreting the same data. It's
10 just a matter of different variations and different
11 conclusions on that interpretation.

12 My first bit of rebuttal is Coyote Springs is on
13 the Coyote Springs investment report and specifically I
14 believe that the estimated recharge from the Sheep Range is
15 inaccurate. And that is because of, as I'll explain in the
16 next couple of slides, that is because of the way they did
17 the calculations.

18 First off, you can see they divided the Sheep
19 Range in to 15 different basins that come off the east side
20 of the Sheep Range. And this table on the right side here
21 show -- And both of these figures are from the Coyote Spring
22 investment report. It shows how they applied four different
23 recharge estimate methods to these 15 different sub-basins.
24 Three of those sub-basins are in Hidden Valley and 12 of them

1 water level and spring discharge decline.

2 Until all pumping is captured from spring
3 discharge, carbonate water levels will continue to decline.
4 And as we've seen -- And I'll discuss a little on the
5 rebuttal section of my presentation -- that linear
6 relationship between EH-4 and spring flow definitely shows
7 that the, you know, shows that spring flow will continue to
8 decline along with that. And then preventing carbonate
9 pumpage -- Maybe I should say may also be necessary for
10 protecting downstream water rights on the Muddy River.

11 Some basin fill pumping could occur without
12 significantly affecting the spring flow. A preliminary
13 estimate is difficult. But the pumping that occurred prior
14 to significant carbonate pumping were about 4,000 acre-feet
15 per year seems a decent level to start.

16 But it's also important to, you know, to verify
17 that doing so is not going to affect the Muddy River flow
18 rights.

19 And then I have one slide here that shows the
20 references I've been using and gives me the opportunity to
21 take a breather before I start my rebuttal.

22 Q. Dr. Myers, you've gone 45 minutes.

23 A. I'll finish, no problem, in two hours. Thank
24 you. That is unless I have a slide that I can't remember

1 are to Coyote Spring Valley. And, for example, you can see
2 the Maxey -- the original 1949 Maxey-Eakin method applied to
3 1966 Eakin precipitation that I'll talk about. You know,
4 I'll mention that a little bit later. And then we have
5 Maxey-Eakin apply to 2015 PRISM data. And then Nichols and
6 Epstein both from 2001, 2004 also applied to 2015 PRISM data.

7 Nichols and Epstein methods are based on the
8 methodology of Maxey and Eakin 1949, by which I mean they
9 utilize -- they estimate recharge which is based on a
10 coefficient that is a percent of the total precipitation
11 volume which falls within a precipitation interval in a
12 basin. For example, if you want to consider the greater than
13 20 inch per year zone which has a 0.25 coefficient, if
14 whichever method you use for estimating precipitation tells
15 you that there was 10,000 acre-feet of volume of
16 precipitation in that zone, the methodology would then tell
17 you that 2500 acre-feet of it would become recharge at some
18 point within that basin.

19 Unfortunately, the application of the methods
20 showed a misunderstanding of this methodology. The methods
21 were originally, all of these methods, all four of them, were
22 derived by equating precipitation bands within entire basins
23 to discharges from the entire basin. And that is an
24 important assumption. Because when you consider an entire

1 basin, you have a blend of the geology, you have a blend --
2 You know, recharge can occur anywhere in the basin. And
3 these methodologies were determined using the blend over the
4 entire basin.

5 It is not -- I mean, the method in general does
6 not consider specific geology. For example, precipitation
7 runs off granitic soil or maybe it runs off granitic outcrops
8 and much off of volcanic rock but it infiltrates carbonate
9 rock. And the method does not specifically take that in to
10 account. But by virtue of considering basins that have a
11 mixture of outcrops, it blends them. Because of the
12 Maxey-Eakin method and the other -- and then these more
13 recent similar methods where we're derived using outflow
14 estimates in precipitation zones for entire basins, it's not
15 appropriate to estimate your recharge for small sub-basins,
16 and thus the subdivision of the Sheep Range it introduces a
17 level of granularity, if you will, to the analysis which is
18 not appropriate, like I showed here of all of these
19 broken-down basins. These methods are not intended to
20 estimate recharge for each of those individual little
21 subdivisions.

22 I would also say the method depended on using the
23 same source of precipitation estimates as was done for
24 developing the methods. For example, it's not appropriate to

1 does support functioning ecosystems. There's no evidence
2 that it could be feasibly captured.

3 And then, second, the report makes no showing
4 that any of the estimated amounts of evapotranspiration is
5 available for capture.

6 And then, third, the report doesn't consider down
7 gradient water rights that could depend on some of that
8 capture.

9 The ET in the hydrographic areas in the Lower
10 White River Flow System, I mean, it supports functioning
11 ecosystems including dense and moderate meadowland, woodland,
12 shrub land vegetation as well as agriculture. And includes
13 this table, which is from, I believe it's from the DeMeo, et
14 al. report, which estimated ET for a variety of the -- for
15 many of the valleys down there. And I include it because it
16 did show the amount of ET that comes from different
17 functioning ecosystems in the Muddy River Springs area, the
18 California Wash area, et cetera. And thus showing that these
19 are potentially valuable wetland ecosystems. And, thus,
20 capturing that ET would effectively make those ecosystems go
21 away or transition. Thus, the proposal to include all ET as
22 available water to be captured is unsupported and should be
23 rejected.

24 And, also, there's a claim that ET in Coyote

1 use Maxey-Eakin coefficients with PRISM-estimated rainfall as
2 described. The method of precipitation estimates were
3 considered more scientifically sophisticated. That doesn't
4 make the estimate better. I mean, I think experience has
5 shown that PRISM actually estimates a lot more precipitation
6 for a basin than some of the older maps do. And in using
7 PRISM with this methodology is fine as long as the
8 coefficients were estimated using PRISM.

9 Thus, my conclusion there is that the estimated
10 recharge of 5,280 acre-feet is not accurate. I can't say
11 whether it should be higher or lower based on this analysis.
12 It just is not accurate and should not be given any -- and
13 not be used for estimating how much flow or how much recharge
14 there is on the west side of the Coyote Spring Valley.

15 Then evapotranspiration. CSI had said something
16 in their report that was actually rather troubling when we
17 read it initially. This report recommends and supports an
18 initial estimate of groundwater available for appropriation
19 should be based on capturing all evapotranspiration and
20 groundwater outflow from the Lower White River Flow System.
21 But there's no evidence that all ET could possibly be
22 captured. And in doing so there is no consideration that
23 this ET supports functioning ecosystems. There's no evidence
24 that all ET from this extensive groundwater system that it

1 Spring Valley is a thousand acre-feet per year. And it was a
2 reference to Thomas, et al., 2001. The problem is that
3 reference and neither the reference nor Stetson says where
4 would that ET occur. I mean, I've been in Coyote Spring
5 Valley. I do not know where you're going to found a thousand
6 acre-feet of potential evapotranspiration out there. But
7 I'll point out that this table, DeMeo, et al. which I pulled
8 from the Coyote Spring investment report, shows the estimated
9 ET from Coyote Spring Valley to be zero.

10 And, just the other thing to consider, in Coyote
11 Spring Valley, the depth of the water in the basin fill is
12 quite high. It's not going -- It's not capturing -- If
13 there's much -- I guess there's a bit of very -- There may be
14 a little shadscale that has a little tiny bit of
15 evapotranspiration. But for all intents and purposes, the ET
16 from the Coyote Spring Valley should be considered zero.

17 The next rebuttal is of the Moapa Band of Paiutes
18 report. And I list the name of the report there, which I
19 refer to throughout as the Johnson-Mifflin report.

20 As I went through before, there is no evidence of
21 a 20-year drought. There was no direct analysis of climate
22 data in that report. So there was really no way to make a
23 conclusion of using just climate data that we were in a
24 drought period.

1 And then, as I stated before, the Climate
2 Division 4 data showed, you know, does not provide evidence
3 of drought.
4 Discharge from the Big Muddy Spring increased by
5 one CFS from 2010 to 2014 as shown on the right side of this
6 graph.
7 But Johnson-Mifflin claimed that the flow
8 increased during the aquifer test. And increase after the
9 test demonstrates a climate dominance rather than pumping as
10 a forcing agent for water level change within the MRSA and
11 perhaps a complete absence of Order 1169 pumping effects.
12 The problem with that analysis is that it ignored
13 the fact that there was a burn of over 600 acres which could
14 have contributed a great deal to the failure to see pumping
15 effect in the Big Muddy Springs.
16 The 40 -- Johnson-Mifflin estimated 40,000
17 acre-feet of flow from the Lower White River Flow System to
18 the Las Vegas Valley. And I would just initially say that it
19 should be given no credence because it is highly dependent on
20 undocumented, unverified assumptions.
21 It was based on a Darcy's law analysis using a
22 transmissivity that was based on a report published for a
23 pump test a long time ago, back in 1992. I did not see that
24 report. Perhaps the State Engineer has had that report. But

1 System to the Las Vegas Valley.
2 And then, plus, there was really no evidence
3 given that the water is available to begin with. I mean, it
4 was based on flow path from a groundwater model. And if
5 memory served, I'm not sure where there would have been
6 enough water to support the Muddy River Springs of all of the
7 water that was shown in that model ran down in to the Lower
8 White River Flow System. Excuse me. In to the Las Vegas
9 Valley Wash.
10 And then a correlation analysis in the
11 Johnson-Mifflin appendix four does not prove correlation
12 between the EH-4 levels and pumping at the Arrow Canyon
13 wells. This table is from that appendix. And I've circled
14 the T-value and the P-values for the coefficients that
15 resulted from that analysis. And I'll point out that only
16 the intercept and lag zero have statistically significant
17 coefficients at the .05 level. Everything else is much
18 higher than that, which suggests that, if anything, the
19 average -- And, I mean, if this means anything, it basically
20 means that the current pumping is most responsible for the --
21 is most responsible for the drawdown. But it also points out
22 that -- The report also pointed out that eight percent of
23 Arrow Canyon well pumping is captured at the springs, which
24 adds further credence to my concept earlier that continuing

1 I was unable to review it.
2 I also found -- And just yesterday, Dwight Sawyer
3 with the City of North Las Vegas, presented transmissivity
4 values in the area for which this flow would occur. I recall
5 them being in the hundreds to low thousands as opposed to, I
6 think, 300,000 for the transmissivity being used by
7 Johnson-Mifflin here. So a great deal of difference in
8 transmissivity. I mean, just one order of magnitude
9 difference would turn 40,000 in to 4,000, which is a hugely
10 different number.
11 There was also a lot of talk about the
12 anisotropic, the form of the model, anisotropic, that somehow
13 in this area the transmissivity along the flow path would be
14 ten times greater than the transmissivity transverse to the
15 flow path. I never did see evidence for that ten-to-one
16 ratio.
17 And I guess the other thing that I would point
18 out is that yesterday Sawyer, with Dwight Sawyer, also
19 pointed out that that water, you know, to the south end of
20 this flow path was actually, the water levels were a little
21 bit higher than they were further to the north. So, for this
22 to actually occur, water would have to go uphill.
23 So I believe that there's really no evidence for
24 a 40,000 acre-foot per year flow from Lower White River Flow

1 to pump from the carbonate aquifer is pulling from storage
2 which will eventually capture spring flow.
3 And I'm not sure what -- I'm curious what the 92
4 observation -- I'm not sure whether this meant 92 weeks of
5 data or whether it meant daily data for 13 weeks. If it was
6 the latter, the data was so -- wasn't very independent as is
7 necessary for statistical analysis.
8 The Lincoln Vidler report, the primary argument
9 is that Kane Springs Valley should not be added to the Lower
10 White River Flow System.
11 Lincoln County present water level data --
12 However, they presented water level data that supported
13 managing Kane Springs Valley as part of Lower White River
14 Flow System. They did this graph here is adapted from the
15 Lincoln Vidler report, Figure 3-9. And it clearly shows, you
16 know, there's a long-term decline in both of them in
17 parallel, a decrease in both of the wells just after the pump
18 test.
19 There is not a significant difference in the
20 delay either. I mean, there's a delay at the start. But
21 between the two wells, there's not a huge different --
22 hugely -- a huge difference in the delay. And then both can
23 go on to continue their decline after a brief recovery.
24 So, to my mind, this is just further evidence

1 that Kane Springs Valley should be managed as part of the
2 Lower White River Flow System.
3 And I think it's -- there is a bit of lower
4 transmissivity between the point of the pump test and the
5 mouth at Kane Springs Valley. There was about a 40-foot
6 increase in the profile going up Coyote Springs Valley. The
7 additional lag would be -- The additional lag would be partly
8 due to that. Now, yesterday, we actually heard some comments
9 that physics should make recovery commence as fast as the
10 initial drawdown. I would beg to differ with that comment.
11 Because physics would make -- that concept would make --
12 would apply in an incident aquifer. But this very definitely
13 is not an incident aquifer. And indeed these are close to,
14 these two wells are pretty close to the boundary. And it
15 would not -- it would not recover at the same time in all
16 directions as was implied yesterday, I do not believe.
17 There was evidence presented that different
18 geochemical data should show that these come from different
19 areas or it's different segmented groundwater sources. So
20 the groundwater from KPW-1 has total dissolved solids of
21 about 774 milligrams per liter, which is a little higher than
22 the groundwater at CSVM-4 at 682. I mean, but the fact that
23 water from Kane Springs Valley is a little higher than that
24 at Coyote Springs Valley is just evidence that it's starting

1 Kane Springs Valley is a completely separate flow system.
2 And these flow paths along here, the blue one over to the
3 west of highway -- to the west of the highway, for example,
4 is drawn to show similar temperatures.
5 What is -- The travel time between these two
6 points is probably many, many years, if not decades. I would
7 expect, if anything, the temperatures to decrease with that
8 flow time, not be the same. I don't interpret these as being
9 the same flow path, necessarily. I mean, you're going to end
10 up with mixing out here. And rather than finding, you know,
11 connecting the dots of two wells or two wells that have the
12 same -- that have the same temperatures.
13 US Fish and Wildlife Service, I agree with almost
14 everything in that report, except they argue for too much
15 pumping from the Lower White River Flow System. They state
16 that the average pumping of years 2015 through '17, which is
17 a little over 9300 acre-feet per year, should be the
18 long-term, allowable, you know, should be the long-term
19 allowed pumping rate from carbonate and alluvial aquifers.
20 The claim is that flows and levels were steady during that
21 period. I, as I pointed out in several graphs a little while
22 ago, that just isn't, you know, they are continuing to go
23 down, and that's including during a relatively wet period,
24 especially 2018 and '19.

1 to mix with water in Coyote Spring Valley. Because the other
2 wells -- I mean, wells further up gradient in Coyote Spring
3 Valley will probably or possibly have lower value. So what
4 you see is a bit of mixing.
5 When I look at these tables, I don't see vastly
6 different groupings of data. And in my experience over the
7 years is things like TDS vary by 20 percent for reading the
8 reading for no particular reason. So there is overlap
9 between a lot of these readings.
10 And then there's also this discussion of flow
11 paths through Coyote Springs Valley. And, for one, the water
12 at KPW-1 has been shown to be the oldest at 29,000 years and
13 the hottest at 136 degrees Fahrenheit of the wells in the
14 area. And that is saying that, well, for one, if the water
15 at that well originated in Kane Springs Valley as recharge,
16 it should certainly -- it circulated very deeply. If it
17 didn't originate in Kane Springs Valley, it means that we
18 don't know where the inter-basin flow to that valley is
19 coming from, because I haven't seen any evidence here that
20 there's flow coming in to Kane Springs Valley from somewhere
21 else.
22 But, once the water from KPW joins water in
23 Coyote Springs Valley, it begins to mix. And so the average
24 age is younger. So this does not stand out as showing that

1 Although the flow briefly recovered to almost 3.6
2 CFS, the Warm Springs West flows have been decreasing since.
3 And that includes during a wet period. Most of the ongoing
4 carbonate pumping is removed from storage. And as it
5 continues, more will be captured from discharge, and spring
6 flow will continue to decrease to critical levels.
7 I mean, I guess the basic argument here is
8 primarily just based on first principles of water balance.
9 Initially, pumping -- pumping removes water from storage and
10 that causes drawdown. That drawdown either captures
11 discharge or induces recharge. And in this system with a
12 possible exception of some flow coming in up around Panaca --
13 I think someone mentioned that. I don't remember who.
14 Actually I think it was Fish and Wildlife. As long as the
15 pumping rate exceeds the rate of captured discharge, water
16 levels will continue to decline. It's not a matter of if but
17 when the pumping the carbonate aquifer fully captures
18 discharge from the springs. And that may ultimately result
19 in spring flow below critical rates.
20 National Park Service they presented simulations
21 that were completed by Tetra Tech that considered several
22 different pumping scenarios with basically different
23 locations of pumping but they use the same total pumping
24 rate. I really wish they had used about 10,000 acre-feet per

1 year less than that on these scenarios just to show how long
2 it might take.
3 But, I mean, the differences among those
4 scenarios were during the initial years. The only point I
5 really want to make here is that there was not a great deal
6 of difference in the long term between moving this amount of
7 pumping around the Lower White River Flow System and so
8 there's really no outcome -- I mean, the lack of difference
9 among the outcomes presented by the Park Service show
10 evidence that there is not some perfect scenario that would
11 allow pumping to continue at a much higher rate.
12 And then, finally, a couple of words about
13 Southern Nevada Water Authority's presentation. They showed
14 that using the same data that I had used in my original
15 report, they showed no significant climate trends since 1895.
16 And they pointed out that since 2016 heads in the carbonate
17 aquifer and discharge measured at Pederson Spring and Warm
18 Springs West have declined. I mean, SNWA's analysis supports
19 the concept that any carbonate pumping anywhere in the Lower
20 White River Flow System will lead to a decrease in critical
21 spring flow.
22 And I will quote from SNWA's report. In the long
23 term it is expected that any groundwater production from the
24 carbonate system within the Lower White River Flow System

1 equilibrium. The relationship shows that pumping is still
2 removing groundwater from storage. The light blue here is
3 showing that as pumping continues, over half of the water by
4 SNWA's estimate is removed -- is being removed from storage.
5 And, as that is removed from storage, it continues to lower
6 the groundwater levels. And the bottom graph here simply
7 shows the relation that they had provided of the water level
8 at EH-4 and discharge at Warm Springs West. And as we get
9 down -- And it's a very linear relationship at this point.
10 And it shows that as the head continues to go down, so will
11 the flow rate. And, thus, I believe the analysis here does
12 not support the recommendation of 4,000 to 6,000 acre-feet
13 per year can be developed from the carbonate aquifer.
14 And then my last slide is just a quick little
15 reference to the Nevada Energy rebuttal report, which
16 basically states that, you know, recent water levels are
17 steady. And I guess I would just say I kind of differ with
18 that because we're drawing a straight line through some data
19 here at the very end of the -- at the very end of the -- Is
20 that EH-4? Yeah -- it's right at the end of the EH-4 graph
21 when really we should be drawing from the same time of year
22 to the same time of year. It's just a minor interpretation
23 of what we see here. But I believe that really, as I've
24 shown on several previous graphs, that it's not -- that we

1 will ultimately capture discharge to the Muddy River Springs
2 area, e.g. spring discharge, subsurface inflow to the
3 alluvial reservoir, and consequently, Muddy River Spring flow
4 because of the high aquifer diffusivity and hydraulic
5 connectivity throughout the flow system and because the MRSA
6 constitutes a majority, if not all, of the discharge from the
7 flow system. I agree with that totally.
8 However, SNWA recommended 4,000 to 6,000
9 acre-feet of carbonate pumping based on the relationship
10 between Warm Springs West flow and Muddy River Spring area
11 flow. And this was a table that I have presented to show
12 that the Muddy River Springs area discharge at several
13 different white -- west -- Warm Springs West discharge rates.
14 And I believe that these are based upon an
15 assumption that the system is at steady state, when previous
16 evidence has shown the system is not at steady state. So
17 while this may seem like an appropriate estimate for right
18 now, as the water levels go down -- And we're already at
19 3.23, that's if indeed the provisional data is correct -- it
20 is suggesting that this estimate based on steady state
21 conditions will allow ultimately the springs to fall below
22 critical levels.
23 And then the Figure 6-3 from SNWA's report shows
24 very direct -- very specifically that the aquifer is not at

1 can't say it's steady but that it is going down.
2 And, with that, I've finished my slide
3 presentation.
4 MR. DONNELLY: Thank you, Dr. Myers.
5 We have nothing further for our presentation.
6 HEARING OFFICER FAIRBANK: So that leaves you
7 about 46 minutes. Do you wish to reserve that time for
8 redirect?
9 MR. DONNELLY: We'll take -- Yeah, we'll hold on
10 to it.
11 HEARING OFFICER FAIRBANK: Okay. Great. Thank
12 you.
13 At this time we'll go ahead and open it up for
14 cross-examination. And we'll start with Coyote Spring
15 Investments.
16 And, for the record, the division of time for
17 today is seven minutes.
18 MR. HERREMA: Thank you.
19 CROSS-EXAMINATION
20 By Mr. Herrema:
21 Q. Good morning, Dr. Myers.
22 A. Good morning.
23 Q. Brad Herrema on behalf of CSI. I wanted to start
24 with some questions on the Sheep Range recharge estimates.

1 A. Okay.
2 Q. Did you review CSI's entire July 3, 2019, Order
3 1303 report?
4 A. I think I reviewed most of it, yeah. I mean,
5 yes, I did review the report.
6 Q. Do you know which method Stetson relied on to
7 recommend the 5,280 acre-feet per year of recharge from the
8 Sheep Range?
9 A. If memory serves, it was sort of a blend. It was
10 a middle one. It wasn't the highest one. I know that. It
11 was -- I don't remember specifically which one it was, no.
12 Q. The Epstein method evaluated both the Maxey,
13 M-a-x-e-y, Eakin, E-a-k-i-n, method and the Nichols method
14 and developed a new model using algorithmic optimization and
15 created four different recharge zones. And there's a table,
16 it's Table D-4, which supports the report. And it indicates
17 that the Epstein method was used to estimate recharge and two
18 coefficients of recharge were used. 1.9 percent for mountain
19 areas with greater than -- at greater than 6,000 feet that
20 receive fewer than ten inches of rainfall and 4.9 percent for
21 mountain areas that receive between ten and 20 inches of
22 rainfall. Does that sound familiar?
23 A. That does sound familiar. But it doesn't take in
24 to account the different geologic differences nor the fact

1 Spring Valley by elevation?
2 A. I don't remember it by number. I would have
3 to -- I would have to look at it right now to verify that I
4 specifically looked at that. I assume that I did because I
5 reviewed the report. I don't remember what Figure 15 is.
6 Q. Are you aware whether those discrete basins that
7 Stetson used to calculate recharge were used for accounting?
8 A. Used for -- I'm sorry. For accounting?
9 Q. And that recharge bands were actually used to
10 develop the amount -- the estimated amount of recharge?
11 A. Recharge bands within each sub-basin, I presume?
12 Q. Throughout the entire area.
13 A. By -- By -- You mean throughout the entire area
14 meaning just the east side of the Sheep Range?
15 Q. Correct.
16 A. But by 12 different sub-basins.
17 Q. Did you review the text on page 40 of the Stetson
18 report that states if the Maxey-Eakin related methods
19 investigated in our analysis are ignored since they rely on
20 older precipitation maps and use runoff coefficient that
21 should not be applied to newer rainfall maps, then the range
22 of recharge in Coyote Spring Valley is between 5,280
23 acre-feet and 7,380 acre-feet per year. And we suggest the
24 lower value be used for sustainability planning?

1 that it should consider an entire basin.
2 Q. Okay. Do you believe that Epstein performed an
3 independent analysis of recharge zones or do you believe that
4 the Epstein recharge is only based on the 1949 Maxey-Eakin
5 methodology as was stated in your rebuttal slide?
6 A. I did not review Epstein's original report for
7 this -- at this time. I read it ten years ago. And it's a
8 similar methodology to Maxey-Eakin. I believe that he -- I
9 believe that he did consider basin discharge and --
10 Q. So, if you believe it's based on Maxey-Eakin, how
11 do you explain why the recharge coefficients of Maxey-Eakin
12 are more than three times of those that were used by Epstein
13 as relied on by Stetson? For example, Epstein uses 4.9
14 percent recharge between 15 and 20 inches of precip and
15 Maxey-Eakin suggests a 15 percent recharge rate.
16 A. Well, when I say it's based on Maxey-Eakin
17 methodology, it means it's based on the same type of method
18 where you were estimating -- I mean you just described it.
19 It's -- What did you say -- 4.9 percent for that particular
20 zone. It's still a methodology of determining precipitation
21 by zone. I didn't say they were the same regression
22 coefficients. I mean, they came up with new coefficients.
23 Q. And you've reviewed that Figure 15 of the CSI
24 July report that showed the recharge zones in the Coyote

1 A. I remember that, yes.
2 Q. And turning to the concept of precipitation, did
3 you review the entire period of record for the Division 4
4 rainfall data beginning in 1895?
5 A. I looked at it as part of rebuttal when I saw --
6 when I considered the SNWA's plot, yes.
7 Q. Do you believe it's important to review that
8 entire period of record to determine relative wet and dry
9 periods?
10 A. I believe I was reviewing -- I focused on the
11 most recent 30 years because that's pretty much what almost
12 all of the reports here were referring to. And then we have
13 no pumping data that goes prior to about 1990, so there's
14 nothing to really directly compare it to.
15 Q. Do you know what the average precip is for the
16 period of record for the Division 4 rainfall?
17 A. Off the top of my head, no.
18 Q. If most of the years after 1990 were below the
19 long term, and that's the period of record average, would you
20 draw the same conclusion that there's no evidence of a
21 20-year drought?
22 A. If they were -- If -- Do you want to say that
23 again? I'm sorry. The average after 1990 is less than the
24 long term --

1 Q. Can I restate the question?
2 A. Sure.
3 Q. Thanks. If most of the years after 1990 were
4 below the long-term average, would you draw the same
5 conclusion that there's no evidence of a 20-year drought?
6 A. It depends on the significance of being below. I
7 mean, if you're talking 01 inches, no. If you're talking a
8 couple tenths of an inch in this area, yeah.
9 Q. If most of the years after 2010 were below the
10 long-term average would you continue to suggest a slight
11 upward trend starting in 2010?
12 A. Well, based on my -- based on what I said about
13 Palmer Drought Severity Index and the fact that I believe it
14 is the rainfall that is the more important value. I mean it
15 shows an upward tick in the trend. I think you should ask
16 that question again. Because I don't think I understood your
17 question.
18 HEARING OFFICER FAIRBANK: Did he answer your
19 question?
20 MR. HERREMA: I had one question that follows up
21 on the last couple.
22 HEARING OFFICER FAIRBANK: I'll permit you one
23 additional question and then you're done.
24 MR. HERREMA: You haven't done that comparison

1 A. Yes.
2 Q. So what's the basis for your opinion that the
3 EH-4 water level is continuing to decline at this time?
4 A. Well, I mean, there's a trend from -- that is
5 higher than that and that is slightly higher than that. I
6 mean, the peak between 2015 and 2016 is slightly higher than
7 the peak in 2017. And, thus, there's a -- I mean, if you
8 just look at the top -- But I'm also comparing it -- It's
9 almost more obvious up here in UMVM-1 and it seems more
10 obvious also in EH-5b, but you can see it in all three of
11 them which are all very closely parallel.
12 Q. Are you familiar at all with the pumping that was
13 occurring during this time from the Arrow Canyon well?
14 A. I believe it was just a similar -- similar to
15 what it's been through time.
16 Q. Okay. If there had been a reduction in Arrow
17 Canyon pumping in the last couple of years of your hydrograph
18 would that influence your view on whether there is a
19 continuing declining trend at this location?
20 A. If there had been a decrease in Arrow Canyon
21 pumping, I would have assumed that there should be a slight
22 uptick in the flows and a slight uptick in the water levels,
23 yes.
24 Q. Okay. On page 15 of your slides, you indicated

1 though to see where the years after 1990 or 2010 fall in
2 relation to the long-term average.
3 THE WITNESS: With the long-term being from 1895?
4 MR. HERREMA: Correct.
5 THE WITNESS: No, I have not.
6 MR. HERREMA: Okay. Thank you.
7 HEARING OFFICER FAIRBANK: Next will be United
8 States Fish and Wildlife Service? Seeing no questions.
9 National Park Service?
10 MS. GLASGOW: No questions.
11 HEARING OFFICER FAIRBANK: Seeing no questions.
12 Moapa Band of Paiute Indians?
13 MR. BERLEY: No questions.
14 HEARING OFFICER FAIRBANK: Stating no questions.
15 Southern Nevada Water Authority and Las Vegas
16 Valley Water District?
17 CROSS-EXAMINATION
18 By Mr. Taggart:
19 Q. Good morning, Dr. Myers.
20 A. Good morning, Mr. Taggart. We meet again.
21 Q. Yes. Not as much time this time though. Could
22 you please turn to page nine of your power point slides. And
23 on that slide I think that shows EH-4, the hydrograph for
24 EH-4; correct?

1 in your testimony that there was a lack of recovery after the
2 pump test at some of these locations that are shown in this
3 slide. Am I accurate in what you said there?
4 A. Well, after the pump test -- These are the two
5 Pederson Springs. I believe I said that Pederson East showed
6 very little recovery because you don't -- if you -- I mean,
7 the Pederson Springs in blue went down and it did jump back
8 up, whereas the Pederson East Springs show very -- I mean,
9 there's a slight recovery, but it's very, very slight.
10 Q. But not back to the pre-aquifer test levels?
11 A. Oh, no. The pre-aquifer test levels are above
12 .2 CFS and now they're below, generally below .15.
13 Q. Now, you indicated that recent flow measurements
14 were at Warm Springs West gage, I mean in the last day, were,
15 did you say 3.23 CFS?
16 A. That is correct.
17 Q. And what's the basis of that statement? Where
18 did you get that information?
19 A. US Geological Survey water science center
20 realtime flow data on the web.
21 Q. Okay. Were you present during the testimony of
22 the panel for Lincoln County?
23 A. I think so, yes.
24 Q. Were you present during the testimony regarding

1 the resistivity data that Mr. Carlson presented?
2 A. Wait. Was that on Monday this week?
3 Q. I think it was yesterday, but I can't keep track
4 of the days. And I think yesterday was Tuesday.
5 A. Well, that was only rebuttal, I thought. I am
6 generally familiar with what you're saying, but I don't think
7 I was there for the whole testimony.
8 Q. All right. On page 23 and in your conclusions
9 there's one, two, there's a sub-bullet under your second
10 conclusion about until all pumping is captured from spring
11 discharge. So do you believe that spring flows at Warm
12 Springs West gage could continue to decline even if current
13 pumping remains at current levels?
14 A. Yes.
15 Q. And why?
16 A. Because we have not yet captured -- Because
17 current pumping is not yet at a point of having captured all
18 of -- it has not yet captured itself from spring discharge.
19 It is still removing water from storage. I have shown quite
20 honestly best by the one slide that SNWA put forth that I
21 used.
22 Q. Okay. And then in your last bullet you indicated
23 during your testimony -- I just want to get you to clarify
24 what you meant by a comment that you made. Is it your belief

1 Q. But if it was pumped for industrial purposes
2 without -- that's fully consumptive, would that help you in
3 clarifying your estimate?
4 A. It's fully consumptive and it's in a different
5 basin where it's not going to recur in two of the rivers,
6 yeah, that would be a one-to-one.
7 MR. TAGGART: Thank you.
8 HEARING OFFICER FAIRBANK: Mr. Taggart, you're
9 out of time. Thank you.
10 Moapa Valley Water District.
11 CROSS-EXAMINATION
12 By Mr. Morrison:
13 Q. Good morning, Dr. Myers.
14 A. Good morning.
15 Q. I'm Greg Morrison with Moapa Valley Water
16 District. Looking at your slide 13 on your presentation, I
17 believe you, like the district's expert, Mr. Lazarus,
18 examined the gradients throughout the Lower White River Flow
19 System?
20 A. I did.
21 Q. All right. And you were aware of Mr. Lazarus'
22 testimony on Monday that the gradient throughout the system
23 is remarkably flat?
24 A. It is Monday that I did -- I mean, two days ago

1 that even if you moved alluvial pumping to carbonate wells --
2 Let's see. This last sentence -- that it's probably not
3 possible to increase that pumpage by transferring carbonate
4 rights to basin fill wells. Is it your view that that would
5 affect Muddy River decreed rights if that occurred, if moving
6 alluvial rights to carbonate rights occurred?
7 A. If you move -- I'm arguing there should be no
8 pumping at all from carbonate. So if you move alluvial to
9 carbonate, that's the opposite of what I'm suggesting. I
10 mean, I am suggesting that some alluvial pumping could
11 possibly continue if it's not completely reducing Muddy River
12 flows to the point of affecting downstream rights on the
13 Muddy River.
14 Q. And do you also agree with the conclusion that
15 others have reached that the pumping of alluvial wells in the
16 Muddy River Springs area captures Muddy River flow on a
17 one-to-one basis?
18 A. It captures it, but I've had this question of is
19 it consumptively used or was some of it possibly ending up
20 back in the Muddy River. In other words, you pump alluvial
21 water and you irrigate with it -- And I'm not an expert on
22 where all of the irrigation is occurring. But some of it
23 could end up back in the Muddy River as a result of return
24 flow.

1 that I did miss. But I agree with that statement, yeah. I
2 believe I have it in my report somewhere.
3 Q. That was my question. Thank you.
4 You recommend that carbonate pumping in the Lower
5 White River Flow System be zero; is that accurate?
6 A. To protect the spring flow, yes.
7 Q. You said you weren't here for Mr. Davis and
8 Mr. Lazarus' testimony on Monday, but did you review the
9 reports submitted by the district?
10 A. I believe so, yeah.
11 Q. Do you recall Mr. Davis' map that showed the
12 location and the communities that this district serves?
13 A. I don't specifically recall that. I stuck with
14 mostly hydrogeology. And, admittedly, I didn't have time to
15 read every word from every report we have here, so I don't --
16 If you could show it to me though.
17 Q. That's understandable. Let's just say Mr. Davis
18 stated the district serves approximately 8500 people,
19 including the reservation of the Moapa Band of Paiutes. Do
20 you recall reading anything like that?
21 A. I don't recall reading it, but I'm familiar with
22 that fact. I mean, I do know approximately your service area
23 or understand approximately where it's at.
24 Q. Okay. And you're aware that the district serves

1 its customers entirely using groundwater from the Arrow
2 Canyon wells?
3 A. Yeah, I think I know that.
4 Q. So I guess my question for you is what should
5 those 8500 people do for water?
6 MR. DONNELLY: Objection. That's not relevant to
7 the facts and data and interpretation that Dr. Myers
8 prepared.
9 HEARING OFFICER FAIRBANK: Can you relate your
10 question to the four critical issues, the boundary, the flow
11 of --
12 MR. MORRISON: We're talking --
13 HEARING OFFICER FAIRBANK: I understand that this
14 is a policy issue as far as I'm understanding your question,
15 so if you can relate it to those four questions or how within
16 that five catch-all it relates back to those four specific
17 questions, then --
18 MR. MORRISON: I'll try.
19 Q. (By Mr. Morrison) Dr. Myers, did you see
20 Dr. Schwemm's presentation for the Fish and Wildlife Service?
21 A. Yeah, yes, I did.
22 Q. Do you recall seeing his slides detailing the
23 number of Moapa dace month over month and year over year?
24 A. Yes.

1 that?
2 A. Can you refer me to a section? I've got my
3 report right in front of me.
4 Q. It's on page 19.
5 A. Okay.
6 Q. Middle paragraph.
7 A. Okay. And what was the statement again? I'm
8 sorry.
9 Q. That Kane Springs Valley pumping will reverse the
10 gradient and draw water from Coyote Spring Valley.
11 A. I say pumping in Kane Springs Valley that
12 decreases that gradient would decrease flow in the CSV. Do I
13 then say --
14 Q. About middle of the way, middle of the way down.
15 A. Well, I would say -- I would say that pumping in
16 Kane Springs Valley, considering it's only five feet higher
17 than in Coyote Spring Valley, if it pumped enough could
18 reverse the gradient, yes.
19 Q. And did you -- how much pumping?
20 A. I don't know.
21 Q. So you didn't run any kind of model or do any
22 kind of analysis to support that conclusion; is that correct?
23 A. There is not sufficient transmissivity data with
24 which to run a model of that.

1 Q. Do you remember seeing month over month and/or
2 year over year increases in dace numbers during certain
3 months and years?
4 A. Yes.
5 Q. Was carbonate pumping occurring during those
6 months of increase?
7 A. There was -- I mean, those increases -- there
8 were increases that occurred during the last 15 years. And,
9 yes, there was carbonate pumping, so yes.
10 MR. MORRISON: All right. Thank you.
11 HEARING OFFICER FAIRBANK: Lincoln County, Vidler
12 Water Company?
13 CROSS-EXAMINATION
14 By Ms. Peterson:
15 Q. Hi, Dr. Myers.
16 A. Good morning.
17 Q. Good morning. Karen Peterson representing
18 Lincoln County Water District and Vidler Water Company. Did
19 you calculate drawdown to the Muddy River Spring area from
20 pumping Kane Spring Valley wells?
21 A. No.
22 Q. You indicate on page 19 of your original report
23 that Kane Springs Valley pumping will reverse the gradient
24 and draw water from Coyote Springs Valley. Do you recall

1 Q. Did you look at the information that Lincoln
2 County and Vidler have supplied with regard to their pump
3 test?
4 A. I don't recall looking at that, no.
5 Q. Do you have the URS report from 2006?
6 A. I didn't review the URS report.
7 Q. And then going to slide 23. The conclusion that
8 Kane Spring Valley should be managed as part of the Lower
9 White River Flow System. And you conclude with there the
10 high likelihood that water pumped from Kane Springs Valley
11 would quickly contribute to the depletion of the carbonate
12 aquifer in Coyote Spring Valley in the Muddy River Springs
13 area. Do you see that?
14 A. Yes.
15 Q. And, again, did you run any kind of model or do
16 any kind of analysis to support that conclusion?
17 A. The analysis I did was qualitative because we are
18 talking -- I mean, the overall results of the Order 1169 pump
19 test were that we were removing water from a carbonate well
20 that showed a drawdown of over about a five-basin area and
21 thus my analysis of what -- of Kane Springs Valley affecting
22 that is that -- is just another way of removing or preventing
23 water from being in that five -- in that really high
24 transmissive zone in the Lower White River Flow System.

1 Q. And you were relying on the State Engineer's
2 findings in Ruling 6254; is that correct?
3 A. And as verified by almost every report here
4 including the one I did.
5 Q. Right. But your report -- I mean, you don't have
6 any -- you didn't do any modeling or you didn't do any
7 independent analysis. It's just qualitative you just said;
8 right?
9 A. I did independent analysis of the water levels
10 and showed that we have a five-basin area, they all went down
11 as a result of removing water from the carbonate.
12 Q. And what was your analysis? Tell me what your
13 analysis was.
14 A. Observation of the water levels in comparison to
15 the carbonate pumping that occurred throughout Lower White
16 River Flow System. Now, I am clearly qualitatively moving
17 that removal of groundwater from the carbonate to the mouth
18 of Kane Springs Valley and assuming -- and at least making a
19 leap of logic that indeed that would have a similar effect.
20 Q. In Kane Springs Valley?
21 A. Because the flow has to come from Kane Springs
22 Valley in to Coyote Spring Valley. The removal of flow --
23 That interception of flow from Kane Springs in to Coyote
24 Springs has to have an effect on the water levels in Coyote

1 presenting today; is that correct?
2 A. Except we have the analysis of water levels at --
3 at the well in Kane Spring Valley.
4 Q. Did you look at the water levels?
5 A. Yes.
6 Q. What's the range, the period of time, that you
7 looked at the water levels for the Kane Springs Valley well?
8 A. I considered the hydrograph for its entire period
9 of record. I believe it started in 2,000 -- What did someone
10 say yesterday? It started -- It was constructed in 2,000 --
11 Is that the one that started in 2005?
12 Q. That's about right.
13 A. Okay. And data started being collected about
14 2007, I believe. And so that whole time period on it.
15 MS. PETERSON: Thank you.
16 HEARING OFFICER FAIRBANK: City of North Las
17 Vegas?
18 MS. URE: No questions.
19 HEARING OFFICER FAIRBANK: Seeing no questions.
20 Georgia Pacific Republic?
21 MS. HARRISON: No questions.
22 HEARING OFFICER FAIRBANK: Not seeing any
23 questions.
24 Nevada Cogeneration Associates? Seeing no

1 Springs. It's based on simple water balance. It doesn't
2 matter whether you're taking it out as a part of pumping down
3 at MX-5 or pumping up at KPW-1.
4 Q. And you understand that in 2006 when the Kane
5 Spring Valley applications of Lincoln and Vidler were
6 approved that there was a proposal to put Kane Springs in to
7 the Order 1169 basin area and that was objected by the State
8 Engineer. Do you recall that?
9 A. I was not -- I did not participate in that
10 particular hearing. I am aware of what you said, however.
11 And I would just point out that was before all of the pump
12 test data that we're analyzing here.
13 Q. Right. But after Order 1169 are you familiar
14 with all of the pumping results and the State Engineer's
15 determinations after Order 1169 and the 1169 pump test?
16 A. I am encouraging the State Engineer to consider
17 adding it. I am aware that the State Engineer has
18 included -- has recommended a certain number of basins. And
19 I and a few other organizations -- us and a few other
20 organizations think KSV should be added.
21 Q. Right. And there's no difference in the
22 information that the State Engineer had when he issued his
23 Order 1169-A, which was a different State Engineer, Jason
24 King, on December 21st, 2012, and the information that you're

1 questions.
2 Muddy Valley Irrigation Company?
3 CROSS-EXAMINATION
4 By Mr. King:
5 Q. Good morning, Dr. Myers. Steve King for Muddy
6 Valley Irrigation Company.
7 A. Good morning.
8 Q. I would like to first turn to your slide 18. The
9 fourth bullet down reads, trends at the Muddy River gage are
10 likely due to surface and groundwater development upstream
11 from the gage. Do you see that?
12 A. Yes.
13 Q. And that Muddy River gage would be the -- Is that
14 the Moapa gage?
15 A. The gage that's presented here in this figure,
16 yes.
17 Q. And then when you -- where it's written
18 groundwater development upstream from the gage, would that be
19 -- include ground, alluvial groundwater development in the
20 Muddy River Springs area upstream from the gage?
21 A. Yes.
22 Q. Then turn to your slide, page 22, please. All
23 right. The second bullet. Some basin fill pumping could be
24 acceptable in MRSA because as a secondary recharge the water

1 has already been used in the spring channels most important
2 for the dace. So this is related to the question just that I
3 raised on slide 18. This pumping -- It's impossible alluvial
4 pumping in the Muddy River Spring area upstream from the
5 gage. Could that be accurate?
6 A. Yes. Yes.
7 Q. All right. And this statement, would it be fair
8 to say that this is in relation to protecting the health of
9 the dace?
10 A. Our -- The primary focus of my client has been
11 sufficient flow in the springs and Muddy River for the dace.
12 And so that's been my primary focus.
13 Q. Thank you. Then slide 23. And that's in
14 conclusion slide. And here with the last bullet, and it's
15 talking about some basin fill pumping could occur without
16 significantly affecting spring flow. I'd like to go to the
17 last sentence which reads, it is probably not possible to
18 increase that pumpage by transferring additional carbonate
19 rights to basin fill wells because of the observed long-term
20 decline in Muddy River flows.
21 My next question in that regard is that I thought
22 when you were testifying and answering a question I think
23 relating to the slide you used the term Muddy River flow
24 rights. I might have been wrong. So when you say Muddy

1 alluvial water. And if that was then take being to an inch
2 have industrial use which I believe he's referring to outside
3 the basin. Then there could be no return flow. I was just
4 opening up the idea that some pumping could have lead to
5 return flow. I honestly don't know whether there is any or
6 not in that area.
7 MR. KING: Thank you. I think I understand
8 better. And I think just for my understanding of some of the
9 permitted alluvial pumping rights were for recharge or power
10 plant uses which are in if not the spring area then directly
11 in to the Lower Meadow Valley Wash. Okay. Thank you.
12 HEARING OFFICER FAIRBANK: Bedroc?
13 MS. URE: No questions.
14 HEARING OFFICER FAIRBANK: Seeing no questions.
15 Nevada Energy?
16 MS. CAVIGLIA: No questions.
17 HEARING OFFICER FAIRBANK: Seeing no questions, I
18 will go ahead and open it up to Division of Water Resources
19 staff.
20 EXAMINATION
21 By Mr. Benedict:
22 Q. Jon Benedict for the record. Going back to slide
23 13, I think. On this legend you provide information about
24 hydraulic gradient in a different way than was provided

1 River flows I think you testified or in answering a question
2 of flow rates, would those be what I would characterize as
3 Muddy River decree rights?
4 A. Well, the Muddy River Decree, which I believe has
5 about -- is about 37,000 acre-feet. And I was referring to
6 Muddy River flows that was on those previous graphs. And
7 there's been a decline but not -- I mean, recently it has
8 come up. I mean, it's gone up and down based on a few
9 management changes.
10 Q. And then in answer to one of Mr. Taggart's
11 questions, I think it might have been his last question, and
12 I'm paraphrasing. I think Mr. Taggart asked if there was a
13 fully consumptive use of an alluvial groundwater well that
14 was pumped in the Muddy River Spring area would that affect
15 downstream senior decree Muddy River rights?
16 A. At a one-to-one ratio was ultimately the question
17 and ultimately what I agreed with, yeah.
18 Q. Well, thank you. The reason I wanted to clarify
19 that because I think that -- your answer I thought you might
20 have -- you might have brought in an analysis in a different
21 basin. But I think his question had to do with the Muddy
22 River Spring area. Would that be right?
23 A. My recollection of the question was that it was
24 pumping in the Muddy River Spring area of alluvial -- of

1 previously but you also state that the gradient is remarkably
2 flat throughout the area?
3 A. That's correct.
4 Q. You show a gradient above 50 feet and ten miles
5 or tenth of a percent. Does that refer to that flat gradient
6 or is that -- What does that refer to?
7 A. That is referring to going upstream from CSVM-6.
8 There's not a 50-foot drop -- There's -- Over 20 miles
9 there's only a couple of feet plus or minus. But when you go
10 from 1820 to about 1870 up to CSVM-4, that's referring to --
11 to about a 50-foot drop over what appears to be about a
12 ten-mile area, excuse me, a ten-mile distance. I should have
13 labeled that better. I don't think I actually talked about
14 it when I was presenting.
15 Q. So that area that you consider to be flat is more
16 the area around CSVM-6 through EH-4 and then --
17 A. Yeah. I mean, the relative flat area is from,
18 yes, from CSVM-6 to EH-4. That's the area that acts kind of
19 like a pond or a reservoir.
20 Q. Do you think the gradient between CSVM-4 and
21 CSVM-6 has any implication to how we consider management?
22 A. Part of the reason for showing that gradient is
23 in a lot of basins -- 0.1 percent would not be considered a
24 steep gradient. It would really not be considered a steep

1 gradient in a lot of places I've worked over the years. But
2 in contrast with this lower, you know, the lower 20-something
3 miles, which is practically flat, it seems steep. It has a
4 lower transmissivity than we have down here in what I'll call
5 the pond there, yeah, which may be -- you know, then in the
6 relatively flat area. But it's not an extremely high
7 gradient and the flow -- and you do have flow coming from the
8 northern part of Coyote Spring Valley through to, you know,
9 down to the MX-5 area in the pump test area. And so you're
10 going to continue to manage that. Because drawdown did
11 propagate to CSV-4, up that 50 feet.

12 MR. BENEDICT: Thank you.

13 THE WITNESS: You're welcome.

14 EXAMINATION

15 By Mr. Kryder:

16 Q. Levi Kryder for the record. Dr. Myers, what do
17 you think the hydrologic boundaries of the Lower White River
18 Flow System are?

19 A. What the State Engineer has stated and plus the
20 Kane Spring Valley. I mean, basically all of Coyote Spring
21 Valley, California Wash, Hidden Valley, Garnet Valley, and
22 that portion of the Black Mountains, and then Kane Springs
23 Valley. And I suppose we can argue whether there's some part
24 of Kane Springs Valley to the north that's too volcanic to be

1 levels.

2 And I don't -- I've said, you know, there's no
3 drought -- I don't think there's a huge drought effect going
4 on here. There could be multi-decade or even multi-century
5 changes that ultimately have to be considered going forward.
6 I mean, a lot of this water is pretty old. It could be it's
7 recharge from a long time ago. Did that answer your
8 question?

9 Q. Yes, it did. And then early on you mentioned a
10 distinction between alluvial pumping in Coyote Spring Valley
11 as an example of something that might be able to be developed
12 without long-term impacts to the Muddy River Springs area.
13 Do you have a similar feeling about alluvial pumping at other
14 places within this Lower White River Flow System?

15 A. Well, I mean, there is only alluvium --
16 saturated -- I'm not even aware of saturated alluvium in
17 Garnet or if you're asking me about other parts of the
18 system, I'm not aware of any in Garnet and Hidden, for
19 example.

20 Q. Yeah. Maybe I should just say wells that are not
21 completed in carbonate where we observe very similar water
22 level trends?

23 A. I'm not -- I'm not aware of any, but I would
24 clearly -- if you don't -- if you didn't see a major impact

1 part of it. But I would include Kane Springs Valley with
2 what otherwise the State Engineer is considering as part of
3 the Lower White River Flow System.

4 MR. KRYDER: Thank you.

5 EXAMINATION

6 By Mr. Sullivan:

7 Q. Adam Sullivan for the record. Dr. Myers,
8 thinking about your characterization or your discussion about
9 steady state capture and observation that water levels are --
10 continue to decline, I'm wondering if you think, would it
11 follow that you could have some lesser amount of carbonate
12 pumping that would reach a steady state at Warm Springs West
13 that would be higher than 3.2 but somewhat less than
14 pre-development flows at that point, so thereby protecting
15 the dace?

16 A. There may be a very small amount. But since
17 we're already at 3.23 it would be very -- it would not be
18 very -- it would not be very much. It would -- I mean,
19 ultimately, if you go to complete steady state and you
20 neglect recharge and you neglect other changes in inflow
21 either from Pahranaagat Valley or from Kane Springs Valley, if
22 you neglect other changes like that, you could -- there would
23 be a point at which the pumping equals the decreased
24 discharge from previous steady state, from steady state

1 during the pump test -- I mean, part of my reason for saying
2 this about the basin fill in Coyote Springs is that the basin
3 fill seems to have substantially higher water levels than is
4 in the carbonate and that's suggesting to me that there's not
5 a whole lot of connectivity between the two and therefore
6 that may be a separate source. But it would also be local
7 recharge. And there's not a whole lot of, as I've said
8 before, there's not a whole lot of local recharge in Coyote
9 Spring Valley either.

10 That requires more study, but it's just a
11 suggestion that you might -- that the State Engineer might
12 consider for additional water in this area.

13 MR. SULLIVAN: Thanks.

14 THE WITNESS: Sure.

15 EXAMINATION

16 By Ms. Barnes:

17 Q. Earlier in your discussion you mentioned that
18 you're recommending additional study to investigate the
19 connection between alluvial and carbonate aquifers. I guess
20 what data or what information would you think is necessary
21 for that recommended study.

22 A. Well, if you're talking about Coyote Spring
23 Valley, I think we would be doing a pump test that has
24 monitoring wells both in carbonate and in basin fill. And

1 also probably -- And this may have already been done, but
2 there needs to be some down-hole geophysics. Is there an
3 unsaturated or a very low transmissivity zone between the
4 saturated basin fill and the underlying carbonate? When I
5 see as much as 200 feet of difference, it's telling me that
6 there's a clay layer or something that does not allow much
7 water to flow in to the deeper carbonate aquifer.

8 And, thus, I don't know if it needs to have any
9 holes drilled or just a reconsideration of well logs. I
10 didn't do that, but that would be one way of getting at what
11 you're asking.

12 MS. BARNES: Thank you.

13 HEARING OFFICER FAIRBANK: Okay. We've been
14 going about two hours, so let's go ahead and take a
15 ten-minute break. And we'll see everyone back here at 10:40.
16 Thank you.

17 (Break was taken)

18 HEARING OFFICER FAIRBANK: So we'll go ahead and
19 open it back up for cross-examination again. And Coyote
20 Spring Investments?

21 MR. HERREMA: No questions at this time.

22 HEARING OFFICER FAIRBANK: Seeing no further
23 questions.

24 US Fish and Wildlife Service. Seeing no

1 asked for reports after the Order 1169 pumping test to be
2 submitted by all parties and that you yourself submitted a
3 report at that time?

4 A. Yes.

5 Q. Do you -- Just for the record, I -- Well, do you
6 remember when that was? Was it mid-2013, does that sound
7 right?

8 A. It was -- Yeah, it was just -- it was within a
9 few months after the pump test. I don't remember the exact
10 date.

11 Q. Okay. And in those reports are marked by the
12 State Engineer as Exhibits 245, 46, 47, 48, there's a CBD
13 Order 1169 report in it's 248 and CSI has a report at Exhibit
14 247.

15 So at the time those reports were submitted was
16 part of the data that's shown in that hydrograph in Figure
17 5-7 available, particularly the data that comes after 2013?

18 A. Well, it would depend. I mean, I don't remember
19 the exact date of that, but, yeah, there would have been some
20 additional data available.

21 Q. Okay. But, I mean, is it fair to say that we
22 have an additional six years of hydrologic data since all of
23 those reports were submitted?

24 A. Oh, absolutely, there's six more years.

1 questions.

2 National Park Service?

3 MS. GLASGOW: No questions.

4 HEARING OFFICER FAIRBANK: Seeing no questions.
5 Moapa Band of Paiute Indians?

6 MR. BERLEY: No questions.

7 HEARING OFFICER FAIRBANK: No questions.
8 Southern Nevada Water Authority, Las Vegas Valley
9 Water District?

10 MR. TAGGART: Yes, we have a couple.

11 Good morning, Dr. Myers. For the record, Paul
12 Taggart for the water authority and then Las Vegas Valley
13 Water District. I just have -- How many minutes do I get?

14 HEARING OFFICER FAIRBANK: Five.

15 MR. TAGGART: Thank you.

16 CROSS-EXAMINATION

17 By Mr. Taggart:

18 Q. Dr. Myers, I put in front of you SNWA's
19 hydrologic exhibit, which I believe is SNWA Number 7, and
20 I've asked you to look at a figure there which is the Warm
21 Springs West gage hydrograph. Do you see that? It's in
22 Figure 5-7.

23 A. Yes, I see that.

24 Q. Okay. Are you aware that the State Engineer

1 Q. And is that data -- And I'm asking because
2 there's been this statement -- And I guess I'll ask you
3 whether you agree with it. But do you agree with the
4 statement that the only new evidence presented at this
5 hearing is the recharge calculations from Mr. Reich and the
6 resistivity data that was presented by Mr. Carlson for CSI
7 and Lincoln County. Do you agree with that statement?

8 A. Well, that's not the only new data. We still
9 have all the continued water level data and spring flow data.

10 Q. Okay. And what I want you to ask you about is
11 that particular data. Is that data important to understand
12 effects of climate on the water levels in the Lower White
13 River Flow System since 2019?

14 A. Since?

15 Q. I'm sorry. Since 2013.

16 A. It is important to -- If I understand your
17 question, it is important to understand the effects of
18 climate. I mean, yes, climate is a part of what we have
19 since 2013. Neither extreme drought nor extreme wet. I
20 mean, neither extreme dry nor extreme wet. But that's why I
21 did focus on it a fair amount.

22 Q. Okay. And obviously the analysis of the six
23 additional years of water level data and stream flow data the
24 analysis of the National Park Service, the Fish and Wildlife

1 Service, SNWA, CBD, the City of North Las Vegas, all of their
2 analysis was not available in 2013; right?
3 A. That's correct.
4 Q. And are you also familiar with the statistical
5 analysis that SNWA performed and specifically the linear
6 regression between MX-4 and other monitor locations in Coyote
7 Spring Valley and the Lower White River Flow System during
8 the 1169 pump test?
9 A. I'm aware of -- Yes, I am aware of the linear
10 regressions.
11 Q. Okay. Well, do you know if that statistical
12 analysis of the relationship during the pump test of certain
13 water levels in monitor wells, I should say, that analysis
14 was not available in 2013 either; correct?
15 A. Not the analysis that you presented or that SNWA
16 presents that includes data to date, to 2019, no.
17 Q. Well, and the recovery of the system to the pump
18 test, what's your view on the importance of the additional
19 six years of data to analyzing the recovery of the system to
20 that pump test?
21 A. Well, in addition to just being additional data
22 for the regression analysis, I mean, I would think in terms
23 of it being -- I mean, recovery data in a relationship like
24 this can be a little different than the initial drawdown. I

1 probably not include it.
2 Q. And you testified earlier today that your
3 client's purpose was to protect the dace. Do you recall
4 that?
5 A. That's correct.
6 Q. Would you agree that the US Fish and Wildlife
7 Service is also the agency responsible for protecting the
8 dace?
9 MR. DONNELLY: Objection.
10 HEARING OFFICER FAIRBANK: And what's the basis
11 for your objection, Mr. Donnelly?
12 MR. DONNELLY: A hydrologist may or may not be
13 familiar with the purpose of federal agencies.
14 HEARING OFFICER FAIRBANK: I think it's a fair
15 question to the extent of his knowledge.
16 THE WITNESS: I'm aware that Fish and Wildlife is
17 responsible for managing the dace.
18 Q. (By Ms. Peterson) And you are aware that the
19 Kane Springs Valley project received a biological opinion
20 from Fish and Wildlife? Are you aware?
21 A. I'm not aware. Though it doesn't surprise me.
22 Q. Okay. All right. That the service found that
23 the project was not likely to jeopardize the continued
24 existence of the endangered dace?

1 mean, there can be a bit of a hysteresis effect, meaning that
2 a lag in -- which I think actually explains -- I mean,
3 there's a bit of a scatter around all the plots that SNWA
4 present. And I've thought about that. Some of it is when
5 water is going up and some of it is when it's going down. It
6 makes a site difference and it adds to the scatter, but it
7 doesn't take away from your overall linear regression
8 results.
9 MR. TAGGART: Thank you.
10 HEARING OFFICER FAIRBANK: Thank you.
11 Moapa Valley Water District? Seeing no further
12 questions.
13 Lincoln County, Vidler.
14 CROSS-EXAMINATION
15 By Ms. Peterson:
16 Q. Hi, Dr. Myers. Karen Peterson again.
17 A. Good morning.
18 Q. Did you consider including Lower Meadow Valley
19 Wash in to the boundaries of the Lower White River Flow
20 System?
21 A. Very briefly. And I don't think I reached a
22 conclusion. I just failed -- I just stopped considering it
23 because there's not much data. There wasn't much reaction
24 from the -- I think, overall, if you were to ask me I would

1 A. I'm sure that's what it said. Although I'll
2 point out that it was prior to the pump test.
3 Q. And you agree that there was a stipulation that
4 was entered in to with Lincoln County, Vidler, and US Fish
5 and Wildlife on the Kane Springs applications that had
6 triggers, the 3.2 trigger, action trigger?
7 A. I'm familiar with the 3.2 action trigger. I
8 don't recall exactly what you just -- I'm sorry. I don't
9 recall exactly that description.
10 Q. Okay. So I'll represent to you that for the Kane
11 Springs pumping for the applications that have been approved
12 and for future applications there is an amended stipulation
13 and the triggers are included in that stipulation, all right.
14 A. Okay.
15 Q. So did you also hear the testimony of
16 Mr. Williams that with the biological opinion and the
17 triggers in place that Lincoln and Vidler are in compliance
18 with the Endangered Species Act?
19 A. I believe Mr. Williams was on Monday when I
20 wasn't here.
21 Q. All right. Well, I'll represent to you that's
22 his testimony, all right.
23 A. Okay.
24 Q. So we're in compliance with the law; right?

1 MR. TAGGART: Objection. This is all outside the
2 scope of any direct that was asked of this witness.
3 MS. PETERSON: It goes --
4 HEARING OFFICER FAIRBANK: I tend to agree with
5 Mr. Taggart's objection on the basis that this is outside the
6 scope of his original testimony today. And I don't know that
7 it is contemplated within the reports proffered by Center for
8 Biological Diversity. So if you could relate the questions
9 to those particular issues then I may entertain the
10 questions.
11 Q. (By Ms. Peterson) Your recommendation to the
12 State Engineer today on behalf of your client is that there
13 is no further carbonate pumping; is that correct?
14 A. That is correct.
15 Q. And I'm telling you that Mr. Williams testified
16 on Monday -- Sorry. The day that you weren't here -- that
17 with the biological opinion and the amended stipulation and
18 the triggers in place, Lincoln and Vidler are in compliance
19 with the Endangered Species Act. I'll give you that premise.
20 Is that correct? I'll give you the premise. Sorry.
21 A. Okay.
22 Q. So I'm giving you that premise and your position
23 is that they're in compliance with the law but they should
24 not be able to pump their water rights?

1 Georgia Pacific Republic?
2 MS. HARRISON: No questions.
3 HEARING OFFICER FAIRBANK: Seeing no questions.
4 Nevada Cogeneration and Associates? Seeing no
5 questions.
6 Muddy Valley Irrigation Company?
7 MR. KING: No questions.
8 HEARING OFFICER FAIRBANK: No further questions.
9 Bedroc?
10 MS. URE: No questions.
11 HEARING OFFICER FAIRBANK: No questions.
12 And Nevada Energy?
13 MS. CAVIGLIA: No questions.
14 HEARING OFFICER FAIRBANK: Seeing no questions,
15 I'll open it back up to Division of Water Resources staff.
16 All right. We'll open it up one last time.
17 Coyote Springs Investments, do you have any further
18 questions?
19 MR. HERREMA: No.
20 HEARING OFFICER FAIRBANK: US Fish and Wildlife?
21 National Park Service?
22 MS. GLASGOW: No questions.
23 HEARING OFFICER FAIRBANK: No further questions.
24 Moapa Tribe? No further questions.

1 A. My hydrologic analysis is that continued pumping
2 of the carbonate will continue a drawdown and that will cause
3 it to go below 3.2 and will cause it to go below further
4 trigger points in the MOA. And I believe in the stipulated
5 agreement you were referring to.
6 Q. And you haven't done any kind of modeling or any
7 kind of Theis equation or any kind of hydrologic analysis
8 like that to support your conclusion that Kane Springs
9 carbonate pumping is going to impact the dace?
10 A. Well, a Theis analysis would be inappropriate for
11 these conditions. But what I have done is a water balance
12 analysis that takes in to account -- I mean, I've done a
13 qualitative water balance under assessment that shows we have
14 not yet captured all of the spring -- I mean, pumping has not
15 captured spring flow. I mean, it has to eventually capture
16 spring flow. It's the first principle. And so -- And it's
17 continuing to go downward and, thus, eventually pumping. And
18 I do think continuing in Kane Springs Valley will contribute
19 to that, yes.
20 MS. PETERSON: Thank you.
21 HEARING OFFICER FAIRBANK: City of North Las
22 Vegas?
23 MS. URE: No questions.
24 HEARING OFFICER FAIRBANK: Seeing no questions.

1 Southern Nevada Water Authority? Seeing no
2 further questions.
3 Muddy -- or excuse me. Moapa Valley Water
4 District? No questions.
5 Lincoln County Vidler? No further questions.
6 All right. I'm assuming that then everyone else
7 who hasn't asked any questions doesn't have any questions.
8 So I'm not going to go through the list name by name unless
9 anybody really expects me to do so.
10 All right. Now, let's go ahead and take about a
11 five-minute break and then we'll transition -- Oh, I'm sorry.
12 Mr. Donnelly, do you have any redirect?
13 MR. DONNELLY: Just a minute or two.
14 REDIRECT EXAMINATION
15 By Mr. Donnelly:
16 Q. Thank you. Patrick Donnelly for the record. I
17 will not be using our full 46 minutes. Just a couple of
18 quick questions.
19 Would you say that, Dr. Myers, that the pump
20 test, Order 1169 pump test, presented substantial new
21 information to our understanding of the hydrology of the
22 Lower White River Flow System?
23 A. Yes.
24 Q. You were evaluating this system prior to the pump

1 test with the Center for Biological Diversity; is that
2 correct?
3 A. I began essentially working with the center on
4 Lower White River Flow System at the beginning of and
5 assessing the MOA at the beginning, as I recall. So, yes,
6 right at the beginning of the pump test.
7 Q. So would you say that the substantial new
8 information you just said was presented by the pump test
9 would influence or otherwise shape your understanding of the
10 system as presented in your report here?
11 A. Yes, it would.
12 Q. And would you think it reasonable for any
13 hydrologic models developed to understand the system to
14 incorporate that 13-year set of data since 2006?
15 A. Oh, yes. I mean, there is -- I mean, the pump
16 test provided a substantial stress to the system, which is,
17 when you're calibrating a groundwater model you like stress,
18 preferably beyond the point of which your future uses are
19 going to occur. I mean, it's great calibration data.
20 MR. DONNELLY: Okay. Thank you. No further
21 questions.
22 HEARING OFFICER FAIRBANK: Okay. Then with that
23 we'll go ahead and take a five-minute break. And then we'll
24 be ready to start with Georgia Pacific, Republic Industries,

1 Q. And can you state your affiliation and title?
2 A. I'm an associate hydrogeologist with Broadbent
3 Associates.
4 Q. And are you here on behalf today of Georgia
5 Pacific and Republic Environmental Technologies?
6 A. I am.
7 Q. And, just for the record, I know the report is
8 written also on behalf of Dry Lake. But are you here today
9 on behalf of Dry Lake?
10 A. I am not.
11 Q. Are you familiar with Exhibit GP-REP01, which is
12 called Broadbent July 2nd, 2019, initial report?
13 A. I am.
14 Q. And did you prepare GP-REP01?
15 A. I did prepare that.
16 Q. And is GP-REP01 a true and correct summary of
17 your review and opinions?
18 A. It is.
19 Q. Are you familiar with Exhibit GP-REP02, which is
20 called Broadbent August 16th, 2019, rebuttal?
21 A. I am.
22 Q. And did you prepare GP-REP02?
23 A. I did.
24 Q. Are there any corrections you would like to make

1 and Dry Lake starting at 11 a.m. Thank you.
2 (Break was taken)
3 HEARING OFFICER FAIRBANK: We will go ahead and
4 get started now with the Georgia Pacific, Republic, and Dry
5 Lake water. And so we will go ahead and turn it over.
6 MS. WILLIAMS: Good morning. I'm Paulina
7 Williams with Baker Botts. I'm here on behalf of Georgia
8 Pacific. And with me is my co-counsel, Sylvia Harrison, with
9 McDonald Carano, who is here on behalf of both Georgia
10 Pacific and Republic Environmental Technologies.
11 And we have with us today John Bell. And so I
12 would ask that he be sworn in.
13 (The witness was sworn in)
14
15 JONATHAN BELL
16 Called as a witness on behalf of
17 Georgia Pacific and Republic, having been first duly sworn,
18 Was examined and testified as follows:
19
20 DIRECT EXAMINATION
21 By Ms. Williams:
22 Q. Mr. Bell, would you please state your full name
23 and the spell it for the record.
24 A. Jonathan Bell, J-o-n-a-t-h-a-n, Bell, B-e-l-l.

1 to GP-REP02?
2 A. I do have one -- two corrections, actually. On
3 page six, the last paragraph, the response paragraph, the
4 final sentence. And I incorrectly list it as eastern portion
5 of the basin moving eastward. And it should be western
6 portion. And the final word in that sentence, basin, should
7 be removed also. That's a typo.
8 Q. With those corrections is GP-REP02 a true and
9 correct summary of your review and opinions?
10 A. It is.
11 Q. Are you familiar with GP-REP03 which is called
12 the --
13 (The court reporter interrupts)
14 Q. (By Ms. Williams) CV, curriculum vitae?
15 A. I am.
16 Q. And did you prepare GP-REP03?
17 A. I did.
18 Q. And is GP-REP03 a true and correct copy of your
19 CV summarizing your qualifications?
20 A. It is.
21 MS. WILLIAMS: So we'll note that there were no
22 objections to Mr. Bell's qualifications as an expert or to
23 these exhibits. And we offer GP-REP01, 02 as corrected, and
24 03 in to evidence.

1 HEARING OFFICER FAIRBANK: And we will go ahead
2 admit Exhibits GP-REP01 through 03. And with respect to the
3 qualification, what is the scope and disciplines in which
4 you're proffering Mr. Bell as an expert in?

5 MS. WILLIAMS: Geology and hydrogeology.

6 HEARING OFFICER FAIRBANK: Okay. And off the
7 basis of that, Mr. Bell was not objected to. Mr. Bell will
8 be qualified for the limited purposes of these proceedings,
9 given that there was no objection. And that qualification
10 will be such limited in any further proceedings he would have
11 to be requalified.

12 MS. WILLIAMS: With that we're prepared to pass
13 the witness, but we would like to reserve the opportunity for
14 redirect.

15 HEARING OFFICER FAIRBANK: All right. We will go
16 ahead and open it up for cross-examination of Mr. Bell. And
17 so we will go ahead and start with Coyote Spring Investments.

18 CROSS-EXAMINATION

19 By Mr. Herrema:

20 Q. Good morning, Mr. Bell.

21 A. Good morning.

22 Q. Brad Herrema on behalf of CSI. I just have one
23 question. The last sentence of your July report, which I
24 believe is your Exhibit Number 1, says, we believe that

1 HEARING OFFICER FAIRBANK: No questions.
2 Nevada Cogeneration Associates? Seeing no
3 questions.

4 Muddy Valley Irrigation Company?

5 MR. KING: No questions.

6 HEARING OFFICER FAIRBANK: Seeing no questions.
7 Bedroc?

8 MS. URE: No questions.

9 HEARING OFFICER FAIRBANK: No questions.
10 And Nevada Energy?

11 MS. CAVIGLIA: No questions.

12 HEARING OFFICER FAIRBANK: Seeing no questions.

13 All right. Well, given the fact that there are
14 no further questions, we will open it up for Georgia Pacific.
15 Do you have any additional questions or presentation?

16 MS. WILLIAMS: No, we do not.

17 HEARING OFFICER FAIRBANK: All right. Seeing
18 nothing further -- Oh, and just one last comment -- Do we
19 have any questions from staff?

20 EXAMINATION

21 By Mr. Benedict:

22 Q. I believe in your report you stated that the
23 exclusion of Las Vegas Valley is arbitrary based on some of
24 the inferences that were made about flow between the two. Do

1 treating all of the Lower White River Flow System as a single
2 heterogeneous basin and correcting any imbalance in
3 groundwater diversions by a priority date is not supported by
4 the current science.

5 My question is whether the word heterogeneous is
6 correct or whether that should say homogenous?

7 A. That, in fact, should be homogenous.

8 MR. HERREMA: Okay. Thank you.

9 HEARING OFFICER FAIRBANK: United States Fish and
10 Wildlife Service? Seeing no questions.

11 National Park Service?

12 MS. GLASGOW: No questions.

13 HEARING OFFICER FAIRBANK: Seeing no questions.

14 Moapa Band of Paiute Indians?

15 MR. BERLEY: No questions.

16 HEARING OFFICER FAIRBANK: Southern Nevada Water
17 Authority?

18 MR. TAGGART: No questions.

19 HEARING OFFICER FAIRBANK: Seeing no questions.

20 Moapa Valley Water District? Seeing no

21 questions.

22 Vidler and Lincoln County? No questions.

23 City of North Las Vegas?

24 MS. URE: No questions.

1 you suggest that the geographic boundaries should be
2 something different than that's been proposed by the State
3 Engineer.

4 A. I believe that boundary needs to be further
5 investigated. There's some evidence I think with some of the
6 groundwater elevations that were collected that there's
7 potential that there could be inflow from Las Vegas basins.
8 So I just think it's a spot where we probably don't have
9 enough data to understand that relationship, that boundary
10 relationship.

11 Q. Do you have any other opinions on other
12 boundaries that exist from the study that you've done?

13 A. Not -- No, not at this point.

14 MR. BENEDICT: Okay. Thank you.

15 HEARING OFFICER FAIRBANK: All right. I'll open
16 it again. Does anybody else have any questions? Seeing lots
17 of shakes of the head, I'm going to take that as a no.

18 All right. Well, then let's go ahead and wrap
19 this day up. And based upon our time schedule, we will go
20 ahead and to allow additional time for lunch tomorrow, since
21 we've concluded today early and gotten through the initial
22 scheduling for tomorrow morning, we will start at 12:30
23 tomorrow with the Muddy Valley Irrigation Company. Excuse
24 me. Let me rephrase that. We will start at 12:30 tomorrow

1 with Nevada Cogeneration and Associates and then we will
2 finish the day with Muddy Valley Irrigation Company. And so
3 we will start tomorrow at 12:30 and we will see everyone
4 then. Thank you.

5 (Hearing concluded at 11:15 a.m.)

6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

1 STATE OF NEVADA)
)ss.

2 COUNTY OF WASHOE)
3

4 I, CHRISTY Y. JOYCE, Official Certified Court
5 Reporter for the State of Nevada, Department of Conservation
6 and Natural Resources, Division of Water Resources, do hereby
7 certify:

8 That on Wednesday, the 2nd day of October,
9 2019, I was present at the Legislative Counsel Bureau, Carson
10 City, Nevada, for the purpose of reporting in verbatim
11 stenotype notes the within-entitled public hearing;

12 That the foregoing transcript, consisting of
13 pages 1499 through 1595, inclusive, includes a full, true and
14 correct transcription of my stenotype notes of said public
15 hearing.

16
17 Dated at Reno, Nevada, this 2nd day of
18 October, 2019.

19
20
21
22
23
24

CHRISTY Y. JOYCE, CCR #625

#	adapted (1) 1538:14	1541:13;1544:7; 1556:14;1558:1; 1578:3,3,7;1581:6; 1582:3;1583:4	1582:12;1583:17	1504:15
#625 (2) 1499:22.5;1596:21.5	added (5) 1514:2;1520:9; 1527:7;1538:9; 1564:20	agreed (1) 1568:17	among (3) 1527:3;1543:3,9	appropriate (5) 1509:14;1531:15,18, 24;1544:17
A	adding (1) 1564:17	agreement (1) 1584:5	amount (13) 1505:2;1509:13; 1510:20;1511:10; 1523:21;1526:8; 1533:16;1543:6; 1549:10,10;1572:11, 16;1578:21	appropriation (1) 1532:18
able (2) 1573:11;1583:24	addition (1) 1579:21	agriculture (1) 1533:12	amounts (2) 1509:5;1533:4	approved (2) 1564:6;1582:11
above (3) 1522:23;1554:11; 1570:4	additional (14) 1526:22;1539:7,7; 1551:23;1567:18; 1574:12,18;1577:20, 22;1578:23;1579:18, 21;1593:15;1594:20	ahead (14) 1503:9;1546:13; 1569:18;1575:14,18; 1586:10;1587:23; 1588:3,5;1591:1,16,17; 1594:18,20	analysis (37) 1505:11;1507:8; 1508:10;1531:17; 1532:11;1534:21; 1535:12,21;1537:10, 15;1538:7;1543:18; 1545:11;1548:3; 1549:19;1561:22; 1562:16,17,21;1563:7, 9,12,13;1565:2; 1568:20;1578:22,24; 1579:2,5,12,13,15,22; 1584:1,7,10,12	approximately (3) 1558:18,22,23
absence (1) 1535:11	addressed (1) 1508:6	AKA (1) 1499:11.5	analyzing (2) 1564:12;1579:19	aquifer (35) 1504:7;1510:19; 1512:6,24;1513:6; 1514:14,16;1515:4,17, 24;1516:21;1517:23; 1518:7;1522:7; 1523:24;1524:17,19, 23;1525:5,22;1526:24; 1527:2,14,22;1535:8; 1538:1;1539:12,13; 1542:17;1543:17; 1544:4,24;1545:13; 1562:12;1575:7
absolutely (1) 1577:24	addressing (1) 1504:16	al (3) 1533:14;1534:2,7	and- (1) 1501:4.5	aquifers (2) 1541:19;1574:19
accelerated (2) 1513:6;1515:3	adds (2) 1537:24;1580:6	Alex (1) 1501:15	and/or (1) 1560:1	arbitrary (1) 1593:23
acceptable (2) 1526:3;1566:24	ADMINISTRATION (2) 1499:6;1503:5	algorithmic (1) 1547:14	Angeles (1) 1501:9.5	AREA (75) 1499:8.5,11; 1508:12;1510:6; 1511:1;1512:11,13; 1513:21;1514:8,10,21, 23;1515:11,15,19; 1516:7,16,18;1517:8, 13,17,19,20;1518:5,18, 19,21,24;1521:13; 1522:13,17;1524:5,7, 14,20;1526:4,15; 1527:1,23;1533:17,18; 1536:4,13;1540:14; 1544:2,10,12;1549:12, 13;1551:8;1556:16; 1558:22;1560:19; 1562:13,20;1563:10; 1564:7;1566:20; 1567:4;1568:14,22,24; 1569:6,10;1570:2,12, 15,16,17,18;1571:6,9, 9;1573:12;1574:12
account (3) 1531:10;1547:24; 1584:12	administrative (1) 1503:6	Allison (1) 1501:13	anistropic (2) 1536:12,12	areas (5) 1509:14;1533:9; 1539:19;1547:19,21
accounting (2) 1549:7,8	admit (1) 1591:2	allow (7) 1513:3;1525:15; 1527:21;1543:11; 1544:21;1575:6; 1594:20	annual (1) 1504:22	argue (2) 1541:14;1571:23
accurate (5) 1532:10,12;1554:3; 1558:5;1567:5	admitted (2) 1506:8,10	allude (1) 1516:7	apologize (1) 1520:16	arguing (1) 1556:7
acre-feet (27) 1504:16,17;1522:11, 16,19,20,22;1523:9,22, 23;1524:1,16;1528:14; 1530:15,17;1532:10; 1534:1,6;1535:17; 1541:17;1542:24; 1544:9;1545:12; 1547:7;1549:23,23; 1568:5	admittedly (1) 1558:14	alluvial (26) 1505:23;1514:15,18, 20;1515:6;1524:2,5; 1525:19,24;1541:19; 1544:3;1556:1,6,8,10, 15,20;1566:19;1567:3; 1568:13,24;1569:1,9; 1573:10,13;1574:19	apparent (1) 1517:3	argument (3) 1506:6;1538:8; 1542:7
acre-foot (1) 1536:24	advocating (1) 1503:23	alluvium (4) 1517:16,17;1573:15, 16	appear (1) 1520:24	aridity (1) 1517:7
acres (1) 1535:13	affect (4) 1513:13;1528:17; 1556:5;1568:14	almost (16) 1504:16;1510:14; 1514:12;1515:11,21; 1516:17;1518:5; 1519:5;1522:6; 1523:13,13;1541:13; 1542:1;1550:11; 1553:9;1563:3	appeared (1) 1503:14	
Act (5) 1504:8,11;1505:8; 1582:18;1583:19	affecting (5) 1527:17;1528:12; 1556:12;1562:21; 1567:16	alluvium (4) 1517:16,17;1573:15, 16	appears (1) 1570:11	
Acting (1) 1500:5	affiliation (1) 1589:1	alluvium (4) 1517:16,17;1573:15, 16	appendix (2) 1537:11,13	
action (2) 1582:6,7	Again (9) 1527:23;1550:23; 1551:16;1552:20; 1561:7;1562:15; 1575:19;1580:16; 1594:16	alluvium (4) 1517:16,17;1573:15, 16	application (1) 1530:19	
actions (2) 1505:15,17	age (1) 1540:24	alluvium (4) 1517:16,17;1573:15, 16	applications (4) 1564:5;1582:5,11,12	
acts (1) 1570:18	agencies (1) 1581:13	alluvium (4) 1517:16,17;1573:15, 16	applied (4) 1529:22;1530:2,6; 1549:21	
actually (14) 1507:24;1514:12; 1522:1;1526:17; 1532:5,16;1536:20,22; 1539:8;1542:14; 1549:9;1570:13; 1580:2;1590:2	agency (1) 1581:7	alluvium (4) 1517:16,17;1573:15, 16	apply (2) 1530:5;1539:12	
Adam (2) 1500:6;1572:7	agent (1) 1535:10	although (4) 1515:4;1519:13; 1542:1;1582:1	applying (1) 1527:16	
	ago (8) 1504:4;1522:3; 1525:15;1535:23; 1541:22;1548:7; 1557:24;1573:7	amended (2)	appreciate (1) 1503:16	
	agree (10)		approach (1)	

Arizona (1) 1507:13	1509:13,13;1510:18; 1513:9;1514:13,17; 1516:12;1521:19; 1525:14;1527:20; 1535:23;1554:7,10; 1556:20,23;1559:16; 1569:22;1575:15,19; 1585:15	basis (7) 1523:17;1553:2; 1554:17;1556:17; 1581:10;1583:5; 1591:7	1501:23	1589:2,12,20
around (11) 1509:1,3;1511:7; 1512:5;1523:21; 1524:22;1525:5; 1542:12;1543:7; 1570:16;1580:3	background (1) 1507:14	become (2) 1519:10;1530:17	Biological (10) 1503:8,12,17; 1506:23;1507:4; 1581:19;1582:16; 1583:8,17;1587:1	broken-down (1) 1531:19
Arrow (7) 1524:17;1537:12,23; 1553:13,16,20;1559:1	Baker (1) 1588:7	Bedroc (4) 1501:20;1569:12; 1585:9;1593:7	bit (13) 1512:22;1519:7,9; 1523:15;1529:12; 1530:4;1534:13,14; 1536:21;1539:3; 1540:4;1580:1,3	brought (1) 1568:20
aside (1) 1509:7	balance (4) 1542:8;1564:1; 1584:11,13	beg (1) 1539:10	BLACK (2) 1499:8;1571:22	Brownstein (1) 1501:8.5
assessing (1) 1587:5	Band (6) 1501:16.5;1534:17; 1552:12;1558:19; 1576:5;1592:14	began (6) 1512:7;1522:21; 1523:4,5;1524:8; 1587:3	blend (4) 1531:1,1,3;1547:9	bullet (4) 1555:22;1566:9,23; 1567:14
assessment (1) 1584:13	bands (3) 1530:22;1549:9,11	begin (1) 1537:3	blends (1) 1531:11	Bureau (1) 1596:9
associate (1) 1589:2	Barnes (4) 1500:9;1502:13; 1574:16;1575:12	beginning (6) 1509:2;1510:15; 1550:4;1587:4,5,6	Bliss (1) 1500:15	burn (1) 1535:13
Associates (5) 1565:24;1585:4; 1589:3;1593:2;1595:1	barriers (1) 1520:22	begins (1) 1540:23	blue (4) 1524:6;1541:2; 1545:2;1554:7	<hr/> C <hr/>
assume (1) 1549:4	based (25) 1509:16;1520:11; 1522:14;1527:8; 1530:7,9;1532:11,19; 1535:21,22;1537:4; 1542:8;1544:9,14,20; 1548:4,10,16,17; 1551:12,12;1564:1; 1568:8;1593:23; 1594:19	begun (2) 1511:23;1513:12	both (15) 1505:24;1509:7,11; 1514:8;1523:16,16; 1526:1;1529:21; 1530:6;1538:16,17,22; 1547:12;1574:24; 1588:9	calculate (2) 1549:7;1560:19
assumed (1) 1553:21	basic (1) 1542:7	behalf (10) 1506:22;1546:23; 1583:12;1588:7,9,16; 1589:4,8,9;1591:22	bottom (3) 1512:17;1515:1; 1545:6	calculations (2) 1529:17;1578:5
assuming (2) 1563:18;1586:6	basically (4) 1537:19;1542:22; 1545:16;1571:20	Belaustegui (1) 1501:6	both (15) 1505:24;1509:7,11; 1514:8;1523:16,16; 1526:1;1529:21; 1530:6;1538:16,17,22; 1547:12;1574:24; 1588:9	calibrating (1) 1587:17
assumption (2) 1530:24;1544:15	BASIN (57) 1499:8,9,9.5,10,10.5, 12;1500:15.5;1504:18; 1512:2,8,23;1513:2; 1514:7,9,9,18,21,24; 1517:1,5,9,12,14,22; 1525:21,21;1526:2,3,9, 12;1527:5;1528:11; 1530:12,18,23;1531:1, 2,4;1532:6;1534:11; 1548:1,9;1556:4; 1557:5;1564:7; 1566:23;1567:15,19; 1568:21;1569:3; 1574:2,2,24;1575:4; 1590:5,6;1592:2	belief (1) 1555:24	bottom (3) 1512:17;1515:1; 1545:6	calibration (1) 1587:19
assumptions (1) 1535:20	basins (13) 1503:5;1511:22; 1527:3,4;1529:19; 1530:22;1531:10,14, 19;1549:6;1564:18; 1570:23;1594:7	BELL (11) 1502:17;1588:11,15, 22,24,24;1591:4,7,7, 16,20	both (15) 1505:24;1509:7,11; 1514:8;1523:16,16; 1526:1;1529:21; 1530:6;1538:16,17,22; 1547:12;1574:24; 1588:9	called (5) 1506:22;1588:16; 1589:12,20;1590:11
August (1) 1589:20		below (10) 1542:19;1544:21; 1550:18;1551:4,6,9; 1554:12,12;1584:3,3	boundary (4) 1539:14;1559:10; 1594:4,9	call (2) 1511:21;1571:4
Authority (6) 1523:8;1552:15; 1576:8,12;1586:1; 1592:17		Berley (4) 1501:16.5;1552:13; 1576:6;1592:15	Brad (2) 1546:23;1591:22	came (1) 1548:22
Authority's (1) 1543:13		best (2) 1509:8;1555:20	Bradley (1) 1501:9	can (23) 1509:20,23;1512:20; 1513:19;1515:11; 1518:5;1521:21; 1524:3,23;1529:18; 1530:1;1531:2; 1538:22;1545:13; 1551:1;1553:10; 1559:9,15;1561:2; 1571:23;1579:24; 1580:1;1589:1
available (9) 1503:15;1532:18; 1533:5,22;1537:3; 1577:17,20;1579:2,14		better (5) 1510:7;1526:16; 1532:4;1569:8; 1570:13	break (5) 1575:15,17;1586:11; 1587:23;1588:2	Canyon (7) 1524:17;1537:12,23; 1553:13,17,20;1559:2
average (11) 1508:21;1523:17; 1537:19;1540:23; 1541:16;1550:15,19, 23;1551:4,10;1552:2		beyond (3) 1511:19,24;1587:18	breather (1) 1528:21	CAPITOL (1) 1499:21
avoid (1) 1527:22		Big (2) 1535:4,15	Bridget (1) 1500:15	capture (6) 1533:5,8;1538:2; 1544:1;1572:9; 1584:15
aware (16) 1504:2;1549:6; 1557:21;1558:24; 1564:10,17;1573:16, 18,23;1576:24;1579:9, 9;1581:16,18,20,21		Biologic (1)	brief (4) 1506:5;1511:6; 1519:11;1538:23	captured (15) 1525:2,6;1528:2; 1532:22;1533:2,22; 1537:23;1542:5,15; 1555:10,16,17,18; 1584:14,15
away (2) 1533:21;1580:7			briefest (1) 1503:21	captures (5)
<hr/> B <hr/>			briefly (2) 1542:1;1580:21	
back (20)			broad (3) 1511:20,21;1526:24	
			Broadbent (3)	

<p>1525:2;1542:10,17; 1556:16,18 capturing (5) 1525:12,13;1532:19; 1533:20;1534:12 Carano (1) 1588:9 carbonate (92) 1504:7;1509:23; 1510:17;1511:3,7,11; 1512:12,21;1513:2,3, 20;1514:14;1515:20; 1516:6,15,21,22; 1517:3,4,6,9,11,13,15; 1518:11,12;1520:21; 1521:21;1523:4,16,22; 1524:6,7,8,9,14,18,19, 21,23;1525:8,10,12,16, 20,23;1526:12,18,20, 24;1527:9,14,21,24,24; 1528:3,8,14;1531:8; 1538:1;1541:19; 1542:4,17;1543:16,19, 24;1544:9;1545:13; 1556:1,3,6,8,9;1558:4; 1560:5,9;1562:11,19; 1563:11,15,17; 1567:18;1572:11; 1573:21;1574:4,19,24; 1575:4,7;1583:13; 1584:2,9 Carlson (2) 1555:1;1578:6 Carson (5) 1499:23.5;1501:4, 14;1503:1;1596:9 cases (1) 1512:24 catch-all (1) 1559:16 cause (4) 1504:7;1510:22; 1584:2,3 caused (1) 1511:17 causes (2) 1510:4;1542:10 Caviglia (4) 1501:10.5;1569:16; 1585:13;1593:11 CBD (4) 1503:15;1506:13; 1577:12;1579:1 CCR (3) 1499:22,22.5; 1596:21.5 cease (1) 1506:2 Center (11) 1501:23;1503:8,12, 17;1506:23;1507:4; 1508:20;1554:19; 1583:7;1587:1,3</p>	<p>central (2) 1511:4,7 certain (4) 1505:13;1560:2; 1564:18;1579:12 certainly (1) 1540:16 Certified (2) 1499:21.5;1596:4 certify (1) 1596:7 cetera (1) 1533:18 CE-VF-2 (1) 1517:3 CFS (14) 1519:3,5,8,11,15,15, 18;1522:6,8;1523:2; 1535:5;1542:2; 1554:12,15 chance (1) 1529:5 change (3) 1513:1;1518:10; 1535:10 changed (1) 1519:17 changes (6) 1508:11,12;1568:9; 1572:20,22;1573:5 channels (2) 1526:5;1567:1 characterization (1) 1572:8 characterize (1) 1568:2 checked (1) 1519:15 Chief (2) 1500:8,11 chose (1) 1506:14 chosen (1) 1508:17 Christi (1) 1500:13.5 CHRISTY (3) 1499:22;1596:4,21.5 circle (1) 1525:14 circled (1) 1537:13 circulated (1) 1540:16 City (11) 1499:23.5;1501:4, 14,21;1503:1;1536:3; 1565:16;1579:1; 1584:21;1592:23; 1596:10 claim (2) 1533:24;1541:20 claimed (1)</p>	<p>1535:7 clarify (2) 1555:23;1568:18 clarifying (1) 1557:3 clay (1) 1575:6 clear (1) 1505:12 clearly (3) 1538:15;1563:16; 1573:24 client (2) 1567:10;1583:12 client's (1) 1581:3 climate (12) 1508:11,17,20; 1510:8;1534:21,23; 1535:1,9;1543:15; 1578:12,18,18 climb (1) 1512:7 close (5) 1513:23;1519:15; 1524:2;1539:13,14 closely (1) 1553:11 closing (1) 1506:6 co-counsel (1) 1588:8 coefficient (3) 1530:10,13;1549:20 coefficients (8) 1532:1,8;1537:14, 17;1547:18;1548:11, 22,22 Cogeneration (4) 1565:24;1585:4; 1593:2;1595:1 collected (2) 1565:13;1594:6 coming (4) 1540:19,20;1542:12; 1571:7 commence (1) 1539:9 commencing (1) 1512:13 comment (3) 1539:10;1555:24; 1593:18 comments (1) 1539:8 communities (1) 1558:12 Company (9) 1501:13;1560:12,18; 1566:2,6;1585:6; 1593:4;1594:23; 1595:2 compare (1)</p>	<p>1550:14 comparing (1) 1553:8 comparison (2) 1551:24;1563:14 complete (2) 1535:11;1572:19 completed (3) 1510:19;1542:21; 1573:21 completely (4) 1515:5;1525:11; 1541:1;1556:11 compliance (4) 1582:17,24;1583:18, 23 compliment (1) 1505:20 concept (4) 1537:24;1539:11; 1543:19;1550:2 conceptualizations (1) 1505:6 conclude (1) 1562:9 concluded (2) 1594:21;1595:5 conclusion (18) 1505:22;1521:18; 1526:23;1527:6,20,23; 1532:9;1534:23; 1550:20;1551:5; 1555:10;1556:14; 1561:22;1562:7,16; 1567:14;1580:22; 1584:8 conclusions (6) 1505:7,16;1506:17; 1507:8;1529:11; 1555:8 conditions (2) 1544:21;1584:11 conductivity (1) 1517:11 cone (2) 1511:20,21 conjunctive (1) 1525:19 connecting (1) 1541:11 connection (3) 1513:2;1516:5; 1574:19 connectivity (3) 1526:17;1544:5; 1574:5 consequently (1) 1544:3 CONSERVATION (2) 1499:2;1596:5 consider (21) 1506:1;1508:11,18; 1509:9;1510:8,16;</p>	<p>1519:1;1521:7; 1525:18;1530:12,24; 1531:6;1533:6; 1534:10;1548:1,9; 1564:16;1570:15,21; 1574:12;1580:18 consideration (1) 1532:22 considered (10) 1505:16;1521:11; 1532:3;1534:16; 1542:21;1550:6; 1565:8;1570:23,24; 1573:5 considering (7) 1510:9;1524:11,11; 1531:10;1561:16; 1572:2;1580:22 consistently (1) 1518:8 consisting (1) 1596:12 constitutes (1) 1544:6 constraints (2) 1505:4,6 constructed (1) 1565:10 consultant (1) 1507:10 consultation (1) 1504:3 consultations (1) 1522:5 consumptive (3) 1557:2,4;1568:13 consumptively (1) 1556:19 contemplated (1) 1583:7 context (1) 1503:22 continuation (1) 1503:3 continue (16) 1503:7;1518:12; 1522:9;1525:3;1528:3, 7;1538:23;1542:6,16; 1543:11;1551:10; 1555:12;1556:11; 1571:10;1572:10; 1584:2 Continued (8) 1501:1.5;1511:11; 1520:4,8;1527:22; 1578:9;1581:23; 1584:1 continues (4) 1542:5;1545:3,5,10 continuing (6) 1537:24;1541:22; 1553:3,19;1584:17,18 contrast (1)</p>
--	--	--	---	--

<p>1571:2 contribute (3) 1527:13;1562:11; 1584:18 contributed (1) 1535:14 Cooper (1) 1500:13.5 copy (1) 1590:18 corrected (1) 1590:23 correcting (1) 1592:2 corrections (3) 1589:24;1590:2,8 correlation (3) 1527:24;1537:10,11 Counsel (1) 1596:9 County (12) 1501:12;1538:11; 1554:22;1560:11,18; 1562:2;1578:7; 1580:13;1582:4; 1586:5;1592:22; 1596:2 couple (12) 1506:14;1508:19; 1509:17;1525:20; 1529:16;1543:12; 1551:8,21;1553:17; 1570:9;1576:10; 1586:17 course (5) 1505:20;1518:20; 1523:23;1524:16; 1527:15 court (3) 1504:13;1590:13; 1596:4 cover (1) 1509:15 covering (1) 1529:6 COYOTE (69) 1499:7.5;1510:17, 22,23;1511:4,8;1512:3, 9;1515:10,12,20,22; 1517:1,12;1518:15,16, 19,21;1520:12;1521:3, 5,9,10,14,16;1524:6,8, 18;1526:9;1527:1,14, 18;1529:12,13,21; 1530:1;1532:14; 1533:24;1534:4,8,9,10, 16;1539:6,24;1540:1,2, 11,23;1546:14; 1548:24;1549:22; 1560:24;1561:10,17; 1562:12;1563:22,23, 24;1571:8,20;1573:10; 1574:2,8,22;1575:19;</p>	<p>1579:6;1585:17; 1591:17 created (1) 1547:15 credence (2) 1535:19;1537:24 critical (5) 1542:6,19;1543:20; 1544:22;1559:10 Cross-Examination (20) 1502:5,6,7,8,9,14,15, 19;1504:5;1546:14,19; 1552:17;1557:11; 1560:13;1566:3; 1575:19;1576:16; 1580:14;1591:16,18 CSI (8) 1501:6,8,5;1532:15; 1546:23;1548:23; 1577:13;1578:6; 1591:22 CSI's (1) 1547:2 CSV (1) 1561:12 CSV3011M (1) 1512:5 CSVM-4 (11) 1515:23;1516:1; 1518:2,9;1520:13,15, 17;1539:22;1570:10, 20;1571:11 CSVM-6 (4) 1570:7,16,18,21 curious (1) 1538:3 current (7) 1504:19;1522:7; 1537:20;1555:12,13, 17;1592:4 curriculum (1) 1590:14 customers (1) 1559:1 CV (3) 1503:15;1590:14,19</p>	<p>1504:19 Darcy's (1) 1535:21 data (53) 1505:1;1508:10,19, 24;1509:12;1519:13; 1520:20;1529:9; 1530:5,6;1534:22,23; 1535:2;1538:5,5,6,11, 12;1539:18;1540:6; 1543:14;1544:19; 1545:18;1550:4,13; 1554:20;1555:1; 1559:7;1561:23; 1564:12;1565:13; 1574:20;1577:16,17, 20,22;1578:1,6,8,9,9, 11,11,23,23;1579:16, 19,21,23;1580:23; 1587:14,19;1594:9 date (4) 1577:10,19;1579:16; 1592:3 Dated (1) 1596:17 Davis (2) 1558:7,17 Davis' (1) 1558:11 day (6) 1554:14;1583:16; 1594:19;1595:2; 1596:8,17 days (2) 1555:4;1557:24 deal (3) 1535:14;1536:7; 1543:5 decade (1) 1503:24 decades (1) 1541:6 December (1) 1564:24 decent (1) 1528:15 decline (15) 1513:6;1514:11; 1515:23;1519:6; 1528:1,3,8;1538:16,23; 1542:16;1553:3; 1555:12;1567:20; 1568:7;1572:10 declined (4) 1515:1,3;1520:1; 1543:18 declining (1) 1553:19 decrease (10) 1513:7;1515:6; 1519:23;1527:22; 1538:17;1541:7; 1542:6;1543:20;</p>	<p>1553:20;1561:12 decreased (5) 1511:8;1519:2,9; 1522:20;1572:23 decreases (3) 1525:11,17;1561:12 decreasing (3) 1519:10;1524:15; 1542:2 Decree (6) 1522:10,11;1523:13; 1568:3,4,15 decreed (1) 1556:5 deeper (1) 1575:7 deeply (1) 1540:16 deficits (1) 1509:21 defined (1) 1523:18 definitely (3) 1518:13;1528:6; 1539:12 degree (1) 1512:19 degrees (1) 1540:13 Delamar (2) 1518:17;1521:12 delay (3) 1538:20,20,22 DeMeo (2) 1533:13;1534:7 demonstrate (2) 1504:20;1517:21 demonstrates (2) 1518:4;1535:9 dense (1) 1533:11 denying (1) 1516:8 DEPARTMENT (2) 1499:2;1596:5 depend (2) 1533:7;1577:18 depended (1) 1531:22 dependent (1) 1535:19 depends (1) 1551:6 depletion (2) 1527:14;1562:11 depth (2) 1517:22;1534:11 Deputy (1) 1500:6.5 derived (2) 1530:22;1531:13 described (2) 1532:2;1548:18</p>	<p>description (1) 1582:9 desert (1) 1510:3 detail (1) 1513:23 Detailed (1) 1529:3 detailing (1) 1559:22 determinations (1) 1564:15 determine (2) 1505:21;1550:8 determined (1) 1531:3 determining (1) 1548:20 develop (1) 1549:10 developed (4) 1545:13;1547:14; 1573:11;1587:13 developing (1) 1531:24 development (4) 1523:1;1566:10,18, 19 DF-1 (2) 1512:8;1517:5 differ (2) 1539:10;1545:17 difference (9) 1536:7,9;1538:19, 22;1543:6,8;1564:21; 1575:5;1580:6 differences (2) 1543:3;1547:24 different (30) 1505:5,5,7;1506:14; 1518:1;1522:4; 1529:10,10,19,22,23; 1533:16;1536:10; 1538:21;1539:17,18, 19;1540:6;1542:22,22; 1544:13;1547:15,24; 1549:16;1557:4; 1564:23;1568:20; 1569:24;1579:24; 1594:2 differently (1) 1521:11 differs (1) 1506:12 difficult (1) 1528:13 diffusivity (1) 1544:4 Direct (13) 1502:4,18;1507:1, 16;1508:5,6;1526:1, 23;1527:24;1534:21; 1544:24;1583:2;</p>
	D			
	<p>D-4 (1) 1547:16 dace (18) 1503:23;1504:8; 1505:11,15,24; 1521:23;1526:6; 1559:23;1560:2; 1567:2,9,11;1572:15; 1581:3,8,17,24;1584:9 dace's (1) 1504:18 daily (1) 1538:5 danger (1)</p>			

1588:20 directions (1) 1539:16 directly (2) 1550:14;1569:10 discharge (24) 1519:1;1522:14,15; 1525:2,6,13;1528:1,3; 1535:4;1542:5,11,15, 18;1543:17;1544:1,2,6, 12,13;1545:8;1548:9; 1555:11,18;1572:24 discharges (3) 1525:21,23;1530:23 disciplines (1) 1591:3 disconnect (2) 1517:10;1526:13 discrete (1) 1549:6 discuss (1) 1528:4 discussed (1) 1512:22 discussion (3) 1540:10;1572:8; 1574:17 discussions (1) 1506:15 dissipated (1) 1510:13 dissolved (1) 1539:20 distance (2) 1515:15;1570:12 distinction (1) 1573:10 District (14) 1501:18;1552:16; 1557:10,16;1558:9,12, 18,24;1560:18;1576:9, 13;1580:11;1586:4; 1592:20 District/ (1) 1501:12.5 district's (1) 1557:17 diversion (1) 1523:2 diversions (2) 1522:14;1592:3 Diversity (7) 1501:23.5;1503:9, 12,17;1506:23;1583:8; 1587:1 Diversity's (1) 1507:4 divided (1) 1529:18 DIVISION (10) 1499:3;1504:12; 1508:21;1535:2; 1546:16;1550:3,16;	1569:18;1585:15; 1596:6 dominance (1) 1535:9 dominated (1) 1524:18 done (10) 1507:13;1510:1; 1531:23;1551:23,24; 1575:1;1584:6,11,12; 1594:12 Donnelly (19) 1501:23.5;1502:4, 16;1503:10,11,12; 1506:11;1507:2; 1546:4,9;1559:6; 1581:9,11,12;1586:12, 13,15,16;1587:20 dots (1) 1541:11 doubt (1) 1508:13 doubtless (1) 1504:2 down (25) 1513:3,4,17; 1516:16,17;1521:15; 1522:9;1527:6;1533:6, 15;1537:7;1541:23; 1544:18;1545:9,10; 1546:1;1554:7; 1561:14;1563:10; 1564:2;1566:9;1568:8; 1571:4,9;1580:5 down-hole (1) 1575:2 downstream (6) 1521:24;1522:12,13; 1528:10;1556:12; 1568:15 downward (10) 1511:6;1512:3,13; 1513:15,18;1514:1,4; 1524:22;1525:4; 1584:17 Dr (21) 1503:13,22;1504:20; 1505:22;1507:4; 1528:22;1546:4,21; 1552:19;1557:13; 1559:7,19,20;1560:15; 1566:5;1571:16; 1572:7;1576:11,18; 1580:16;1586:19 draw (5) 1521:5;1550:20; 1551:4;1560:24; 1561:10 drawdown (15) 1511:18,20,21; 1514:23;1520:4; 1525:5;1537:21; 1539:10;1542:10,10;	1560:19;1562:20; 1571:10;1579:24; 1584:2 drawing (2) 1545:18,21 drawn (2) 1511:18;1541:4 DRI (1) 1510:3 drilled (1) 1575:9 drives (1) 1509:19 drop (5) 1516:15,17,21; 1570:8,11 dropped (4) 1518:8;1519:5; 1524:1,2 drought (13) 1508:23;1509:10,22; 1510:9;1534:21,24; 1535:3;1550:21; 1551:5,13;1573:3,3; 1578:19 dry (9) 1509:19;1520:5,6; 1550:8;1578:20; 1588:1,4;1589:8,9 drying (1) 1504:19 due (8) 1509:23;1515:6; 1517:10;1522:24; 1523:5;1525:12; 1539:8;1566:10 duly (2) 1506:23;1588:17 during (37) 1509:19;1510:19; 1511:9;1512:4; 1513:11;1514:23; 1515:2,16,23;1516:11; 1518:7;1519:4,5,6,11, 23;1520:3,7,19; 1522:7;1523:24; 1524:17;1535:8; 1541:20,23;1542:3; 1543:4;1553:13; 1554:21,24;1555:23; 1560:2,5,8;1574:1; 1579:7,12 dwelt (1) 1508:15 Dwight (2) 1536:2,18	1547:13 earlier (4) 1510:2;1537:24; 1574:17;1581:2 early (4) 1511:5;1513:15; 1573:9;1594:21 earth (1) 1503:18 east (9) 1509:13,13;1516:18; 1520:2,6;1529:19; 1549:14;1554:5,8 eastern (1) 1590:4 eastward (1) 1590:5 ecosystems (6) 1532:23;1533:1,11, 17,19,20 effect (8) 1513:20;1523:10; 1527:18;1535:15; 1563:19,24;1573:3; 1580:1 effectively (1) 1533:20 effects (4) 1521:14;1535:11; 1578:12,17 eg (1) 1544:2 EH-4 (14) 1513:10,24;1518:2; 1524:11;1528:6; 1537:12;1545:8,20,20; 1552:23,24;1553:3; 1570:16,18 EH-5b (2) 1514:1;1553:10 eight (1) 1537:22 eighties (2) 1513:11,15 either (5) 1538:20;1542:10; 1572:21;1574:9; 1579:14 electrical (1) 1523:3 elements (1) 1506:14 elevation (1) 1549:1 elevations (2) 1515:13;1594:6 eliciting (1) 1504:5 eliminating (1) 1523:9 else (4) 1537:17;1540:21; 1586:6;1594:16	encouraging (1) 1564:16 end (11) 1510:14;1515:8,18; 1516:2;1526:11; 1536:19;1541:9; 1545:19,19,20;1556:23 endangered (6) 1503:19;1504:8; 1505:8;1581:24; 1582:18;1583:19 ending (1) 1556:19 Energy (5) 1501:10.5;1545:15; 1569:15;1585:12; 1593:10 Engineer (25) 1500:5,6,5,9,5,15,5; 1503:14;1507:12,22; 1510:18;1522:2; 1523:19;1525:15; 1527:21;1535:24; 1564:8,16,17,22,23; 1571:19;1572:2; 1574:11;1576:24; 1577:12;1583:12; 1594:3 Engineer's (5) 1504:15;1505:21; 1506:5;1563:1; 1564:14 enough (4) 1507:23;1537:6; 1561:17;1594:9 ensure (1) 1506:15 entered (1) 1582:4 entertain (1) 1583:9 entire (14) 1523:13,18;1530:22, 23,24;1531:4,14; 1547:2;1548:1; 1549:12,13;1550:3,8; 1565:8 entirely (1) 1559:1 Environmental (2) 1588:10;1589:5 Epstein (8) 1530:6,7;1547:12, 17;1548:2,4,12,13 Epstein's (1) 1548:6 equals (3) 1525:2,6;1572:23 equating (1) 1530:22 equation (1) 1584:7 equilibrium (2)
			E	
		Eakin (4) 1522:14;1530:3,8; 1547:13 E-a-k-i-n (1)		

1525:9;1545:1 especially (6) 1509:18;1510:10; 1514:2;1519:24,24; 1541:24 Esq (11) 1501:3.5,5,7,9,10,5, 13.5,15,16.5,18,20,21 essentially (1) 1587:3 estimate (12) 1528:13;1529:23; 1530:9;1531:15,20; 1532:4,18;1544:17,20; 1545:4;1547:17; 1557:3 estimated (9) 1522:15;1529:14; 1532:8,9;1533:4,14; 1534:8;1535:16; 1549:10 estimates (5) 1531:14,23;1532:2, 5;1546:24 estimating (3) 1530:14;1532:13; 1548:18 ET (16) 1532:21,23,24; 1533:9,13,14,16,18,20, 21,24;1534:2,4,7,9,15 evaluated (1) 1547:12 evaluating (1) 1586:24 evaluation (1) 1506:3 evap (1) 1509:15 evaporation (2) 1509:16,16 evapotranspiration (6) 1523:10;1532:15,19; 1533:4;1534:6,15 even (15) 1504:19;1509:4,19, 22;1510:12,18; 1511:13;1513:11; 1514:5;1525:5;1526:1; 1555:12;1556:1; 1573:4,16 event (1) 1510:4 eventually (3) 1538:2;1584:15,17 everyone (5) 1506:12;1507:6; 1575:15;1586:6; 1595:3 evidence (24) 1507:16;1508:5,23; 1521:5;1526:23; 1532:21,23;1533:1;	1534:20;1535:2; 1536:15,23;1537:2; 1538:24;1539:17,24; 1540:19;1543:10; 1544:16;1550:20; 1551:5;1578:4; 1590:24;1594:5 evidenced (2) 1524:22;1525:4 evidentiary (1) 1504:24 exact (2) 1577:9,19 exactly (2) 1582:8,9 Examination (16) 1502:4,10,11,12,13, 16,18,20;1507:1; 1569:20;1571:14; 1572:5;1574:15; 1586:14;1588:20; 1593:20 examined (3) 1506:24;1557:18; 1588:18 example (10) 1509:20;1510:2; 1530:1,12;1531:6,24; 1541:3;1548:13; 1573:11,19 exceed (1) 1517:14 exceeds (2) 1517:5;1542:15 except (3) 1511:6;1541:14; 1565:2 exception (2) 1512:4;1542:12 exclusion (1) 1593:23 exclusive (1) 1505:16 Excuse (4) 1537:8;1570:12; 1586:3;1594:23 Exhibit (8) 1503:15;1506:13; 1514:23;1576:19; 1577:13;1589:11,19; 1591:24 Exhibits (6) 1506:7,9;1529:4; 1577:12;1590:23; 1591:2 exist (1) 1594:12 existence (1) 1581:24 expansions (1) 1520:21 expect (1) 1541:7	expected (1) 1543:23 expects (1) 1586:9 experience (2) 1532:4;1540:6 expert (5) 1503:13;1556:21; 1557:17;1590:22; 1591:4 experts (1) 1505:1 explain (2) 1529:15;1548:11 explains (1) 1580:2 extending (1) 1527:10 extends (1) 1516:6 extensive (1) 1532:24 extent (1) 1581:15 extreme (5) 1508:20;1578:19,19, 20,20 extremely (3) 1504:18;1515:14; 1571:6	1585:3,8,11,14,20,23; 1587:22;1588:3; 1591:1,6,15;1592:9,13, 16,19;1593:1,6,9,12, 17;1594:15 fall (2) 1544:21;1552:1 falls (1) 1530:11 familiar (13) 1512:14;1547:22,23; 1553:12;1555:6; 1558:21;1564:13; 1579:4;1581:13; 1582:7;1589:11,19; 1590:11 far (6) 1515:2;1516:16; 1518:2;1524:3; 1526:11;1559:14 Farber (1) 1501:8.5 Fahrenheit (1) 1540:13 fast (1) 1539:9 fault (4) 1516:8,9,11;1520:23 feasibly (1) 1533:2 federal (1) 1581:13 feel (1) 1505:8 feeling (1) 1573:13 feet (23) 1511:8;1512:11; 1513:1,8;1514:23; 1515:21;1516:3,10,17, 19;1517:4,5,6;1518:8, 11,13;1520:15; 1547:19;1561:16; 1570:4,9;1571:11; 1575:5 few (7) 1510:16;1516:10; 1525:14;1564:19,19; 1568:8;1577:9 fewer (1) 1547:20 Field (3) 1514:9,22;1515:3 figure (9) 1522:1;1538:15; 1544:23;1548:23; 1549:5;1566:15; 1576:20,22;1577:16 figures (1) 1529:21 filed (1) 1507:21 fill (32)	1512:2,8,23;1513:2; 1514:7,9,9,18,21,24; 1517:1,5,9,12,14,22; 1525:21,21;1526:2,3,9, 12;1528:11;1534:11; 1556:4;1566:23; 1567:15,19;1574:2,3, 24;1575:4 final (2) 1590:4,6 finalize (1) 1519:17 finally (1) 1543:12 finding (1) 1541:10 findings (2) 1505:19;1563:2 fine (1) 1532:7 finish (2) 1528:23;1595:2 finished (1) 1546:2 fire (1) 1523:7 first (12) 1506:23;1508:4,9, 17;1518:4;1519:22; 1529:12,18;1542:8; 1566:8;1584:16; 1588:17 fish (14) 1504:1,2;1541:13; 1542:14;1552:8; 1559:20;1575:24; 1578:24;1581:6,16,20; 1582:4;1585:20; 1592:9 five (7) 1511:22;1516:3; 1520:15;1559:16; 1561:16;1562:23; 1576:14 five-basin (2) 1562:20;1563:10 five-minute (2) 1586:11;1587:23 Flangas (1) 1501:15 flat (9) 1515:9;1527:9; 1557:23;1570:2,5,15, 17;1571:3,6 Flatley (1) 1500:7.5 flatness (1) 1518:4 FLOW (107) 1499:7;1503:5; 1504:23;1505:10; 1519:14,20;1520:10; 1521:1,5,11,12,16,17;
		F		
		fact (13) 1510:20;1516:10,20; 1518:14;1520:14; 1521:11;1535:13; 1539:22;1547:24; 1551:13;1558:22; 1592:7;1593:13 factor (1) 1505:9 facts (1) 1559:7 failed (1) 1580:22 failure (1) 1535:14 fair (7) 1509:12;1516:21; 1523:21;1567:7; 1577:21;1578:21; 1581:14 FAIRBANK (54) 1499:4;1500:3; 1503:3;1506:9;1546:6, 11;1551:18,22;1552:7, 11,14;1557:8;1559:9, 13;1560:11;1565:16, 19,22;1569:12,14,17; 1575:13,18,22;1576:4, 7,14;1580:10;1581:10, 14;1583:4;1584:21,24;		

1522:3,15,18;1523:12,18;1524:9;1525:11,16;1526:1,18;1527:8,22;1528:6,7,12,17;1532:13,20;1533:10;1535:7,17,17;1536:4,13,15,20,24,24;1537:4,8;1538:2,10,14;1539:2;1540:10,18,20;1541:1,2,8,9,15;1542:1,6,12,19;1543:7,20,21,24;1544:3,5,7,10,11;1545:11;1554:13,20;1556:16,24;1557:18;1558:5,6;1559:10;1561:12;1562:9,24;1563:16,21,22,23;1567:11,16,23;1568:2;1569:3,5;1571:7,7,18;1572:3;1573:14;1575:7;1578:9,13,23;1579:7;1580:19;1584:15,16;1586:22;1587:4;1592:1;1593:24	found (5) 1510:18;1520:4;1534:5;1536:2;1581:22 founded (1) 1503:17 four (10) 1516:3;1519:3;1520:15;1529:22;1530:21;1537:11;1547:15;1559:10,15,16 fourth (1) 1566:9 frequently (1) 1508:3 front (3) 1503:14;1561:3;1576:18 full (4) 1510:20;1586:17;1588:22;1596:13 fully (4) 1542:17;1557:2,4;1568:13 functioning (4) 1532:23;1533:1,10,17 further (25) 1516:4;1518:9,10;1521:24;1525:17;1536:21;1537:24;1538:24;1540:2;1546:5;1575:22;1580:11;1583:13;1584:3;1585:8,17,23,24;1586:2,5;1587:20;1591:10;1593:14,18;1594:4 future (3) 1521:21;1582:12;1587:18	geochemical (1) 1539:18 geographic (1) 1594:1 geologic (1) 1547:24 Geological (1) 1554:19 geology (3) 1531:1,6;1591:5 geophysics (1) 1575:2 Georgia (9) 1565:20;1585:1;1587:24;1588:4,7,9,17;1589:4;1593:14 given (5) 1532:12;1535:19;1537:3;1591:9;1593:13 gives (1) 1528:20 giving (1) 1583:22 Glasgow (5) 1501:22;1552:10;1576:3;1585:22;1592:12 goal (2) 1505:11,23 goals (1) 1510:21 goes (2) 1550:13;1583:3 Good (19) 1503:11;1507:6;1517:6;1526:19;1546:21,22;1552:19,20;1557:13,14;1560:16,17;1566:5,7;1576:11;1580:17;1588:6;1591:20,21 GP-REP01 (5) 1589:11,14,16;1590:23;1591:2 GP-REP02 (4) 1589:19,22;1590:1,8 GP-REP03 (3) 1590:11,16,18 gradient (20) 1511:17;1513:1;1517:22;1518:16;1533:7;1540:2;1557:22;1560:23;1561:10,12,18;1569:24;1570:1,4,5,20,22,24;1571:1,7 gradients (1) 1557:18 granitic (2) 1531:7,7 granularity (1) 1531:17	graph (18) 1510:7,17;1511:15;1512:10,16;1515:1,11;1517:24;1518:12;1519:22;1523:15;1524:4,23,24;1535:6;1538:14;1545:6,20 graphs (6) 1509:3;1513:22;1514:8;1541:21;1545:24;1568:6 gray (2) 1524:4,4 great (5) 1535:14;1536:7;1543:5;1546:11;1587:19 greater (4) 1530:12;1536:14;1547:19,19 Greg (2) 1501:18;1557:15 ground (1) 1566:19 groundwater (35) 1504:17,22;1507:17,20;1512:2,18;1515:8;1516:1,15;1518:9;1520:14,18;1521:1;1522:24;1526:20;1527:4;1532:18,20,24;1537:4;1539:19,20,22;1543:23;1545:2,6;1559:1;1563:17;1566:10,18,19;1568:13;1587:17;1592:3;1594:6 groupings (1) 1540:6 guess (9) 1510:12;1511:20;1534:13;1536:17;1542:7;1545:17;1559:4;1574:19;1578:2	1543:16 health (1) 1567:8 hear (1) 1582:15 heard (3) 1509:1;1513:9;1539:8 HEARING (64) 1499:4,15,16;1500:3,5,8;1503:3,4;1506:6,9;1546:6,11;1551:18,22;1552:7,11,14;1557:8;1559:9,13;1560:11;1564:10;1565:16,19,22;1569:12,14,17;1575:13,18,22;1576:4,7,14;1578:5;1580:10;1581:10,14;1583:4;1584:21,24;1585:3,8,11,14,20,23;1587:22;1588:3;1591:1,6,15;1592:9,13,16,19;1593:1,6,9,12,17;1594:15;1595:5;1596:11,15 help (1) 1557:2 helps (1) 1517:16 hereby (1) 1596:6 Here's (1) 1521:18 Herrema (15) 1501:9;1502:5,19;1546:18,20,23;1551:20,24;1552:4,6;1575:21;1585:19;1591:19,22;1592:8 heterogeneous (2) 1592:2,5 Hi (2) 1560:15;1580:16 HIDDEN (6) 1499:9,5;1510:24;1527:2;1529:24;1571:21;1573:18 high (11) 1509:5;1516:5;1520:11,11;1523:5;1527:12;1534:12;1544:4;1562:10,23;1571:6 higher (20) 1511:19;1512:11;1515:21;1517:2,4;1518:11,13;1520:15;1532:11;1536:21;1537:18;1539:21,23;1543:11;1553:5,5,6;1561:16;1572:13;
flows (15) 1508:12;1518:17,18;1520:1;1521:22;1522:6;1541:20;1542:2;1553:22;1555:11;1556:12;1567:20;1568:1,6;1572:14 fluctuation (1) 1512:21 focus (4) 1503:19;1567:10,12;1578:21 focused (1) 1550:10 focuses (1) 1505:15 focusing (1) 1503:24 follow (1) 1572:11 follows (3) 1506:24;1551:20;1588:18 foot (2) 1513:4;1518:10 forcing (1) 1535:10 foregoing (1) 1596:12 form (1) 1536:12 forth (2) 1514:17;1555:20 forward (5) 1508:16;1509:6;1510:10;1521:20;1573:5	G	gauge (14) 1522:14;1523:1,11;1554:14;1555:12;1566:9,11,13,14,15,18,20;1567:5;1576:21 GARNET (9) 1499:9;1511:1;1513:12,13,19;1527:2;1571:21;1573:17,18 geared (1) 1505:11 general (3) 1524:22;1525:4;1531:5 generally (3) 1525:1;1554:12;1555:6 generating (1) 1523:3	habitat (2) 1504:7,19 habitats (1) 1503:20 half (8) 1511:10;1513:4,7;1519:20;1520:5,7;1524:19;1545:3 HARRISON (3) 1565:21;1585:2;1588:8 head (3) 1545:10;1550:17;1594:17 heads (1)	H

1574:3 highest (2) 1509:1;1547:10 highlight (1) 1506:14 highly (2) 1526:24;1535:19 highway (2) 1541:3,3 hold (1) 1546:9 holes (1) 1575:9 homogenous (2) 1592:6,7 honestly (4) 1521:7,24;1555:20; 1569:5 hottest (1) 1540:13 hours (2) 1528:23;1575:14 huge (4) 1516:11;1538:21,22; 1573:3 hugely (2) 1536:9;1538:22 hundreds (1) 1536:5 Hyatt (1) 1501:8.5 hydraulic (2) 1544:4;1569:24 hydrogeologic (2) 1520:22,24 hydrogeologist (1) 1589:2 hydrogeology (2) 1558:14;1591:5 hydrograph (5) 1552:23;1553:17; 1565:8;1576:21; 1577:16 HYDROGRAPHIC (7) 1499:7.5,8.5,9.5,10, 10.5,11.5;1533:9 hydrologic (8) 1507:10;1517:10; 1571:17;1576:19; 1577:22;1584:1,7; 1587:13 Hydrologist (3) 1500:12.5;1503:13; 1581:12 Hydrology (2) 1500:11;1586:21 hysteresis (1) 1580:1	1569:4 identified (3) 1512:15,17;1523:8 ignored (2) 1535:12;1549:19 imbalance (1) 1592:2 impact (4) 1505:13;1520:24; 1573:24;1584:9 impacts (2) 1510:22;1573:12 impedence (2) 1516:12,22 implication (1) 1570:21 implicit (1) 1505:3 implied (1) 1539:16 implies (1) 1504:10 importance (1) 1579:18 important (13) 1509:6;1511:13,14; 1523:11;1524:12; 1528:16;1530:24; 1550:7;1551:14; 1567:1;1578:11,16,17 impossible (1) 1567:3 inaccurate (1) 1529:15 inappropriate (1) 1584:10 inch (3) 1530:13;1551:8; 1569:1 inches (4) 1547:20,21;1548:14; 1551:7 incident (2) 1539:12,13 include (6) 1523:2;1533:15,21; 1566:19;1572:1; 1581:1 included (2) 1564:18;1582:13 includes (5) 1526:1;1533:12; 1542:3;1579:16; 1596:13 including (6) 1512:18;1533:11; 1541:23;1558:19; 1563:4;1580:18 inclusive (1) 1596:13 incorporate (1) 1587:14 incorrectly (1)	1590:4 increase (11) 1511:6,17;1519:11; 1522:21;1523:5,5; 1535:8;1539:6;1556:3; 1560:6;1567:18 increased (4) 1512:5;1523:24; 1535:4,8 increases (3) 1560:2,7,8 increasing (1) 1523:8 indeed (4) 1515:13;1539:13; 1544:19;1563:19 independent (4) 1538:6;1548:3; 1563:7,9 Index (4) 1509:11,22;1510:10; 1551:13 Indians (3) 1552:12;1576:5; 1592:14 indicate (1) 1560:22 indicated (3) 1553:24;1554:13; 1555:22 indicates (2) 1511:17;1547:16 individual (2) 1504:10;1531:20 induced (1) 1525:7 induces (1) 1542:11 industrial (2) 1557:1;1569:2 Industries (1) 1587:24 inferences (1) 1593:24 infiltrates (1) 1531:8 inflow (6) 1518:16,21;1525:7; 1544:2;1572:20; 1594:7 influence (2) 1553:18;1587:9 information (8) 1554:18;1562:1; 1564:22,24;1569:23; 1574:20;1586:21; 1587:8 initial (6) 1532:18;1539:10; 1543:4;1579:24; 1589:12;1594:21 initially (3) 1532:17;1535:18;	1542:9 inn (1) 1573:10 installation (1) 1512:6 instead (1) 1505:20 in-stream (1) 1506:1 intended (1) 1531:19 intents (1) 1534:15 inter-basin (1) 1540:18 intercept (1) 1537:16 intercepted (1) 1521:13 interception (1) 1563:23 interchangeably (2) 1514:18,20 interconnected (1) 1527:3 interpret (3) 1513:14,17;1541:8 interpretation (4) 1508:15;1529:11; 1545:22;1559:7 interpreting (2) 1505:1;1529:9 interrupts (1) 1590:13 interval (1) 1530:11 introduces (1) 1531:16 investigate (1) 1574:18 investigated (2) 1549:19;1594:5 investment (3) 1529:13,22;1534:8 Investments (4) 1546:15;1575:20; 1585:17;1591:17 involved (1) 1504:24 involving (1) 1504:24 irrigate (1) 1556:21 Irrigation (10) 1501:19;1522:13; 1526:2;1556:22; 1566:2,6;1585:6; 1593:4;1594:23; 1595:2 issue (1) 1559:14 issued (1) 1564:22	issues (2) 1559:10;1583:9 <hr/> J <hr/> January (1) 1509:1 Jason (1) 1564:23 jeopardize (1) 1581:23 John (1) 1588:11 Johnson-Mifflin (5) 1534:19;1535:7,16; 1536:7;1537:11 joins (1) 1540:22 joint (1) 1503:5 Jon (2) 1500:12;1569:22 JONATHAN (3) 1502:17;1588:15,24 J-o-n-a-t-h-a-n (1) 1588:24 JOYCE (3) 1499:22;1596:4,21.5 July (4) 1547:2;1548:24; 1589:12;1591:23 jump (1) 1554:7 jumping (1) 1527:6 Justina (1) 1501:10.5 <hr/> K <hr/> Kane (46) 1510:24;1516:2,4; 1520:9,19;1521:2,6; 1527:7,10,13,17; 1538:9,13;1539:1.5,2,3; 1540:15,17,20;1541:1; 1560:20,23;1561:9,11, 16;1562:8,10,21; 1563:18,20,21,23; 1564:4,6;1565:3,7; 1571:20,22,24;1572:1, 21;1581:19;1582:5,10; 1584:8,18 Karen (4) 1501:13.5,22; 1560:17;1580:16 keep (2) 1521:22;1555:3 Kent (1) 1501:7 kick (1) 1503:9 kidding (1)
I				
idea (3) 1506:2;1513:12;				

<p>1529:1 kind (10) 1522:4;1545:17; 1561:21,22;1562:15, 16;1570:18;1584:6,7,7 King (8) 1501:19;1502:9; 1564:24;1566:4,5; 1569:7;1585:7;1593:5 KMW (1) 1520:15 KMW-1 (4) 1516:3,10;1520:14, 17 knowledge (1) 1581:15 KPW (1) 1540:22 KPW-1 (3) 1539:20;1540:12; 1564:3 Kryder (5) 1500:10.5;1502:11; 1571:15,16;1572:4 KSV (1) 1564:20</p>	<p>18,24;1514:2 later (2) 1516:13;1530:4 latter (1) 1538:6 law (3) 1535:21;1582:24; 1583:23 layer (1) 1575:6 Lazarus (1) 1557:17 Lazarus' (2) 1557:21;1558:8 lead (2) 1543:20;1569:4 leap (1) 1563:19 least (8) 1506:2;1510:24; 1511:8;1513:17; 1515:23;1520:11,12; 1563:18 leaves (1) 1546:6 legend (1) 1569:23 Legislative (1) 1596:9 less (8) 1511:10;1518:10; 1519:10;1522:19,20; 1543:1;1550:23; 1572:13 lesser (2) 1512:19;1572:11 level (23) 1508:11,12;1516:1; 1518:6,7,9;1520:14,18, 20;1521:23;1527:9; 1528:1,15;1531:17; 1535:10;1537:17; 1538:11,12;1545:7; 1553:3;1573:22; 1578:9,23 levels (52) 1504:20;1511:3,12, 21;1512:2,5,10,18; 1513:4,11,20;1515:8, 16,20,23;1516:15,17; 1517:1,14;1518:1,3,11, 12;1522:8;1525:5,24; 1526:2;1528:3; 1536:20;1537:12; 1541:20;1542:6,16; 1544:18,22;1545:6,16; 1553:22;1554:10,11; 1555:13;1563:9,14,24; 1565:2,4,7;1572:9; 1573:1;1574:3; 1578:12;1579:13 Levi (2) 1500:10.5;1571:16</p>	<p>Lewis (3) 1514:9,22;1515:3 lies (1) 1504:12 life (1) 1503:18 light (1) 1545:2 likelihood (2) 1527:12;1562:10 likely (3) 1522:24;1566:10; 1581:23 limb (1) 1523:11 limit (1) 1521:6 limited (3) 1521:2;1591:8,10 limiting (1) 1505:9 Lincoln (16) 1501:12;1538:8,11, 15;1554:22;1560:11, 18;1562:1;1564:5; 1578:7;1580:13; 1582:4,17;1583:18; 1586:5;1592:22 line (2) 1524:4;1545:18 linear (5) 1528:5;1545:9; 1579:5,9;1580:7 list (3) 1534:18;1586:8; 1590:4 listening (2) 1509:7,12 liter (1) 1539:21 literally (1) 1515:17 litigate (1) 1504:13 litigated (1) 1504:2 little (21) 1512:1,22;1513:23; 1519:7,9;1522:22; 1523:15;1526:10; 1528:4;1530:4; 1531:20;1534:14,14; 1536:20;1539:21,23; 1541:17,21;1545:14; 1554:6;1579:24 local (3) 1521:3;1574:6,8 location (3) 1516:23;1553:19; 1558:12 locations (4) 1505:13;1542:23; 1554:2;1579:6</p>	<p>logic (2) 1527:17;1563:19 logs (1) 1575:9 long (10) 1524:13;1532:7; 1535:23;1542:14; 1543:1,6,22;1550:19, 24;1573:7 long-term (12) 1503:24;1504:22; 1512:13;1538:16; 1541:18,18;1551:4,10; 1552:2,3;1567:19; 1573:12 look (6) 1540:5;1549:3; 1553:8;1562:1;1565:4; 1576:20 looked (4) 1510:1;1549:4; 1550:5;1565:7 looking (3) 1510:6;1557:16; 1562:4 looks (1) 1520:16 Los (1) 1501:9.5 lost (1) 1525:11 lot (12) 1509:11,15;1523:24; 1532:5;1536:11; 1540:9;1570:23; 1571:1;1573:6;1574:5, 7,8 lots (2) 1509:8;1594:16 Low (4) 1501:6.5;1517:10; 1536:5;1575:3 LOWER (55) 1499:6.5;1503:4; 1504:23;1505:10; 1516:3,19;1517:6,18; 1518:15,17,18,22; 1520:9;1521:17; 1522:2,15;1523:18; 1525:16;1527:8; 1532:11,20;1533:9; 1535:17;1536:24; 1537:7;1538:9,13; 1539:2,3;1540:3; 1541:15;1543:7,19,24; 1545:5;1549:24; 1557:18;1558:4; 1562:8,24;1563:15; 1569:11;1571:2,2,4,17; 1572:3;1573:14; 1578:12;1579:7; 1580:18,19;1586:22; 1587:4;1592:1</p>	<p>lowering (2) 1511:12;1520:18 lowest (1) 1508:24 Ltd (1) 1501:3 lunch (1) 1594:20</p> <hr/> <p style="text-align: center;">M</p> <hr/> <p>MacKenzie (1) 1501:13 magnitude (1) 1536:8 major (1) 1573:24 majority (1) 1544:6 makes (3) 1527:18;1533:3; 1580:6 making (1) 1563:18 manage (2) 1527:4;1571:10 managed (3) 1527:8;1539:1; 1562:8 MANAGEMENT (6) 1499:6.5;1507:17, 20;1520:10;1568:9; 1570:21 managing (2) 1538:13;1581:17 many (7) 1508:16;1509:2; 1512:21;1533:15; 1541:6,6;1576:13 map (1) 1558:11 maps (3) 1532:6;1549:20,21 marked (1) 1577:11 MATTER (6) 1499:6;1504:16; 1525:10;1529:10; 1542:16;1564:2 Maxey (3) 1530:2,8;1547:12 M-a-x-e-y (1) 1547:13 Maxey-Eakin (11) 1530:2,5;1531:12; 1532:1;1548:4,8,10,11, 15,16;1549:18 may (22) 1504:11,22;1505:2, 4,20;1510:10;1513:10, 13;1514:17;1518:22; 1526:12;1528:9; 1534:13;1542:18;</p>
L				
<p>labeled (1) 1570:13 lack (3) 1511:16;1543:8; 1554:1 lag (4) 1537:16;1539:7,7; 1580:2 Lake (4) 1588:1,5;1589:8,9 land (1) 1533:12 Lane (1) 1499:23 large (1) 1520:21 Las (14) 1501:21;1535:18; 1536:3;1537:1,8; 1552:15;1565:16; 1576:8,12;1579:1; 1584:21;1592:23; 1593:23;1594:7 last (17) 1509:7;1514:5; 1522:3;1545:14; 1551:21;1553:17; 1554:14;1555:22; 1556:2;1560:8; 1567:14,17;1568:11; 1585:16;1590:3; 1591:23;1593:18 late (6) 1512:4;1513:11,15,</p>				

1544:17;1571:5; 1572:16;1574:6; 1575:1;1581:12,12; 1583:9 maybe (5) 1521:10;1526:1; 1528:9;1531:7; 1573:20 McDonald (1) 1588:9 Meadow (3) 1517:18;1569:11; 1580:18 meadowland (1) 1533:11 mean (67) 1508:6;1509:20,22; 1511:17;1514:8; 1515:16;1516:20; 1518:22;1519:16; 1526:21;1527:16; 1530:8;1531:5;1532:4; 1533:10;1534:4; 1536:8;1537:3,19; 1538:20;1539:22; 1540:2;1541:9;1542:7; 1543:3,8,18;1547:4; 1548:18,22;1549:13; 1551:7,14;1553:4,6,7; 1554:6,8,14;1556:10; 1557:24;1558:22; 1560:7;1562:18; 1563:5;1568:7,8; 1570:17;1571:20; 1572:18;1573:6,15; 1574:1;1577:18,21; 1578:18,20;1579:22, 23;1580:1,2;1584:12, 14,15;1587:15,15,19 meaning (2) 1549:14;1580:1 means (4) 1537:19,20;1540:17; 1548:17 meant (4) 1529:1;1538:4,5; 1555:24 measured (1) 1543:17 measurements (1) 1554:13 meet (1) 1552:20 meetings (1) 1522:3 Melissa (1) 1500:7.5 members (1) 1507:6 memorandum (2) 1507:17,20 memory (2) 1537:5;1547:9	mention (2) 1521:8;1530:4 mentioned (6) 1507:11;1511:14; 1516:1;1542:13; 1573:9;1574:17 met (1) 1523:12 method (13) 1530:2,14;1531:5,9, 12,22;1532:2;1547:6, 12,13,13,17;1548:17 methodologies (1) 1531:3 methodology (8) 1530:8,16,20; 1532:7;1548:5,8,17,20 methods (9) 1529:23;1530:7,19, 20,21;1531:13,19,24; 1549:18 Mexico (1) 1507:14 MICHELINE (2) 1499:4;1500:3 Michelle (1) 1500:9 mid-2000s (2) 1519:3,21 mid-2013 (1) 1577:6 middle (6) 1512:9;1515:12; 1547:10;1561:6,14,14 midway (1) 1515:10 might (8) 1543:2;1567:24; 1568:11,19,20; 1573:11;1574:11,11 miles (3) 1570:4,8;1571:3 milligrams (1) 1539:21 mind (1) 1538:24 minor (3) 1519:23;1520:16; 1545:22 minus (1) 1570:9 minute (1) 1586:13 minutes (5) 1528:22;1546:7,17; 1576:13;1586:17 miss (1) 1558:1 mission (1) 1503:18 misunderstanding (1) 1530:20 mix (2)	1540:1,2,3 mixing (2) 1540:4;1541:10 mixture (1) 1531:11 MOA (4) 1504:3;1522:5; 1584:4;1587:5 MOAPA (19) 1499:11.5; 1501:16.5,17.5; 1503:23;1521:23; 1522:12;1534:17; 1552:12;1557:10,15; 1558:19;1559:23; 1566:14;1576:5; 1580:11;1585:24; 1586:3;1592:14,20 model (8) 1536:12;1537:4,7; 1547:14;1561:21,24; 1562:15;1587:17 modeling (2) 1563:6;1584:6 models (1) 1587:13 moderate (1) 1533:11 moisture (2) 1509:21;1510:13 Monday (6) 1555:2;1557:22,24; 1558:8;1582:19; 1583:16 monitor (2) 1579:6,13 monitoring (5) 1511:3,11;1512:12; 1513:7;1574:24 Montana (1) 1507:13 month (5) 1524:16;1559:23,23; 1560:1,1 monthly (2) 1523:17,20 months (3) 1560:3,6;1577:9 more (21) 1509:14;1511:18,24; 1513:23;1514:11,20; 1515:2;1516:13; 1519:7;1526:16; 1531:12;1532:3,5; 1542:5;1548:12; 1551:14;1553:9,9; 1570:15;1574:10; 1577:24 morning (19) 1503:11;1507:6; 1519:14;1546:21,22; 1552:19,20;1557:13, 14;1560:16,17;1566:5,	7;1576:11;1580:17; 1588:6;1591:20,21; 1594:22 Morrison (8) 1501:18;1502:7; 1557:12,15;1559:12, 18,19;1560:10 Most (12) 1511:11;1515:5; 1517:3;1537:20,21; 1542:3;1547:4; 1550:11,18;1551:3,9; 1567:1 mostly (4) 1515:4;1524:17,21; 1558:14 mountain (2) 1547:18,21 mountain-front (1) 1509:24 MOUNTAINS (2) 1499:8.5;1571:22 mouth (2) 1539:5;1563:17 move (3) 1506:7;1556:7,8 moved (2) 1509:13;1556:1 movement (1) 1517:15 moving (4) 1543:6;1556:5; 1563:16;1590:5 MRSA (3) 1535:10;1544:5; 1566:24 much (24) 1512:24;1513:7; 1517:8;1519:16,22; 1520:24;1522:7,7; 1527:3;1531:8; 1532:13,13;1534:13; 1537:17;1541:14; 1543:11;1550:11; 1552:21;1561:19; 1572:18;1575:5,6; 1580:23,23 MUDDY (72) 1499:11;1501:19; 1507:18,20;1511:1; 1512:12;1513:21; 1514:7,10,22;1515:10; 1516:15,18;1517:13, 17;1518:1,20,23; 1522:10,10,12,17; 1524:5,7,14,20;1526:4; 1527:1,15,23;1528:10, 17;1533:17;1535:4,15; 1537:6;1544:1,3,10,12; 1556:5,11,13,16,16,20, 23;1560:19;1562:12; 1566:2,5,9,13,20; 1567:4,11,20,23,24;	1568:3,4,6,14,15,21, 24;1573:12;1585:6; 1586:3;1593:4; 1594:23;1595:2 multi-century (1) 1573:4 multi-decade (1) 1573:4 must (1) 1506:2 MW-1 (1) 1517:21 MX-4 (1) 1579:6 MX-5 (3) 1518:20;1564:3; 1571:9 MYERS (22) 1502:3;1503:13; 1504:20;1505:22; 1506:21;1507:4,9; 1528:22;1546:4,21; 1552:19;1557:13; 1559:7,19;1560:15; 1566:5;1571:16; 1572:7;1576:11,18; 1580:16;1586:19 Myers' (1) 1503:22 M-y-e-r-s (1) 1507:9
N				
name (5) 1507:9;1534:18; 1586:8,8;1588:22 National (7) 1501:22;1542:20; 1552:9;1576:2; 1578:24;1585:21; 1592:11 NATURAL (2) 1499:2;1596:6 NCA (1) 1501:15 near (3) 1514:24;1516:2; 1522:12 necessarily (1) 1541:9 necessary (6) 1505:15;1521:23; 1527:3;1528:9;1538:7; 1574:20 need (1) 1506:1 needed (1) 1518:23 needs (5) 1506:3;1526:15; 1575:2,8;1594:4 neglect (3)				

<p>1572:20,20,22 neither (3) 1534:3;1578:19,20 NEVADA (33) 1499:1,22,5,23,5; 1501:4,7,5,11,14,15,5; 1503:14;1507:12,22; 1508:22;1510:18; 1523:8;1525:15; 1527:20;1543:13; 1545:15;1552:15; 1565:24;1569:15; 1576:8;1585:4,12; 1586:1;1592:16; 1593:2,10;1595:1; 1596:1,5,10,17 new (8) 1506:16;1507:13; 1547:14;1548:22; 1578:4,8;1586:20; 1587:7 newer (1) 1549:21 next (4) 1529:16;1534:17; 1552:7;1567:21 Nichols (3) 1530:5,7;1547:13 nine (2) 1519:6;1552:22 nineties (4) 1513:11,15,18; 1519:2 nor (4) 1534:3;1547:24; 1578:19,20 North (14) 1501:21;1510:22; 1516:4;1518:9,10,22; 1526:11;1536:3,21; 1565:16;1571:24; 1579:1;1584:21; 1592:23 northern (5) 1515:20;1518:14; 1521:9,16;1571:8 note (5) 1506:11;1507:23; 1517:18;1529:7; 1590:21 noted (1) 1523:6 notes (2) 1596:11,14 number (8) 1505:22;1527:20; 1536:10;1549:2; 1559:23;1564:18; 1576:19;1591:24 numbers (3) 1508:2,5;1560:2 numerous (1) 1503:14</p>	<p>NV (1) 1501:10.5 Nye (1) 1499:23 O objected (2) 1564:7;1591:7 Objection (6) 1559:6;1581:9,11; 1583:1,5;1591:9 objections (1) 1590:22 objective (1) 1521:21 observation (4) 1516:20;1538:4; 1563:14;1572:9 observe (1) 1573:21 observed (3) 1520:7;1527:9; 1567:19 obvious (3) 1520:20;1553:9,10 obviously (2) 1519:16;1578:22 occur (10) 1509:20,23;1522:5; 1528:11;1531:2; 1534:4;1536:4,22; 1567:15;1587:19 occurred (9) 1511:6;1519:11,23; 1520:18;1528:13; 1556:5,6;1560:8; 1563:15 occurring (4) 1514:4;1553:13; 1556:22;1560:5 occurs (3) 1509:24;1514:5,15 O'Connor (1) 1501:5 OCTOBER (4) 1499:18,5;1503:1; 1596:8,18 off (10) 1503:9;1518:4,12; 1529:18,19;1531:7,7,8; 1550:17;1591:6 offer (1) 1590:23 office (3) 1504:15;1505:21; 1506:5 OFFICER (55) 1499:4;1500:3,5,8; 1503:3;1506:9;1546:6, 11;1551:18,22;1552:7, 11,14;1557:8;1559:9, 13;1560:11;1565:16,</p>	<p>19,22;1569:12,14,17; 1575:13,18,22;1576:4, 7,14;1580:10;1581:10, 14;1583:4;1584:21,24; 1585:3,8,11,14,20,23; 1587:22;1588:3; 1591:1,6,15;1592:9,13, 16,19;1593:1,6,9,12, 17;1594:15 Official (1) 1596:4 often (1) 1508:7 old (1) 1573:6 older (2) 1532:6;1549:20 oldest (1) 1540:12 once (2) 1525:22;1540:22 one (27) 1505:20;1510:4; 1515:18;1522:2; 1525:18;1528:19; 1529:4;1535:5;1536:8; 1540:11,14;1541:2; 1547:10,10,11; 1551:20,22;1555:9,20; 1563:4;1565:11; 1568:10;1575:10; 1585:16;1590:2; 1591:22;1593:18 one-to-one (3) 1556:17;1557:6; 1568:16 ongoing (2) 1506:15;1542:3 only (14) 1515:14;1516:9; 1524:10;1525:6,10; 1537:15;1543:4; 1548:4;1555:5; 1561:16;1570:9; 1573:15;1578:4,8 oOo- (2) 1499:5;1503:2 open (8) 1546:13;1569:18; 1575:19;1585:15,16; 1591:16;1593:14; 1594:15 opening (1) 1569:4 opinion (4) 1553:2;1581:19; 1582:16;1583:17 opinions (3) 1589:17;1590:9; 1594:11 opportunity (5) 1503:16;1506:5; 1507:7;1528:20;</p>	<p>1591:13 opposed (1) 1536:5 opposite (1) 1556:9 optimization (1) 1547:14 ORDER (20) 1499:16;1503:4; 1504:21;1505:1; 1507:22;1508:10; 1510:18,21;1519:5; 1535:11;1536:8; 1547:2;1562:18; 1564:7,13,15,23; 1577:1,13;1586:20 ordered (1) 1510:21 organizations (2) 1564:19,20 original (5) 1530:2;1543:14; 1548:6;1560:22; 1583:6 originally (2) 1510:21;1530:21 originate (1) 1540:17 originated (1) 1540:15 originates (1) 1521:2 others (1) 1556:15 otherwise (3) 1526:18;1572:2; 1587:9 out (18) 1519:13;1521:8,16; 1534:6,7;1536:18,19; 1537:15,21,22; 1540:24;1541:10,21; 1543:16;1557:9; 1564:2,11;1582:2 outcome (2) 1505:24;1543:8 outcomes (1) 1543:9 outcrops (3) 1509:23;1531:7,11 outflow (2) 1531:13;1532:20 outline (1) 1507:15 outlined (1) 1529:2 outside (4) 1517:19;1569:2; 1583:1,5 over (24) 1503:24;1504:5; 1507:3;1508:9,12; 1519:17,18;1522:22;</p>	<p>1524:1;1531:3; 1535:13;1540:6; 1541:2,17;1545:3; 1559:23,23;1560:1,2; 1562:20;1570:8,11; 1571:1;1588:5 overall (5) 1505:9;1515:8; 1562:18;1580:7,24 over-allocated (1) 1504:18 overlap (2) 1529:7;1540:8 P Pacific (9) 1565:20;1585:1; 1587:24;1588:4,8,10, 17;1589:5;1593:14 PAGE (11) 1502:2;1508:2,5; 1549:17;1552:22; 1553:24;1555:8; 1560:22;1561:4; 1566:22;1590:3 Pages (2) 1499:17,5;1596:13 Pahranaagat (3) 1518:17;1521:12; 1572:21 Paiute (3) 1552:12;1576:5; 1592:14 Paiutes (3) 1501:16,5;1534:17; 1558:19 Palmer (4) 1509:10,21;1510:9; 1551:13 Panaca (1) 1542:12 panel (2) 1507:6;1554:22 paragraph (3) 1561:6;1590:3,3 parallel (3) 1511:5;1538:17; 1553:11 paraphrase (1) 1508:7 paraphrasing (1) 1568:12 Park (8) 1501:22;1542:20; 1543:9;1552:9;1576:2; 1578:24;1585:21; 1592:11 part (21) 1506:3;1508:4,5; 1519:22,22;1522:5; 1527:4,8;1538:13; 1539:1;1550:5;1562:8;</p>
--	---	---	---	--

<p>1564:2;1570:22; 1571:8,23;1572:1,2; 1574:1;1577:16; 1578:18 participants (1) 1503:8 participate (1) 1564:9 participating (1) 1504:14 particular (9) 1503:19;1512:10,17; 1524:4;1540:8; 1548:19;1564:10; 1578:11;1583:9 particularly (1) 1577:17 parties (5) 1504:1;1505:5,17; 1506:13;1577:2 partly (3) 1511:24;1516:23; 1539:7 parts (1) 1573:17 pass (1) 1591:12 passing (1) 1518:23 past (1) 1504:6 path (5) 1536:13,15,20; 1537:4;1541:9 paths (2) 1540:11;1541:2 Patrick (4) 1501:23.5;1503:11; 1507:11;1586:16 Paul (2) 1501:3.5;1576:11 Paulina (1) 1588:6 PDSI (3) 1509:10,14,15 peak (2) 1553:6,7 Pederson (12) 1519:20,24;1520:1, 1,2,4,6;1543:17; 1554:5,5,7,8 people (3) 1510:2;1558:18; 1559:5 per (19) 1522:12,16,19,20,22; 1523:22,23;1524:1,16; 1528:15;1530:13; 1534:1;1536:24; 1539:21;1541:17; 1542:24;1545:13; 1547:7;1549:23 percent (13)</p>	<p>1519:6;1520:2,3; 1530:10;1537:22; 1540:7;1547:18,20; 1548:14,15,19;1570:5, 23 perfect (1) 1543:10 performed (2) 1548:2;1579:5 perhaps (3) 1508:15;1535:11,24 period (20) 1509:20;1511:9; 1512:5;1513:16; 1514:3;1515:4;1518:3; 1519:4,6;1534:24; 1541:21,23;1542:3; 1550:3,8,16,19;1565:6, 8,14 periods (1) 1550:9 permanent (1) 1503:24 permit (1) 1551:22 permitted (1) 1569:9 pervious (1) 1509:23 Peterson (12) 1501:13.5;1502:8, 15;1560:14,17; 1565:15;1580:15,16; 1581:18;1583:3,11; 1584:20 physics (2) 1539:9,11 place (2) 1582:17;1583:18 places (2) 1571:1;1573:14 planning (1) 1549:24 plant (1) 1569:10 please (4) 1506:18;1552:22; 1566:22;1588:22 plot (1) 1550:6 plots (1) 1580:3 plus (3) 1537:2;1570:9; 1571:19 point (22) 1510:5,12;1516:22; 1518:21;1519:13; 1521:4;1530:18; 1534:7;1536:17; 1537:15;1539:4; 1543:4;1545:9; 1552:22;1555:17;</p>	<p>1556:12;1564:11; 1572:14,23;1582:2; 1587:18;1594:13 pointed (4) 1536:19;1537:22; 1541:21;1543:16 points (4) 1522:4;1537:21; 1541:6;1584:4 policy (1) 1559:14 pond (3) 1515:18;1570:19; 1571:5 PORTION (8) 1499:8;1512:3; 1514:10,22;1515:22; 1571:22;1590:4,6 position (1) 1583:22 possibility (1) 1526:19 possible (4) 1526:8;1542:12; 1556:3;1567:17 possibly (5) 1514:15;1532:21; 1540:3;1556:11,19 potential (5) 1514:14;1526:13,17; 1534:6;1594:7 potentially (3) 1504:11;1505:23; 1533:19 potentiometric (2) 1515:9;1518:5 power (2) 1552:22;1569:9 practically (1) 1571:3 pre-aquifer (2) 1554:10,11 precip (2) 1548:14;1550:15 precipitation (24) 1508:18,22;1509:5, 10,15,18;1511:15; 1514:4,6;1523:6; 1530:3,10,11,14,16,22; 1531:6,14,23;1532:2,5; 1548:20;1549:20; 1550:2 pre-development (1) 1572:14 preferably (1) 1587:18 preliminary (1) 1528:12 premise (3) 1583:19,20,22 prepare (4) 1589:14,15,22; 1590:16</p>	<p>prepared (3) 1522:2;1559:8; 1591:12 present (10) 1503:16;1506:5; 1507:4,7,18;1538:11; 1554:21,24;1580:4; 1596:9 presentation (16) 1503:22;1506:12,13, 17;1507:15;1508:2; 1521:20;1528:5; 1529:3,7;1543:13; 1546:3,5;1557:16; 1559:20;1593:15 presentations (1) 1503:7 presented (15) 1510:7;1536:3; 1538:12;1539:17; 1542:20;1543:9; 1544:11;1555:1; 1566:15;1578:4,6; 1579:15;1586:20; 1587:8,10 presenters (1) 1509:4 presenting (3) 1505:1;1565:1; 1570:14 presents (2) 1505:22;1579:16 presume (1) 1549:11 pretty (6) 1507:15;1519:18; 1520:20;1539:14; 1550:11;1573:6 prevent (1) 1525:17 preventing (2) 1528:8;1562:22 previous (6) 1510:7;1514:13; 1544:15;1545:24; 1568:6;1572:24 previously (1) 1570:1 primarily (2) 1508:18;1542:8 primary (4) 1505:9;1538:8; 1567:10,12 principle (1) 1584:16 principles (1) 1542:8 prior (4) 1528:13;1550:13; 1582:2;1586:24 priority (1) 1592:3 PRISM (5)</p>	<p>1530:5,6;1532:5,7,8 PRISM-estimated (1) 1532:1 probably (16) 1514:18;1515:6; 1516:9,12,13,23; 1521:2;1522:9;1526:1; 1540:3;1541:6;1556:2; 1567:17;1575:1; 1581:1;1594:8 problem (3) 1528:23;1534:2; 1535:12 proceeding (2) 1504:14,24 PROCEEDINGS (4) 1499:14;1503:15; 1591:8,10 proceeding's (1) 1505:24 production (2) 1524:16;1543:23 Professional (1) 1500:9.5 proffered (1) 1583:7 proffering (1) 1591:4 profile (3) 1517:24;1518:4; 1539:6 prohibited (1) 1504:9 project (2) 1581:19,23 propagate (2) 1520:19;1571:11 proposal (2) 1533:21;1564:6 proposed (1) 1594:2 protect (5) 1505:17,24;1506:1; 1558:6;1581:3 protecting (5) 1505:11;1528:10; 1567:8;1572:14; 1581:7 protection (2) 1503:19,23 prove (2) 1512:20;1537:11 provide (4) 1503:21;1517:16; 1535:2;1569:23 provided (5) 1506:13;1529:5; 1545:7;1569:24; 1587:16 providing (1) 1516:11 provisional (3) 1519:14,16;1544:19</p>
---	---	--	--	--

<p>PUBLIC (3) 1499:15;1596:11,14 published (1) 1535:22 pull (3) 1511:23,23;1515:18 pulled (1) 1534:7 pulling (1) 1538:1 pump (39) 1508:10;1511:9; 1514:24;1515:9; 1516:11;1517:19; 1518:3;1519:5,7,23; 1520:8,19;1535:23; 1538:1,17;1539:4; 1554:2,4;1556:20; 1562:2,18;1564:11,15; 1571:9;1574:1,2,3; 1577:9;1579:8,12,17, 20;1582:2;1583:24; 1586:19,20,24;1587:6, 8,15 pumpage (8) 1523:14,15,15,20; 1525:6;1528:9;1556:3; 1567:18 pumped (12) 1504:22;1505:3,4; 1524:10;1526:14,21, 21;1527:12;1557:1; 1561:17;1562:10; 1568:14 pumpers (1) 1504:10 pumping (114) 1504:19;1505:6,10, 13,23;1506:2;1510:19, 22;1512:23;1513:12, 13,19;1514:15;1515:7, 16;1520:7;1521:5,15, 21;1523:4,16,16,22; 1524:2,5,7,8,12,14,18, 18,21;1525:1,2,9,10, 12,16;1526:3,9; 1527:11,16,17,21,24; 1528:2,11,13,14; 1535:9,11,14;1537:12, 20,23;1541:15,16,19; 1542:4,9,9,15,17,22,23, 23;1543:7,11,19; 1544:9;1545:1,3; 1550:13;1553:12,17, 21;1555:10,13,17; 1556:1,8,10,15;1558:4; 1560:5,9,20,23;1561:9, 11,15,19;1563:15; 1564:2,3,14;1566:23; 1567:3,4,15;1568:24; 1569:4,9;1572:12,23; 1573:10,13;1577:1; 1582:11;1583:13;</p>	<p>1584:1,9,14,17 purpose (3) 1581:3,13;1596:10 purposes (4) 1520:10;1534:15; 1557:1;1591:8 put (3) 1555:20;1564:6; 1576:18 P-values (1) 1537:14</p>	<p>1504:13;1532:16; 1535:9;1541:10 ratio (2) 1536:16;1568:16 reach (2) 1518:19;1572:12 reached (7) 1505:7;1506:16; 1511:22;1522:21; 1525:8;1556:15; 1580:21 reaction (1) 1580:23 read (5) 1515:13;1521:10; 1532:17;1548:7; 1558:15 readable (1) 1515:14 reading (5) 1509:8;1540:7,8; 1558:20,21 readings (1) 1540:9 reads (2) 1566:9;1567:17 ready (1) 1587:24 realize (7) 1507:24;1509:7,14; 1514:17;1515:12; 1523:12;1524:12 realizing (1) 1509:12 really (17) 1511:23;1513:19; 1521:13,15;1526:14; 1534:22;1536:23; 1537:2;1542:24; 1543:5,8;1545:21,23; 1550:14;1562:23; 1570:24;1586:9 realtime (1) 1554:20 reason (7) 1521:7,8,15;1540:8; 1568:18;1570:22; 1574:1 reasonable (1) 1587:12 reasonably (1) 1509:5 reasons (1) 1522:8 rebuttal (15) 1507:5,19,21; 1528:5,21;1529:2,4,6, 12;1534:17;1545:15; 1548:5;1550:5;1555:5; 1589:20 rebuttals (1) 1529:8 recall (13)</p>	<p>1536:4;1558:11,13, 20,21;1559:22; 1560:24;1562:4; 1564:8;1581:3;1582:8, 9;1587:5 receive (2) 1547:20,21 received (1) 1581:19 recent (4) 1531:13;1545:16; 1550:11;1554:13 recently (4) 1509:11,13;1514:11; 1568:7 recharge (47) 1509:9,22,24; 1510:4,8,9;1517:8; 1521:3;1525:7,22,24; 1526:2,4;1529:14,23; 1530:9,17;1531:2,15, 20;1532:10,13; 1540:15;1542:11; 1546:24;1547:7,15,17, 18;1548:3,4,11,14,15, 24;1549:7,9,10,11,22; 1566:24;1569:9; 1572:20;1573:7; 1574:7,8;1578:5 recognize (1) 1514:19 recollection (1) 1568:23 recommend (2) 1547:7;1558:4 recommendation (5) 1525:14;1526:8,22; 1545:12;1583:11 recommended (3) 1544:8;1564:18; 1574:21 recommending (2) 1526:16;1574:18 recommends (1) 1532:17 reconsideration (1) 1575:9 record (15) 1506:8;1546:16; 1550:3,8,16,19;1565:9; 1569:22;1571:16; 1572:7;1576:11; 1577:5;1586:16; 1588:23;1589:7 recorded (1) 1522:18 recover (1) 1539:15 recovered (4) 1511:9;1515:5; 1519:7;1542:1 recovery (12) 1511:16;1512:1;</p>	<p>1515:5;1519:24; 1538:23;1539:9; 1554:1,6,9;1579:17,19, 23 recur (1) 1557:5 reddish (1) 1524:7 Redirect (5) 1502:16;1546:8; 1586:12,14;1591:14 reduced (2) 1510:19;1522:8 reduces (1) 1515:18 reducing (2) 1526:17;1556:11 reduction (2) 1504:7;1553:16 Reed-Gardner (1) 1523:2 refer (5) 1514:19;1534:19; 1561:2;1570:5,6 reference (6) 1508:3;1529:3; 1534:2,3,3;1545:15 referenced (1) 1510:2 references (1) 1528:20 referring (7) 1508:4;1550:12; 1568:5;1569:2;1570:7, 10;1584:5 reflect (1) 1517:8 reflected (1) 1518:15 reflects (3) 1516:22;1517:14; 1518:14 regard (2) 1562:2;1567:21 regarding (3) 1503:4;1508:17; 1554:24 region (2) 1509:9,21 Regional (1) 1508:20 regions (1) 1509:19 regression (4) 1548:21;1579:6,22; 1580:7 regressions (1) 1579:10 Reich (1) 1578:5 rejected (1) 1533:23 relate (4)</p>
	Q			
<p>qualification (2) 1591:3,9 qualifications (2) 1590:19,22 qualified (1) 1591:8 qualitative (3) 1562:17;1563:7; 1584:13 qualitatively (1) 1563:16 quantity (3) 1504:7,22;1505:9 quick (2) 1545:14;1586:18 quickly (3) 1515:19;1527:13; 1562:11 quite (4) 1521:7,24;1534:12; 1555:19 quote (3) 1508:7;1510:23; 1543:22</p>				
	R			
<p>rainfall (8) 1510:6;1532:1; 1547:20,22;1549:21; 1550:4,16;1551:14 raised (2) 1505:17;1567:3 ran (1) 1537:7 range (10) 1524:15;1529:14,19, 20;1531:16;1546:24; 1547:8;1549:14,21; 1565:6 rate (9) 1520:4;1525:9; 1541:19;1542:15,15, 24;1543:11;1545:11; 1548:15 rates (3) 1542:19;1544:13; 1568:2 Rather (4)</p>				

<p>1512:23;1559:9,15; 1583:8 related (3) 1514:15;1549:18; 1567:2 relates (1) 1559:16 relating (1) 1567:23 relation (3) 1545:7;1552:2; 1567:8 relationship (8) 1528:6;1544:9; 1545:1,9;1579:12,23; 1594:9,10 relative (3) 1527:9;1550:8; 1570:17 relatively (4) 1520:11;1522:23; 1541:23;1571:6 relevant (2) 1506:15;1559:6 relied (2) 1547:6;1548:13 rely (2) 1503:20;1549:19 relying (1) 1563:1 remainder (1) 1521:20 remains (1) 1555:13 remarkably (2) 1557:23;1570:1 remarks (1) 1503:22 remember (11) 1521:9;1528:24; 1542:13;1547:11; 1549:2,5;1550:1; 1560:1;1577:6,9,18 removal (2) 1563:17,22 removed (5) 1542:4;1545:4,4,5; 1590:7 removes (2) 1524:21;1542:9 removing (6) 1525:3;1545:2; 1555:19;1562:19,22; 1563:11 Reno (4) 1501:7,5,11,15,5; 1596:17 repeating (1) 1510:20 repetitious (1) 1508:13 rephrase (1) 1594:24</p>	<p>report (61) 1505:14,16,19; 1507:5,16,19;1508:3,5; 1512:15,15,17;1520:3; 1521:9;1524:24; 1529:4,13,22;1532:16, 17;1533:3,6,14;1534:8, 18,18,19,22;1535:22, 24,24;1537:22;1538:8, 15;1541:14;1543:15, 22;1544:23;1545:15; 1547:3,5,16;1548:6,24; 1549:5,18;1558:2,15; 1560:22;1561:3; 1562:5,6;1563:3,5; 1577:3,13,13;1587:10; 1589:7,12;1591:23; 1593:22 REPORTED (1) 1499:21 reporter (2) 1590:13;1596:5 REPORTERS (2) 1499:21,21.5 reporting (1) 1596:10 reports (12) 1505:19;1506:15; 1507:21;1508:8; 1509:8;1550:12; 1558:9;1577:1,11,15, 23;1583:7 represent (2) 1582:10,21 represented (1) 1509:21 representing (1) 1560:17 represents (2) 1524:5,6 Republic (7) 1565:20;1585:1; 1587:24;1588:4,10,17; 1589:5 requalified (1) 1591:11 request (1) 1506:4 requirements (1) 1523:12 requires (1) 1574:10 requisite (1) 1505:17 research (2) 1510:1,3 reservation (1) 1558:19 reserve (2) 1546:7;1591:13 reservoir (2) 1544:3;1570:19 resistivity (2)</p>	<p>1555:1;1578:6 RESOURCES (7) 1499:2,3;1504:12; 1569:18;1585:15; 1596:6,6 respect (2) 1507:22;1591:2 respectfully (1) 1506:4 responded (2) 1515:17,17 response (5) 1507:21;1512:18; 1516:13;1527:10; 1590:3 responses (1) 1512:16 responsibility (1) 1504:12 responsible (5) 1516:23;1537:20,21; 1581:7,17 restate (1) 1551:1 reporting (1) 1542:18;1556:23; 1563:11 resulted (1) 1537:15 results (4) 1527:23;1562:18; 1564:14;1580:8 return (3) 1556:23;1569:3,5 reverse (4) 1527:17;1560:23; 1561:9,18 review (11) 1536:1;1547:2,5; 1548:6;1549:17; 1550:3,7;1558:8; 1562:6;1589:17; 1590:9 reviewed (3) 1547:4;1548:23; 1549:5 reviewing (1) 1550:10 Richard (1) 1501:16,5 right (39) 1504:15;1508:24; 1518:2;1519:19,21; 1524:3;1529:20; 1535:5;1544:17; 1545:20;1549:3; 1555:8;1557:21; 1560:10;1561:3; 1563:5,8;1564:13,21; 1565:12;1566:23; 1567:7;1568:22; 1577:7;1579:2; 1581:22;1582:13,21,</p>	<p>22,24;1585:16;1586:6, 10;1587:6;1591:15; 1593:13,17;1594:15,18 rights (21) 1504:17,18;1505:14, 18;1506:1;1521:24; 1522:11;1528:10,18; 1533:7;1556:4,5,6,6, 12;1567:19,24;1568:3, 15;1569:9;1583:24 rising (1) 1523:11 RIVER (99) 1499:7,11;1503:4; 1504:23;1505:10; 1507:18,20;1511:1; 1512:12;1513:21; 1514:7,10,23;1515:10; 1516:16,19;1517:13, 17;1518:1,20,23; 1520:10;1521:17; 1522:3,10,10,12,15,17; 1523:18;1524:5,7,14, 20;1525:16;1526:4; 1527:1,8,15,23; 1528:10,17;1532:20; 1533:10,17;1535:17; 1536:24;1537:6,8; 1538:10,13;1539:2; 1541:15;1543:7,20,24; 1544:1,3,10,12;1556:5, 11,13,16,16,20,23; 1557:18;1558:5; 1560:19;1562:9,12,24; 1563:16;1566:9,13,20; 1567:4,11,20,23; 1568:1,3,4,6,14,15,22, 24;1571:17;1572:3; 1573:12,14;1578:13; 1579:7;1580:19; 1586:22;1587:4; 1592:1 rivers (1) 1557:5 Robison (2) 1501:6,7 rock (5) 1509:24;1516:6; 1520:21;1531:8,9 room (2) 1504:1;1507:7 Ruling (1) 1563:2 run (3) 1561:21,24;1562:15 running (2) 1504:13;1508:21 runoff (5) 1509:19,20,23; 1510:3;1549:20 runs (2) 1531:7,7</p>	<p style="text-align: center;">S</p> <p>same (16) 1513:22;1529:9; 1531:23;1539:15; 1541:8,9,12,12; 1542:23;1543:14; 1545:21,22;1548:17, 21;1550:20;1551:4 satisfied (1) 1510:21 saturated (3) 1573:16,16;1575:4 save (2) 1503:18;1505:15 saw (1) 1550:5 Sawyer (3) 1536:2,18,18 saying (4) 1520:22;1540:14; 1555:6;1574:1 scatter (2) 1580:3,6 scenario (1) 1543:10 scenarios (3) 1542:22;1543:1,4 schedule (1) 1594:19 scheduling (1) 1594:22 Schreck (1) 1501:8,5 Schwemm's (1) 1559:20 science (2) 1554:19;1592:4 scientific (1) 1505:1 scientifically (1) 1532:3 scope (3) 1583:2,6;1591:3 Scott (1) 1510:3 seasonal (5) 1508:23;1512:21,24; 1514:12,14 seasonally (1) 1513:1 second (6) 1508:5;1519:22; 1520:16;1533:3; 1555:9;1566:23 Secondary (4) 1525:22,24;1526:4; 1566:24 Section (8) 1500:8,11;1504:3, 21;1508:9;1528:5; 1529:2;1561:2</p>
---	---	---	--	---

securing (1) 1503:24	several-foot (1) 1515:14	significantly (3) 1525:11;1528:12; 1567:16	soil (3) 1509:15;1510:13; 1531:7	1510:17,22,23;1511:4, 8;1512:3,9;1515:10,12, 20,22;1517:1,12;
seeing (28) 1508:14;1552:8,11; 1559:22;1560:1; 1565:19,22,24; 1569:14,17;1575:22, 24;1576:4;1580:11; 1584:24;1585:3,4,14; 1586:1;1592:10,13,19, 20;1593:2,6,12,17; 1594:16	Severity (4) 1509:10,22;1510:9; 1551:13	similar (9) 1521:15;1531:13; 1541:4;1548:8; 1553:14,14;1563:19; 1573:13,21	solids (1) 1539:20	1518:15,16,19,21; 1520:2,5,6,12,19; 1521:3,5,6,9,10,14,16; 1524:5,6,7,8,14,18,20; 1525:11;1526:1,5,9; 1527:1,10,22,23; 1528:1,2,6,7,12; 1529:21;1530:1;
seem (1) 1544:17	shadscale (1) 1534:14	simple (3) 1503:18;1507:15; 1564:1	somehow (1) 1536:12	1532:14;1534:1,4,8,9, 11,16;1535:4;1538:2; 1540:1,2;1542:5,19; 1543:17,21;1544:2,3, 10;1546:14;1549:1,22; 1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17
seems (5) 1527:12;1528:15; 1553:9;1571:3;1574:3	shakes (1) 1594:17	simply (1) 1545:6	someone (2) 1542:13;1565:9	1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17
segmented (1) 1539:19	shape (1) 1587:9	simulates (1) 1509:16	somewhat (1) 1572:13	1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17
semblance (1) 1525:9	Sharp (1) 1501:6	simulations (1) 1542:20	somewhere (4) 1509:3;1523:7; 1540:20;1558:2	1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17
Senior (4) 1500:12,5;1505:14, 18;1568:15	Sheep (7) 1529:14,18,20; 1531:16;1546:24; 1547:8;1549:14	single (1) 1592:1	sophisticated (1) 1532:3	1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17
sense (1) 1527:18	Shorthand (1) 1499:21,5	site (1) 1580:6	Sorry (9) 1507:24;1549:8; 1550:23;1561:8; 1578:15;1582:8; 1583:16,20;1586:11	1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17
sentence (5) 1556:2;1567:17; 1590:4,6;1591:23	show (18) 1511:11;1512:13; 1513:22,24;1514:1,8; 1515:7,9;1529:21; 1533:16;1539:18; 1541:4;1543:1,9; 1544:11;1554:8; 1558:16;1570:4	six (5) 1577:22,24;1578:22; 1579:19;1590:3	sort (3) 1517:21;1527:16; 1547:9	1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17
separate (4) 1521:8,16;1541:1; 1574:6	showed (11) 1511:15;1530:20; 1531:18;1535:2; 1543:13,15;1548:24; 1554:5;1558:11; 1562:20;1563:10	sixth (1) 1507:11	sound (3) 1547:22,23;1577:6	1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17
separated (1) 1526:12	showing (5) 1533:3,18;1540:24; 1545:3;1570:22	slide (20) 1513:17;1515:7; 1520:17;1528:19,24; 1545:14;1546:2; 1548:5;1552:23; 1554:3;1555:20; 1557:16;1562:7; 1566:8,22;1567:3,13, 14,23;1569:22	source (3) 1524:24;1531:23; 1574:6	1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17
served (1) 1537:5	shown (12) 1512:9;1513:23; 1523:14;1532:5; 1535:5;1537:7; 1540:12;1544:16; 1545:24;1554:2; 1555:19;1577:16	slides (5) 1525:15;1529:16; 1552:22;1553:24; 1559:22	sources (2) 1523:20;1539:19	1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17
serves (4) 1547:9;1558:12,18, 24	shows (17) 1508:22;1511:16; 1522:4;1523:15; 1528:6,7,19;1529:22; 1534:8;1538:15; 1544:23;1545:1,7,10; 1551:15;1552:23; 1584:13	slight (12) 1509:2;1513:14,18; 1514:1,3,6,11;1551:10; 1553:21,22;1554:9,9	south (3) 1510:24;1516:18; 1536:19	1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17
Service (17) 1501:22;1541:13; 1542:20;1543:9; 1552:8,9;1558:22; 1559:20;1575:24; 1576:2;1578:24; 1579:1;1581:7,22; 1585:21;1592:10,11	shrub (1) 1533:12	slightly (5) 1506:12;1519:10; 1524:15;1553:5,6	southeast (3) 1511:1;1515:22; 1516:16	1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17
Services (1) 1504:3	side (6) 1524:3;1529:19,20; 1532:14;1535:5; 1549:14	slowly (1) 1507:23	southern (15) 1508:21,22;1511:4, 8;1512:2,9;1516:2; 1518:19;1521:14; 1523:7;1543:13; 1552:15;1576:8; 1586:1;1592:16	1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17
SESSION (2) 1499:17,5;1503:1	significance (1) 1551:6	slug (1) 1510:4	speak (1) 1507:23	1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17
set (1) 1587:14	significant (5) 1515:6;1528:14; 1537:16;1538:19; 1543:15	slugs (1) 1510:8	species (5) 1503:19;1504:8; 1505:8;1582:18; 1583:19	1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17
seven (2) 1504:3;1546:17	significantly (3) 1525:11;1528:12; 1567:16	small (4) 1508:14;1512:20; 1531:15;1572:16	specific (2) 1531:6;1559:16	1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17
seventh (1) 1507:12	SNWA (8) 1501:3;1544:8; 1555:20;1576:19; 1579:1,5,15;1580:3	SNWA's (6) 1543:18,22;1544:23; 1545:4;1550:6; 1576:18	specifically (7) 1529:13;1531:9; 1544:24;1547:11; 1549:4;1558:13; 1579:5	1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17
several (12) 1512:16,18;1514:5, 23;1515:21;1516:7,13; 1521:19;1541:21; 1542:21;1544:12; 1545:24	SNWA (8) 1501:3;1544:8; 1555:20;1576:19; 1579:1,5,15;1580:3	SNWA's (6) 1543:18,22;1544:23; 1545:4;1550:6; 1576:18	spell (1) 1588:23	1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17
	ss (1) 1596:1.5		spot (1) 1594:8	1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17
	staff (3) 1569:19;1585:15; 1593:19		SPRING (107) 1499:7,5;1508:12;	1555:10,11,18;1558:6; 1560:19,20;1561:10, 17;1562:8,12;1563:22; 1564:5;1565:3;1567:1, 4,16;1568:14,22,24; 1569:10;1571:8,20,20; 1573:10;1574:9,22; 1575:20;1578:9; 1579:7;1584:14,15,16; 1591:17

stakeholder (2) 1507:21;1529:3	20;1545:17;1546:1; 1572:9,12,19,24,24	1507:17;1558:9; 1577:2,2,15,23	1525:21;1526:2; 1532:17,23;1533:10; 1543:18;1547:16	Taggart's (2) 1568:10;1583:5
stakeholders (1) 1529:8	steep (3) 1570:24,24;1571:3	subsequent (1) 1508:10	suppose (1) 1571:23	talk (3) 1523:14;1530:3; 1536:11
stand (1) 1540:24	steeper (1) 1518:15	substantial (4) 1511:8;1586:20; 1587:7,16	sure (8) 1512:20;1513:19; 1537:5;1538:3,4; 1551:2;1574:14; 1582:1	talked (1) 1570:13
start (11) 1510:14;1528:15,21; 1538:20;1546:14,23; 1587:24;1591:17; 1594:22,24;1595:3	stems (1) 1521:18	substantially (4) 1511:18,23;1517:2; 1574:3	surface (7) 1504:17;1505:14,18; 1515:9;1518:5;1523:1; 1566:10	talking (6) 1551:7,7;1559:12; 1562:18;1567:15; 1574:22
started (5) 1565:9,10,11,13; 1588:4	stenotype (2) 1596:11,14	substantive (1) 1506:16	swear (1) 1506:18	TDS (1) 1540:7
starting (5) 1503:8;1514:2; 1539:24;1551:11; 1588:1	Stetson (5) 1534:3;1547:6; 1548:13;1549:7,17	subsurface (1) 1544:2	surprise (1) 1581:21	Tech (1) 1542:21
starts (1) 1526:14	Steve (2) 1501:19;1566:5	sufficient (2) 1561:23;1567:11	Survey (1) 1554:19	technical (3) 1504:24;1507:17,19
STATE (43) 1499:1;1500:5,6,5; 1503:14;1504:15; 1505:21;1506:4; 1507:12,22;1510:18; 1522:2;1523:19; 1525:15;1527:21; 1535:24;1541:15; 1544:15,16,20;1563:1; 1564:7,14,16,17,22,23; 1570:1;1571:19; 1572:2,9,12,19,24,24; 1574:11;1576:24; 1577:12;1583:12; 1588:22;1589:1; 1594:2;1596:1,5	stipulated (1) 1584:4	suggest (5) 1516:4;1517:7; 1549:23;1551:10; 1594:1	sustainability (1) 1549:24	telling (2) 1575:5;1583:15
stated (5) 1535:1;1548:5; 1558:18;1571:19; 1593:22	stipulation (4) 1582:3,12,13; 1583:17	suggested (3) 1521:10;1526:7,13	sustainable (1) 1526:10	tells (1) 1530:14
statement (8) 1514:13;1554:17; 1558:1;1561:7;1567:7; 1578:2,4,7	stopped (1) 1580:22	suggesting (4) 1544:20;1556:9,10; 1574:4	sworn (5) 1506:19,23;1588:12, 13,17	temperature (1) 1509:16
statements (1) 1525:20	storage (9) 1524:22;1525:3; 1538:1;1542:4,9; 1545:2,4,5;1555:19	suggestion (1) 1574:11	Sylvia (1) 1588:8	temperatures (4) 1510:11;1541:4,7,12
states (5) 1507:13;1545:16; 1549:18;1552:8; 1592:9	stream (1) 1578:23	suggests (3) 1517:9;1537:18; 1548:15	SYSTEM (55) 1499:7;1503:5; 1504:23;1505:10; 1520:10;1521:17; 1522:3,16;1523:18; 1524:9;1525:8,16; 1527:8;1532:20,24; 1533:10;1535:17; 1537:1,8;1538:10,14; 1539:2;1541:1,15; 1542:11;1543:7,20,24, 24;1544:5,7,15,16; 1557:19,22;1558:5; 1562:9,24;1563:16; 1571:18;1572:3; 1573:14,18;1578:13; 1579:7,17,19;1580:20; 1586:22,24;1587:4,10, 13,16;1592:1	ten (7) 1504:4;1513:1; 1536:14;1547:20,21; 1548:7;1570:4
Stating (1) 1552:14	stress (2) 1587:16,17	Suite (1) 1499:23	T	tend (2) 1514:20;1583:4
station (1) 1523:3	structural (1) 1520:23	Sullivan (5) 1500:6;1502:12; 1572:6,7;1574:13	table (7) 1529:20;1533:13; 1534:7;1537:13; 1544:11;1547:15,16	ten-foot (1) 1514:12
statistical (3) 1538:7;1579:4,11	structure (1) 1520:22	summarize (1) 1507:16	tables (1) 1540:5	ten-mile (2) 1570:12,12
statistically (1) 1537:16	stuck (1) 1558:13	summarizing (1) 1590:19	Taggart (17) 1501:3,3,3,5;1502:6, 14;1552:18,20;1557:7, 8;1568:12;1576:10,12, 15,17;1580:9;1583:1; 1592:18	ten-minute (1) 1575:15
steady (20) 1513:10,10,17; 1514:11;1519:10,10, 19;1522:23;1524:15; 1541:20;1544:15,16,	study (7) 1517:19;1526:15,22; 1574:10,18,21;1594:12	summary (3) 1507:19;1589:16; 1590:9		tens (1) 1515:21
	sub-basin (1) 1549:11	summer (1) 1522:3		tenth (1) 1570:5
	sub-basins (4) 1529:23,24;1531:15; 1549:16	summers (1) 1522:3		tenths (1) 1551:8
	sub-bullet (1) 1555:9	Supervising (1) 1500:9.5		ten-to-one (1) 1536:15
	subdivision (1) 1531:16	Supervisor (1) 1500:14		term (5) 1543:6,23;1550:19, 24;1567:23
	subdivisions (1) 1531:21	supplied (1) 1562:2		termination (1) 1506:6
	subject (1) 1526:22	supply (2) 1504:1;1522:17		terms (1) 1579:22
	subjective (1) 1505:2	support (10) 1521:23;1525:23; 1526:6,20;1533:1; 1537:6;1545:12; 1561:22;1562:16; 1584:8		test (52) 1508:10;1510:19; 1511:9;1512:6;1513:6; 1514:24;1515:4,9,24; 1516:11;1517:19; 1518:3,7;1519:5,7,23; 1520:3,8,19;1522:7; 1523:24;1524:1,17; 1535:8,9,23;1538:18;
	submitted (6)	supported (2) 1538:12;1592:3		
		supports (7)		

1539:4;1554:2,4,10,11; 1562:3,19;1564:12,15; 1571:9;1574:1,23; 1577:1,9;1579:8,12,18, 20;1582:2;1586:20,20; 1587:1,6,8,16 testified (5) 1506:24;1568:1; 1581:2;1583:15; 1588:18 testifying (1) 1567:22 testimony (11) 1505:12;1554:1,21, 24;1555:7,23;1557:22; 1558:8;1582:15,22; 1583:6 Tetra (1) 1542:21 Thanks (2) 1551:3;1574:13 Theis (2) 1584:7,10 thereby (1) 1572:14 therefore (1) 1574:5 Therese (2) 1501:20,21 thick (1) 1517:22 thinking (1) 1572:8 third (2) 1527:6;1533:6 Thomas (1) 1534:2 though (5) 1514:5;1552:1,21; 1558:16;1581:21 thought (5) 1509:11;1555:5; 1567:21;1568:19; 1580:4 thousand (3) 1523:9;1534:1,5 thousands (1) 1536:5 three (6) 1507:13;1517:20; 1520:7;1529:24; 1548:12;1553:10 throughout (10) 1511:21;1515:19; 1534:19;1544:5; 1549:12,13;1557:18, 22;1563:15;1570:2 throw (1) 1507:24 thus (14) 1504:9;1505:7,10; 1511:22;1531:16; 1532:9;1533:18,19,21;	1545:11;1553:7; 1562:21;1575:8; 1584:17 tick (1) 1551:15 Tim (2) 1500:4,5;1501:5 times (8) 1508:16,19;1509:2; 1516:7,13;1521:19; 1536:14;1548:12 tiny (1) 1534:14 title (1) 1589:1 titled (1) 1507:19 today (14) 1503:8,13,16; 1506:12,17;1546:17; 1565:1;1581:2;1583:6, 12;1588:11;1589:4,8; 1594:21 TOM (4) 1502:3;1503:13; 1506:21;1507:9 tomorrow (5) 1594:20,22,23,24; 1595:3 top (2) 1550:17;1553:8 total (7) 1522:11;1523:16,16, 22;1530:10;1539:20; 1542:23 totally (1) 1544:7 toward (1) 1505:11 track (1) 1555:3 tracks (1) 1509:15 TRANSCRIPT (2) 1499:14;1596:12 transcription (1) 1596:14 transferring (2) 1556:3;1567:18 transition (2) 1533:21;1586:11 transmissive (2) 1526:24;1562:24 transmissivity (18) 1511:19;1516:5,6; 1518:14,18,19,22; 1520:12;1535:22; 1536:3,6,8,13,14; 1539:4;1561:23; 1571:4;1575:3 transverse (1) 1536:14 travel (1)	1541:5 treating (1) 1592:1 trend (14) 1509:2;1511:5; 1512:13;1513:15,18; 1514:2,3,4;1524:22; 1525:4;1551:11,15; 1553:4,19 trends (10) 1508:18;1510:8,16; 1512:3;1522:24; 1524:11,12;1543:15; 1566:9;1573:22 Tribe (1) 1585:24 trigger (5) 1522:4;1582:6,6,7; 1584:4 triggers (4) 1582:6,13,17; 1583:18 troubling (1) 1532:16 true (5) 1510:10;1589:16; 1590:8,18;1596:13 try (3) 1507:23;1508:15; 1559:18 Tuesday (1) 1555:4 turn (6) 1507:3;1536:9; 1552:22;1566:8,22; 1588:5 turning (1) 1550:2 T-value (1) 1537:14 two (28) 1504:6;1511:5,8; 1513:7,22;1515:7; 1516:9;1518:8;1520:6; 1522:3;1526:11; 1527:20;1528:23; 1538:21;1539:14; 1541:5,11,11;1547:17; 1554:4;1555:9;1557:5, 24;1574:5;1575:14; 1586:13;1590:2; 1593:24 two-foot (1) 1511:20 Tyler (1) 1510:3 type (2) 1510:5;1548:17 types (1) 1505:13 typo (2) 1520:16;1590:7	U ultimately (8) 1526:20;1542:18; 1544:1,21;1568:16,17; 1572:19;1573:5 UMVM (1) 1514:1 UMVM-1 (1) 1553:9 unable (1) 1536:1 under (3) 1504:8;1555:9; 1584:13 underlying (3) 1517:6;1527:1; 1575:4 understandable (1) 1558:17 understood (1) 1551:16 undocumented (1) 1535:20 Unfortunately (1) 1530:19 unit (1) 1503:6 United (2) 1552:7;1592:9 unless (2) 1528:24;1586:8 unsaturated (1) 1575:3 unsuccessfully (1) 1504:2 unsupported (1) 1533:22 unverified (1) 1535:20 up (38) 1504:19;1505:20; 1509:22;1511:22; 1513:3,4,23;1515:10; 1517:20;1518:2,12; 1520:12;1527:20; 1539:6;1540:2; 1541:10;1542:12; 1546:13;1548:22; 1551:20;1553:9; 1554:8;1556:19,23; 1564:3;1568:8,8; 1569:4,18;1570:10; 1571:11;1575:19; 1580:5;1585:15,16; 1591:16;1593:14; 1594:19 uphill (1) 1536:22 upon (4) 1503:20;1527:9; 1544:14;1594:19	UPPER (1) 1499:11,5 upstream (7) 1523:1;1524:9; 1566:10,18,20;1567:4; 1570:7 uptick (5) 1512:14;1514:6; 1515:2;1553:22,22 upticked (1) 1519:4 upward (6) 1509:2;1514:3; 1517:15,22;1551:11,15 Ure (8) 1501:20,21;1565:18; 1569:13;1584:23; 1585:10;1592:24; 1593:8 URS (2) 1562:5,6 USDOJ (3) 1512:15;1520:3; 1524:24 use (7) 1525:19;1530:14; 1532:1;1542:23; 1549:20;1568:13; 1569:2 used (17) 1526:5;1532:13; 1536:6;1542:24; 1543:14;1547:17,18; 1548:12;1549:7,7,8,9, 24;1555:21;1556:19; 1567:1,23 uses (3) 1548:13;1569:10; 1587:18 using (12) 1528:20;1531:3,13, 22;1532:6,8;1534:23; 1535:21;1543:14; 1547:14;1559:1; 1586:17 usually (1) 1508:7 utilize (1) 1530:9
V				
VALLEY (139) 1499:7,5,9,10,11,5; 1501:17,5,19;1510:22, 23,24,24;1511:1,4,8; 1512:3,9;1513:12,13, 19;1515:10,12,21,22; 1516:2,4,7;1517:2,12, 19;1518:15,16,17,19, 21;1520:9,12,19; 1521:2,3,5,6,9,10,12, 12,14,16;1524:6,8,18;				

1526:9;1527:1,2,2,7, 10,11,13,14;1529:24; 1530:1;1532:14; 1534:1,5,9,11,16; 1535:18;1537:1,9; 1538:9,13;1539:1,5,6, 23,24;1540:1,3,11,15, 17,18,20,23;1541:1; 1549:1,22;1552:16; 1557:10,15;1560:20, 23,24;1561:9,10,11,16, 17;1562:8,10,12,21; 1563:18,20,22,22; 1564:5;1565:3,7; 1566:2,6;1569:11; 1571:8,20,21,21,21,23, 24;1572:1,21,21; 1573:10;1574:9,23; 1576:8,12;1579:7; 1580:11,18;1581:19; 1584:18;1585:6; 1586:3;1592:20; 1593:4,23;1594:23; 1595:2 valleys (1) 1533:15 valuable (1) 1533:19 value (3) 1540:3;1549:24; 1551:14 values (1) 1536:4 variability (4) 1508:14;1514:14; 1515:15;1516:10 variable (1) 1523:20 variables (1) 1509:17 variation (2) 1508:23;1514:13 variations (1) 1529:10 varied (3) 1511:5;1523:20,22 varies (2) 1512:24;1518:6 variety (1) 1533:14 various (2) 1529:8,8 vary (2) 1516:10;1540:7 vastly (1) 1540:5 Vegas (14) 1501:21;1535:18; 1536:3;1537:1,8; 1552:15;1565:17; 1576:8,12;1579:1; 1584:22;1592:23; 1593:23;1594:7	vegetation (1) 1533:12 verbatim (1) 1596:10 verified (1) 1563:3 verify (2) 1528:16;1549:3 vicinity (1) 1523:7 Vidler (13) 1501:13;1538:8,15; 1560:11,18;1562:2; 1564:5;1580:13; 1582:4,17;1583:18; 1586:5;1592:22 view (3) 1553:18;1556:4; 1579:18 VIII (1) 1499:17 violating (1) 1504:11 virtue (1) 1531:10 vitae (1) 1590:14 volcanic (2) 1531:8;1571:24 VOLUME (3) 1499:17;1530:11,15	1520:20;1521:24; 1522:11;1523:1,8; 1524:21;1525:3,4,20, 22,24;1526:2,5,12,14, 18;1527:9,12;1528:1,3, 10;1533:7,22;1534:11; 1535:10;1536:19,20, 22;1537:3,6,7;1538:11, 12;1539:23;1540:1,11, 14,22,22;1542:8,9,15; 1543:13;1544:18; 1545:3,7,16;1552:15, 16;1553:3,22;1554:19; 1555:19;1556:21; 1557:10,15;1559:5; 1560:12,18,18,24; 1561:10;1562:10,19, 23;1563:9,11,14,24; 1564:1;1565:2,4,7; 1566:24;1569:1,18; 1572:9;1573:6,21; 1574:3,12;1575:7; 1576:8,9,12,13;1578:9, 12,23;1579:13;1580:5, 11;1583:24;1584:11, 13;1585:15;1586:1,3; 1588:5;1592:16,20; 1596:6 way (9) 1515:11;1527:19; 1529:16;1534:22; 1561:14,14;1562:22; 1569:24;1575:10 web (1) 1554:20 WEDNESDAY (3) 1499:18.5;1503:1; 1596:8 week (3) 1509:8;1519:18; 1555:2 weeks (3) 1504:6;1538:4,5 welcome (1) 1571:13 wells (43) 1510:17;1511:4,7, 11;1512:11,12,22; 1513:2,3,7;1514:1,7,9, 9,22,24;1515:3; 1516:9;1517:6,20; 1518:1;1524:17; 1525:19;1526:11; 1527:11;1537:13; 1538:17,21;1539:14; 1540:2,2,13;1541:11, 11;1556:1,4,15; 1559:2;1560:20; 1567:19;1573:20; 1574:24;1579:13 weren't (2) 1558:7;1583:16 West (16)	1519:2,14;1521:22; 1532:14;1541:3,3; 1542:2;1543:18; 1544:10,13,13;1545:8; 1554:14;1555:12; 1572:12;1576:21 Western (2) 1508:20;1590:5 wet (14) 1510:13;1511:13; 1512:4,16,18;1513:16; 1519:4,12;1522:21; 1541:23;1542:3; 1550:8;1578:19,20 wetland (1) 1533:19 what's (6) 1517:22;1553:2; 1554:17;1565:6; 1579:18;1581:10 whereas (1) 1554:8 whichever (1) 1530:14 WHITE (38) 1499:7;1503:4; 1504:23;1505:10; 1520:10;1521:17; 1522:2,15;1523:18; 1525:16;1527:8; 1532:20;1533:10; 1535:17;1536:24; 1537:8;1538:10,13; 1539:2;1541:15; 1543:7,20,24;1544:13; 1557:18;1558:5; 1562:9,24;1563:15; 1571:17;1572:3; 1573:14;1578:12; 1579:7;1580:19; 1586:22;1587:4; 1592:1 whole (7) 1515:19;1527:5; 1555:7;1565:14; 1574:5,7,8 Wildlife (13) 1504:3;1541:13; 1542:14;1552:8; 1559:20;1575:24; 1578:24;1581:6,16,20; 1582:5;1585:20; 1592:10 Williams (12) 1502:18;1582:16,19; 1583:15;1588:6,7,21; 1590:14,21;1591:5,12; 1593:16 Wilson (1) 1500:4.5 winter (1) 1509:4 winters (1)	1511:13 wish (2) 1542:24;1546:7 withdrawals (1) 1504:6 WITHIN (13) 1499:7;1505:4,10; 1530:11,18,22; 1535:10;1543:24; 1549:11;1559:15; 1573:14;1577:8; 1583:7 within-entitled (1) 1596:11 without (4) 1528:11;1557:2; 1567:15;1573:12 WITNESS (14) 1502:2;1503:13; 1506:18,19,22;1552:3, 5;1571:13;1574:14; 1581:16;1583:2; 1588:13,16;1591:13 wondering (1) 1572:10 woodland (1) 1533:11 word (3) 1558:15;1590:6; 1592:5 words (2) 1543:12;1556:20 worked (1) 1571:1 working (3) 1507:10,11;1587:3 wrap (1) 1594:18 written (4) 1506:5;1529:6; 1566:17;1589:8 wrong (1) 1567:24
	W			Y
	Wait (1) 1555:2 warm (14) 1510:11;1519:1,14; 1521:22;1522:6; 1542:2;1543:17; 1544:10,13;1545:8; 1554:14;1555:11; 1572:12;1576:20 WASH (9) 1499:10.5;1511:2; 1517:19;1527:2; 1533:18;1537:9; 1569:11;1571:21; 1580:19 washes (1) 1510:3 WASHOE (1) 1596:2 WATER (138) 1499:3;1501:12,5, 13,18;1504:1,12,17; 1505:14,18;1506:1; 1508:11,12;1510:14; 1511:3,12,19,24; 1512:5,10;1513:4,11, 20;1515:16,18,20,23; 1517:1,13,15,16; 1518:1,2,6,11,12,23;			

1550:11,18;1551:3,9; 1552:1;1553:17; 1560:3,8;1571:1; 1577:22,24;1578:23; 1579:19 yesterday (10) 1512:22;1513:9; 1519:14;1536:2,18; 1539:8,16;1555:3,4; 1565:10 younger (1) 1540:24	1169 (14) 1508:10;1513:6; 1519:5;1523:24; 1535:11;1562:18; 1564:7,13,15,15; 1577:1,13;1579:8; 1586:20 1169-A (1) 1564:23 12 (2) 1529:24;1549:16 12,000 (1) 1523:21 12:30 (2) 1594:24;1595:3 123 (1) 1499:23 12-month (2) 1508:21;1523:17 13 (3) 1538:5;1557:16; 1569:23 1303 (6) 1499:16;1503:4; 1504:21;1505:2; 1507:22;1547:3 136 (1) 1540:13 13-year (1) 1587:14 14 (1) 1524:10 1499 (2) 1499:17.5;1596:13 15 (9) 1529:19,23;1548:14, 15,23;1549:5;1553:24; 1554:12;1560:8 1507 (1) 1502:4 1546 (1) 1502:5 1552 (1) 1502:6 1557 (1) 1502:7 1560 (1) 1502:8 1566 (1) 1502:9 1569 (1) 1502:10 1571 (1) 1502:11 1572 (1) 1502:12 1574 (1) 1502:13 1576 (1) 1502:14 1580 (1) 1502:15 1586 (1)	1502:16 1588 (1) 1502:18 1591 (1) 1502:19 1593 (1) 1502:20 1595 (1) 1596:13 1596 (1) 1499:17.5 16 (1) 1520:17 16th (1) 1589:20 17 (1) 1541:16 18 (2) 1566:8;1567:3 1813 (1) 1518:7 1814 (1) 1518:6 1820 (2) 1518:6;1570:10 1870 (1) 1570:10 1895 (3) 1543:15;1550:4; 1552:3 19 (3) 1541:24;1560:22; 1561:4 1920 (1) 1522:10 1940 (1) 1523:13 1943 (1) 1522:18 1949 (3) 1530:2,8;1548:4 1960 (2) 1522:18,19 1964 (1) 1522:15 1966 (1) 1530:3 1989 (1) 1503:17 1990 (5) 1550:13,18,23; 1551:3;1552:1 1990s (4) 1512:4,14;1515:2; 1523:4 1992 (2) 1512:19;1535:23 1998 (1) 1512:19	1499:18.5;1503:1; 1554:12 2,000 (3) 1517:5;1565:9,10 20 (5) 1530:13;1540:7; 1547:21;1548:14; 1570:8 200 (6) 1512:10;1516:19; 1517:6;1518:11,13; 1575:5 2000 (1) 1523:21 2000s (1) 1511:5 2001 (2) 1530:6;1534:2 2002 (1) 1509:1 2004 (1) 1530:6 2005 (10) 1509:1;1511:7; 1512:5,14,19;1515:2; 1522:21;1523:5; 1524:9;1565:11 2006 (4) 1519:4;1562:5; 1564:4;1587:14 2007 (1) 1565:14 2008 (1) 1512:6 2010 (7) 1509:3;1523:6,21; 1535:5;1551:9,11; 1552:1 2011 (1) 1512:19 2012 (2) 1519:8;1564:24 2013 (8) 1512:15;1520:3; 1524:24;1577:17; 1578:15,19;1579:2,14 2014 (1) 1535:5 2015 (6) 1514:2;1524:2; 1530:5,6;1541:16; 1553:6 2016 (7) 1511:10,12;1513:24; 1519:9;1525:5; 1543:16;1553:6 2017 (4) 1509:4;1511:13; 1519:12;1553:7 2018 (1) 1541:24 2018-19 (1) 1509:4	2019 (10) 1499:18.5;1503:1; 1511:14;1547:2; 1578:13;1579:16; 1589:12,20;1596:9,18 20-mile (1) 1518:5 20-something (1) 1571:2 20-year (4) 1508:23;1534:21; 1550:21;1551:5 210 (1) 1499:8 215 (1) 1499:9 216 (1) 1499:9.5 217 (1) 1499:10 218 (1) 1499:11 219 (1) 1499:12 21st (1) 1564:24 22 (1) 1566:22 23 (3) 1555:8;1562:7; 1567:13 24,000 (1) 1522:20 245 (1) 1577:12 247 (1) 1577:14 248 (1) 1577:13 25 (1) 1507:10 250 (1) 1516:17 2500 (1) 1530:17 29,000 (1) 1540:12 2nd (3) 1589:12;1596:8,17
Z				
zero (5) 1524:3;1534:9,16; 1537:16;1558:5 zone (9) 1508:22;1511:20; 1517:11;1530:13,16; 1548:20,21;1562:24; 1575:3 zones (4) 1531:14;1547:15; 1548:3,24				
0				
0.1 (1) 1570:23 0.25 (1) 1530:13 01 (1) 1551:7 02 (1) 1590:23 03 (2) 1590:24;1591:2 05 (1) 1537:17				
1				
1 (3) 1503:15;1506:7; 1591:24 1.9 (1) 1547:18 10,000 (2) 1530:15;1542:24 10:40 (1) 1575:15 100 (1) 1524:15 107 (1) 1499:23 11 (1) 1588:1 11:15 (1) 1595:5 1164 (1) 1510:21				
		2		
				3
				3 (1) 1547:2 3.2 (7) 1519:5,15;1522:6; 1572:13;1582:6,7; 1584:3 3.23 (6) 1519:15,18;1522:8; 1544:19;1554:15; 1572:17 3.4 (3)
		2 (3)		

1519:3,8,11	1576:22;1577:17			
3.6 (1)				
1542:1	6			
30 (1)				
1550:11	6,000 (3)			
30,000 (2)	1544:8;1545:12;			
1522:22,23	1547:19			
300,000 (1)	600 (1)			
1536:6	1535:13			
30-mile (2)	6254 (2)			
1515:15,15	1510:18;1563:2			
34,000 (1)	6-2-C (1)			
1522:19	1504:21			
36,000 (1)	63 (1)			
1522:16	1520:2			
37,000 (3)	6-3 (1)			
1504:17;1522:11;	1544:23			
1568:5	682 (1)			
3-9 (1)	1539:22			
1538:15				
	7			
4				
	7 (1)			
4 (5)	1576:19			
1506:7,13;1535:2;	7,380 (1)			
1550:3,16	1549:23			
4,000 (4)	7200 (1)			
1528:14;1536:9;	1523:23			
1544:8;1545:12	774 (1)			
4.9 (3)	1539:21			
1547:20;1548:13,19	775882-5322 (1)			
40 (2)	1499:24			
1535:16;1549:17				
40,000 (4)	8			
1504:16;1535:16;				
1536:9,24	8,000 (1)			
400 (2)	1524:1			
1515:21;1524:15	8500 (2)			
40-foot (1)	1558:18;1559:5			
1539:5	89706 (1)			
45 (2)	1499:23.5			
1520:2;1528:22				
46 (3)	9			
1546:7;1577:12;				
1586:17	9.2 (1)			
47 (1)	1523:2			
1577:12	92 (3)			
48 (1)	1513:16;1538:3,4			
1577:12	93 (2)			
4800 (1)	1512:19;1513:17			
1523:23	9300 (1)			
	1541:17			
5	9600 (1)			
	1523:21			
5,280 (3)				
1532:10;1547:7;				
1549:22				
50 (3)				
1517:4;1570:4;				
1571:11				
50-foot (2)				
1570:8,11				
5-7 (2)				

In The Matter Of:

*DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES*

*Vol. IX
October 03, 2019*

*Capitol Reporters
123 W. Nye Lane, Ste 107

Carson City, Nevada 89706*

Original File 100319finalWater.txt
Min-U-Script® with Word Index

SE ROA 53657

JA_18054

Page 1597

1 STATE OF NEVADA
 2 DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
 3 DIVISION OF WATER RESOURCES
 4 BEFORE MICHELINE FAIRBANK, HEARING OFFICER
 5 ---oOo---
 6 IN THE MATTER OF THE ADMINISTRATION
 AND MANAGEMENT OF THE LOWER
 7 WHITE RIVER FLOW SYSTEM WITHIN
 COYOTE SPRING VALLEY HYDROGRAPHIC
 8 BASIN (210), A PORTION OF BLACK
 MOUNTAIN'S AREA HYDROGRAPHIC
 9 BASIN (215), GARNET VALLEY
 HYDROGRAPHIC BASIN (216), HIDDEN
 10 VALLEY HYDROGRAPHIC BASIN (217),
 CALIFORNIA WASH HYDROGRAPHIC BASIN
 11 (218), AND MUDDY RIVER SPRINGS AREA
 (AKA UPPER MOAPA VALLEY HYDROGRAPHIC
 12 BASIN (219). /

13
 14 TRANSCRIPT OF PROCEEDINGS
 15 PUBLIC HEARING
 16 HEARING ON ORDER 1303
 17 VOLUME IX
 (P.M. SESSION, Pages 1597 - 1712)

18 THURSDAY, OCTOBER 3, 2019

19
 20
 21 REPORTED BY: CAPITOL REPORTERS
 Certified Shorthand Reporters
 22 BY: CHRISTY Y. JOYCE, CCR
 Nevada CCR #625
 23 123 W. Nye Lane Suite 107
 Carson City, Nevada 89706
 24 (775)882-5322

Page 1598

1 A P P E A R A N C E S
 2
 3 Micheline N. Fairbank,
 Hearing Officer
 4
 5 Tim Wilson,
 Acting State Engineer
 6 Adam Sullivan,
 Deputy State Engineer
 7
 8 Melissa Flatley,
 Chief of the Hearing Officer Section
 9 Michelle Barnes,
 Supervising Professional Engineer
 10
 11 Levi Kryder,
 Chief of the Hydrology Section
 12 Jon Benedict,
 Senior Hydrologist
 13
 14 Christi Cooper,
 Well Supervisor
 15 Bridget Bliss,
 Basin Engineer
 16
 17
 18
 19
 20
 21
 22
 23
 24

Page 1599

1 A P P E A R A N C E S
 (Continued)
 2
 3 For SNWA: Taggart & Taggart, Ltd.
 By: Paul G. Taggart, Esq.
 4 Carson City, Nevada
 -and-
 5 Tim O'Connor, Esq.
 6 For CSI: Robison, Belaustegui, Sharp
 & Low
 7 By: Kent R. Robison, Esq.
 Reno, Nevada
 8
 9 For CSI: Brownstein Hyatt Farber Schreck
 By: Bradley J. Herrema, Esq.
 Los Angeles, California
 10
 11 For NV Energy: Justina Caviglia, Esq.
 Reno, Nevada
 12 For Lincoln County
 Water District/
 13 Vidler Water Company: Allison MacKenzie
 By: Karen Peterson, Esq.
 14 Carson City, Nevada
 15 For NCA: Alex Flangas, Esq.
 Reno, Nevada
 16
 17 For Moapa Band of Paiutes: Richard Berley, Esq.
 18 For Moapa Valley
 Water District: Greg Morrison, Esq.
 19 For Muddy Valley Irrigation: Steve King
 20 For Bedroc: Therese Ure, Esq.
 21 For City of North Las Vegas: Therese Ure, Esq.
 22 For National Park Service: Karen Glasgow
 23 For Center for Biologic
 Diversity: Patrick Donnelly
 24

Page 1600

1 I N D E X
 2 WITNESS PAGE
 3 JAY DIXON
 4 Direct Examination by Mr. Flangas 1604
 5 ROBERT COACHE
 6 Direct Examination by Mr. Flangas 1605
 7 HUGH RICCI
 8 Direct Examination by Mr. Flangas 1607
 9 THE FOLLOWING QUESTIONS ARE OF THE ABOVE 3-MEMBER PANEL
 10 Cross-Examination by Mr. Herrema 1650
 11 Cross-Examination by Mr. Taggart 1654
 12 Cross-Examination by Mr. Morrison 1658
 13 Cross-Examination by Ms. Peterson 1661
 14 Cross-Examination by Ms. Ure 1666
 15 Cross-Examination by Mr. Donnelly 1667
 16 Cross-Examination by Ms. Caviglia 1670
 17 Examination by Mr. Benedict 1672
 18 Examination by Mr. Kryder 1677
 19 Examination by Mr. Sullivan 1678
 20 Cross-Examination by Mr. Taggart 1680
 21 Cross-Examination by Ms. Peterson 1682
 22 Examination by Mr. Sullivan 1685
 23 Redirect Examination by Mr. Flangas 1686
 24

1 I N D E X
2 (Continued)

3 WITNESS	PAGE
4 TODD ROBISON	
5 Direct Examination by Mr. King	1691
6 Cross-Examination by Mr. Herrema	1704
7 Cross-Examination by Mr. Taggart	1706

1 to make sure that we had our time down so that -- We had sort
2 of prepared to do a one-hour presentation with a ten-minute
3 redirect. But if I have it wrong, that's fine. We'll just
4 have to speed it up. I just want to make sure.

5 Okay, guys.
6 HEARING OFFICER FAIRBANK: Well, it looks like I
7 made a typographic error, so hopefully we can try to work
8 around it. But we'll make sure that we give everybody an
9 equal opportunity. Because all of the other participants who
10 submitted rebuttal reports were allotted two hours. And so
11 that's what happens when you give lawyers calculators.

12 MR. FLANGAS: Okay. Guys. Would you do me a
13 favor then, if you can just let us know when we're at 50
14 minutes so we don't go over our time, so we can reserve just
15 a little bit of time.

16 HEARING OFFICER FAIRBANK: We'll do that. And
17 we'll also work to accommodate. I think we can probably have
18 a little bit of time to accommodate due to that error in the
19 state hearing notice.

20 MR. FLANGAS: No problem.

21 HEARING OFFICER FAIRBANK: We didn't recognize
22 that prior to this moment. Thank you.

23 MR. FLANGAS: Thank you very much. Well, thank
24 you. Nevada Cogeneration Associates Number 1 and 2. I'm

1 CARSON CITY, THURSDAY, OCTOBER 3, 2019, P.M. SESSION
2 ---oOo---

3 HEARING OFFICER FAIRBANK: This is the
4 continuation of the hearing regarding the administration of
5 the Lower White River Flow System in Order 1303. And today
6 we are going to go ahead and hear presentations from Nevada
7 Cogeneration Associates and then from the Muddy Valley
8 Irrigation Company. And so we will go ahead and get started
9 this morning.

10 And so, Mr. Flangas, you have one hour for the
11 presentation of your evidence and testimony from your experts
12 and witnesses with respect to the Order 1303 matters. And
13 then after the expiration of the hour or if you finish
14 earlier, then we'll go ahead and open that up for
15 cross-examination.

16 MR. FLANGAS: Just for clarification, I thought
17 we had -- Yeah. I thought we had two and a half hours total,
18 so I was thinking we had an hour with a little bit of time
19 for redirect. Was I wrong on that?

20 HEARING OFFICER FAIRBANK: We divided it up in to
21 two hours.

22 MR. FLANGAS: Okay.

23 MR. COACHE: The order says two and a half.

24 MR. FLANGAS: I'm sorry. I was -- We just wanted

1 here with three witnesses that are all authors of the NCA
2 report. And we will use NCA as an abbreviation. I have with
3 me here today Mr. Hugh Ricci, Mr. Jay Dixon, and Mr. Bob
4 Coache. I'll begin with Mr. Dixon. Mr. Dixon, could you
5 tell us --

6 (The court reporter interrupts)
7 (The three witnesses were sworn in)

8
9 JAY DIXON

10 Called as a witness on behalf of
11 Nevada Cogeneration Associates, having been first duly sworn,
12 Was examined and testified as follows:

13
14 DIRECT EXAMINATION

15 By Mr. Flangas:

16 Q. Mr. Dixon, could you give us a little bit of your
17 background, please.

18 A. My name is Jay Dixon for the record. So I've
19 been a practicing hydrologist for over 25 years. I've got a
20 Master's degree in civil engineering from the University of
21 Nevada, Las Vegas. And, specifically, I've been working on
22 various projects in what is now the Lower White River Flow
23 System for about 15 years in the capacity of a consultant.

24 Q. Mr. Dixon, were you one of the authors of the NCA

1 rebuttal report in this matter?
 2 A. I was. I wrote specific sections on my own and I
 3 reviewed and contributed to all sections included in the
 4 report.
 5 Q. Did you work -- Who did you work with in regards
 6 to that report?
 7 A. Bob Coache and Hugh Ricci.
 8 Q. With regard to Mr. Coache and Mr. Ricci, did they
 9 have input in to your sections prior to becoming finalized?
 10 A. Yes, they reviewed, edited, and approved my
 11 sections as necessary.
 12 Q. And with regard to their sections, who else was
 13 involved in drafting?
 14 A. Bob Coache drafted specific sections on his own
 15 and then Hugh and I reviewed and edited as necessary.
 16
 17 ROBERT COACHE
 18 Called as a witness on behalf of
 19 Nevada Cogeneration Associates, having been first duly sworn,
 20 Was examined and testified as follows:
 21
 22 DIRECT EXAMINATION
 23 By Mr. Flangas:
 24 Q. Okay. Mr. Coache, could you give us a little bit

1 HUGH RICCI
 2 Called as a witness on behalf of
 3 Nevada Cogeneration Associates, having been first duly sworn,
 4 Was examined and testified as follows:
 5
 6 DIRECT EXAMINATION
 7 By Mr. Flangas:
 8 Q. Mr. Ricci, could you give us a little bit of your
 9 background, please.
 10 A. My background, I was the -- I worked for the
 11 Division of Water Resources -- Let me back up. I have a
 12 Bachelor of science degree civil engineering from the
 13 University of Nevada. I worked with the Nevada Division of
 14 Water Resources for 26 years from 1981 to 2006. From 1991 to
 15 2000, I was the Deputy State Engineer. And from 2000 to
 16 2006, I was the Nevada State Engineer.
 17 Q. And you heard Mr. Dixon's response with regard to
 18 how the report, the NCA rebuttal report, was prepared. Did
 19 you have input with regard to the editing and input in regard
 20 to how that final report was made?
 21 A. Yes. My role mainly was under the review and
 22 editing and suggestions dealing with some of the issues that
 23 they stated.
 24 Q. Thank you. Okay. Mr. Dixon, did you prepare --

1 of your background, please.
 2 A. Yes, sir. This is Robert Coache --
 3 HEARING OFFICER FAIRBANK: Mr. Coache, will you
 4 make sure your microphone is on.
 5 THE WITNESS: Robert Coache, C-o-a-c-h-e. I have
 6 a Bachelor of science degree in watershed science from the
 7 University of -- Utah State University. I'm also a
 8 registered professional engineer.
 9 My experience, personal experience, with the
 10 White River flow system goes back to 64-65, starting with the
 11 Division of Water Resources in '81. I have approximately 35
 12 plus years of experience in hydrology, water rights, the
 13 Lower White River Flow System, and other basins in that area.
 14 Q. (By Mr. Flangas) Could you bring the microphone
 15 just a little closer to you. That will be better. Thank
 16 you.
 17 You heard Mr. Dixon's response with regard to how
 18 the report was prepared. Is that consistent with your
 19 understanding?
 20 A. Yes, sir.
 21 Q. Thank you.
 22 ///
 23 ///
 24 ///

1 Did the team here prepare a power point for today's
 2 presentation?
 3 A. Yes, we did.
 4 MR. FLANGAS: Okay. At this time we would like
 5 to, if we could, turn on the power point, if we know how.
 6 HEARING OFFICER FAIRBANK: May need to go ahead
 7 and open or get the projector warmed up.
 8 MS. PETERSON: Just before we start the power
 9 point, because I don't want to take up too much of your time.
 10 But we, Lincoln and Vidler, have an objection to page 27, 29,
 11 30, 31, 36, and 39 of the power point because it's additional
 12 analysis and reasoning and additional opinion not contained
 13 in the reports of these experts.
 14 HEARING OFFICER FAIRBANK: Karen, can I have you
 15 do that on the record, just because I am not going to
 16 summarize -- Can you do it on a microphone so that we can
 17 make sure that those who may be appearing and attending from
 18 afar.
 19 MS. PETERSON: Okay. Thank you. Karen Peterson
 20 on behalf of Lincoln and Vidler. We would object to the
 21 power point pages 27, 29, 30, 31, 36, and 39, because they
 22 contain additional analysis, additional opinions, that are
 23 not contained in the rebuttal report.
 24 HEARING OFFICER FAIRBANK: And just so I'm clear,

1 that was 27, 29, 30, 31, 36, and 39?

2 MS. PETERSON: Yes.

3 HEARING OFFICER FAIRBANK: Mr. Flangas, do you
4 have a response?

5 MR. FLANGAS: Part of our response would be that
6 some of our power point is a response to testimony that we've
7 had in this case already and the experts in this matter have
8 heard the testimony from Vidler's experts in this case. I
9 think it's appropriate for my experts to show up at this
10 point in time and respond to the testimony they've heard in
11 this case.

12 If part of our power point responds to the Vidler
13 responses in this case, the fact that it wasn't contained in
14 our response or report is appropriate testimony. These
15 experts are here responding to testimony that occurred just
16 days ago from Vidler's own experts. That's a completely
17 appropriate response from experts in this case.

18 I don't know -- I haven't reviewed every single
19 matter. But when I went to the very first page, 27, this is
20 just a direct response to what was in Vidler's report. And I
21 don't think this is, the second bullet, was one of the
22 cross-examination questions that I asked of Vidler's experts,
23 which was the CH2M Hill report.

24 I haven't reviewed every other page. But my

1 when we get to those particular slides.

2 Ms. Peterson, your objection is noted and to that
3 extent it's sustained. However, we also recognize that the
4 power point presentation is not -- is not necessarily
5 evidence of which will be considered by the State Engineer in
6 making determinations. The State Engineer is relying on the
7 reports that have been submitted. And, again, the purpose of
8 this hearing is for the experts to provide their salient
9 conclusions and to point the State Engineer to the evidence
10 that supports those conclusions.

11 And so the weight of any that's assigned with
12 respect to the power point presentation that's been provided
13 and which will be contained within the hearing record is not
14 necessarily -- will not necessarily be given -- the State
15 Engineer will make the determination as to what if any weight
16 based upon this objection and our determination.

17 MS. PETERSON: Thank you.

18 MR. FLANGAS: If I could respond to one thing so
19 that I can put this on the record. If I understand
20 correctly, if witnesses have testified in this hearing to
21 certain points that my experts have a rebuttal point to make
22 and the State Engineer does not want to hear that rebuttal
23 point simply because it wasn't contained in earlier report, I
24 would respectfully submit that you're deciding not to hear

1 response would be if this is in response to their testimony,
2 I think my experts are perfectly appropriate to testify to
3 things that they've already testified to in this case.

4 HEARING OFFICER FAIRBANK: Mr. Flangas, so the
5 scope of the testimony and the purpose of this hearing is
6 limited to those reports and for the experts to opine and
7 provide the State Engineer with the salient conclusions of
8 the reports in which they submitted before the State
9 Engineer's office. Vidler and other participants have all
10 submitted reports. And their testimony thus far,
11 presentations to the State Engineer, have been confined to
12 those particular issues which were memorialized within their
13 reports.

14 I do find that some of these slides are beyond
15 the scope of the report that was submitted by Nevada
16 Cogeneration and Associates and I do believe that it would be
17 inappropriate and improper for that testimony to be provided,
18 as that would be supplemental to the rebuttal reports. And
19 we have precluded such analysis and testimony by other
20 participants in these proceedings.

21 So I will go ahead and limit the testimony to
22 that to which is the subject of the report that was submitted
23 by Nevada Cogeneration and Associates. For the purposes of
24 the power point presentation, we'll go ahead and address that

1 evidence from qualified witnesses that would be helpful to
2 the State Engineer to reach a decision.

3 It is my experience that especially in civil
4 matters exclusion of relevant evidence is a slippery slope.
5 So I'm just pointing out to this panel that if you decide not
6 to accept relevant evidence, especially when other witnesses
7 have already testified to certain things, you're excluding
8 evidence that could be helpful to the decision maker. And I
9 would put my objection right out there right up front.

10 HEARING OFFICER FAIRBANK: So, Mr. Flangas,
11 number one, this is an administrative proceeding and the
12 State Engineer has invited expert analysis to help inform him
13 in terms of making particular decisions with respect to the
14 management of the Lower White River Flow System. This is not
15 a civil proceeding.

16 MR. FLANGAS: Understood.

17 HEARING OFFICER FAIRBANK: So, in that particular
18 scope, it is up to the State Engineer to make a determination
19 as to what evidence is relevant. Mr. Flangas, you've had the
20 opportunity to cross-examine witnesses and address these
21 particular issues. Furthermore, you're making an assumption
22 that there may not be an opportunity to address these
23 particular issues. And those are things that are still under
24 consideration. There's been requests by participants to

1 submit closing statements and there's also been a request by
2 participants for an opportunity to submit draft orders.

3 And so on that basis there's not an ignoring or a
4 rejection of consideration of particular evidence. The
5 evidence is before the State Engineer and his staff. The
6 staff is qualified to understand and analyze the evidence
7 and to make a determination based upon the totality of the
8 information before him.

9 And so I appreciate your feedback. However, I
10 want you to understand that this is a different proceeding.
11 And so on that basis, I will again sustain the objection
12 offered by Ms. Peterson on behalf of Lincoln County and
13 Vidler and you may go ahead and proceed.

14 MR. FLANGAS: That's fine. That's fine. Okay.

15 MR. TAGGART: Excuse me. Are there any more
16 copies of the power point?

17 MR. FLANGAS: I put all the power point copies I
18 had over there.

19 MR. TAGGART: Okay.

20 MR. HERREMA: If I may. Brad Herrema on behalf
21 of CSI. We have a similar objection to one of the points on
22 slide 41 regarding the presence of faults and whether they
23 act as a conduit to flow or impediment to flow. I don't
24 believe that is in the rebuttal report either. I'll check

1 system. And at the time it wasn't really considered a flow
2 system. Even though we believed it was, we were still
3 looking at Coyote Spring Valley individually.

4 After nearly four weeks of hearings, hundreds and
5 hundreds, if not thousands, of pages of documents, a lot of
6 internal discussion between Mr. Ricci and myself, it became
7 evident to us that there was insufficient data available to
8 proceed with any action regarding the applications that are
9 before us in the Coyote Spring Valley.

10 Slide four, please. What came of those four
11 weeks of hearings was the issuance of Order 1169. And I know
12 this has been beat to death on some issues. But it basically
13 was required to pump 50 percent of the existing rights in
14 Coyote Springs Valley. It was looked at over multiple
15 basins. And, after eight years, it finally started in
16 November of 2010. And this became the largest scaled aquifer
17 test in Nevada. Tens of millions of dollars were spent on
18 this test by the participants, mainly SNWA. Hundreds of
19 thousands, if not more, data points were collected, I mean
20 some of those wells were collecting data every 15 minutes for
21 a couple of years.

22 It became clear that the responses to pumping
23 stress imposed during the Order 1169 aquifer test were very
24 apparent and significant.

1 before we get to slide 41, but I believe it is not.

2 HEARING OFFICER FAIRBANK: So I will note the
3 objection. And, likewise, if it's beyond the scope of the
4 rebuttal report submitted then we'll address that at the
5 time. But your objection is noted and we'll take that under
6 consideration.

7 MR. HERREMA: Thank you.

8 MR. FLANGAS: Mr. Dixon.

9 MR. COACHE: Actually it's going to be Mr. Coache
10 that begins.

11 Q. (By Mr. Flangas)

12 ANSWERS BY MR. COACHE:

13 Q. Okay, Mr. Coache. Thank you.

14 A. We're here to present a hearing that may be a
15 little bit shortened power point presentation to you on the
16 five matters of interest to the State Engineer. And each one
17 of those matters shown on slide two will be addressed to
18 route the presentation with regards to each of the matters
19 that we discussed.

20 About 18 years ago, Mr. Ricci and I were actually
21 sitting right where you guys are at when the original Coyote
22 Springs Valley service began. And hearings were conducted
23 for a matter for almost four weeks. And a tremendous amount
24 of water was looked at as being appropriated within this flow

1 ANSWERS BY MR. DIXON:

2 A. We're on slide five now. Jay Dixon for the
3 record.

4 So, as indicated in our rebuttal report, NCA
5 disagrees. The next two sections cover the boundary issue
6 and Item E in the State Engineer's interim order in the other
7 matters. Specifically to the boundary issue regarding the
8 Park Service's recommendation to include the entire Black
9 Mountains area basin in the LWRFS. So I'm going to walk
10 through some slides that deal with that issue and our
11 perspective on it. Specifically, obviously a big question is
12 where is the appropriate southeastern LWRFS boundary and is
13 the proposed location correct.

14 Q. Now, Mr. Dixon, in dealing with -- in dealing
15 with the boundary issues and that, did NCA prepare a rebuttal
16 report in this matter that was submitted to the State
17 Engineer?

18 A. Yes.

19 Q. Is that NCA 1, Exhibit 1?

20 A. Yes.

21 MR. FLANGAS: We would offer that exhibit at this
22 time.

23 HEARING OFFICER FAIRBANK: NCA Exhibit 1 is so
24 admitted.

1 MR. FLANGAS: Thank you.
 2 Q. (By Mr. Flangas) Go ahead, Mr. Dixon.
 3 A. And one of the things that came out of this
 4 hearing that we have taken a closer look at is the issue of
 5 pumping in the Black Mountain area and whether or not it
 6 contributes or the extent to which it may or may not
 7 contribute to effects observed at the Muddy River Spring
 8 area.
 9 Also, in explaining this issue, I'm going to
 10 touch on some geology, some map geology. This is all
 11 information that's been presented previously. However, my
 12 focus is obviously going to be in that part of Black
 13 Mountains basin.
 14 Slide six, please. All right. So this question
 15 of NCA, Nevada Cogen Associates, pumping and the extent to
 16 which it affects or may not affect the springs. The area I'm
 17 talking about, obviously, is shown in the southwestern corner
 18 of the current proposed boundary, just this little area right
 19 here. The NCA wells are shown here, the blue dots. There's
 20 also a couple of monitoring wells included in that cluster of
 21 wells.
 22 So, you know, right now, the State Engineer has
 23 included NCA pumping which averages about 1500 acre-feet a
 24 year, again, based on perfected water rights in that initial

1 Q. Is Siri helping out, Mr. Dixon?
 2 A. I guess. I don't think she's qualified though.
 3 Again, still staying on this recommendation
 4 regarding this boundary and focusing on the geologic section
 5 GG that I pointed out in the previous slide. The NCA wells,
 6 as you can see, are put right in the middle of those
 7 strike-slip faults. That's where Marty purposely sited them.
 8 And referring back to the larger question should
 9 the entire basin be included? As you continue to the east,
 10 you see a complete different map geology on this side. There
 11 is no apparent consistency in the geology on the other side
 12 of that Muddy Mountain thrust fault, at least relative to
 13 this pumping.
 14 Slide nine, please. So this is kind of zooming
 15 in on the area getting a little closer, and you're going to
 16 hear me talk about these series of wells. To the south is
 17 EBP-2. That is the third of the three pumping wells furthest
 18 to the south. It is not a very productive well. They use it
 19 sparingly. The water chemistry is a little challenged
 20 compared to the other two.
 21 And the nice thing about that is there is right
 22 within 300 feet of it was when Marty had drill rigs out there
 23 poking around trying to find the sweet spot, this is one of
 24 the first holes he drilled or oversaw, EBM-3. This has a

1 suggest pumping limit of 9318. So, if any portion of NCA's
 2 pumping should be excluded, then is this initial pumping
 3 limit maybe too high?
 4 Slide seven, please. So you've seen this several
 5 times throughout this hearing. This is the representative
 6 portion of the Rowley geologic map. The purple line drawn
 7 across here is actually a section that was included in the
 8 Page publication, Page 2011. I just added it here because of
 9 its location and proximity to the geology that has been
 10 encountered where these wells are constructed.
 11 And of specific particular interest is the
 12 presence of this extension of a Dry Lake regional thrust
 13 fault just to the west of these wells. And then as you move
 14 to the east, the geology shown here is -- of particular
 15 interest is the Muddy Mountains regional thrust. That's the
 16 south end of that thrust.
 17 These wells were purposely, intentionally, sited
 18 by Marty Mifflin. At that time in the early nineties, he was
 19 a consultant to the owners of Nevada Cogen. And he sited
 20 these wells in a perfect location, obviously, but it was
 21 intentional. He was aware of a series of strike slip faults
 22 and you can see coming off the east side of the Dry Lake
 23 Range.
 24 Slide eight, please.

1 monitoring record that goes back to 1993 and it's continuous.
 2 The problem with that record, though, is when you look at the
 3 data, it's hard -- you have to acknowledge that there appears
 4 to be some pumping influence. The company tries very hard to
 5 make sure that their water levels -- They're all recorded
 6 manually. They don't use transducers. But they try to get
 7 their levels when that well has been off for a certain amount
 8 of time. Unfortunately, when you look at that record, you
 9 can tell that hasn't always been the case. And we are
 10 acknowledging that. It's very obvious.
 11 So, moving ahead, recent -- So the next wells to
 12 the north, EBM-6, is the new well that replaced EBM-4 in
 13 2015. And then further to the north is the third well,
 14 EBM-5, which replaced EGV-3. Those wells were replaced
 15 within a couple hundred feet of each other. And the reason
 16 is because they're in carbonate rock and the chemistry is
 17 pretty tough on low carbon steel. And those casings failed.
 18 However, when we completed the wells, we converted the wells
 19 to monitoring. And, for reasons you're about to see, we
 20 waived the requirement to plug them. Because anything we
 21 pump down those wells to plug it we're going to pull out in
 22 the pumping well due to the karst features.
 23 So we did a little investigation, obviously, we
 24 spent a lot of time reviewing Marty Mifflin's work. He did a

1 very good job of documenting what he saw when he was out
2 there in the early nineties.

3 So three things that caught my attention from his
4 completion report in 1992 from the wells that we replaced.
5 He made reference to the upper 600 feet of the borehole
6 having a hang wall on the northerly trending high angle
7 fault. That's the strike-slip fault that they were
8 targeting. He saw evidence of that in his cuttings.

9 He also noted a series of high angle fractures
10 penetrated below 600 feet, abundant fractured limestone.

11 He also -- And this is really important.
12 Confirmation that he was in the fault. Bottom hole samples
13 indicated travertine and collapsing blocks, large open
14 solution structure.

15 Slide 11. So, we've been talking about this
16 carbonate rock for the last two weeks and I wanted to show
17 you a picture. The picture on the left is the well -- the
18 borehole for the well we replaced in 2015. This is -- Marty
19 couldn't see it at the time. But this is what he was
20 drilling through, large caverns, right in that strike-slip
21 fault area. That's what it looked like before we -- That's
22 what it looks like today.

23 The picture on the right is the borehole after we
24 drilled the replacement well and more modern image. Also we

1 I'm on slide 13 now. So let's take a closer look
2 at this table from their rebuttal report. This was put in
3 the appendix. So I've called out the Black Mountain area.
4 And first let me explain what these values mean, and
5 specifically the P-value. We heard a little bit about it.
6 Tim Mayer talked about it earlier and you heard Mr. Burns and
7 Mr. Drici talking about it last Friday as well. But I want
8 to try to tie this -- give it a little more color, if you
9 will.

10 So let's talk about this P-value because this is
11 very important. A predictor, which is the EH-4 water levels,
12 that has a low P-value, in other words less than .05, means
13 that changes in the predictor value, again, EH-4 levels, are
14 related to changes in responsible variable -- the response
15 variable. Sorry. In this context, the response variable is
16 pumping. Okay. P-values that are greater than .05 are not
17 statistically significant.

18 And what's interesting here, whether or not this
19 is right or not, it's significantly higher than the other
20 four basins. And that really caught our attention,
21 obviously. You heard Mr. Smith for the City of North Las
22 Vegas talk about the issues that he found in Garnet Valley.
23 Okay. We're focusing on Black Mountains area. And relative
24 contributions of observed water levels in EH-4 as a result of

1 went a little deeper, 1400 feet. This picture is from 1366.
2 That's what the carbonate rock looks like, the aquifer.

3 So, you know -- I'm on slide 12 now. And
4 regarding -- We want to -- The following slides summarize --
5 I want to be very clear about this. These slides, the next
6 series of slides, summarize our review of data and provide
7 our opinions as to how SNWA may have arrived at this
8 conclusion regarding Black Mountain area pumping and the
9 current location near these NCA wells. This is not -- We did
10 not -- This is something we weren't looking at when we wrote
11 our rebuttal report. This was made -- This was put in to
12 their rebuttal report. And the exact quote is BM-DL-2 -- And
13 I'll show you where that is in a moment -- is undoubtedly
14 within the carbonate aquifer of the LWRFS but the current
15 production wells are probably not.

16 So the next few slides just simply -- We wanted
17 to obviously in the last couple of weeks we took a closer
18 look at this and all we're doing now is stating our opinions
19 because we think it would be very helpful for the State
20 Engineer to have this information. SNWA didn't look at it
21 beyond what they have. We agree with them, we need more
22 information to confirm this. But all I'm doing now is
23 providing our opinions as to how SNWA may have arrived at
24 this conclusion. We're not speaking for them.

1 pumping from these individual basins.

2 So I want to go to slide 14, Hugh. So this is
3 right out of the SNWA rebuttal report. I apologize. I
4 forgot to put the figure caption for the plot on the right.
5 But I want to be very clear it's not Garnet Valley. It's
6 Coyote Spring Valley. So the plot on the left is the Black
7 Mountains area. And all this shows is that we're
8 examining -- they were examining a proportional response of
9 the system, EH-4 representing the system, that is the Muddy
10 River Springs area, that are attributable to pumping from
11 each individual basin. So each incremental component, this
12 is a small part of the EH-4 water levels that can be
13 attributed or correlated to pumping in the Black Mountains
14 area. Very small in comparison to pumping in Coyote Spring
15 Valley that portion of the EH-4 water level observation
16 responded fairly significantly to pumping in Coyote Spring
17 Valley.

18 Slide 15. So, again, going back, the two wells
19 that -- We took SNWA's regression analysis. I reproduced it
20 to make sure I could get the exact same results. And for
21 these two wells I did. I also took it a step further and
22 that's what I want to talk about.

23 BM-DL-2, this is not an NCA well, but this well
24 is only 3600 feet north northeast of EBM-3 down here. The

1 period of record for this well only goes back to 2002, but
2 there's several months of water levels. It's a really good
3 data set for BM-DL-2. I've already told you the issues with
4 monitoring data for EBM-3. I'm not trying to work around
5 that. It's very evident. There's noise in it and it's from
6 pumping.

7 So next slide, 16. This is my reproduction of
8 SNWA's result regression analysis on BM-DL-2 versus EH-4 .95,
9 that's the same result that they got. That's this plot on
10 the left.

11 So I took it a step further. Even though, again,
12 I'm acknowledging the pumping noise in EBM-3, especially
13 early on, the correlation to EH-4 is .52. Significant --
14 Whether or not that value is correct, it's just significantly
15 lower than BM-DL-2. These wells are only 3600 feet apart, so
16 what's going on? What is causing this response.

17 Q. Mr. Dixon, both of those wells are approximately
18 30 miles?

19 A. From EH-4, that's right.

20 Q. EH-4. But they're less than two-thirds of a mile
21 apart?

22 A. That's right.

23 Q. They're 3600 feet apart?

24 A. Correct.

1 develop that resource now.

2 This is the Las Vegas Valley -- Excuse me -- Lake
3 Las Vegas test wells that were installed in the early
4 nineties. Even though it wasn't a successful development
5 program, there's a lot of good information that came out of
6 it regarding the Horse Springs formation.

7 Slide 19. So this is another issue that we
8 identified in our rebuttal report and it's regarding, again,
9 boundary, boundary primarily, the boundary question. And
10 it's relative to Lower Meadow Valley Wash.

11 So four things I want to review real quickly.

12 Carbonate aquifer is deep. And the potential for development
13 is low. There's no effects from the LWRFS pumping observing
14 groundwater levels in that basin. Current pumping in that
15 basin is minimal. And, as Colby Pellegrino mentioned last
16 Friday for SNWA, you can't look at this boundary issues in
17 changing boundaries in a vacuum with only hydrology. There's
18 management implications to adding basin to this. And I want
19 to talk about the ramifications of inactive water rights in
20 that basin if it were to be included.

21 So this is a cross-section from some surface
22 geophysics gravity mapping that was done and reported in USGS
23 Open File Report 2006-1396. I've shown the location of the
24 current LWRFS boundary coincident with the southern end of

1 Q. So very close together but 30 miles away from the
2 other well and one of them correlates almost one to one?

3 A. Pretty close.

4 Q. And the other one significantly different?

5 A. Right.

6 Q. Okay. Thank you.

7 A. Slide 17. So this is a section from -- Now I
8 want to move beyond this boundary and talk a little bit about
9 the rest of the basin, specifically to the south, and to
10 demonstrate the significant difference in geology that
11 exists.

12 This is line HH that you see on here from Page
13 2011. And I'm extending it to the south in to the Las Vegas
14 shear zone near Lake Las Vegas. So, again, this is that
15 section HH. The NCA well is located within that strike-slip
16 fault zone. As you move to the south, we go through the
17 shear zone, Las Vegas shear zone. And then once you get in
18 to that Lake Las Vegas area, the east side of the Black
19 Mountains basin, there's a completely different geology. In
20 fact, you know, there's a formation over there that's being
21 targeted for groundwater exploration. And the thing is,
22 those water rights would have been developed years ago if
23 there were a carbonate rock aquifer there. It's not there.
24 And that's why, you know, their efforts are being made to

1 Lower Meadow Valley Wash. And our contention is carbonate
2 aquifer is very deep here. The bottom of the Cenozoic fill
3 has been estimated at approximately 5,000 feet. That matches
4 the geology interpretations as well.

5 And the point I want to make is we think the
6 State Engineer already has the authority to prevent a deep
7 carbonate production well from being constructed here.

8 As far as responses, this is the south end of the
9 basin. You see Moapa Valley here, Muddy River Spring area.
10 There are three nested monitoring wells were installed and
11 they've got a really good monitoring record. And what I'm
12 showing here is the portion of that record when the Order
13 1169 pump test occurred. And, as you can see, there's no
14 response there. This particular borehole was encountered
15 consolidated material at 1600 feet but it was only screened
16 down to 829. Again, no response from 1169 pumping.

17 Slide 22. Moving down to the south end, this is
18 a hydrograph from EH-8a, the monitoring well near the south
19 end of the boundary. And what you see here is the response
20 from intense pumping that ceased in the late eighties. That
21 response has been continuous with some cyclical variations
22 every year as you would expect.

23 This particular well is completed. It's a dual
24 completion Muddy Creek formation, which is an aquitard below

1 the sediment, alluvial sediment, in that area.
2 Slide 23.
3 Q. Again, no response?
4 A. No response. Third point here, current pumping
5 in the basin is minimal. I pulled this right out of the 2015
6 statewide pumping inventory. Even though there's 25,000
7 acre-feet of underground rights appropriated in this basin,
8 as of 2015 only about 1800 is being pumped. There's no
9 reason to include it.
10 And in terms of -- If this basin were to be
11 included, there's a substantial quantity of inactive
12 underground rights with a priority date in the 1960s. Adding
13 Basin 205 in to LWRFS would reactivate these senior rights
14 elsewhere. And right now where they're at, they're not
15 usable at their current location. The wells are shallow and
16 the water quality is pretty bad. TDS 3,000 milligrams per
17 liter. That's not usable. So that might sound like a great
18 idea, but that changes -- that really has a huge effect on
19 future management decisions if it were to be included. And
20 that's my point. This goes beyond just looking at the
21 hydrology.
22 Slide 25. And we'll turn it over to Mr. Coache.
23 ANSWERS BY MR. COACHE:
24 A. Robert Coache for the record. This part of the

1 about that there was a comment from the State Engineer that
2 there would be no effect in Kane Springs Valley for a hundred
3 years. That was discussed in our rebuttal report.
4 MS. PETERSON: If I may. The objection is to
5 that second bullet. The first bullet was in the report.
6 HEARING OFFICER FAIRBANK: I'll sustain the
7 objection as to the second bullet.
8 Q. (By Mr. Flangas) So don't talk about the CH2M
9 Hill report.
10 A. Fine. What I'm going to do at this point is just
11 pass over 29 and 30 so I can go for a little bit and then if
12 I have time at the end we can discuss those. Is that fine?
13 Okay.
14 MR. DIXON: Which slide?
15 MR. COACHE: 29 and 30. So we're on 27 right
16 now.
17 Q. (By Mr. Flangas) Mr. Coache, do you want to
18 skip -- There's no objection to 28. Do you want to use slide
19 28?
20 A. Oh, I just took out 29 and 30.
21 Q. Oh, okay. We're going to use 28?
22 A. Yes, sir. Okay. Lincoln-Vidler was asked
23 questions about this on cross. And, if I remember right,
24 they -- the response was that the basis for this finding was

1 presentation will be looking at Kane Springs Valley. And NCA
2 disagrees with the following key findings from the
3 Lincoln-Vidler report. Each one of these points we're going
4 to discuss individually.
5 26, please. Lincoln-Vidler key finding number
6 one was that the effects of pumping from Kane Springs Valley
7 would not be felt for over a hundred years. And then Lincoln
8 County makes a number of claims in their rebuttal report
9 states the following three items at the bottom that were
10 found in Ruling 5712 and Ruling 6254.
11 Go to slide 27, please.
12 MR. FLANGAS: Now, in slide 27, I would like to
13 respond to Ms. Peterson's objection. At pages 12 and 13, we
14 specifically discuss Lincoln-Vidler's comment that there
15 would be no significant effect felt for a hundred years. And
16 if the State Engineer takes a look at our report at those
17 pages, the comment was rebutted at those pages and the
18 discussion was had about that.
19 The portion of the slide that I think
20 Ms. Peterson is objecting to is the CH2M Hill report portion,
21 which is what I discussed earlier. I don't know if she's
22 objecting to the whole slide because there's that portion in
23 it. But there was a specific discussion about the fallacy
24 that the State Engineer made a determination specifically

1 the effect of -- the finding that the effect of pumping from
2 Kane Springs Valley would not be felt for over a hundred
3 years outside of the Kane Springs Valley was the result of an
4 SNWA model. However, in their report, they state otherwise.
5 And they quote specifically that the State
6 Engineer found that where no significant effects would be
7 felt for hundreds of years, the up gradient water could be
8 appropriated. And that's from pages 2-2 to 2-3 of the
9 report.
10 And, unless I've missed something, I wrote some
11 of this stuff. And to my knowledge the State Engineer has
12 never stated that Kane Springs Valley groundwater can be
13 developed because there will be no significant impact, if
14 any, from appropriation of groundwater for hundreds of years.
15 Go to slide 28, please. In fact, with all the
16 limitations that are on the State Engineer's at the time with
17 regards to legislation that hadn't been passed yet and no
18 information that was obtained from the carbonate pumpage, the
19 State Engineer still found that in Ruling 5712 that the
20 applicant's pumping, being Lincoln-Vidler, supports the --
21 pumping test supports the conclusion that there is
22 considerable potential for groundwater flow in the carbonate
23 rocks in the vicinity of well KPW-1.
24 The State Engineer also found the evidence

1 indicates a strong hydrologic connection between Kane Springs
 2 Valley and Coyote Springs Valley, specifically that
 3 groundwater flows from Kane Springs Valley in to Coyote
 4 Spring Valley.
 5 And, lastly, given the unique hydraulic
 6 connections between the Kane Springs Valley hydrographic
 7 basin and the Coyote Spring Valley hydrographic basin, the
 8 development of groundwater within the Kane Springs Valley
 9 will ultimately affect water levels and the flow in the White
 10 River regional carbonate rock aquifer system.
 11 All right. So we're blowing through the next
 12 two.
 13 Q. Did you go to --
 14 A. I didn't realize the next one was one she was
 15 objecting too also.
 16 MR. FLANGAS: 29. I don't think you're objecting
 17 to 30?
 18 HEARING OFFICER FAIRBANK: 30 and 31.
 19 MS. PETERSON: If you go through those then I
 20 have to be up here.
 21 MR. FLANGAS: 31 I have a response to as well if
 22 I could, Ms. Fairbank.
 23 HEARING OFFICER FAIRBANK: Go ahead, Mr. Flangas.
 24 MR. FLANGAS: Specifically, once again, I'm not

1 And then, yes, the last dash on the bottom of
 2 that slide, that comes from the rebuttal report of SNWA. So,
 3 of course, it would not have been in the rebuttal report of
 4 Nevada Cogen because they were submitted at the same time.
 5 MR. FLANGAS: I suggest you read it directly from
 6 our rebuttal.
 7 HEARING OFFICER FLANGAS: Just a moment.
 8 Mr. Flangas, please.
 9 MR. COACHE: Robert Coache for the record.
 10 HEARING OFFICER FAIRBANK: One moment, please.
 11 Based upon a review of the report, as well as the hydrographs
 12 and other tables contained within the report, it appears to
 13 me that the contents of slide 31 is maybe a restatement but
 14 is a summarization of those findings and conclusions set
 15 forth in the report. So to the extent the objection is that
 16 this is new analysis, I'm going to go ahead and overrule that
 17 objection and allow the content -- the experts to go ahead
 18 and provide their analysis with respect to those opinions
 19 stated on slide 31.
 20 MR. COACHE: Robert Coache again for the record.
 21 Okay. The first two bullet points are basically points two
 22 and three that we previously discussed or stated that we were
 23 going to discuss. And NCA believes that there's a
 24 discernible trend pattern in water levels over time between

1 sure about -- the comment, everything on 30 is discussed
 2 in -- pardon me -- on 31 is discussed in our rebuttal report.
 3 Specifically at pages 13, 14, 15, and 16, virtually
 4 everything on that slide is discussed in our rebuttal report
 5 almost verbatim, in fact, in some places. The fact that
 6 there were effects showing a high correlation between the
 7 carbonate wells plotted against EH-4 is at the bottom of page
 8 13. Based on this -- I'm quoting now. Based on this high
 9 correlation between EH-4 and spring discharge -- I'm looking
 10 at page 14. I'm looking also on page 15 are the hydrographs.
 11 And page 16, once again, references the high correlation
 12 between carbonate wells plotted against EH-4 with a
 13 correlation of CSVW-4 and EH-4.
 14 I'm not sure what the objection is to this. The
 15 comment at the very top, NCA believes there's a discernible
 16 trend pattern, is nothing more than a conclusion of our
 17 entire section there in the rebuttal report.
 18 HEARING OFFICER FAIRBANK: Ms. Peterson.
 19 MS. PETERSON: Thank you. The first two bullets,
 20 those opinions are not contained in the rebuttal report.
 21 Obviously, the first dash under the second bullet is
 22 commenting, I guess, on all the other reports that have been
 23 submitted related to CSVW-4 and KMV-1 and is not in the
 24 report.

1 production well KPW-1 and pumping trends. And NCA also
 2 believes that there is correspondence between the water level
 3 trends in the wells in Kane Springs Valley, northern Coyote
 4 Spring Valley, and wells located in southern Coyote Spring
 5 Valley.
 6 Additionally, SNWA, Fish and Wildlife Service,
 7 National Park Service, Center for Biological Diversity, and
 8 ourselves all found that monitor well CSVW-4 and KMV-1 showed
 9 effects resulting from the Order 1169 pump test. The values
 10 for several wells, including CSVW-4, were then plotted
 11 against EH-4 for various periods, based on the record that
 12 was available. There were high correlations between all
 13 carbonate wells plotted against EH-4 with the correlation of
 14 CSVW-4 and EH-4 resulting in the R-squared value of .82.
 15 And I do need to make a statement for the record.
 16 There seem to be some software issues on our end. Wherever
 17 in our report you see R2, lower case or regular, that's
 18 R-squared. Something happened in the conversion. So if you
 19 see R2 in our report, read it, please, as R-squared.
 20 These high correlations between carbonate wells
 21 in the Lower Right River Flow System indicate a high level of
 22 hydraulic connectivity across the basins within the Lower
 23 White River Flow System.
 24 Page 32. For example, you've seen this before.

1 I believe this was in SNWA's presentation. But this is a
2 simple scatter graph with a correlation coefficient between
3 CSVM-4 and the one I was talking about in EH-4 with the
4 R-squared value of .82.

5 Q. (By Mr. Flangas) That was also contained at page
6 15 of our NCA Exhibit 1; correct, Mr. Coache?

7 A. Yes, sir.

8 Going to slide 33. SNWA did not calculate a
9 correlation between EH-4 and KMW-1, therefore a direct visual
10 comparison of the hydrograph of CSVM-4 and KMW-1 wasn't done.
11 The visual comparison was done because at the time I could
12 not locate the data to actually do the actual analysis. And
13 I'll talk about that a little bit later also.

14 But the visual comparison found that the
15 hydrographs for CSVM-4 and KMW-1 are virtually identical with
16 an estimated R-squared value greater than .9, which indicates
17 a high correlation between KMW-1 and carbonate wells in the
18 Lower White River Flow System with a high level of hydrologic
19 connectivity across all of the basins within the Lower White
20 River Flow System.

21 34. Lincoln-Vidler also claims that there was no
22 effect ascribable to the start and stop of the Order 1169
23 aquifer test. NCA believes that the contrary is true and
24 that there is a high correlation between KMW-1 and carbonate

1 The Lincoln-Vidler groundwater rights are junior
2 in priority to approximately 98 percent of the groundwater
3 rights within the Lower White River Flow System and during
4 any curtailment of pumpage within the Lower White River Flow
5 System. Assuming that Kane Springs Valley was included, the
6 Lincoln-Vidler rights would be among the first in the subject
7 to curtailment.

8 HEARING OFFICER FAIRBANK: And excuse me really
9 quick. Just to let you know, Mr. Flangas, you're at 40
10 minutes.

11 MR. COACHE: We're at 40?

12 HEARING OFFICER FAIRBANK: Yes.

13 MR. FLANGAS: This is the next slide. Hold on,
14 Bob.

15 MS. PETERSON: So we objected to slide 36, which
16 is all new analysis as to why the inclusion of KSV is
17 important.

18 HEARING OFFICER FAIRBANK: So, based on my review
19 of the report, it appears that the first bullet point is
20 contained within the report. But based upon my review of the
21 substance of the analysis relating to the inclusion of Kane
22 Springs Valley, the second two bullet points don't appear to
23 be directly contained within the report. Mr. Flangas.

24 MR. FLANGAS: They're not essentially contained

1 wells in the Lower White River Flow System with a high level
2 of hydraulic connectivity across all of the basins within the
3 Lower White River Flow System including Kane Springs Valley.

4 Below is statements from the following agencies
5 which all make various references that are supportive to the
6 inclusion of Kane Springs Valley within the Lower White River
7 Flow System.

8 And I want to make it clear that not every one of
9 these agencies specifically state that Kane Springs Valley
10 should be in the Lower White River Flow System. But they do
11 make statements that indicate that there is a connectivity
12 between Kane Springs Valley and the Lower White River Flow
13 System.

14 The purpose of this slide is to discuss -- We've
15 been discussing item A in the State Engineer's questions.
16 And this is also going to go in to item E a little bit with
17 other things that are of interest. And the reason that this
18 is important is that in the event that Lincoln-Vidler
19 develops water from KPW-1 and the State Engineer excludes
20 pumpage from that well, from the management of the Lower
21 White River Flow System, there would be detrimental impacts
22 to existing senior right owned and controlled by NCA and
23 other senior water right holders, users within the Lower
24 White River Flow System.

1 within the report. They're an analysis. I mean, to the
2 extent that they're -- They are essentially just analysis.
3 They're not really contained in the report. They're just an
4 analysis --

5 HEARING OFFICER FAIRBANK: Can you explain to me?
6 Because this appears to me to go beyond the scope of the
7 Order 1303 limitations, which is really the scientific
8 analysis, and this seems to extend more in to the policy
9 analysis.

10 MR. FLANGAS: It's a little bit of the other
11 matters.

12 HEARING OFFICER FAIRBANK: So on that basis, on
13 the basis that both it's not contained within the rebuttal
14 report doesn't necessarily seem directly related and outside
15 of the scope, I'm going to go ahead and sustain the objection
16 as to the second two bullet points but overrule the objection
17 as to the first bullet point.

18 Q. (By Mr. Flangas) Okay. Just limit it, if you
19 would, Mr. Coache, to the very first bullet point.

20 A. And we apologize. There was a little bit of a
21 different interpretation of E on your key points that you're
22 interested in.

23 So sticking with the first bullet point, assuming
24 that the Nevada State Engineer determines that the maximum

1 long-term annual quantity of groundwater that may be pumped
 2 from the Lower White River Flow System is 9318 acre-feet.
 3 Lincoln-Vidler would maintain the right to pump 500 acre-feet
 4 from KPW-1 and an additional 500 acre-feet from a separate
 5 site in Kane Springs Valley, which equates to an additional
 6 11 percent of pumpage for a total potential of 10,318
 7 acre-feet of pumpage actually impacting the Lower White River
 8 Flow System.
 9 Slide 37, please. NCA disagrees with
 10 Lincoln-Vidler's key finding that the trend in water levels
 11 in both KMW-1 and CSVM-4 indicate that waters levels are
 12 still being affected by the 2005 precipitation event.
 13 Lincoln-Vidler well KVV-1 was completed in October of 2005
 14 and the first depth-to-water level reading was collected
 15 sometime in April, approximately sometime in April 2007.
 16 The next slide, number 38, is simply a diagram
 17 showing the area in red that encompasses -- encompasses the
 18 exceptional 2005 precipitation event. And the middle graph
 19 is the KMW-1 showing that they were unable to collect any
 20 water level samples during that period.
 21 And then I believe she objected to the next one.
 22 MS. PETERSON: She did.
 23 MR. FLANGAS: Thanks.
 24 MS. PETERSON: 39. So this slide appears to be

1 MR. HERREMA: Actually we object to both of the
 2 bullets. I don't think either of them are contained in the
 3 rebuttal report. And it's a little bit difficult to
 4 determine because the rebuttal report is framed in terms of
 5 the eight or nine conclusions. It's not really framed in
 6 terms of answers to the five questions. But I don't believe
 7 either of these two points are made in the rebuttal or these
 8 conclusions.
 9 HEARING OFFICER FAIRBANK: Thank you,
 10 Mr. Herrema. Your objection is noted and I'll go ahead and
 11 proceed with how I responded to Mr. Coache with respect to
 12 overrule the objection to the extent that those other bullet
 13 points but sustain the objection as to that which Mr. Coache
 14 is willing to go ahead and move on from. Okay. Thank you.
 15 MR. COACHE: Okay. We're on slide 39 now.
 16 Robert Coache for the record.
 17 On cross, Lincoln-Vidler stated that they
 18 determined the effects of the extraordinary 2005
 19 precipitation event on KMW-1 was made by correlating the
 20 hydrographs of CSVM-4 and KMW-1. And NCA, we agree, that
 21 there's a strong correlation between CSVM-4 and KMW-1 and it
 22 was proper for Lincoln-Vidler to determine the effects of the
 23 extraordinary event in 2005 on KMW-1 by correlating the
 24 hydrographs at CSVM-4 and KMW-1. However, a correlation

1 related to cross-examination during the hearing of the
 2 Lincoln-Vidler witnesses. And it would be, you know,
 3 inappropriate sur-rebuttal to rebuttal or sur-rebuttal, I
 4 guess.
 5 MR. TAGGART: And can I be heard on this? I
 6 mean, it's been common throughout this hearing for us to ask
 7 witnesses did you hear what so and so said yesterday and do
 8 you agree or do you disagree. So I think we're getting a
 9 little bit in to the weeds on some of these objections.
 10 HEARING OFFICER FAIRBANK: And, Mr. Taggart,
 11 thank you for your comments with respect to the objection.
 12 And based upon our analysis, while it may not directly be
 13 contained within the report, it is within the scope of much
 14 of the testimony that has been asked as these proceedings
 15 have gone on. So certainly I recognize and will assign the
 16 weight that we give to the testimony within the discretion of
 17 the State Engineer. But I'm going to overrule the objection.
 18 MR. FLANGAS: Go ahead, Mr. Coache.
 19 MR. COACHE: I was going to ask you if we can do
 20 the objection to slide 41 because I think I know the section
 21 that she's talking about. I'm going to drop that out if that
 22 will be okay.
 23 HEARING OFFICER FAIRBANK: That's fine. If
 24 you're comfortable doing that, Mr. Coache, we'll accept that.

1 between CSVM-4 and KMW-1 cannot be relied upon to determine
 2 precipitation impacts and disregard the correlation between
 3 CSVM-4 and KMW-1 when considering hydrologic impacts from the
 4 Order 1169 pump test.
 5 40. So now we're going to get in to the basis of
 6 why we're here. And these are the points that the State
 7 Engineer put forward. And I'm hoping we're clarifying
 8 what -- We wanted to address these directly and we've taken
 9 our conclusions and tried to address them directly in to your
 10 questions of concern.
 11 So, question A, our responses are, as shown
 12 earlier there's a basis for SNWA's statement that the NCA
 13 current production wells are probably not within the Lower
 14 White River Flow System.
 15 NCA believes that additional work needs to be
 16 done to validate SNWA's multi -- multiple linear regression
 17 analysis with regards to the attributable impacts to the
 18 Muddy River Springs area resulting from groundwater pumpage
 19 from NCA's production wells in the Black Mountain
 20 hydrographic basin.
 21 And I say in here it's important -- And I got to
 22 correct that. I think it's very important for the Nevada
 23 State Engineer to know if the NCA pumpage within the Black
 24 Mountain hydrographic basin is impacting the Muddy River

1 Springs area. If this pumpage is not affecting the Muddy
2 River Springs area, we readily admit that's obviously good
3 for NCA. But, more importantly, that means that the actual
4 impacts to the Muddy River Springs area are being caused by
5 less pumpage than initially thought. So this is a very
6 important question that we need to address.

7 Therefore, NCA supports SNWA's position that the
8 current boundary of the Lower White River Flow System should
9 stay the same pending the water management decisions in the
10 next phase.

11 Q. (By Mr. Flangas) So, in other words, Mr. Coache,
12 if the 9318 includes NCA's production well pumping, that's
13 one number. But if the 9318 is calculated and NCA is not in
14 that number then, in fact, that number might be lower?

15 A. That's correct.

16 Q. Okay. Thank you.

17 A. Question B. I told you I would slip by the first
18 one. The various structures within the Lower White River
19 Flow System with lower transmissivity values result in a lag
20 of measurable impacts in some areas but not the overall
21 impact. These delayed impacts can even be more detrimental
22 to the Muddy River Springs area, as the impact will take
23 longer to identify and benefits of any subsequent corrective
24 action will also take longer to be -- to begin recovery from

1 Cappaert-type decision to manage spring flow through minimum
2 groundwater hydraulic head levels, thus preventing the State
3 Nevada the ability to manage its own resources.

4 D. I tried to make this one as clear as I could
5 and it seems to get a little complicated sometimes. But this
6 is with regards to the effects of moving alluvial water
7 rights and carbonate water rights and the deliveries of
8 senior decreed rights on the Muddy River.

9 NCA does not support the transfer of a senior
10 alluvium groundwater rights within the Muddy River Springs
11 area to the carbonate system within the Lower White River
12 Flow System as the supply source for new uses.

13 NCA does support the transfer of senior alluvium
14 groundwater rights within the Muddy River Springs area to the
15 carbonate system within the Lower White River Flow System to
16 upgrade the priority date of existing carbonate pumpage
17 within the Lower White River Flow System but on a one-to-one
18 basis.

19 If someone has a hundred acre-feet of carbonate
20 water but let's say a 2000 priority date and they're going to
21 be curtailed and they want to go buy some water rights, they
22 could buy a hundred acre-feet of senior alluvium rights and
23 transfer those to the carbonate on a one-for-one basis to
24 upgrade their priority.

1 the impacts.

2 Slide 42. Point C, this deals with the amount of
3 groundwater that can be pumped from the Lower White River
4 Flow System. There has been substantial discussion regarding
5 the amount of underflow out of the Lower White River Flow
6 System. And NCA agrees that there is some amount of
7 underflow. However, NCA is not aware of any location where
8 the underflow can be captured by carbonate pumpage within the
9 Lower White River Flow System without detrimental impact to
10 the Muddy River Springs area.

11 While NCA does not completely agree with the
12 current pumpage goal of 9318 acre-feet a year, NCA
13 understands the complexity.

14 And I, you know, since I worked there for 30
15 plus -- almost 30 years and Mr. Ricci worked there for almost
16 that amount of time, we completely get how complex this is,
17 okay. And so we understand the complexity of the
18 determination and potential fluency of the proposed pumping
19 limit and urge the State Engineer to proceed expeditiously
20 but with extreme caution.

21 And our last bullet point with regards to our
22 question C. NCA is concerned that a delayed decision with
23 regards to the management of the Lower White River Flow
24 System could result in federal action resulting in a

1 That would create no additional new effects on
2 the Muddy River Springs area. And that indeed would create a
3 shuffling of priorities, but it would not create an impact on
4 the water rights -- I mean, on the spring. Sorry.

5 NCA believes that simplified guidelines should be
6 established for the movement of groundwater within and near
7 the Lower White River Flow System as part of this process but
8 not necessarily through the issuance of an order at this
9 time. I just don't see -- other orders that, you know, we
10 have worked on in the years when I was there, it's almost
11 impossible to foresee all the things that could pop up and
12 the little nuances that you didn't think of.

13 So I think we would have guidelines at first, let
14 those mature, address some of these issues, and then at some
15 point issue an order that's going to limit pumpage or move in
16 water within the basin.

17 And NCA also supports the change in place of use
18 of Muddy River Spring alluvium rights -- And that could be
19 manner of use too -- when associated with a conjunctive use
20 agreement between a holder of Muddy River decreed rights and
21 the user of the pumped Muddy River Spring alluvium rights.
22 So if somebody wanted to go change those alluvium rights and
23 impact the flow of the Muddy River, which is obviously
24 impacting senior decreed rights, and they wanted to have an

1 agreement with a holder of these decreed rights and take the
2 water out of the ground instead of the river, we're okay with
3 that.

4 Am I doing 44?

5 Q. We're almost done.

6 A. E. Okay. NCA does not believe that the State
7 Engineer should proceed with any new aquifer test within the
8 Lower White River Flow System. New aquifer test. To see
9 verifiable results, any aquifer test would require pumpage in
10 the thousands of acre-feet over a period greater than six
11 months. It makes little sense to do and conduct an aquifer
12 test for less than a six-month period when it's known that
13 some impacts in the Lower White River Flow System are delayed
14 by a period of three to four months.

15 And given the lack of full recovery from the
16 Order 1169 aquifer test, the pumpage required by additional
17 aquifer test may cause detrimental impacts to the senior
18 water rights holders. And that concludes our presentation.

19 MR. FLANGAS: I have a procedural question.

20 HEARING OFFICER FAIRBANK: Yes.

21 MR. FLANGAS: We submitted a significant number
22 of exhibits, all of which were utilized in the preparation of
23 the report. There was simply no time go through, mark,
24 address, and talk about each one. We had 40-some-odd

1 did you rely on the Southern Nevada Water Authority
2 correlation analysis to assess connectivity within the Lower
3 White River Flow System or did you perform any of your own
4 analysis?

5 A. Both. I reviewed their analysis. I have access
6 to the same data that they do. It all came from DWR and it
7 was made available for this hearing for this study. I wanted
8 to make sure that I could reproduce their results. And in
9 certain areas I did my own regression analysis where I --
10 where they didn't, to help inform some of the conclusions
11 that we arrived at.

12 Q. Okay. If you were to -- When I use the word
13 disaggregate, do you know what I mean?

14 A. No.

15 Q. Disaggregate, kind of pull apart the different
16 pieces?

17 A. Sure.

18 Q. Okay. If you were to disaggregate each of the
19 hydrographs in to a climate response, pumping response, and
20 barometric response, do you think a correlation analysis on
21 those individual responses as opposed to the aggregate
22 observed water level changes would yield a better correlation
23 analysis?

24 A. I did not perform that analysis. I focused on

1 exhibits. If we had tried to do that, we would have run out
2 of time. I would like to offer those exhibits in to
3 evidence. I'm not exactly sure how to do that.

4 HEARING OFFICER FAIRBANK: So all of the exhibits
5 that have been submitted by the participants, except for
6 their reports or rebuttal reports, were admitted in to
7 evidence by the State Engineer.

8 MR. FLANGAS: Thank you.

9 HEARING OFFICER FAIRBANK: But the rebuttals --
10 the reports and rebuttal reports required the presentation of
11 those witnesses for cross-examination.

12 MR. FLANGAS: Thank you. That's a weight off my
13 shoulders.

14 HEARING OFFICER FAIRBANK: All right. So we'll
15 go ahead and proceed with the cross-examination. And we have
16 allotted seven minutes. And we'll go ahead and start with
17 Coyote Springs Investments.

18 CROSS-EXAMINATION

19 By Mr. Herrema:

20 ANSWERS BY MR. DIXON:

21 Q. Good afternoon. Brad Herrema on behalf of CSI,
22 for the record. Just a couple of questions. I think this is
23 most appropriately addressed to Mr. Dixon. Before you --
24 When you prepared your portions of the NCA rebuttal report,

1 the data and used it in the same manner that they did. I
2 have a high level of confidence in their experts. I know
3 them very well and I trust the information that they put in
4 their report.

5 Q. I understand that that's not what you did. My
6 question is if you had done that to disaggregate climate
7 response, pumping response, barometric response, and then do
8 a correlation analysis on those individual responses, those
9 individual pieces, do you think that would yield a better
10 correlation analysis than using that aggregated observed
11 water level?

12 A. Perhaps in some areas. But I didn't -- I didn't
13 do that, so I can't comment beyond that.

14 Q. Do you know whether the Southern Nevada Water
15 Authority analysis that you -- that you reviewed, whether
16 they disaggregated those impacts or whether they performed it
17 within an aggregate hydrograph?

18 A. I do not.

19 Q. Could the degree of correlation between two wells
20 in the system be predominantly due to pumping while the
21 correlation between two other wells in the flow system be
22 predominantly due to climate?

23 A. No.

24 Q. So you believe then that correlation between EH-4

1 and EH-4 or 5B in the Muddy River Springs area would be due
2 to the same responses as the correlation between EH-4 and a
3 well in the Black Mountains area?
4 A. If it's BM-DL-2, that correlation, that R-squared
5 value is .95. That's what SNWA got and that's what I got.
6 That particular well, absolutely. And I talk about EBM-3 and
7 I don't have a high level of confidence in that R-squared
8 value of .52 because I acknowledge that there's some noise in
9 those water levels. They're obtained manually. They are
10 reported sometimes to the nearest foot. So there's some
11 issues there. And I acknowledge that.
12 Q. Was it your testimony or is it your testimony
13 that groundwater wells located in or near fault zones are
14 higher-producing wells than those located further away from
15 fault zones?
16 A. In some cases, yes.
17 MR. HERREMA: Okay. I have no further questions
18 at this time. Thank you.
19 HEARING OFFICER FAIRBANK: United States Fish and
20 Wildlife Service? Seeing no questions.
21 National Park Service?
22 MS. GLASGOW: No questions.
23 HEARING OFFICER FAIRBANK: Seeing no questions.
24 Moapa Band of Paiute Indians? No questions.

1 A. Yes, he has.
2 Q. And what is that?
3 A. That was SB-47 in 2017.
4 Q. And what's the significance of that, in your
5 opinion?
6 A. That legislation cleared up the issue of whether
7 or not the State Engineer could look at the impacts of a
8 water right application in one basin on other basins.
9 Q. Okay.
10 A. And allowed him to conjunctively manage the
11 water. And I believe it says conjunctively manage the water
12 from any and all sources.
13 Q. Okay. Now, I started by asking you about the
14 ruling in 2014, 6254 through 60. Since that time there's
15 been new data collected, new hydrologic data, collected in
16 the Lower White River Flow System; correct?
17 A. Yes.
18 Q. And do you believe that, the data since that
19 time, since 2014, is significant in the analysis of the four
20 questions the State Engineer is reviewing today?
21 A. Yes.
22 Q. Okay. And I want to ask you specifically --
23 Well, first, why?
24 A. Because it continues -- One, it continues the

1 Southern Nevada Water Authority and Las Vegas
2 Valley Water District?
3 CROSS-EXAMINATION
4 By Mr. Taggart:
5 ANSWERS BY MR. COACHE:
6 Q. Good afternoon. For the record, Paul Taggart for
7 the water district and the Southern Nevada Water Authority.
8 I want to start with Mr. Coache. And my questions are going
9 to center around whether new evidence exists for the State
10 Engineer to consider since the issuance of Ruling 6254
11 through 59. And do you know what those rulings were?
12 A. I believe those were the rulings that denied --
13 Hold on. Let me double-check. No, I'm not. Let me put it
14 that way.
15 Q. Okay. Just Ruling 6254 through 60, are you
16 familiar with those at all?
17 A. Give me the numbers again. I'm sorry, sir.
18 Q. 6254 through 60, which came out after the reports
19 were issued on the 1169 pump test.
20 A. Yes. These are the rulings that denied all the
21 applications.
22 Q. Okay. Since that time has the State Engineer
23 acquired any additional statutory powers with respect to
24 groundwater and surface water?

1 increase of knowledge and data known in the Lower White River
2 Flow System. Two, it's another four or five years of data
3 since the pretty close to the max recovery of the 1169 pump
4 test. And it's showing now what's happening in real world
5 conditions of the impacts to the springs since we've
6 recovered over that four or five-year period.
7 Q. And you mentioned recovered a few times there in
8 your answer. What's the significance of having an additional
9 five to six years of data to understand and recover?
10 A. It takes out any question of what the actual
11 recovery was and the impacts from the pumping test. The
12 farther you go, the better you can determine what the actual
13 impacts of the pumping test was.
14 Q. And have you developed an opinion on whether, for
15 instance, Warm Springs West flows have recovered to their
16 pre-test levels as of today?
17 A. Yes, I have.
18 Q. And what's that opinion?
19 A. The Warm Springs West flows spring test levels it
20 is not recovered to anywhere actually near those pre-test
21 levels.
22 ANSWERS BY MR. RICCI:
23 Q. Okay. And my question is to Mr. Ricci. Good
24 afternoon, sir.

1 A. Good afternoon, Mr. Taggart.
2 Q. Mr. Ricci, do you have an opinion on whether the
3 State Engineer when he issued the groundwater rights to
4 parties, including rights that are owned by the Southern
5 Nevada Water Authority, in Coyote Spring Valley, whether the
6 State Engineer retained the power to limit those water rights
7 in the future and reduce the ability of those water right
8 owners to pump that water?

9 MR. HERREMA: Brad Herrema for CSI. I would like
10 to object on relevance to the scope of this proceeding.

11 HEARING OFFICER FAIRBANK: Mr. Taggart, can you
12 relate your question to those four primary issues as set
13 forth in Order 1303?

14 MR. TAGGART: I think it relates to the long-term
15 quantity of groundwater that be can be pumped in the five
16 basins and whether the State Engineer maintains the ability
17 to use that control, use that long-term quantity of water in
18 these basins.

19 HEARING OFFICER FAIRBANK: I'm going to sustain
20 the objection, because I think the question as to the
21 authority of the State Engineer over any individual water
22 right is beyond the scope of these particular proceedings.

23 MR. TAGGART: Okay. I think I'm out of time or
24 do I get anymore?

1 at your slide 40. And your final bullet point there says
2 that it's your position that the current boundary of the
3 Lower White River Flow System should stay the same. And I'm
4 looking more at your slides 25 through 39. I know some were
5 objected to. I'm not going to ask you about the substance of
6 those. Just the heading of each one of those slides is
7 inclusion of Kane Springs Valley, is it not?

8 A. Robert Coache. Yes, it is, sir.

9 Q. Okay. So I just want to be clear. Are you
10 recommending the inclusion of Kane Springs Valley in this
11 management area?

12 A. Initially, yes, we are. But we don't think that
13 this is the -- because this was supposed to be mostly for
14 hydraulic data that this was the proper venue to do that.
15 And then we also recognize the importance of getting
16 additional data for Black Mountain. And so I felt that if we
17 made -- if we went against what the hydraulic -- what the
18 significance of this was with collecting hydrologic data and
19 those opinions and then also recommended Kane Springs be
20 brought in but give us more time for Black Mountain, I
21 thought that was pretty hypocritical.

22 Q. Okay. I appreciate that.

23 ANSWERS BY MR. RICCI:

24 Q. There's a substantial amount of institutional

1 HEARING OFFICER FAIRBANK: You still have a
2 little more time.

3 MR. TAGGART: Oh, I do? I thought I heard a
4 buzzer. I'm sorry.

5 HEARING OFFICER FAIRBANK: Not mine.

6 Q. (By Mr. Taggart) Mr. Ricci, to you again. Do
7 you believe that the protection of senior water rights on the
8 Muddy River is a matter the State Engineer should use to
9 determine how much groundwater can be pumped in the Lower
10 White River Flow System. Should that number be based upon
11 not inflicting with senior water rights in the Muddy River?

12 A. Hugh Ricci. I believe the State Engineer is
13 required, I believe, as Mr. Coache mentioned with SB-47 that
14 he has to look at all sources of water and what the impacts
15 are as a result of any pumping.

16 MR. TAGGART: Okay. Thank you. No more
17 questions.

18 HEARING OFFICER FAIRBANK: Moapa Valley Water
19 District.

20 CROSS-EXAMINATION

21 By Mr. Morrison:

22 ANSWERS BY MR. COACHE:

23 Q. Greg Morrison for Moapa Valley Water District.
24 Just a question of clarification for Mr. Coache. I'm looking

1 knowledge up there at the table right now. I'll start with
2 Mr. Ricci. If you were the State Engineer October 2019 faced
3 all the evidence we've been looking at for the last couple of
4 weeks, would you include Kane Springs in the management area?

5 A. Hugh Ricci. I would have another option. I
6 could retire. But I will have to go back to 2002, actually
7 2001, when the hearing was held on Coyote Springs Valley as
8 far as the Southern Nevada Water Authority applications in
9 Coyote Springs Investments. And when that order was written,
10 it did not include Kane Springs at that time. And the reason
11 I think was that there was nothing going on in Kane Springs.
12 Had I had the knowledge that I would today as of a result and
13 had to issue Order 1169 again, Kane Springs would have been
14 included.

15 Q. Okay. Thanks.

16 Mr. Coache, what about you, if I posed the same
17 question. If you were sitting where Mr. Wilson is today,
18 would you want to include Kane Springs in this management
19 area?

20 MR. COACHE: Yes, I would.

21 MR. MORRISON: Thanks. That's all I have.

22 HEARING OFFICER FAIRBANK: Lincoln County, Vidler
23 Water Company.

24 ///

1 CROSS-EXAMINATION
2 By Ms. Peterson:
3 ANSWERS BY MR. RICCI:
4 Q. Gentlemen, Karen Peterson here representing
5 Lincoln County and Vidler Water Company.
6 So, Mr. Ricci, just following up on that last
7 statement that you made. Mr. Coache indicated that I guess
8 it was his recommendation that Kane not be included right now
9 in terms of the boundary at this stage. So you disagree with
10 that?
11 A. Hugh Ricci. No. What I said had I -- if I were
12 to issue Order 1169 again and had the information that I had
13 available then as there is enough information today I would
14 have included it.
15 Q. Right. But is it your testimony today that the
16 boundary should not be changed? As we are now in this
17 proceeding, the last bullet point on slide 40, says that the
18 recommendation is, I assumed of Nevada Cogen, that the
19 boundaries not be changed.
20 A. You know, when we -- Hugh Ricci again. When we
21 did this, this was a collaboration among the three of us, and
22 there were certain things that we thought of and two to one
23 or whatever, however it was ruled, we put it in it. But the
24 answer to my question originally that you asked is what I

1 MS. PETERSON: All right. Did any of the three
2 of you calculate drawdown to the wells owned or controlled by
3 NCA from pumping Kane Spring Valley wells?
4 MR. DIXON: No.
5 MR. RICCI: You're asking each us of us again,
6 Ms. Peterson?
7 MS. PETERSON: Yes.
8 MR. RICCI: No. The answer to that question is
9 no.
10 MR. COACHE: I'm sorry. I didn't follow that
11 question.
12 ANSWERS BY MR. COACHE:
13 Q. Mr. Coache, did you calculate drawdown to the
14 wells owned or controlled by NCA from pumping Kane Spring
15 Valley wells?
16 A. No, I did not.
17 Q. Mr. Coache, did you review the hydrograph of the
18 KSVM during the Kane Springs pump test? KSVM-4, sorry, well.
19 A. I'm sorry. What did you ask?
20 Q. Sorry. It was bad. Did you review the
21 hydrograph of the KSVM-4 well during the Kane Springs pump
22 test, the aquifer test?
23 A. I did.
24 Q. And do you agree that the pump test was for 1800

1 would do then if I knew what I do know today.
2 Q. So do you support that bullet point or not?
3 A. Since my name is on the report I would say yes.
4 Q. Did any of the three of you calculate drawdown to
5 the Muddy River Springs area from pumping Kane Spring Valley
6 wells?
7 MR. COACHE: I first want to clarify the bullet
8 point, the previous bullet point. My position hasn't changed
9 in that I believe Kane Springs Valley should be included. I
10 don't believe this is the venue for which to discuss that.
11 And that's why that bullet point says what it does in
12 relation to the next phase.
13 The answer to your question is that I did not
14 calculate drawdowns of the Muddy River Springs area from Kane
15 Springs pumpage.
16 MS. PETERSON: Mr. Dixon?
17 MR. DIXON: So.
18 MS. PETERSON: Did you calculate drawdown to the
19 Muddy River Spring area from pumping Kane Spring Valley
20 wells?
21 MR. DIXON: No. And that wasn't the purpose of
22 that regression analysis.
23 MS. PETERSON: Mr. Ricci?
24 MR. RICCI: No.

1 gallons per minute?
2 A. I can't -- I believe that's the number but I
3 can't say for sure.
4 Q. And do you agree that from that well where the
5 pump test was conducted that Lincoln-Vidler was awarded 500
6 acre-feet which when pumped would be much less than the 1800
7 gallons per minute?
8 A. Well, it depends on over what time you pump the
9 water.
10 Q. Well, do you understand that 1800 gallons per
11 minute that was a continuous pump test?
12 A. Yeah, absolutely. But if you want to take your
13 water out over a one-month period it might be 1800 gallons a
14 minute.
15 Q. Right. But you would have no idea what the plan
16 is for the development of the water out of that well, the 500
17 acre-feet, do you?
18 A. But you didn't ask me that.
19 Q. Do you have any idea?
20 (The court reporter interrupts)
21 THE WITNESS: No.
22 Q. (By Ms. Peterson) And you indicate on pages --
23 page 18, I think, Mr. Coache, you wrote this section of the
24 report, NCA number one. The last sentence there right before

1 the footnotes start, that the aquifer test, the 1169 aquifer
 2 test, clearly indicates that carbonate pumping from the
 3 northern portion of Kane Springs Valley and -- Sorry --
 4 Coyote Spring Valley and KSW-1 within Kane Springs Valley
 5 will impact carbonate aquifer, hydraulic head within the
 6 LWRFS, which in turn will increase impact to spring flows
 7 within the MRSA and be detrimental to the existing
 8 groundwater rights held by NCA. Do you see that?
 9 A. Yes, I do.
 10 Q. And so you're indicating that our pumping will
 11 impact the springs and then will impact Nevada Cogen; is that
 12 correct?
 13 A. That's correct.
 14 Q. So do you agree then that the Nevada Cogen wells
 15 have a direct hydraulic connection with the springs?
 16 A. To reach my conclusion on that, they don't have
 17 to have a one-to-one direct impact. The issue is in the
 18 whole picture of the management of the system, if NCA has a
 19 priority of water rights, as many other people do in this
 20 whole system, so when you look at where the line is going to
 21 be drawn by the Nevada State Engineer -- There's a numbering
 22 issue on the well, I understand that. But if the KPW-1 is
 23 pumped and the pumpage from those wells in that northern
 24 Kane -- from Kane Springs Valley and/or northern Coyote

1 CROSS-EXAMINATION
 2 By Mr. Donnelly:
 3 ANSWERS BY MR. COACHE:
 4 Q. Thank you. Patrick Donnelly for the record. I'm
 5 not entirely sure who to direct my questions to, so I will
 6 start with Mr. Coache. But perhaps you can point me in the
 7 right direction. There are some things in your report that
 8 you didn't present here today. Did you reference Center for
 9 Biological Diversity's Order 1303 report prepared by Dr. Tom
 10 Myers on slide 31 and 34 of your presentation today?
 11 A. Yes, I did.
 12 Q. And did you reference our reports in order to
 13 provide evidence in favor of your arguments?
 14 A. Yes, we did.
 15 Q. Did pages one to two of your written report,
 16 rebuttal report, recommend excluding non-governmental
 17 organizations from this proceeding?
 18 A. Yes, it did.
 19 ANSWERS BY MR. RICCI:
 20 Q. I guess this is a question for Mr. Ricci. Have
 21 citizen or non-profit groups been party to Nevada State
 22 Engineer proceedings in the past? It's a yes or no question.
 23 A. Yes.
 24 Q. Are you aware if the Center for Biological

1 Springs Valley impact the spring area and have a detrimental
 2 impact that requires the State Engineer to lower the bar,
 3 then that subsequently has a detrimental impact to our client
 4 because that could be an impact on their priority and result
 5 in them having to curtail pumpage. So it doesn't have to be
 6 a direct impact from well to well if the bullseye is the
 7 Muddy River Springs area.
 8 MS. PETERSON: Thank you.
 9 HEARING OFFICER FAIRBANK: Thank you.
 10 City of North Las Vegas?
 11 CROSS-EXAMINATION
 12 MS. URE: Good afternoon. Therese Ure
 13 representing City of North Las Vegas.
 14 Mr. Dixon, did you complete an independent
 15 analysis for Garnet Valley carbonate pumping as related to
 16 the Muddy River Springs area?
 17 MR. DIXON: So, to answer that question, I
 18 performed an independent analysis on the carbonate system as
 19 a whole with a specific focus on Coyote, Kane, and Black
 20 Mountain area. I did not focus on Garnet Valley
 21 specifically.
 22 MS. URE: Okay. Thank you.
 23 HEARING OFFICER FAIRBANK: Center for Biological
 24 Diversity?

1 Diversity or the Great Basin Water Network has previously
 2 been party to Nevada State Engineer proceedings?
 3 A. Yes.
 4 Q. Does Order 1303 expressly limit the proceedings
 5 to water rights holders?
 6 A. I don't recall if it does or doesn't.
 7 MR. DONNELLY: Mr. Coache, do you have an answer
 8 to that question?
 9 MR. COACHE: It does not. And I would like to
 10 put some perspective in that if I could. If not, then let's
 11 go to the next question.
 12 MR. DONNELLY: I would like to finish my
 13 question. Thank you.
 14 MR. COACHE: Fine. Excellent.
 15 MR. DONNELLY: I would ask which one is it?
 16 Should we be excluded from these proceedings or should our
 17 data be utilized by you to bolster your arguments?
 18 MR. DIXON: It wasn't our decision to include
 19 NGOs. Since they're included, there's some information in
 20 that report that we happen to agree with.
 21 MR. DONNELLY: Which of the four questions raised
 22 by Order 1303 does section one of your written report
 23 address?
 24 MR. DIXON: That would be item E in the order, in

1 the other matter.

2 MR. DONNELLY: I would like to move to the State
3 Engineer that you exclude from the record section one of the
4 Nevada Cogeneration Associates rebuttal report. It is not
5 pertinent to the questions asked by the Nevada State Engineer
6 in Order 1303 and, thus, is outside the scope of these
7 proceedings.

8 MR. FLANGAS: Do I need to respond to that?

9 HEARING OFFICER FAIRBANK: You may, Mr. Flangas.

10 MR. FLANGAS: There's no basis to exclude it.
11 I'll come back on a rebuttal question and ask a very simple
12 question, have non-governmental organizations been excluded
13 on the basis of standing. And I'm sure the answer is going
14 to be yes.

15 HEARING OFFICER FAIRBANK: So, Mr. Flangas, the
16 response was that there's no reason to exclude it and you're
17 going to address it on redirect. I've admitted the report.
18 And while we're trying to maintain the focus within those
19 four issues, the fifth issue was somewhat broad. And for the
20 purpose of admitting the report in its entirety we're going
21 to do that. We're not going to alter that, this
22 determination.

23 MR. DONNELLY: Thank you. No further questions.

24 HEARING OFFICER FAIRBANK: Bedroc?

1 the difference between alluvium groundwater rights and
2 carbonate groundwater rights, until that time they're one in
3 the same.

4 And that's also said with the understanding that
5 the State Engineer probably has the right to limit the depth
6 of wells, of alluvium wells, so they don't tap to carbonate.
7 But the water rights themselves at this time as they sit are
8 a different thing.

9 MS. CAVIGLIA: Mr. Ricci?

10 MR. RICCI: If the boundary stays exactly the
11 same and the State Engineer does nothing with those water
12 rights that haven't been used in the past that are senior to
13 some of those that have been used, possibly the State
14 Engineer would have no recourse except to go based on
15 priority.

16 Again, getting back to what Mr. Coache says, is
17 if you look at the 50,000 plus acre-feet that is appropriated
18 in these basins, about 9,000 has been used over the last four
19 or five years, that's 20 percent. So what have those junior
20 right holders that have used the water for continuous for 20
21 years, such as the client for which we work, what are they to
22 do because they are way down the list?

23 So that's a tough decision that the State
24 Engineer is going to have to make. If he makes it based on

1 MS. URE: No questions.

2 HEARING OFFICER FAIRBANK: Seeing no questions.
3 Nevada Energy?

4 CROSS-EXAMINATION

5 MS. CAVIGLIA: Justina Caviglia on behalf of
6 Nevada Energy. And I have a question for Mr. Coache or
7 Mr. Ricci. If regulation of groundwater rights is deemed
8 necessary in the Lower White River Flow System, state law
9 requires regulation by priority. Are you recommending the
10 State Engineer regulate senior certificated alluvial
11 groundwater rights in favor of junior carbonate water rights?

12 MR. COACHE: Well, unless he makes, the State
13 Engineer, makes a ruling and/or there's some other statutes
14 available to him, there's no difference with regards to the
15 alluvium rights in the Lower White River Flow System and the
16 carbonate rights in the Lower White River Flow System with
17 regards to priority.

18 And, so as they sit right now, that's how it is.
19 And it's unfortunate, because there's also people that are
20 using their water and spent hundreds of millions of dollars
21 to develop projects that, you know, could be in jeopardy
22 because of this stuff.

23 So, you know, if the State Engineer wants to make
24 a ruling order or have the statute changed that he can split

1 priority, he's going to have to do that.

2 MS. CAVIGLIA: Thank you. I have no further
3 questions.

4 HEARING OFFICER FAIRBANK: At this time I'll go
5 ahead and open it up to the Division of Water Resources.

6 Oh, I'm sorry.

7 MR. KING: Madam Hearing Officer, Steve King,
8 Muddy Valley Irrigation Company. We have no questions.

9 HEARING OFFICER FAIRBANK: And my apologies for
10 skipping over you. I think I was looking ahead when I was
11 putting together my little checklist. Thank you, Mr. King.
12 Muddy Valley Irrigation Company has no questions.

13 So at this time I'll go ahead and open it up to
14 the Division of Water Resources staff and the State Engineer
15 for questions.

16 EXAMINATION

17 By Mr. Benedict:

18 ANSWERS BY MR. DIXON:

19 Q. Jon Benedict for the record. I think my first
20 question is probably for Mr. Dixon. You guys, I guess, would
21 be the local experts on your own wells and the information
22 that you've collected there in terms of that I guess what I
23 call a connection that exists between those wells. And I
24 just wanted to drill down a little bit deeper with respect to

1 that discussion. You've suggested that the production wells
 2 may not be directly connected to the well to the north that
 3 is a monitoring well and you've shown some geologic slides
 4 for some of those wells that suggest they're all in
 5 carbonate. Am I correct about that?
 6 A. Yes.
 7 Q. And yet you've also suggested that the data is
 8 not conclusive with respect to that connection. From a
 9 geologic perspective you've also shown some maps. But you
 10 didn't necessarily tie that together. So I just want to get
 11 your opinion on whether you think that the potential for
 12 disconnections between some of those wells is due to
 13 structure, due to lithology? Do you have any data that
 14 suggests explanation?
 15 A. Jay Dixon. So the structure, the map geology and
 16 the structure out there, provides one piece of information
 17 that suggests it is possible. But relying on geologic maps
 18 in cross-sections where structures have been identified alone
 19 is not enough.
 20 And I'd like to add, water level information,
 21 pumping water level, you know, these wells pump, drawdown is
 22 minimal, there doesn't seem to be much of a response at
 23 BM-DL-2. But the key thing is that EBM-3 monitor that's by
 24 the southern most production well it just has too much

1 A. The periodic hand measurements, yeah, that's
 2 right. It is a long period of record but it's fairly noisy.
 3 Q. Fair enough.
 4 ANSWERS BY MR. COACHE:
 5 Q. Next question. This may be for Mr. Coache. I
 6 think you suggested that measurements perhaps of both water
 7 levels but certainly of Warm Springs West discharge or
 8 measurements there show a lack of recovery from the 1169
 9 aquifer test; is that correct?
 10 A. A lack of recovery --
 11 Q. A full recovery.
 12 A. -- to the pre-test levels.
 13 Q. Okay. That's what I was wondering. I was
 14 wondering if you can characterize whether you think that lack
 15 of recovery is a consequence of the test itself or other
 16 factors or if you have an opinion on them?
 17 A. Well, I have lots of opinions. I think -- I do
 18 think it's a direct result, the impacts for a direct result
 19 of the pump test, I believe that. And I believe that's
 20 clear.
 21 The lack of recovery to the pre-test levels I
 22 believe is a direct response from the very low storativity in
 23 the system and that a chunk of that water, whatever
 24 percentage you want to assign to it, a chunk of that water

1 external influence from pumping at that particular well
 2 because that's an area where the transmissivity appears to be
 3 lower, the specific yield, specific capacity is lower. And
 4 there's just too much uncertainty with that data. So I wish
 5 I could tie it together more confidently, but I just can't.
 6 Q. Do you think the question or the unanswered
 7 question, I guess, could be answered with a test other than
 8 1169 type test to be able to determine those connections or
 9 do you think those issues with regard to that uncertainty are
 10 also compounded by the need to have a high volume and long
 11 term test to be able to diagnose the problem?
 12 A. Well, here's the thing. We got -- We got a
 13 25-year test at NCA. Particularly those two northern most
 14 wells they've been pumped. They use all of their water
 15 rights every year.
 16 If I could make one recommendation, and I'll talk
 17 to them about this, I think we need to get transducers in the
 18 two wells that we converted to monitoring wells. I think
 19 that would help at least provide an opportunity to decipher
 20 some of that noise from pumping and maybe resolve what the
 21 actual response is with more confidence.
 22 Q. Okay. So what you're saying is you've got -- you
 23 don't have the data collected during that pumping to be able
 24 to resolve that out. So you need --

1 for the pump test was taken out of storage. That storage
 2 then reduced the hydraulic head that feeds the spring system
 3 in the Muddy River Springs area. And since that water was
 4 taken out of storage, it hasn't recovered sufficiently from
 5 inflow to boost that level up significantly to increase that
 6 hydraulic head to the point to increase the flows of the
 7 springs.
 8 Q. Is that the same as saying it hasn't reached
 9 equilibrium yet?
 10 A. Well, I don't believe the system has reached
 11 equilibrium. And I don't know if you could ever -- This is
 12 kind of going in the weeds of this a little bit. But I'm not
 13 sure -- When you're looking at a system that's as big as the
 14 Lower White River Flow System and all the things that are
 15 occurring around it, I'm not sure you can ever reach
 16 equilibrium. I think you can manage around a line or an
 17 area. But I don't think you're ever going to get to a point
 18 of pure equilibrium in that system.
 19 Q. Got it. I guess maybe a better way to say that
 20 is, so you think the impacts from the 1169 test continue on
 21 after what we've seen as a recovery at this point. Are there
 22 some influence that exists still from that?
 23 A. I don't think the impacts are continuing. I
 24 think -- I think the impacts have leveled off. What I think

1 has happened is that the ability for the system to recover
2 because of the amount of the water that was taken out of
3 storage has limited to the recovery. So I don't think that
4 the water level is still going down from the 1169 aquifer
5 test. So I think we've leveled off there.

6 It's a continuation of how much water is flowing
7 in to the system to get the carbonate level up to increase
8 the hydraulic head in that alluvium to drive that water out.

9 MR. BENEDICT: Okay. Thank you.

10 EXAMINATION

11 By Mr. Kryder:

12 ANSWERS BY MR. DIXON:

13 Q. Levi Kryder for the record. The first question
14 is for Mr. Dixon. On your slide 16, the right-hand panel
15 where you're showing the correlation between EBM-3 and EH-4,
16 what are the linear horizontal features that are present in
17 the scatter data?

18 A. That is a reflection of hand measurements that
19 don't have a lot of resolution in them. And I looked at that
20 and it's -- they rounded it to the nearest foot. So there's
21 several months where it's the same level.

22 Q. Okay. Thank you. And in your -- in any of the
23 analyses that you did here, did you look at the response time
24 of the system or the delay time in response across the

1 A. I relied on other stakeholders' reports regarding
2 that information. Those are the references I provided. And
3 I'm familiar with the statements that they made. And it
4 seemed reasonable to me. So, no, I don't have anything
5 beyond that though, unfortunately.

6 Q. Are you -- Is it your belief that all the water
7 from Rogers and Blue Point is sourced from recharge in the
8 Muddy Mountains?

9 A. A portion perhaps. But, you know, I think other
10 stakeholders commented on the fact that the response at those
11 springs from Order 1169 pumping wasn't there. I don't deny
12 that a portion of that water is definitely coming from
13 carbonate rock, just like the pumping wells at NCA are coming
14 from carbonate rock. That's carbonate rock that the wells
15 are starting to drill in. But that doesn't mean necessarily
16 that the water that's there is being removed from the same
17 system that we are talking about in the LWRFS because of the
18 geologic structures and features between, such as the Muddy
19 Mountains.

20 HEARING OFFICER FAIRBANK: Okay. So we are
21 nearly out of time. So I'm just going to quickly go through
22 and see if there -- We can do just a couple of minutes for
23 recross if there are anybody. Coyote Springs Investments,
24 any additional questions? Seeing none.

1 system, the pumping signals?

2 A. When I did this simple regression analysis for
3 CSVN-4 versus EH-4, first of all, I tried to reproduce SNWA's
4 results to make sure I could reproduce that. And then I saw
5 the three -- It could have been five months. It could have
6 been two months. Whatever. I did not disagree with their
7 assessment that there was three months. That was a
8 reasonable explanation for why that -- why that water level
9 CSVN-4 responded with a bit of a delay. So only there. I
10 didn't see that type of delay anywhere else when I was
11 looking at these correlations.

12 MR. KRYDER: Okay. Thank you.

13 EXAMINATION

14 By Mr. Sullivan:

15 ANSWERS BY MR. DIXON:

16 Q. Adam Sullivan. In your rebuttal report, one of
17 your sections is responding to the National Park Services
18 discussion or recommendation to include the entire Black
19 Mountains area. And I'm wondering if -- Well, first, you use
20 the geologic analysis and then you refer to a water chemistry
21 data that would support not including Black Mountains area.
22 And just a specific question is do you have another citation
23 that's not referred to here that this water chemistry data
24 came from?

1 US Fish and Wildlife? Seeing none.

2 Let me do it this way. Are there any
3 participants that wish to have about two minutes for recross?
4 Okay. So I see Lincoln County and Southern Nevada Water
5 Authority. I'm not seeing any other participants.

6 So we'll go ahead and start with the Southern
7 Nevada Water Authority and Las Vegas Valley Water District.
8 And, given our time frame, I'm going to go ahead and give you
9 two minutes, Mr. Taggart.

10 CROSS-EXAMINATION

11 By Mr. Taggart:

12 Q. I have to think about my questions first before
13 the clock starts. So this question I think is to Mr. Ricci
14 but also Mr. Coache. A proposal has been made by my client
15 to use the Warm Springs West gage and the 3.2 flow at that
16 gage as a control on how much groundwater can be pumped. Do
17 you understand that my client has made that proposal?

18 MR. COACHE: Yes, sir.

19 MR. TAGGART: And I heard in your testimony you
20 alluded to a case called Cappaert or Cappaert, depending on
21 how it's pronounced. But I want to just ask you to explain a
22 little bit more about why is -- why is the -- do you believe
23 the need to utilize a control at Warm Springs West of a
24 certain flow rate as a control on groundwater pumping, is

1 that comparable to what needs to occur at Cappaert at Devil's
2 Hole.
3 MR. COACHE: In my belief absolutely. And I
4 believe it's actually even more relevant than what happened
5 at Devil's Hole. At Devil's Hole the water didn't flow at
6 all, doesn't flow. They didn't have any water rights. And
7 it's simply a -- It's not even a water right. It's a water
8 elevation maintenance above -- below the washer. And so they
9 were given that right to maintain that water level at level X
10 to maintain water on the shelf to where the Devil's Hole pup
11 fish can breathe. There's, let's say, a one-foot decline in
12 water level just like it would be detrimental to the Moapa
13 dace, one-foot level in Devil's Hole eliminates probably 50,
14 60 percent of the breeding area for the fish. And that's why
15 I put it in there. I really believe that they're directly
16 related on what can happen if we don't get our hands around
17 this and manage this system.
18 MR. TAGGART: And Mr. Ricci, do you have anything
19 to add to that?
20 MR. RICCI: No.
21 MR. TAGGART: Okay. One other question is in
22 Cappaert was the State Engineer required to do what he did or
23 did he have the choice ahead of time to manage the system
24 itself?

1 with, if these obligations are met within the Muddy River
2 Springs area, there is no evidence suggesting impacts would
3 propagate north of and beyond the Lower White River flow
4 boundary as currently proposed by the State Engineer. Do you
5 see that?
6 A. I do.
7 Q. Okay. And, Mr. Dixon, you wrote that?
8 A. Yes.
9 Q. All right. And are you aware that in Kane
10 Springs Valley in Ruling 5712 the State Engineer granted a
11 thousand acre-feet of water rights to Lincoln and Vidler but
12 he required that the pumping of those water rights, 500 be at
13 the existing production well, and 500 acre-feet be pumped
14 from a future well to be developed under the applications,
15 which is about seven miles away. Were you aware of that?
16 A. Yes.
17 Q. And would you agree that that's reasonable
18 management by the State Engineer of the Kane Springs Valley
19 hydrographic basin?
20 A. No. Because in that same ruling he also said
21 there was a hydraulic connection with Coyote Spring Valley.
22 Q. And there are some questions to Mr. Coache about
23 new evidence in the record before the State Engineer. And
24 I'm wondering where the SNWA model is with all that new

1 MR. COACHE: In Cappaert he was required to do
2 what they did. There was an opportunity to manage some of
3 the rights beforehand. They didn't take that complete
4 opportunity. But Cappaert took all decision making out of it
5 for the State Engineer.
6 MR. TAGGART: All right. Thank you.
7 HEARING OFFICER FAIRBANK: Lincoln County,
8 Vidler.
9 CROSS-EXAMINATION
10 By Ms. Peterson:
11 ANSWERS BY MR. COACHE:
12 Q. Gentlemen, if you could turn to page 19 of your
13 report, section six. I think, Mr. Coache, you said you wrote
14 this section. Do you have that in front of you?
15 A. I'm sorry, ma'am. Did you say section six?
16 Q. Yeah, section six on page 19.
17 A. I did not write this portion.
18 ANSWERS BY MR. DIXON:
19 Q. Okay. So who ever wrote this portion, the
20 question is addressed to them. There's a recommendation
21 there that the Moapa dace will be protected if there is
22 certain management of the Lower White River Flow System and
23 sustainable levels of pumping and the decreed rights also on
24 the Muddy River will be protected. And then the section ends

1 evidence in it?
2 MR. TAGGART: Objection.
3 (The court reporter interrupts)
4 HEARING OFFICER FAIRBANK: Mr. Taggart's
5 objection was as to the --
6 MR. TAGGART: Vagueness. What model exactly?
7 HEARING OFFICER FAIRBANK: Yes. Question as to
8 vagueness regarding the use of the term SNWA model.
9 MS. PETERSON: I can rephrase. There's new --
10 There's -- Do I get to rephrase?
11 HEARING OFFICER FAIRBANK: Yes. Finish your
12 question.
13 MS. PETERSON: Thank you.
14 You had questions from SNWA about the new
15 evidence that had been developed -- Yes, to you, Mr.
16 Coache -- since I guess 2012. Do you recall that line of
17 questioning?
18 MR. COACHE: I recall that line of questioning.
19 I do not remember them mentioning a model.
20 MS. PETERSON: Right. Do you know if SNWA has
21 developed any kind of model with all of that new data?
22 MR. COACHE: I do not.
23 MS. PETERSON: Okay. Thank you.
24 HEARING OFFICER FAIRBANK: All right. Given the

1 fact that I haven't seen any other participants express an
2 interest for additional questions, we'll go ahead and open it
3 back up to -- Oh, I'm sorry. I'm going to open it back up to
4 the Division of Water Resources staff.
5 EXAMINATION
6 By Mr. Sullivan:
7 ANSWERS BY MR. DIXON:
8 Q. Just one point of clarity in your rebuttal report
9 on page six and also on page seven. On the Y-axis on both of
10 those charts, it appears that there is a typo and the decimal
11 point was removed from the units on the Y-axis; is that
12 correct?
13 A. Feet above main sea level, is that what you're
14 talking about?
15 Q. Feet above main sea levels. So from the bottom
16 goes 1562 and then 1563 and then 1563 again. Should that be
17 1563.5?
18 A. Point-five, yep. I cut off the decimal.
19 Q. Okay. That was done on Figure 4 and also Figure
20 5?
21 A. Yep. Good catch.
22 HEARING OFFICER FAIRBANK: Okay. So we'll go
23 ahead and open it up to Mr. Flangas for redirect. And I'm
24 going to give you seven minutes. It's a little bit more but

1 explain -- You still provided data, so I need you to explain
2 to this panel here, are you telling them to ignore the
3 information on EB-3 or are you saying that the findings in
4 EB-3 are important? What's your point with regard to EB-3?
5 A. I believe they're important. But I -- I can't
6 draw any conclusions on the data with a hundred percent
7 certainty because of the obvious influence from pumping in
8 the manner in which the resolution in the water levels that
9 are being reported. So that -- those two things right there
10 definitely affect the R-squared value in the regression
11 analysis.
12 Q. Can you ever draw anything with a hundred percent
13 certainty in hydrology, sir, really?
14 A. Well, I guess not.
15 Q. So I guess what I'm asking now, this is
16 important, this is an important point. I don't mean to make
17 light of it. But I just want to make sure that we're clear
18 here. When you say that you don't have a high degree of
19 confidence, those of us who are lay persons wonder if that
20 means should it be disregarded or should it be considered?
21 A. You know, if that R-squared value was .7, .8, you
22 know, I would -- The fact that it's so much different. I did
23 put the hydrograph in here, you know. The water levels
24 definitely show response to pumping, but there is overall

1 there was some delay with respect to the objections.
2 MR. FLANGAS: I won't need that. Just a couple
3 of questions hopefully.
4 REDIRECT EXAMINATION
5 By Mr. Flangas:
6 ANSWERS BY MR. DIXON:
7 Q. Let's just clarify a couple of points.
8 Mr. Dixon, is it the position of the three members up there
9 that Kane Springs should be included in the State Engineer's
10 consideration of the Lower White River System?
11 A. Yes.
12 Q. And why is that?
13 A. There's a hydraulic connection based on
14 observations made before, during, and after the Order 1169
15 test that clearly demonstrate it. At that location, at
16 KPW-1, very specific at that location. I don't know what
17 would happen if they pumped up the north end of the valley.
18 I don't have any information up there.
19 Q. Okay. Thank you. In response to Mr. Benedict's
20 questions you commented that there was noise in the well at
21 EB-3. Do you remember that?
22 A. EBM-3 yes.
23 Q. I realize there's noise and I realize you said
24 you don't have a great degree of confidence. But can you

1 trends. This is a more diagnostic tool. And it's because of
2 the dramatic difference between the results, you know .95
3 versus .52. By definition .52 does indicate some
4 correlation, but it's significantly different than the nearby
5 well, you know, three quarters of a mile away BM-DL-2, which
6 is a high correlation to EH-4b. It's the difference between
7 those two.
8 Q. So the entire difference can't be explained just
9 by, because there's hand measurements and just because
10 there's a rounding, is that what you're saying?
11 A. Right. There's something different between those
12 two wells, something causing the response to be that much
13 different.
14 Q. Last question. And this is a question for the
15 panel generally. Are you aware of circumstances where
16 non-water right holders have been excluded from hearings on
17 the basis of standing? Mr. Ricci, in your experience? Is
18 the question clear?
19 MR. RICCI: I can't -- I can't recall that I -- I
20 couldn't say with a hundred percent certainty one way or
21 another.
22 MR. FLANGAS: Okay. Mr. Coache?
23 MR. COACHE: Yes. Water right holders that do
24 not file protest and try to get in to the hearing process

1 subsequent to the -- not subsequent to, but after the protest
 2 period is expired, have been excluded all the time.
 3 Q. (By Mr. Flangas)
 4 ANSWERS BY MR. DIXON:
 5 Q. Mr. Dixon, have you ever experienced a situation
 6 where folks who do not have water rights in the area in the
 7 basin that is subject to hearings have been excluded on the
 8 basis of standing?
 9 A. Not beyond the situation that Mr. Coache just
 10 mentioned. You know, our process is transparent. It gives
 11 people a right to protest, right. And it doesn't matter who
 12 you are, you have that right.
 13 Q. But isn't that the reason why we had .1 in our
 14 rebuttal report?
 15 A. Right. We feel that the stakeholders who have
 16 the most on the line here are the people who have invested to
 17 resources, the people who rely on that water to run their
 18 business or to -- The 8500 people in Overton and Logandale,
 19 the Moapa Valley Water District is required by law to deliver
 20 water. Those are stakeholders. The public interest is by
 21 law protected by the Fish and Wildlife and the Park Service.
 22 That's their job. And it's also the job of the State
 23 Engineer.
 24 Q. Okay. And that is the reason for the inclusion

1 sworn in.
 2 HEARING OFFICER FAIRBANK: Thank you, Mr. King.
 3 (The witness was sworn in)
 4
 5 TODD ROBISON
 6 Called as a witness on behalf of
 7 Muddy Valley Irrigation Company, having been first duly sworn
 8 Was examined and testified as follows:
 9
 10 DIRECT EXAMINATION
 11 By Mr. King:
 12 Q. Good afternoon, Mr. Robison. Can you please
 13 state and spell your name for the record.
 14 A. Todd Robison, T-o-d-d R-o-b-i-s-o-n. I'm the
 15 president of the Muddy Valley Irrigation Company here
 16 representing the shareholders.
 17 Q. Thank you, Mr. Robison. And did you prepare or
 18 direct the preparation of the Muddy Valley Irrigation Company
 19 Exhibit Number 1?
 20 A. I did.
 21 Q. Are there any changes to that exhibit that you
 22 would like me to identify for the record?
 23 A. There is. There's a couple of typographical
 24 errors.

1 of the .1 in the rebuttal report?
 2 A. It was.
 3 Q. Okay. We don't have any -- We don't have
 4 anything -- We're not out to get the NGOs in any particular
 5 reason. And I say we meaning Nevada Cogeneration Associates.
 6 A. That's correct.
 7 MR. FLANGAS: Okay. Thank you. I have no
 8 further questions.
 9 HEARING OFFICER FAIRBANK: Thank you. So we will
 10 go ahead and take a ten-minute break. We'll get started
 11 around, make it 2:45-ish, a little bit thereafter. And we'll
 12 get started with the Muddy Valley Irrigation Company.
 13 (Break was taken)
 14 HEARING OFFICER FAIRBANK: We will continue with
 15 the Muddy Valley Irrigation Company.
 16 MR. KING: Thank you. Good afternoon. Steve
 17 King here for Muddy Valley Irrigation Company. This
 18 afternoon I'm going to present for the hearing Mr. Todd
 19 Robison, who is the chairman/president of the Muddy Valley
 20 Irrigation Company.
 21 The company filed one exhibit in its August 15th,
 22 2019, rebuttal report. And Mr. Robison will be going over
 23 that for the proceeding this afternoon.
 24 So, in order to begin, if the witness may be

1 MR. KING: And, if it please the hearing officer,
 2 I would be prepared to identify those specifically. On page
 3 one, paragraph two, at line six, there is a missing word,
 4 specifically after the words State Engineer's options in view
 5 of, the word that is missing should then be inserted and that
 6 word is what. And that will then complete that sentence.
 7 And then there is another clerical error,
 8 typographical error, that the company is aware of. And that
 9 would be on page three. And that is in Roman numeral section
 10 two at sub three. The first line, which reads, the long-term
 11 annual quantity of groundwater that may be purged from the
 12 Lower White River Flow System. The word should be pumped,
 13 not purged.
 14 So with the permission of the hearing officer, we
 15 would like those to be entered in to the record. Are there
 16 any other corrections that you're aware of, Mr. Robison?
 17 THE WITNESS: Those are the corrections, yes.
 18 MR. KING: Okay. Thank you.
 19 HEARING OFFICER FAIRBANK: Those exhibits --
 20 Those exhibits will be admitted.
 21 Q. (By Mr. King) And was Muddy Valley Irrigation
 22 Company's rebuttal report filed pursuant to State Engineer
 23 Interim Order 1303?
 24 A. Yes.

1 Q. And is Muddy Valley Irrigation Company's
2 participation in this proceeding to confirm its status as a
3 holder of senior decreed water rights relative to the
4 questions presented by the State Engineer regarding
5 consideration of conjunctive management plan for the Lower
6 White River Flow System and the fully decreed Muddy River?

7 A. Yes.

8 MR. KING: Madam Hearing Officer, I would move
9 that the Muddy Valley Irrigation Company Exhibit 1 be
10 admitted in to evidence.

11 HEARING OFFICER FAIRBANK: It's so admitted.

12 MR. KING: Thank you.

13 Q. (By Mr. King) Mr. Robison, could you please
14 provide a brief history of your membership and board of
15 director responsibilities as president/chairman in relation
16 to the Muddy Valley Irrigation Company?

17 A. Yes. I currently serve as president and chairman
18 of the board of directors of the Muddy Valley Irrigation
19 Company. We're a non-profit Nevada corporation that operates
20 an irrigation system in the Lower Muddy River Basin. And
21 I've served in the capacity of board of director for close to
22 30 years and been a chairman for the last 15 or 16 years,
23 something like that.

24 Q. For clarification, you just mentioned that the

1 its corporate assets, specifically, its senior decreed water
2 right for the use of Muddy River water?

3 A. Yes.

4 Q. This is the first day you've been here attending
5 these proceedings that have been going on since Monday of
6 last week; is that accurate?

7 A. That's correct.

8 Q. Okay. With that being said, are you aware of
9 other participants in this proceeding who own shares in Muddy
10 Valley Irrigation Company? If you do, can you please
11 identify those shareholders for the record?

12 A. Yes. CSI, Vidler Water, Moapa Valley Water
13 District, Southern Nevada Water Authority are all
14 shareholders.

15 Q. Thank you. So you named -- Two of those four are
16 Nevada political subdivisions. Do you recall if there are
17 any other Nevada local government/political subdivision
18 entities owning Muddy Valley Irrigation shares and who are
19 those shareholders?

20 A. There is Overton Power District, Clark County
21 representing the Township of Overton and Logandale.

22 Q. All right. And how about are there any State of
23 Nevada agencies or entities that are shareholders in Muddy
24 Valley Irrigation Company?

1 company is a non-profit. I think if I'm recalling, the
2 company is incorporated under the laws of the State of Nevada
3 1895 and in its articles of corporation it said it will be a
4 not for profit company. Would that be accurate?

5 A. That's correct.

6 Q. And so I just wanted the record to reflect that
7 it's not the specific more recent, within the last several
8 decades, section of the Nevada Revised Statutes which allows
9 for, quote, non-profit corporations to be incorporated in the
10 state; is that correct?

11 A. That's correct.

12 Q. Thank you. So approximately how many
13 shareholders are there in the Muddy Valley Irrigation
14 Company?

15 A. Approximately 250.

16 Q. Are Muddy Valley Irrigation Company shareholders
17 the beneficial owners of the Muddy Valley Irrigation
18 Company's decreed water rights in the Muddy River and
19 entitled to the water according to their individual
20 proportionate interests and their shares owned?

21 A. Yes.

22 Q. As a member of the board of directors and
23 president of the company, do you believe that the Muddy
24 Valley Irrigation Company has a duty to preserve and protect

1 A. I believe there's two. Nevada Department of
2 Wildlife and also the University of Nevada Reno Board of
3 Regents.

4 Q. All right. And so for all of those shareholders
5 and all the shareholders in the combined 250, from what I
6 understand your testimony, is your responsibility as one of
7 the board of directors president the governing body of the
8 Muddy Valley Irrigation Company to protect those valuable
9 senior decreed water right interests in the company; is that
10 accurate?

11 A. That's correct.

12 Q. All right. And is that -- would that protection
13 interest, that obligation, be about with regard to how many
14 shares an individual shareholder owns or whether they are a
15 private or a public entity?

16 A. It has no bearing on that.

17 Q. Thank you. Now let's -- May I turn your
18 attention to the Muddy Valley Irrigation Company rebuttal
19 report. In the rebuttal report is just a four-page letter
20 that you signed as the chairman, it should also have
21 identified you as the president, I believe. Is that
22 accurate?

23 A. Yes.

24 Q. And MVID did not present an independent

1 hydrologic or related scientific analysis report with respect
2 to the four specific Lower White River Flow System issues and
3 questions identified in Interim Order 1303, did it?
4 A. That's correct.
5 Q. So can you please tell us how Muddy Valley
6 Irrigation Company's rebuttal report answered those
7 questions?
8 A. Yes. We believe that as an irrigation company
9 that the senior groundwater rights take precedent over any
10 other rights --
11 Q. Excuse me, Mr. Robison. May I interject? I
12 believe you said senior groundwater rights. Did you mean to
13 say surface water?
14 A. Surface water rights. I apologize for that.
15 Yes. We believe that the senior adjudicated rights in the
16 decree take precedent over any other rights in the system.
17 Q. And that is your understanding that at least one
18 of the central purposes of these 1303 proceedings is to
19 determine whether depletions caused by junior groundwater
20 right development may impair or affect the senior decreed
21 surface water rights?
22 A. That is correct.
23 Q. Thank you. So, on the specific questions, I
24 believe the first question had to do with the geographic

1 Q. And when you say the upper rights, I want to just
2 see if I can get you to clarify that a bit. So in the Muddy
3 River decree, that's entered in 1920; is that correct?
4 A. That's correct.
5 Q. And as I'm just recalling in these provisions
6 that all the water rights that were determined, the relative
7 rights adjudicated to determine that decree were found to be
8 found -- found to be appropriated, placed to beneficial use
9 before 1905; is that accurate?
10 A. That's correct.
11 Q. And do you also know that under the decree the
12 river is divided in to two sections, the upper and the lower;
13 is that accurate?
14 A. That's correct.
15 Q. And when you say the upper rights, you're not
16 necessarily referring to the decreed rights in the river.
17 Are you more accurately referring to any possible depletions
18 by spring flow?
19 A. Yeah. That's our only gage that we have is
20 actual flow that shows up at our diversion point. And any
21 diminished flow from that is a concern to us.
22 Q. And is it true that in the decree the Nevada
23 district court judge determined that as to all the water that
24 reaches the diversion point, as you said, and I think that

1 boundary of the State Engineer's Lower White River Flow
2 System. And the Muddy Valley Irrigation Company did not
3 disagree with the State Engineer's determination as set forth
4 in Order 1303, did it?
5 A. We did not.
6 Q. Okay. Thank you. Then as to the next three
7 questions. Can you just please identify, just in a summary
8 way, the concurrence that Muddy Valley Irrigation Company
9 raised in its rebuttal report?
10 A. Yes. I think, I believe to answer the next three
11 points, our concern is driven from the reduced stream flows
12 in the Muddy River, which the end result is at our point of
13 diversion that we have a reduced flow. And the concern is,
14 is that the upper rights have a great impact on our lower
15 rights. And being able to identify the problems that are
16 risen from that is outside the scope of our ability, and we
17 rely heavily on the State Water Engineer to assist us with
18 that.
19 And, clearly, we're a small company that is an
20 end right user. And we do not have any hydrological
21 expertise in the upper basin to make any kind of
22 determination as to what's causing the reduced stream flow.
23 So our purpose in our letter today I think clearly spells out
24 that our concern is protecting our senior water right.

1 would be at wells siting, that the Muddy Valley Irrigation
2 Company is entitled to take and divert all of that water for
3 the benefit of its shareholders and others?
4 A. That's correct. I think it actually has a little
5 stronger language than that. It says we're obligated to take
6 it.
7 Q. Obligated to take it. I think you're right.
8 A. And put it to beneficial use.
9 Q. It's a long decree. It incorporates the relative
10 determinations of the State Engineer. It actually has a
11 Supplemental Exhibit B to it that confirms the rights of all
12 the holders in the Muddy River.
13 Now, as I remember also, that decree has some
14 specific language that states that the Muddy River by the
15 appropriation and placing to beneficial use of the holders of
16 the rights determined in the decree has been fully consumed
17 and exhausted and that it's fully appropriated; is that
18 correct?
19 A. That's correct.
20 Q. I think there's some language in the decree that
21 talks about that there's a prohibition on any further
22 development on the sources or the spring heads. Is that your
23 recollection?
24 A. Yes, it is.

Page 1701

1 Q. And so that would be kind of consistent then with
2 the language about fully consuming and exhausting. And so
3 that language, does that tell you that any -- there would be
4 no further appropriations available for river or spring flows
5 in the Muddy River system?
6 A. That's my understanding.
7 Q. All right. Thank you. And is that the way since
8 your tenure and association with Muddy Valley Irrigation
9 Company the company has operated with regard to the water
10 rights adjudicated to the company?
11 A. That's correct.
12 Q. And is it not also true that below the division
13 between the Upper and the Lower Muddy River that the company
14 is actually directed to effectively manage those flows and
15 all the water that reaches the diversion point for the
16 benefit of the shareholders?
17 A. That's correct.
18 Q. But you're not an attorney so you don't know
19 how -- you just understand how the decree works and as a
20 president of the company?
21 A. That's correct.
22 Q. And this is an unusual company in some ways in
23 Nevada, would you agree that it's a shareholder company that
24 owns water rights for the benefit of its individual

Page 1702

1 shareholders; is that accurate?
2 A. Yeah, the irrigation company does hold those
3 rights.
4 Q. Okay. Thank you. So can you explain, and I
5 think you have, that the company is relying on the State
6 Engineer to enforce the rights that were decreed by the
7 Nevada District Court in 1920 to the Muddy Valley Irrigation
8 Company, as to why the company joined -- not joined, but
9 concurred with some of the analysis that was presented in
10 actually certain sections in the July 3rd, 2019, report by
11 Southern Nevada Water Authority. I think you already
12 mentioned one reason for us as far as budget and surface
13 water assets of the company unrelated to groundwater assets.
14 Would that be accurate?
15 A. That's correct.
16 Q. I think you stated that as the president of the
17 company, one of the board of directors, that there's an
18 obligation to protect the assets of the company which for the
19 benefit of the shareholders?
20 A. That's correct. We represent all shareholders.
21 Q. So that being said, would it be a fair statement
22 that the decision to concur in the specific technical
23 scientific hydrologic positions that were -- that SNWA had in
24 particular sections of its July 3rd report were done as a

Page 1703

1 conservative and a cautionary way to protect those assets?
2 A. That's correct.
3 Q. Because the company has no independent hydrologic
4 or scientific technical analysis, does it?
5 A. No, we do not.
6 Q. And the company doesn't own any groundwater
7 rights, does it?
8 A. No.
9 Q. So the company's interest are for the State
10 Engineer to always keep those rights as a baseline that are
11 necessary to be protected in these proceedings as it
12 considers the questions presented in the possible conjunctive
13 management of the Lower White River Flow System; is that
14 correct?
15 A. Yes.
16 MR. KING: Thank you, Mr. Robison.
17 Madam Hearing Officer, I believe this would be
18 the -- conclude the direct examination for Muddy Valley
19 Irrigation Company of Mr. Robison. And we would like to
20 reserve whatever time might be appropriate for redirect after
21 cross-examination.
22 HEARING OFFICER FAIRBANK: Thank you, Mr. King.
23 And you have approximately an hour and 40 minutes remaining,
24 so we'll go ahead and reserve that for you.

Page 1704

1 MR. KING: Thank you.
2 HEARING OFFICER FAIRBANK: All right. We'll go
3 ahead and open it up for cross-examination. And for this
4 we'll go ahead and limit it to seven minutes per participant.
5 And we'll start with Coyote Springs Investments.
6 CROSS-EXAMINATION
7 By Mr. Herrema:
8 Q. Good afternoon, Mr. Robison. I'm Brad Herrema,
9 counsel for CSI.
10 A. Okay.
11 Q. Just a few very quick questions for you. You
12 signed the irrigation company's rebuttal report; is that
13 correct?
14 A. I did.
15 Q. Were you qualified as an expert witness in these
16 proceedings at all?
17 A. I think as stated we don't have any expert
18 witnesses, per se. And as a representative of the company I
19 signed it.
20 Q. Okay. Did the irrigation company engage in the
21 services of any technical expert in preparing its August 15
22 rebuttal report?
23 A. No.
24 Q. You mentioned earlier that a number of parties to

Page 1705

1 these proceedings are shareholders in the irrigation company.
2 Do you recall that?
3 A. Yes.
4 Q. Okay. Who is the irrigation company's largest
5 shareholder?
6 A. By actual certificates, Southern Nevada Water
7 Authority.
8 Q. Okay. And the others that you mentioned, CSI,
9 Vidler, Moapa Valley Water District, they are all minority
10 shareholders; is that correct?
11 A. Yeah, they own a portion of the shares. To my
12 knowledge, exactly how many, I'm --
13 Q. None of them are majority shareholders?
14 A. No.
15 Q. You mentioned the irrigation company's points of
16 diversion. Do these points of diversion include points
17 downstream of Glendale?
18 A. Yeah. Downstream of the Glendale gage.
19 Q. And you also talked about or you distinguished
20 between an upper basin and a lower basin. Can you tell me
21 what the point of demarcation is for --
22 A. When we talk as long-time residents, we talk
23 about the Upper Muddy and the Lower Muddy.
24 Q. And what separates those two?

Page 1706

1 A. The freeway. The Glendale gage.
2 MR. HERREMA: Thank you very much. No further
3 questions.
4 HEARING OFFICER FAIRBANK: United States Fish and
5 Wildlife Service? Not seeing any questions.
6 National Park Service?
7 MS. GLASGOW: No questions.
8 HEARING OFFICER FAIRBANK: Seeing no questions.
9 Moapa Band of Paiute Indians? No questions.
10 Southern Nevada Water Authority and Las Vegas
11 Valley Water District?
12 CROSS-EXAMINATION
13 By Mr. Taggart:
14 Q. Good afternoon. For the record, Paul Taggart for
15 the water authority and the district. Just to clarify, SNWA
16 is not a majority shareholder either; correct?
17 A. That is correct.
18 Q. All right. So I might have to repeat a few
19 things just to set up this next question. So I heard your
20 testimony to be that there's a decree and the decree divides
21 the water in the river at the Glendale gage. So do you
22 consider any water that gets to that point to be the
23 company's water?
24 A. Yes.

Page 1707

1 Q. Okay. And so do you consider any groundwater
2 pumping that depletes water from the river or water that
3 could have gotten to the river to be a conflict with that
4 surface water right?
5 A. It can be, yes.
6 Q. Okay. Now, I think you mentioned to me one time
7 that a shovel in one share at the head waters is better than
8 ten shares at the tail waters.
9 A. Yeah, I did.
10 Q. Can you describe what you mean by that
11 specifically with respect to the Muddy River?
12 A. Yeah. That's kind of an old farmers wives tail
13 that if you control the water at the head of the ditch you'll
14 get all of your water and the guy at the end of the ditch a
15 lot of times gets what's left over. And, you know, a lot of
16 this is in the same regard to potential over pumping or usage
17 of water beyond the ability to maintain the stream of the
18 river. It can happen. If during the test pump we've seen a
19 decrease in the stream flows. And in regards that's what I
20 mean by that is the person that's upstream of us can
21 definitely control what happens to us.
22 Q. And when you say the test, do you mean the 1169
23 pump test?
24 A. That's correct.

Page 1708

1 Q. Okay. And in this situation though, that one
2 share and a shovel upstream could be somebody with a well in
3 the groundwater system; right?
4 A. That's correct.
5 Q. So do you think the State Engineer can determine
6 the long-term quantity of groundwater that can be pumped from
7 the Lower White River Flow System without taking in to
8 consideration MVIC's water right?
9 A. No.
10 Q. You're aware, are you not, that in the last few
11 years there's a power plant that's not operating anymore in
12 the Overton area; right?
13 A. Yes, I'm aware of that.
14 Q. And so there was alluvial pumping for that power
15 plant for a series of years from what we sometimes in these
16 proceedings have referred to as the LDS water and the power
17 company water; right?
18 A. That's correct.
19 Q. Now, in the years since that water has stopped
20 being used for the power plant, have you seen a change in
21 river flows?
22 A. Yes.
23 Q. Could you describe that?
24 A. Yeah. A little bit complicated. When the river

1 flow in the summer months decreased that well siting, we --
2 Well, let me back up. In the early 1960s, the irrigation
3 company took on a huge task of creating a reservoir to store
4 water that was not mostly benefitted in the winter months to
5 be able to supplement the summer months. And over the period
6 of time, as the stream flows diminish or go back up, we
7 constantly are adjusting from an operational standpoint the
8 flow coming out of Bowman Reservoir to maintain a level of
9 consistency for our shareholders. Obviously it was
10 shareholder water that went in there and the benefit was back
11 to the shareholders.

12 Since the pumping, the alluvial pumping, has
13 stopped, then that frequency of adjustment seems to have
14 leveled out a little bit. Did I answer your question?

15 Q. Yes. I mean, do you think there's more water in
16 the river now?

17 A. No.

18 MR. TAGGART: Okay. Great. I have no further
19 questions. Thank you.

20 HEARING OFFICER FAIRBANK: Moapa Valley Water
21 District? Seeing no questions.

22 Lincoln County, Vidler? Seeing no questions.

23 City of Las Vegas?

24 MS. URE: No questions.

1 are done before lunch, then we'll go ahead and open it up for
2 public comment. If we're not done until the lunch time, then
3 we'll return after lunch for public comment. But public
4 comment will follow the conclusion of the presentation by
5 stakeholders who have submitted rebuttal reports. And at
6 that time then we'll also address any other administrative or
7 procedural matters that we have remaining. And so we'll see
8 everyone tomorrow morning. Thank you.

9 (Hearing concluded at 3:19 p.m.)
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

1 HEARING OFFICER FAIRBANK: Center for Biological
2 Diversity? No questions.

3 Georgia Pacific Republic? Seeing no questions.

4 Nevada Cogeneration Associates? Seeing no
5 questions.

6 Bedroc?

7 MS. URE: No questions.

8 HEARING OFFICER FAIRBANK: And Nevada Energy?

9 MS. CAVIGLIA: No questions.

10 HEARING OFFICER FAIRBANK: No questions.

11 I will open it up to the Division of Water
12 Resources staff and the State Engineer. Okay. Seeing no
13 questions on our end, Coyote Springs Investments, do you have
14 any further questions?

15 And Southern Nevada Water Authority?

16 All right. Well, thank you very much. We'll
17 conclude the proceedings with the Muddy Valley Irrigation
18 Company.

19 Before we conclude for the day, I wanted to go
20 ahead and address a couple of just kind of procedural
21 administrative matters. So tomorrow morning we will go ahead
22 and get started with Bedroc. And then at the conclusion of
23 the two hours allocated for Bedroc and for cross-examination,
24 then we'll get started with Nevada Energy. And then if we

1 STATE OF NEVADA)
2)ss.

3 COUNTY OF WASHOE)
4

5 I, CHRISTY Y. JOYCE, Official Certified Court
6 Reporter for the State of Nevada, Department of Conservation
7 and Natural Resources, Division of Water Resources, do hereby
8 certify:

9 That on Thursday, the 3rd day of October,
10 2019, I was present at the Legislative Counsel Bureau, Carson
11 City, Nevada, for the purpose of reporting in verbatim
12 stenotype notes the within-entitled public hearing;

13 That the foregoing transcript, consisting of
14 pages 1597 through 1711, inclusive, includes a full, true and
15 correct transcription of my stenotype notes of said public
16 hearing.

17 Dated at Reno, Nevada, this 4th day of
18 October, 2019.
19
20
21

22 _____
23 CHRISTY Y. JOYCE, CCR #625
24

#	Acting (1) 1598:5	1608:18	1597:11.5	1599:9.5
#625 (2) 1597:22.5;1712:21.5	action (3) 1615:8;1645:24; 1646:24	affect (4) 1617:16;1633:9; 1687:10;1697:20	Alex (1) 1599:15	angle (2) 1621:6,9
/	actual (7) 1637:12;1645:3; 1656:10,12;1674:21; 1699:20;1705:6	affected (1) 1641:12	Allison (1) 1599:13	annual (2) 1641:1;1692:11
/// (4) 1606:22,23,24; 1660:24	affecting (1) 1645:1	affects (1) 1617:16	allocated (1) 1710:23	answered (2) 1674:7;1697:6
A	Actually (13) 1614:9,20;1618:7; 1637:12;1641:7; 1643:1;1656:20; 1660:6;1681:4;1700:4, 10;1701:14;1702:10	afternoon (11) 1650:21;1654:6; 1656:24;1657:1; 1666:12;1690:16,18, 23;1691:12;1704:8; 1706:14	allotted (2) 1603:10;1650:16	anymore (2) 1657:24;1708:11
abbreviation (1) 1604:2	Adam (2) 1598:6;1678:16	against (5) 1634:7,12;1636:11, 13;1659:17	allow (1) 1635:17	apart (4) 1625:15,21,23; 1651:15
ability (6) 1647:3;1657:7,16; 1677:1;1698:16; 1707:17	add (2) 1673:20;1681:19	agencies (3) 1638:4,9;1695:23	allowed (1) 1655:10	apologies (1) 1672:9
able (5) 1674:8,11,23; 1698:15;1709:5	added (1) 1618:8	aggregate (2) 1651:21;1652:17	allows (1) 1694:8	apologize (3) 1624:3;1640:20; 1697:14
ABOVE (4) 1600:9;1681:8; 1685:13,15	adding (2) 1627:18;1629:12	ago (3) 1609:16;1614:20; 1626:22	alluded (1) 1680:20	apparent (2) 1615:24;1619:11
absolutely (3) 1653:6;1664:12; 1681:3	additional (14) 1608:11,12,22,22; 1641:4,5;1644:15; 1648:1;1649:16; 1654:23;1656:8; 1659:16;1679:24; 1685:2	agreed (1) 1652:10	alluvial (5) 1629:1;1647:6; 1670:10;1708:14; 1709:12	appear (1) 1639:22
abundant (1) 1621:10	address (13) 1610:24;1612:20,22; 1614:4;1644:8,9; 1645:6;1648:14; 1649:24;1668:23; 1669:17;1710:20; 1711:6	against (5) 1634:7,12;1636:11, 13;1659:17	alluvium (10) 1647:10,13,22; 1648:18,21,22; 1670:15;1671:1,6; 1677:8	appearing (1) 1608:17
accept (2) 1612:6;1642:24	additionally (1) 1636:6	agencies (3) 1638:4,9;1695:23	almost (7) 1614:23;1626:2; 1634:5;1646:15,15; 1648:10;1649:5	appears (7) 1620:3;1635:12; 1639:19;1640:6; 1641:24;1674:2; 1685:10
access (1) 1651:5	address (13) 1610:24;1612:20,22; 1614:4;1644:8,9; 1645:6;1648:14; 1649:24;1668:23; 1669:17;1710:20; 1711:6	agencies (3) 1638:4,9;1695:23	alone (1) 1673:18	appendix (1) 1623:3
accommodate (2) 1603:17,18	address (13) 1610:24;1612:20,22; 1614:4;1644:8,9; 1645:6;1648:14; 1649:24;1668:23; 1669:17;1710:20; 1711:6	aggregate (2) 1651:21;1652:17	alter (1) 1669:21	applicant's (1) 1632:20
according (1) 1694:19	access (1) 1651:5	aggregated (1) 1652:10	always (2) 1620:9;1703:10	application (1) 1655:8
accurate (8) 1694:4;1695:6; 1696:10,22;1699:9,13; 1702:1,14	accommodate (2) 1603:17,18	ago (3) 1609:16;1614:20; 1626:22	among (2) 1639:6;1661:21	applications (4) 1615:8;1654:21; 1660:8;1683:14
accurately (1) 1699:17	according (1) 1694:19	agree (10) 1622:21;1642:8; 1643:20;1646:11; 1663:24;1664:4; 1665:14;1668:20; 1683:17;1701:23	amount (8) 1614:23;1620:7; 1646:2,5,6,16;1659:24; 1677:2	appreciate (2) 1613:9;1659:22
acknowledge (3) 1620:3;1653:8,11	accurate (8) 1694:4;1695:6; 1696:10,22;1699:9,13; 1702:1,14	agreement (2) 1648:20;1649:1	analyses (1) 1677:23	appropriate (6) 1609:9,14,17; 1610:2;1616:12; 1703:20
acknowledging (2) 1620:10;1625:12	accurately (1) 1699:17	agrees (1) 1646:6	analysis (38) 1608:12,22;1610:19; 1612:12;1624:19; 1625:8;1635:16,18; 1637:12;1639:16,21; 1640:1,2,4,8,9; 1642:12;1644:17; 1651:2,4,5,9,20,23,24; 1652:8,10,15;1655:19; 1662:22;1666:15,18; 1678:2,20;1687:11; 1697:1;1702:9;1703:4	appropriately (1) 1650:23
acquired (1) 1654:23	acknowledge (3) 1620:3;1653:8,11	ahead (33) 1602:6,8,14;1608:6; 1610:21,24;1613:13; 1617:2;1620:11; 1633:23;1635:16,17; 1640:15;1642:18; 1643:10,14;1650:15, 16;1672:5,10,13; 1680:6,8;1681:23; 1685:2,23;1690:10; 1703:24;1704:3,4; 1710:20,21;1711:1	analyze (1) 1613:6	appropriation (2) 1632:14;1700:15
across (5) 1618:7;1636:22; 1637:19;1638:2; 1677:24	acknowledging (2) 1620:10;1625:12	AKA (1)	and- (1) 1599:4.5	appropriations (1) 1701:4
act (1) 1613:23	acquired (1) 1654:23		and/or (2) 1665:24;1670:13	approved (1) 1605:10
	acre-feet (15) 1617:23;1629:7; 1641:2,3,4,7;1646:12; 1647:19,22;1649:10; 1664:6,17;1671:17; 1683:11,13		Angeles (1)	approximately (8) 1606:11;1625:17; 1628:3;1639:2; 1641:15;1694:12,15; 1703:23
	across (5) 1618:7;1636:22; 1637:19;1638:2; 1677:24			April (2) 1641:15,15
	act (1) 1613:23			aquifer (21)

1615:16,23;1622:2, 14;1626:23;1627:12; 1628:2;1633:10; 1637:23;1649:7,8,9,11, 16,17;1663:22;1665:1, 1,5;1675:9;1677:4	association (1) 1701:8	Band (3) 1599:16.5;1653:24; 1706:9	behalf (9) 1604:10;1605:18; 1607:2;1608:20; 1613:12,20;1650:21; 1670:5;1691:6	1699:2;1708:24; 1709:14
aquitar (1) 1628:24	assumed (1) 1661:18	bar (1) 1666:2	Belaustegui (1) 1599:6	BLACK (18) 1597:8;1616:8; 1617:5,12;1622:8; 1623:3,23;1624:6,13; 1626:18;1644:19,23; 1653:3;1659:16,20; 1666:19;1678:18,21
AREA (50) 1597:8.5,11; 1606:13;1616:9; 1617:5,8,16,18; 1619:15;1621:21; 1622:8;1623:3,23; 1624:7,10,14;1626:18; 1628:9;1629:1; 1641:17;1644:18; 1645:1,2,4,22;1646:10; 1647:11,14;1648:2; 1653:1,3;1659:11; 1660:4,19;1662:5,14, 19;1666:1,7,16,20; 1674:2;1676:3,17; 1678:19,21;1681:14; 1683:2;1689:6; 1708:12	assumption (1) 1612:21	Barnes (1) 1598:9	belief (2) 1679:6;1681:3	Bliss (1) 1598:15
areas (3) 1645:20;1651:9; 1652:12	attending (2) 1608:17;1695:4	barometric (2) 1651:20;1652:7	believes (6) 1634:15;1635:23; 1636:2;1637:23; 1644:15;1648:5	blocks (1) 1621:13
arguments (2) 1667:13;1668:17	attention (3) 1621:3;1623:20; 1696:18	based (14) 1611:16;1613:7; 1617:24;1634:8,8; 1635:11;1636:11; 1639:18,20;1642:12; 1658:10;1671:14,24; 1686:13	below (5) 1621:10;1628:24; 1638:4;1681:8; 1701:12	blowing (1) 1633:11
around (8) 1603:8;1619:23; 1625:4;1654:9; 1676:15,16;1681:16; 1690:11	attorney (1) 1701:18	baseline (1) 1703:10	Benedict (5) 1598:12;1600:17; 1672:17,19;1677:9	blue (2) 1617:19;1679:7
arrived (3) 1622:7,23;1651:11	attributable (2) 1624:10;1644:17	basically (2) 1615:12;1635:21	Benedict's (1) 1686:19	BM-DL-2 (8) 1622:12;1624:23; 1625:3,8,15;1653:4; 1673:23;1688:5
articles (1) 1694:3	attributed (1) 1624:13	BASIN (35) 1597:8,9,9.5,10,10.5, 12;1598:15.5;1616:9; 1617:13;1619:9; 1624:11;1626:9,19; 1627:14,15,18,20; 1628:9;1629:5,7,10,13; 1633:7,7;1644:20,24; 1648:16;1655:8; 1668:1;1683:19; 1689:7;1693:20; 1698:21;1705:20,20	beneficial (4) 1694:17;1699:8; 1700:8,15	board (7) 1693:14,18,21; 1694:22;1696:2,7; 1702:17
ascribable (1) 1637:22	author (2) 1604:1,24	basins (11) 1606:13;1615:15; 1623:20;1624:1; 1636:22;1637:19; 1638:2;1655:8; 1657:16,18;1671:18	benefit (5) 1700:3;1701:16,24; 1702:19;1709:10	Bob (4) 1604:3;1605:7,14; 1639:14
assess (1) 1651:2	authors (2) 1604:1,24	basis (13) 1613:3,11;1631:24; 1640:12,13;1644:5,12; 1647:18,23;1669:10, 13;1688:17;1689:8	benefits (1) 1645:23	body (1) 1696:7
assessment (1) 1678:7	available (6) 1615:7;1636:12; 1651:7;1661:13; 1670:14;1701:4	bearing (1) 1696:16	benefitted (1) 1709:4	bolster (1) 1668:17
assets (5) 1695:1;1702:13,13, 18;1703:1	averages (1) 1617:23	beat (1) 1615:12	Berley (1) 1599:16.5	boost (1) 1676:5
assign (2) 1642:15;1675:24	awarded (1) 1664:5	became (3) 1615:6,16,22	better (6) 1606:15;1651:22; 1652:9;1656:12; 1676:19;1707:7	borehole (4) 1621:5,18,23; 1628:14
assigned (1) 1611:11	aware (11) 1618:21;1646:7; 1667:24;1683:9,15; 1688:15;1692:8,16; 1695:8;1708:10,13	becoming (1) 1605:9	beyond (12) 1610:14;1614:3; 1622:21;1626:8; 1629:20;1640:6; 1652:13;1657:22; 1679:5;1683:3;1689:9; 1707:17	both (7) 1625:17;1640:13; 1641:11;1643:1; 1651:5;1675:6;1685:9
assist (1) 1698:17	away (4) 1626:1;1653:14; 1683:15;1688:5	bedroc (5) 1599:20;1669:24; 1710:6,22,23	biologic (1) 1599:23	Bottom (6) 1621:12;1628:2; 1630:9;1634:7;1635:1; 1685:15
associated (1) 1648:19	Bachelor (2) 1606:6;1607:12	beforehand (1) 1682:3	Biological (5) 1636:7;1666:23; 1667:9,24;1710:1	boundaries (2) 1627:17;1661:19
Associates (11) 1602:7;1603:24; 1604:11;1605:19; 1607:3;1610:16,23; 1617:15;1669:4; 1690:5;1710:4	back (14) 1606:10;1607:11; 1619:8;1620:1; 1624:18;1625:1; 1660:6;1669:11; 1671:16;1685:3,3; 1709:2,6,10	began (1) 1614:22	bit (25) 1602:18;1603:15,18; 1604:16;1605:24; 1607:8;1614:15; 1623:5;1626:8; 1631:11;1637:13; 1638:16;1640:10,20; 1642:9;1643:3; 1672:24;1676:12; 1678:9;1680:22; 1685:24;1690:11;	boundary (20) 1616:5,7,12,15; 1617:18;1619:4; 1626:8;1627:9,9,9,16, 24;1628:19;1645:8; 1659:2;1661:9,16; 1671:10;1683:4; 1698:1
	background (4) 1604:17;1606:1; 1607:9,10	begins (1) 1614:10		Bowman (1) 1709:8
	bad (2) 1629:16;1663:20			Brad (4) 1613:20;1650:21; 1657:9;1704:8
				Bradley (1) 1599:9
				break (2)

B

1690:10,13 breathe (1) 1681:11 breeding (1) 1681:14 Bridget (1) 1598:15 brief (1) 1693:14 bring (1) 1606:14 broad (1) 1669:19 brought (1) 1659:20 Brownstein (1) 1599:8.5 budget (1) 1702:12 bullet (20) 1609:21;1631:5,5,7; 1634:21;1635:21; 1639:19,22;1640:16, 17,19,23;1643:12; 1646:21;1659:1; 1661:17;1662:2,7,8,11 bullets (2) 1634:19;1643:2 bullseye (1) 1666:6 Bureau (1) 1712:9 Burns (1) 1623:6 business (1) 1689:18 buy (2) 1647:21,22 buzzer (1) 1658:4	1603:7,13,14,17; 1608:14,16,16; 1611:19;1618:22; 1619:6;1620:9; 1624:12;1628:13; 1631:11,12;1632:12; 1640:5;1642:5,19; 1645:21;1646:3,8; 1656:12;1657:11,15; 1658:9;1667:6; 1670:24;1675:14; 1676:15,16;1679:22; 1680:16;1681:11,16; 1684:9;1686:24; 1687:12;1691:12; 1695:10;1697:5; 1698:7;1699:2;1702:4; 1705:20;1707:5,10,18, 20;1708:5,6 capacity (3) 1604:23;1674:3; 1693:21 CAPITOL (1) 1597:21 Cappaert (6) 1680:20,20;1681:1, 22;1682:1,4 Cappaert-type (1) 1647:1 caption (1) 1624:4 captured (1) 1646:8 carbon (1) 1620:17 carbonate (37) 1620:16;1621:16; 1622:2,14;1626:23; 1627:12;1628:1,7; 1632:18,22;1633:10; 1634:7,12;1636:13,20; 1637:17,24;1646:8; 1647:7,11,15,16,19,23; 1665:2,5;1666:15,18; 1670:11,16;1671:2,6; 1673:5;1677:7; 1679:13,14,14 Carson (5) 1597:23.5;1599:4, 14;1602:1;1712:9 case (9) 1609:7,8,11,13,17; 1610:3;1620:9; 1636:17;1680:20 cases (1) 1653:16 casings (1) 1620:17 catch (1) 1685:21 caught (2) 1621:3;1623:20 cause (1)	1649:17 caused (2) 1645:4;1697:19 causing (3) 1625:16;1688:12; 1698:22 caution (1) 1646:20 cautionary (1) 1703:1 caverns (1) 1621:20 Caviglia (7) 1599:10.5;1600:16; 1670:5,5;1671:9; 1672:2;1710:9 CCR (3) 1597:22,22.5; 1712:21.5 ceased (1) 1628:20 Cenozoic (1) 1628:2 Center (7) 1599:23;1636:7; 1654:9;1666:23; 1667:8,24;1710:1 central (1) 1697:18 certain (8) 1611:21;1612:7; 1620:7;1651:9; 1661:22;1680:24; 1682:22;1702:10 certainly (2) 1642:15;1675:7 certainty (3) 1687:7,13;1688:20 certificated (1) 1670:10 certificates (1) 1705:6 Certified (2) 1597:21.5;1712:4 certify (1) 1712:7 CH2M (3) 1609:23;1630:20; 1631:8 chairman (3) 1693:17,22;1696:20 chairman/president (1) 1690:19 challenged (1) 1619:19 change (3) 1648:17,22;1708:20 changed (4) 1661:16,19;1662:8; 1670:24 changes (5) 1623:13,14;1629:18; 1651:22;1691:21	changing (1) 1627:17 characterize (1) 1675:14 charts (1) 1685:10 check (1) 1613:24 checklist (1) 1672:11 chemistry (4) 1619:19;1620:16; 1678:20,23 Chief (2) 1598:8,11 choice (1) 1681:23 Christi (1) 1598:13.5 CHRISTY (3) 1597:22;1712:4,21.5 chunk (2) 1675:23,24 circumstances (1) 1688:15 citation (1) 1678:22 citizen (1) 1667:21 City (10) 1597:23.5;1599:4, 14,21;1602:1;1623:21; 1666:10,13;1709:23; 1712:10 civil (4) 1604:20;1607:12; 1612:3,15 claims (2) 1630:8;1637:21 clarification (3) 1602:16;1658:24; 1693:24 clarify (4) 1662:7;1686:7; 1699:2;1706:15 clarifying (1) 1644:7 clarity (1) 1685:8 Clark (1) 1695:20 clear (10) 1608:24;1615:22; 1622:5;1624:5;1638:8; 1647:4;1659:9; 1675:20;1687:17; 1688:18 cleared (1) 1655:6 clearly (4) 1665:2;1686:15; 1698:19,23 clerical (1)	1692:7 client (4) 1666:3;1671:21; 1680:14,17 climate (3) 1651:19;1652:6,22 clock (1) 1680:13 close (4) 1626:1,3;1656:3; 1693:21 closer (5) 1606:15;1617:4; 1619:15;1622:17; 1623:1 closing (1) 1613:1 cluster (1) 1617:20 COACHE (73) 1600:5;1602:23; 1604:4;1605:7,8,14,17, 24;1606:2,3,5;1614:9, 9,12,13;1629:22,23,24; 1631:15,17;1635:9,9, 20,20;1637:6;1639:11; 1640:19;1642:18,19, 24;1643:11,13,15,16; 1645:11;1654:5,8; 1658:13,22,24;1659:8; 1660:16,20;1661:7; 1662:7;1663:10,12,13, 17;1664:23;1667:3,6; 1668:7,9,14;1670:6,12; 1671:16;1675:4,5; 1680:14,18;1681:3; 1682:1,11,13;1683:22; 1684:16,18,22; 1688:22,23;1689:9 C-o-a-c-h-e (1) 1606:5 coefficient (1) 1637:2 Cogen (6) 1617:15;1618:19; 1635:4;1661:18; 1665:11,14 Cogeneration (10) 1602:7;1603:24; 1604:11;1605:19; 1607:3;1610:16,23; 1669:4;1690:5;1710:4 coincident (1) 1627:24 Colby (1) 1627:15 collaboration (1) 1661:21 collapsing (1) 1621:13 collect (1) 1641:19 collected (6)
C				
calculate (6) 1637:8;1662:4,14, 18;1663:2,13 calculated (1) 1645:13 calculators (1) 1603:11 CALIFORNIA (2) 1597:10.5;1599:9.5 call (1) 1672:23 Called (6) 1604:10;1605:18; 1607:2;1623:3; 1680:20;1691:6 came (6) 1615:10;1617:3; 1627:5;1651:6; 1654:18;1678:24 can (51)				

1615:19;1641:14; 1655:15,15;1672:22; 1674:23 collecting (2) 1615:20;1659:18 color (1) 1623:8 combined (1) 1696:5 comfortable (1) 1642:24 coming (4) 1618:22;1679:12,13; 1709:8 comment (9) 1630:14,17;1631:1; 1634:1,15;1652:13; 1711:2,3,4 commented (2) 1679:10;1686:20 commenting (1) 1634:22 comments (1) 1642:11 common (1) 1642:6 Company (59) 1599:13;1602:8; 1620:4;1660:23; 1661:5;1672:8,12; 1690:12,15,17,20,21; 1691:7,15,18;1692:8; 1693:9,16,19;1694:1,2, 4,14,16,23,24;1695:10, 24;1696:8,9,18; 1697:8;1698:2,8,19; 1700:2;1701:9,9,10,13, 20,22,23;1702:2,5,8,8, 13,17,18;1703:3,6,19; 1704:18,20;1705:1; 1708:17;1709:3; 1710:18 Company's (9) 1692:22;1693:1; 1694:18;1697:6; 1703:9;1704:12; 1705:4,15;1706:23 comparable (1) 1681:1 compared (1) 1619:20 comparison (4) 1624:14;1637:10,11, 14 complete (4) 1619:10;1666:14; 1682:3;1692:6 completed (3) 1620:18;1628:23; 1641:13 completely (4) 1609:16;1626:19; 1646:11,16	completion (2) 1621:4;1628:24 complex (1) 1646:16 complexity (2) 1646:13,17 complicated (2) 1647:5;1708:24 component (1) 1624:11 compounded (1) 1674:10 concern (5) 1644:10;1698:11,13, 24;1699:21 concerned (1) 1646:22 conclude (3) 1703:18;1710:17,19 concluded (1) 1711:9 concludes (1) 1649:18 conclusion (7) 1622:8,24;1632:21; 1634:16;1665:16; 1710:22;1711:4 conclusions (9) 1610:7;1611:9,10; 1635:14;1643:5,8; 1644:9;1651:10; 1687:6 conclusive (1) 1673:8 concur (1) 1702:22 concurring (1) 1702:9 concurrence (1) 1698:8 conditions (1) 1656:5 conduct (1) 1649:11 conducted (2) 1614:22;1664:5 conduit (1) 1613:23 confidence (5) 1652:2;1653:7; 1674:21;1686:24; 1687:19 confidently (1) 1674:5 confined (1) 1610:11 confirm (2) 1622:22;1693:2 Confirmation (1) 1621:12 confirms (1) 1700:11 conflict (1)	1707:3 conjunctive (3) 1648:19;1693:5; 1703:12 conjunctively (2) 1655:10,11 connected (1) 1673:2 connection (6) 1633:1;1665:15; 1672:23;1673:8; 1683:21;1686:13 connections (2) 1633:6;1674:8 connectivity (5) 1636:22;1637:19; 1638:2,11;1651:2 consequence (1) 1675:15 CONSERVATION (2) 1597:2;1712:5 conservative (1) 1703:1 consider (3) 1654:10;1706:22; 1707:1 considerable (1) 1632:22 consideration (6) 1612:24;1613:4; 1614:6;1686:10; 1693:5;1708:8 considered (3) 1611:5;1615:1; 1687:20 considering (1) 1644:3 considers (1) 1703:12 consistency (2) 1619:11;1709:9 consistent (2) 1606:18;1701:1 consisting (1) 1712:12 consolidated (1) 1628:15 constantly (1) 1709:7 constructed (2) 1618:10;1628:7 consultant (2) 1604:23;1618:19 consumed (1) 1700:16 consuming (1) 1701:2 contain (1) 1608:22 contained (15) 1608:12,23;1609:13; 1611:13,23;1634:20; 1635:12;1637:5;	1639:20,23,24;1640:3, 13;1642:13;1643:2 content (1) 1635:17 contention (1) 1628:1 contents (1) 1635:13 context (1) 1623:15 continuation (2) 1602:4;1677:6 continue (3) 1619:9;1676:20; 1690:14 Continued (2) 1599:1.5;1601:1.5 continues (2) 1655:24,24 continuing (1) 1676:23 continuous (4) 1620:1;1628:21; 1664:11;1671:20 contrary (1) 1637:23 contribute (1) 1617:7 contributed (1) 1605:3 contributes (1) 1617:6 contributions (1) 1623:24 control (6) 1657:17;1680:16,23, 24;1707:13,21 controlled (3) 1638:22;1663:2,14 conversion (1) 1636:18 converted (2) 1620:18;1674:18 Cooper (1) 1598:13.5 copies (2) 1613:16,17 corner (1) 1617:17 corporate (1) 1695:1 corporation (2) 1693:19;1694:3 corporations (1) 1694:9 corrections (2) 1692:16,17 corrective (1) 1645:23 correctly (1) 1611:20 correlated (1) 1624:13	correlates (1) 1626:2 correlating (2) 1643:19,23 correlation (26) 1625:13;1634:6,9, 11,13;1636:13;1637:2, 9,17,24;1643:21,24; 1644:2;1651:2,20,22; 1652:8,10,19,21,24; 1653:2,4;1677:15; 1688:4,6 correlations (3) 1636:12,20;1678:11 correspondence (1) 1636:2 counsel (2) 1704:9;1712:9 County (10) 1599:12;1613:12; 1630:8;1660:22; 1661:5;1680:4;1682:7; 1695:20;1709:22; 1712:2 couple (11) 1615:21;1617:20; 1620:15;1622:17; 1650:22;1660:3; 1679:22;1686:2,7; 1691:23;1710:20 course (1) 1635:3 court (6) 1604:6;1664:20; 1684:3;1699:23; 1702:7;1712:4 cover (1) 1616:5 COYOTE (24) 1597:7.5;1614:21; 1615:3,9,14;1624:6,14, 16;1633:2,3,7;1636:3, 4;1650:17;1657:5; 1660:7,9;1665:4,24; 1666:19;1679:23; 1683:21;1704:5; 1710:13 create (3) 1648:1,2,3 creating (1) 1709:3 Creek (1) 1628:24 cross (2) 1631:23;1643:17 Cross-Examination (30) 1600:10,11,12,13,14, 15,16,20,21;1601:6,7; 1602:15;1609:22; 1642:1;1650:11,15,18; 1654:3;1658:20; 1661:1;1666:11; 1667:1;1670:4;
--	--	--	--	--

1680:10;1682:9; 1703:21;1704:3,6; 1706:12;1710:23 cross-examine (1) 1612:20 cross-section (1) 1627:21 cross-sections (1) 1673:18 CSI (8) 1599:6,8,5;1613:21; 1650:21;1657:9; 1695:12;1704:9; 1705:8 CSVW-4 (15) 1634:23;1636:8,10, 14;1637:3,10,15; 1641:11;1643:20,21, 24;1644:1,3;1678:3,9 CSVW-4 (1) 1634:13 current (11) 1617:18;1622:9,14; 1627:14,24;1629:4,15; 1644:13;1645:8; 1646:12;1659:2 currently (2) 1683:4;1693:17 curtail (1) 1666:5 curtailed (1) 1647:21 curtailment (2) 1639:4,7 cut (1) 1685:18 cuttings (1) 1621:8 cyclical (1) 1628:21	1712:8,17 days (1) 1609:16 deal (1) 1616:10 dealing (3) 1607:22;1616:14,14 deals (1) 1646:2 death (1) 1615:12 decades (1) 1694:8 decide (1) 1612:5 deciding (1) 1611:24 decimal (2) 1685:10,18 decipher (1) 1674:19 decision (8) 1612:2,8;1646:22; 1647:1;1668:18; 1671:23;1682:4; 1702:22 decisions (3) 1612:13;1629:19; 1645:9 decline (1) 1681:11 decrease (1) 1707:19 decreased (1) 1709:1 decree (12) 1697:16;1699:3,7, 11,22;1700:9,13,16,20; 1701:19;1706:20,20 decreed (13) 1647:8;1648:20,24; 1649:1;1682:23; 1693:3,6;1694:18; 1695:1;1696:9; 1697:20;1699:16; 1702:6 deemed (1) 1670:7 deep (3) 1627:12;1628:2,6 deeper (2) 1622:1;1672:24 definitely (4) 1679:12;1687:10,24; 1707:21 definition (1) 1688:3 degree (6) 1604:20;1606:6; 1607:12;1652:19; 1686:24;1687:18 delay (4) 1677:24;1678:9,10;	1686:1 delayed (3) 1645:21;1646:22; 1649:13 deliver (1) 1689:19 deliveries (1) 1647:7 demarcation (1) 1705:21 demonstrate (2) 1626:10;1686:15 denied (2) 1654:12,20 deny (1) 1679:11 DEPARTMENT (3) 1597:2;1696:1; 1712:5 depending (1) 1680:20 depends (1) 1664:8 depletes (1) 1707:2 depletions (2) 1697:19;1699:17 depth (1) 1671:5 depth-to-water (1) 1641:14 Deputy (2) 1598:6,5;1607:15 describe (2) 1707:10;1708:23 determination (9) 1611:15,16;1612:18; 1613:7;1630:24; 1646:18;1669:22; 1698:3,22 determinations (2) 1611:6;1700:10 determine (9) 1643:4,22;1644:1; 1656:12;1658:9; 1674:8;1697:19; 1699:7;1708:5 determined (4) 1643:18;1699:6,23; 1700:16 determines (1) 1640:24 detrimental (8) 1638:21;1645:21; 1646:9;1649:17; 1665:7;1666:1,3; 1681:12 develop (2) 1627:1;1670:21 developed (6) 1626:22;1632:13; 1656:14;1683:14; 1684:15,21	development (6) 1627:4,12;1633:8; 1664:16;1697:20; 1700:22 develops (1) 1638:19 Devil's (5) 1681:1,5,5,10,13 diagnose (1) 1674:11 diagnostic (1) 1688:1 diagram (1) 1641:16 difference (6) 1626:10;1670:14; 1671:1;1688:2,6,8 different (11) 1613:10;1619:10; 1626:4,19;1640:21; 1651:15;1671:8; 1687:22;1688:4,11,13 difficult (1) 1643:3 diminish (1) 1709:6 diminished (1) 1699:21 Direct (19) 1600:4,6,8;1601:5; 1604:14;1605:22; 1607:6;1609:20; 1637:9;1665:15,17; 1666:6;1667:5; 1675:18,18,22; 1691:10,18;1703:18 directed (1) 1701:14 direction (1) 1667:7 directly (8) 1635:5;1639:23; 1640:14;1642:12; 1644:8,9;1673:2; 1681:15 director (2) 1693:15,21 directors (4) 1693:18;1694:22; 1696:7;1702:17 disaggregate (4) 1651:13,15,18; 1652:6 disaggregated (1) 1652:16 disagree (4) 1642:8;1661:9; 1678:6;1698:3 disagrees (3) 1616:5;1630:2; 1641:9 discernible (2) 1634:15;1635:24	discharge (2) 1634:9;1675:7 disconnections (1) 1673:12 discretion (1) 1642:16 discuss (6) 1630:4,14;1631:12; 1635:23;1638:14; 1662:10 discussed (7) 1614:19;1630:21; 1631:3;1634:1,2,4; 1635:22 discussing (1) 1638:15 discussion (6) 1615:6;1630:18,23; 1646:4;1673:1; 1678:18 disregard (1) 1644:2 disregarded (1) 1687:20 distinguished (1) 1705:19 District (15) 1599:18;1654:2,7; 1658:19,23;1680:7; 1689:19;1695:13,20; 1699:23;1702:7; 1705:9;1706:11,15; 1709:21 District/ (1) 1599:12,5 ditch (2) 1707:13,14 diversion (6) 1698:13;1699:20,24; 1701:15;1705:16,16 Diversity (5) 1599:23,5;1636:7; 1666:24;1668:1; 1710:2 Diversity's (1) 1667:9 divert (1) 1700:2 divided (2) 1602:20;1699:12 divides (1) 1706:20 DIVISION (10) 1597:3;1606:11; 1607:11,13;1672:5,14; 1685:4;1701:12; 1710:11;1712:6 DIXON (40) 1600:3;1604:3,4,4,9, 16,18,24;1607:24; 1614:8;1616:1,2,14; 1617:2;1619:1; 1625:17;1631:14;
D				
dace (2) 1681:13;1682:21 dash (2) 1634:21;1635:1 data (30) 1615:7,19,20; 1620:3;1622:6;1625:3, 4;1637:12;1651:6; 1652:1;1655:15,15,18; 1656:1,2,9;1659:14,16, 18;1668:17;1673:7,13; 1674:4,23;1677:17; 1678:21,23;1684:21; 1687:1,6 date (3) 1629:12;1647:16,20 Dated (1) 1712:17 day (4) 1695:4;1710:19;				

1650:20,23;1662:16, 17,21;1663:4;1666:14, 17;1668:18,24; 1672:18,20;1673:15; 1677:12,14;1678:15; 1682:18;1683:7; 1685:7;1686:6,8; 1689:4,5 Dixon's (2) 1606:17;1607:17 documenting (1) 1621:1 documents (1) 1615:5 dollars (2) 1615:17;1670:20 done (10) 1627:22;1637:10,11; 1644:16;1649:5; 1652:6;1685:19; 1702:24;1711:1,2 Donnelly (10) 1599:23.5;1600:15; 1667:2,4;1668:7,12,15, 21;1669:2,23 dots (1) 1617:19 double-check (1) 1654:13 down (8) 1603:1;1620:21; 1624:24;1628:16,17; 1671:22;1672:24; 1677:4 downstream (2) 1705:17,18 Dr (1) 1667:9 draft (1) 1613:2 drafted (1) 1605:14 drafting (1) 1605:13 dramatic (1) 1688:2 draw (2) 1687:6,12 drawdown (5) 1662:4,18;1663:2, 13;1673:21 drawdowns (1) 1662:14 drawn (2) 1618:6;1665:21 Drici (1) 1623:7 drill (3) 1619:22;1672:24; 1679:15 drilled (2) 1619:24;1621:24 drilling (1)	1621:20 drive (1) 1677:8 driven (1) 1698:11 drop (1) 1642:21 Dry (2) 1618:12,22 dual (1) 1628:23 due (7) 1603:18;1620:22; 1652:20,22;1653:1; 1673:12,13 duly (4) 1604:11;1605:19; 1607:3;1691:7 during (9) 1615:23;1639:3; 1641:20;1642:1; 1663:18,21;1674:23; 1686:14;1707:18 duty (1) 1694:24 DWR (1) 1651:6	1637:22 effectively (1) 1701:14 effects (10) 1617:7;1627:13; 1630:6;1632:6;1634:6; 1636:9;1643:18,22; 1647:6;1648:1 efforts (1) 1626:24 EGV-3 (1) 1620:14 EH-4 (24) 1623:11,13,24; 1624:9,12,15;1625:8, 13,19,20;1634:7,9,12, 13;1636:11,13,14; 1637:3,9;1652:24; 1653:1,2;1677:15; 1678:3 EH-4b (1) 1688:6 EH-8a (1) 1628:18 eight (3) 1615:15;1618:24; 1643:5 eighties (1) 1628:20 either (4) 1613:24;1643:2,7; 1706:16 elevation (1) 1681:8 eliminates (1) 1681:13 else (2) 1605:12;1678:10 elsewhere (1) 1629:14 encompasses (2) 1641:17,17 encountered (2) 1618:10;1628:14 end (12) 1618:16;1627:24; 1628:8,17,19;1631:12; 1636:16;1686:17; 1698:12,20;1707:14; 1710:13 ends (1) 1682:24 Energy (5) 1599:10.5;1670:3,6; 1710:8,24 enforce (1) 1702:6 engage (1) 1704:20 Engineer (78) 1598:5,6,5,9,5,15,5; 1606:8;1607:15,16; 1610:7,11;1611:5,6,9,	15,22;1612:2,12,18; 1613:5;1614:16; 1616:17;1617:22; 1622:20;1628:6; 1630:16,24;1631:1; 1632:6,11,19,24; 1638:19;1640:24; 1642:17;1644:7,23; 1646:19;1649:7; 1650:7;1654:10,22; 1655:7,20;1657:3,6,16, 21;1658:8,12;1660:2; 1665:21;1666:2; 1667:22;1668:2; 1669:3,5;1670:10,13, 23;1671:5,11,14,24; 1672:14;1681:22; 1682:5;1683:4,10,18, 23;1689:23;1692:22; 1693:4;1698:17; 1700:10;1702:6; 1703:10;1708:5; 1710:12 engineering (2) 1604:20;1607:12 Engineer's (8) 1610:9;1616:6; 1632:16;1638:15; 1686:9;1692:4;1698:1, 3 enough (3) 1661:13;1673:19; 1675:3 entered (2) 1692:15;1699:3 entire (5) 1616:8;1619:9; 1634:17;1678:18; 1688:8 entirely (1) 1667:5 entirety (1) 1669:20 entities (2) 1695:18,23 entitled (2) 1694:19;1700:2 entity (1) 1696:15 equal (1) 1603:9 equates (1) 1641:5 equilibrium (4) 1676:9,11,16,18 error (4) 1603:7,18;1692:7,8 errors (1) 1691:24 especially (3) 1612:3,6;1625:12 Esq (11) 1599:3,5,5,7,9,10,5,	13,5,15,16,5,18,20,21 essentially (2) 1639:24;1640:2 established (1) 1648:6 estimated (2) 1628:3;1637:16 Even (7) 1615:2;1625:11; 1627:4;1629:6; 1645:21;1681:4,7 event (5) 1638:18;1641:12,18; 1643:19,23 everybody (1) 1603:8 everyone (1) 1711:8 evidence (23) 1602:11;1611:5,9; 1612:1,4,6,8,19; 1613:4,5,6;1621:8; 1632:24;1650:3,7; 1654:9;1660:3; 1667:13;1683:2,23; 1684:1,15;1693:10 evident (2) 1615:7;1625:5 exact (2) 1622:12;1624:20 exactly (4) 1650:3;1671:10; 1684:6;1705:12 Examination (19) 1600:4,6,8,17,18,19, 22,23;1601:5;1604:14; 1605:22;1607:6; 1672:16;1677:10; 1678:13;1685:5; 1686:4;1691:10; 1703:18 examined (4) 1604:12;1605:20; 1607:4;1691:8 examining (2) 1624:8,8 example (1) 1636:24 Excellent (1) 1668:14 except (2) 1650:5;1671:14 exceptional (1) 1641:18 exclude (3) 1669:3,10,16 excluded (6) 1618:2;1668:16; 1669:12;1688:16; 1689:2,7 excludes (1) 1638:19 excluding (2)
	E			

1612:7;1667:16 exclusion (1) 1612:4 Excuse (4) 1613:15;1627:2; 1639:8;1697:11 exhausted (1) 1700:17 exhausting (1) 1701:2 Exhibit (9) 1616:19,21,23; 1637:6;1690:21; 1691:19,21;1693:9; 1700:11 exhibits (6) 1649:22;1650:1,2,4; 1692:19,20 existing (5) 1615:13;1638:22; 1647:16;1665:7; 1683:13 exists (4) 1626:11;1654:9; 1672:23;1676:22 expect (1) 1628:22 expeditiously (1) 1646:19 experience (5) 1606:9,9,12;1612:3; 1688:17 experienced (1) 1689:5 expert (4) 1612:12;1704:15,17, 21 expertise (1) 1698:21 experts (16) 1602:11;1608:13; 1609:7,8,9,15,16,17, 22;1610:2,6;1611:8, 21;1635:17;1652:2; 1672:21 expiration (1) 1602:13 expired (1) 1689:2 explain (6) 1623:4;1640:5; 1680:21;1687:1,1; 1702:4 explained (1) 1688:8 explaining (1) 1617:9 explanation (2) 1673:14;1678:8 exploration (1) 1626:21 express (1) 1685:1	expressly (1) 1668:4 extend (1) 1640:8 extending (1) 1626:13 extension (1) 1618:12 extent (6) 1611:3;1617:6,15; 1635:15;1640:2; 1643:12 external (1) 1674:1 extraordinary (2) 1643:18,23 extreme (1) 1646:20	far (4) 1610:10;1628:8; 1660:8;1702:12 Farber (1) 1599:8.5 farmers (1) 1707:12 farther (1) 1656:12 fault (9) 1618:13;1619:12; 1621:7,7,12,21; 1626:16;1653:13,15 faults (3) 1613:22;1618:21; 1619:7 favor (3) 1603:13;1667:13; 1670:11 features (3) 1620:22;1677:16; 1679:18 federal (1) 1646:24 feedback (1) 1613:9 feeds (1) 1676:2 feel (1) 1689:15 feet (12) 1619:22;1620:15; 1621:5,10;1622:1; 1624:24;1625:15,23; 1628:3,15;1685:13,15 felt (5) 1630:7,15;1632:2,7; 1659:16 few (5) 1622:16;1656:7; 1704:11;1706:18; 1708:10 fifth (1) 1669:19 figure (3) 1624:4;1685:19,19 File (2) 1627:23;1688:24 filed (2) 1690:21;1692:22 fill (1) 1628:2 final (2) 1607:20;1659:1 finalized (1) 1605:9 finally (1) 1615:15 find (2) 1610:14;1619:23 finding (4) 1630:5;1631:24; 1632:1;1641:10	findings (3) 1630:2;1635:14; 1687:3 fine (7) 1603:3;1613:14,14; 1631:10,12;1642:23; 1668:14 finish (3) 1602:13;1668:12; 1684:11 first (29) 1604:11;1605:19; 1607:3;1609:19; 1619:24;1623:4; 1631:5;1634:19,21; 1635:21;1639:6,19; 1640:17,19,23; 1641:14;1645:17; 1648:13;1655:23; 1662:7;1672:19; 1677:13;1678:3,19; 1680:12;1691:7; 1692:10;1695:4; 1697:24 Fish (7) 1636:6;1653:19; 1680:1;1681:11,14; 1689:21;1706:4 five (8) 1614:16;1616:2; 1643:6;1656:2,9; 1657:15;1671:19; 1678:5 five-year (1) 1656:6 Flangas (65) 1599:15;1600:4,6,8, 23;1602:10,16,22,24; 1603:12,20,23; 1604:15;1605:23; 1606:14;1607:7; 1608:4;1609:3,5; 1610:4;1611:18; 1612:10,16,19; 1613:14,17;1614:8,11; 1616:21;1617:1,2; 1630:12;1631:8,17; 1633:16,21,23,24; 1635:5,7,8;1637:5; 1639:9,13,23,24; 1640:10,18;1641:23; 1642:18;1645:11; 1649:19,21;1650:8,12; 1669:8,9,10,15; 1685:23;1686:2,5; 1688:22;1689:3; 1690:7 Flatley (1) 1598:7.5 FLOW (71) 1597:7;1602:5; 1604:22;1606:10,13; 1612:14;1613:23,23;	1614:24;1615:1; 1632:22;1633:9; 1636:21,23;1637:18, 20;1638:1,3,7,10,12, 21,24;1639:3,4;1641:2, 8;1644:14;1645:8,19; 1646:4,5,9,23;1647:1, 12,15,17;1648:7,23; 1649:8,13;1651:3; 1652:21;1655:16; 1656:2;1658:10; 1659:3;1670:8,15,16; 1676:14;1680:15,24; 1681:5,6;1682:22; 1683:3;1692:12; 1693:6;1697:2;1698:1, 13,22;1699:18,20,21; 1703:13;1708:7; 1709:1,8 flowing (1) 1677:6 flows (11) 1633:3;1656:15,19; 1665:6;1676:6; 1698:11;1701:4,14; 1707:19;1708:21; 1709:6 fluency (1) 1646:18 focus (4) 1617:12;1666:19,20; 1669:18 focused (1) 1651:24 focusing (2) 1619:4;1623:23 folks (1) 1689:6 follow (2) 1663:10;1711:4 FOLLOWING (6) 1600:9;1622:4; 1630:2,9;1638:4; 1661:6 follows (4) 1604:12;1605:20; 1607:4;1691:8 foot (2) 1653:10;1677:20 footnotes (1) 1665:1 foregoing (1) 1712:12 foresee (1) 1648:11 forgot (1) 1624:4 formation (3) 1626:20;1627:6; 1628:24 forth (3) 1635:15;1657:13; 1698:3
	F			
	faced (1) 1660:2 fact (9) 1609:13;1626:20; 1632:15;1634:5,5; 1645:14;1679:10; 1685:1;1687:22 factors (1) 1675:16 failed (1) 1620:17 Fair (2) 1675:3;1702:21 FAIRBANK (71) 1597:4;1598:3; 1602:3,20;1603:6,16, 21;1606:3;1608:6,14, 24;1609:3;1610:4; 1612:10,17;1614:2; 1616:23;1631:6; 1633:18,22,23; 1634:18;1635:10; 1639:8,12,18;1640:5, 12;1642:10,23;1643:9; 1649:20;1650:4,9,14; 1653:19,23;1657:11, 19;1658:1,5,18; 1660:22;1666:9,23; 1669:9,15,24;1670:2; 1672:4,9;1679:20; 1682:7;1684:4,7,11,24; 1685:22;1690:9,14; 1691:2;1692:19; 1693:11;1703:22; 1704:2;1706:4,8; 1709:20;1710:1,8,10 fairly (2) 1624:16;1675:2 fallacy (1) 1630:23 familiar (2) 1654:16;1679:3			

<p>forward (1) 1644:7</p> <p>found (10) 1623:22;1630:10; 1632:6,19,24;1636:8; 1637:14;1699:7,8,8</p> <p>four (16) 1614:23;1615:4,10, 10;1623:20;1627:11; 1649:14;1655:19; 1656:2,6;1657:12; 1668:21;1669:19; 1671:18;1695:15; 1697:2</p> <p>four-page (1) 1696:19</p> <p>fractured (1) 1621:10</p> <p>fractures (1) 1621:9</p> <p>frame (1) 1680:8</p> <p>framed (2) 1643:4,5</p> <p>freeway (1) 1706:1</p> <p>frequency (1) 1709:13</p> <p>Friday (2) 1623:7;1627:16</p> <p>front (2) 1612:9;1682:14</p> <p>full (3) 1649:15;1675:11; 1712:13</p> <p>fully (4) 1693:6;1700:16,17; 1701:2</p> <p>further (13) 1620:13;1624:21; 1625:11;1653:14,17; 1669:23;1672:2; 1690:8;1700:21; 1701:4;1706:2; 1709:18;1710:14</p> <p>Furthermore (1) 1612:21</p> <p>furthest (1) 1619:17</p> <p>future (3) 1629:19;1657:7; 1683:14</p>	<p>generally (1) 1688:15</p> <p>Gentlemen (2) 1661:4;1682:12</p> <p>geographic (1) 1697:24</p> <p>geologic (7) 1618:6;1619:4; 1673:3,9,17;1678:20; 1679:18</p> <p>geology (10) 1617:10,10;1618:9, 14;1619:10,11; 1626:10,19;1628:4; 1673:15</p> <p>geophysics (1) 1627:22</p> <p>Georgia (1) 1710:3</p> <p>gets (2) 1706:22;1707:15</p> <p>GG (1) 1619:5</p> <p>given (6) 1611:14;1633:5; 1649:15;1680:8; 1681:9;1684:24</p> <p>gives (1) 1689:10</p> <p>Glasgow (3) 1599:22;1653:22; 1706:7</p> <p>Glendale (4) 1705:17,18;1706:1, 21</p> <p>goal (1) 1646:12</p> <p>goes (5) 1606:10;1620:1; 1625:1;1629:20; 1685:16</p> <p>good (15) 1621:1;1625:2; 1627:5;1628:11; 1645:2;1650:21; 1654:6;1656:23; 1657:1;1666:12; 1685:21;1690:16; 1691:12;1704:8; 1706:14</p> <p>governing (1) 1696:7</p> <p>government/political (1) 1695:17</p> <p>gradient (1) 1632:7</p> <p>granted (1) 1683:10</p> <p>graph (2) 1637:2;1641:18</p> <p>gravity (1) 1627:22</p> <p>great (5) 1629:17;1668:1; 1686:24;1698:14; 1709:18</p> <p>greater (3) 1623:16;1637:16; 1649:10</p> <p>Greg (2) 1599:18;1658:23</p> <p>ground (1) 1649:2</p> <p>groundwater (37) 1626:21;1627:14; 1632:12,14,22;1633:3, 8;1639:1,2;1641:1; 1644:18;1646:3; 1647:2,10,14;1648:6; 1653:13;1654:24; 1657:3,15;1658:9; 1665:8;1670:7,11; 1671:1,2;1680:16,24; 1692:11;1697:9,12,19; 1702:13;1703:6; 1707:1;1708:3,6</p> <p>groups (1) 1667:21</p> <p>guess (12) 1619:2;1634:22; 1642:4;1661:7; 1667:20;1672:20,22; 1674:7;1676:19; 1684:16;1687:14,15</p> <p>guidelines (2) 1648:5,13</p> <p>guy (1) 1707:14</p> <p>guys (4) 1603:5,12;1614:21; 1672:20</p>	<p>1647:2;1665:5; 1676:2,6;1677:8; 1707:7,13</p> <p>heading (1) 1659:6</p> <p>heads (1) 1700:22</p> <p>hear (5) 1602:6;1611:22,24; 1619:16;1642:7</p> <p>heard (11) 1606:17;1607:17; 1609:8,10;1623:5,6,21; 1642:5;1658:3; 1680:19;1706:19</p> <p>HEARING (97) 1597:4,15,16; 1598:3,5,8;1602:3,4, 20;1603:6,16,19,21; 1606:3;1608:6,14,24; 1609:3;1610:4,5; 1611:8,13,20;1612:10, 17;1614:2,14;1616:23; 1617:4;1618:5;1631:6; 1633:18,23;1634:18; 1635:7,10;1639:8,12, 18;1640:5,12;1642:1,6, 10,23;1643:9;1649:20; 1650:4,9,14;1651:7; 1653:19,23;1657:11, 19;1658:1,5,18;1660:7, 22;1666:9,23;1669:9, 15,24;1670:2;1672:4,7, 9;1679:20;1682:7; 1684:4,7,11,24; 1685:22;1688:24; 1690:9,14,18;1691:2; 1692:1,14,19;1693:8, 11;1703:17,22;1704:2; 1706:4,8;1709:20; 1710:1,8,10;1711:9; 1712:11,15</p> <p>hearings (5) 1614:22;1615:4,11; 1688:16;1689:7</p> <p>heavily (1) 1698:17</p> <p>held (2) 1660:7;1665:8</p> <p>help (3) 1612:12;1651:10; 1674:19</p> <p>helpful (3) 1612:1,8;1622:19</p> <p>helping (1) 1619:1</p> <p>hereby (1) 1712:6</p> <p>here's (1) 1674:12</p> <p>Herrema (16) 1599:9;1600:10; 1601:6;1613:20,20;</p>	<p>1614:7;1643:1,10; 1650:19,21;1653:17; 1657:9,9;1704:7,8; 1706:2</p> <p>HH (2) 1626:12,15</p> <p>HIDDEN (1) 1597:9,5</p> <p>high (18) 1618:3;1621:6,9; 1634:6,8,11;1636:12, 20,21;1637:17,18,24; 1638:1;1652:2;1653:7; 1674:10;1687:18; 1688:6</p> <p>higher (1) 1623:19</p> <p>higher-producing (1) 1653:14</p> <p>Hill (3) 1609:23;1630:20; 1631:9</p> <p>history (1) 1693:14</p> <p>Hold (3) 1639:13;1654:13; 1702:2</p> <p>holder (3) 1648:20;1649:1; 1693:3</p> <p>holders (8) 1638:23;1649:18; 1668:5;1671:20; 1688:16,23;1700:12,15</p> <p>hole (6) 1621:12;1681:2,5,5, 10,13</p> <p>holes (1) 1619:24</p> <p>hopefully (2) 1603:7;1686:3</p> <p>hoping (1) 1644:7</p> <p>horizontal (1) 1677:16</p> <p>Horse (1) 1627:6</p> <p>hour (4) 1602:10,13,18; 1703:23</p> <p>hours (4) 1602:17,21;1603:10; 1710:23</p> <p>huge (2) 1629:18;1709:3</p> <p>HUGH (10) 1600:7;1604:3; 1605:7,15;1607:1; 1624:2;1658:12; 1660:5;1661:11,20</p> <p>hundred (10) 1620:15;1630:7,15; 1631:2;1632:2;</p>
G		H	
<p>gage (6) 1680:15,16;1699:19; 1705:18;1706:1,21</p> <p>gallons (4) 1664:1,7,10,13</p> <p>GARNET (5) 1597:9;1623:22; 1624:5;1666:15,20</p>	<p>half (2) 1602:17,23</p> <p>hand (3) 1675:1;1677:18; 1688:9</p> <p>hands (1) 1681:16</p> <p>hang (1) 1621:6</p> <p>happen (4) 1668:20;1681:16; 1686:17;1707:18</p> <p>happened (3) 1636:18;1677:1; 1681:4</p> <p>happening (1) 1656:4</p> <p>happens (2) 1603:11;1707:21</p> <p>hard (2) 1620:3,4</p> <p>head (7)</p>		

1647:19,22;1687:6,12; 1688:20 hundreds (6) 1615:4,5,18;1632:7, 14;1670:20 Hyatt (1) 1599:8.5 hydraulic (13) 1633:5;1636:22; 1638:2;1647:2; 1659:14,17;1665:5,15; 1676:2,6;1677:8; 1683:21;1686:13 hydrograph (6) 1628:18;1637:10; 1652:17;1663:17,21; 1687:23 HYDROGRAPHIC (11) 1597:7.5,8.5,9.5,10, 10.5,11.5;1633:6,7; 1644:20,24;1683:19 hydrographs (6) 1634:10;1635:11; 1637:15;1643:20,24; 1651:19 hydrologic (8) 1633:1;1637:18; 1644:3;1655:15; 1659:18;1697:1; 1702:23;1703:3 hydrological (1) 1698:20 Hydrologist (2) 1598:12.5;1604:19 Hydrology (5) 1598:11;1606:12; 1627:17;1629:21; 1687:13 hypocritical (1) 1659:21	1665:5,6,11,11,17; 1666:1,2,3,4,6;1698:14 impacting (3) 1641:7;1644:24; 1648:24 impacts (21) 1638:21;1644:2,3, 17;1645:4,20,21; 1646:1;1649:13,17; 1652:16;1655:7; 1656:5,11,13;1658:14; 1675:18;1676:20,23, 24;1683:2 impair (1) 1697:20 impediment (1) 1613:23 implications (1) 1627:18 importance (1) 1659:15 important (11) 1621:11;1623:11; 1638:18;1639:17; 1644:21,22;1645:6; 1687:4,5,16,16 importantly (1) 1645:3 imposed (1) 1615:23 impossible (1) 1648:11 improper (1) 1610:17 inactive (2) 1627:19;1629:11 inappropriate (2) 1610:17;1642:3 include (8) 1616:8;1629:9; 1660:4,10,18;1668:18; 1678:18;1705:16 included (15) 1605:3;1617:20,23; 1618:7;1619:9; 1627:20;1629:11,19; 1639:5;1660:14; 1661:8,14;1662:9; 1668:19;1686:9 includes (2) 1645:12;1712:13 including (4) 1636:10;1638:3; 1657:4;1678:21 inclusion (6) 1638:6;1639:16,21; 1659:7,10;1689:24 inclusive (1) 1712:13 incorporated (2) 1694:2,9 incorporates (1) 1700:9	increase (5) 1656:1;1665:6; 1676:5,6;1677:7 incremental (1) 1624:11 indeed (1) 1648:2 independent (4) 1666:14,18;1696:24; 1703:3 Indians (2) 1653:24;1706:9 indicate (5) 1636:21;1638:11; 1641:11;1664:22; 1688:3 indicated (3) 1616:4;1621:13; 1661:7 indicates (3) 1633:1;1637:16; 1665:2 indicating (1) 1665:10 individual (9) 1624:1,11;1651:21; 1652:8,9;1657:21; 1694:19;1696:14; 1701:24 individually (2) 1615:3;1630:4 inflicting (1) 1658:11 inflow (1) 1676:5 influence (4) 1620:4;1674:1; 1676:22;1687:7 inform (2) 1612:12;1651:10 information (16) 1613:8;1617:11; 1622:20,22;1627:5; 1632:18;1652:3; 1661:12,13;1668:19; 1672:21;1673:16,20; 1679:2;1686:18; 1687:3 initial (2) 1617:24;1618:2 initially (2) 1645:5;1659:12 input (3) 1605:9;1607:19,19 inserted (1) 1692:5 installed (2) 1627:3;1628:10 instance (1) 1656:15 instead (1) 1649:2 institutional (1)	1659:24 insufficient (1) 1615:7 intense (1) 1628:20 intentional (1) 1618:21 intentionally (1) 1618:17 interest (8) 1614:16;1618:11,15; 1638:17;1685:2; 1689:20;1696:13; 1703:9 interested (1) 1640:22 interesting (1) 1623:18 interests (2) 1694:20;1696:9 interim (3) 1616:6;1692:23; 1697:3 interject (1) 1697:11 internal (1) 1615:6 interpretation (1) 1640:21 interpretations (1) 1628:4 interrupts (3) 1604:6;1664:20; 1684:3 inventory (1) 1629:6 invested (1) 1689:16 investigation (1) 1620:23 Investments (5) 1650:17;1660:9; 1679:23;1704:5; 1710:13 invited (1) 1612:12 involved (1) 1605:13 Irrigation (42) 1599:19;1602:8; 1672:8,12;1690:12,15, 17,20;1691:7,15,18; 1692:21;1693:1,9,16, 18,20;1694:13,16,17, 24;1695:10,18,24; 1696:8,18;1697:6,8; 1698:2,8;1700:1; 1701:8;1702:2,7; 1703:19;1704:12,20; 1705:1,4,15;1709:2; 1710:17 issuance (3) 1615:11;1648:8;	1654:10 issue (13) 1616:5,7,10;1617:4, 9;1627:7;1648:15; 1655:6;1660:13; 1661:12;1665:17,22; 1669:19 issued (2) 1654:19;1657:3 issues (16) 1607:22;1610:12; 1612:21,23;1615:12; 1616:15;1623:22; 1625:3;1627:16; 1636:16;1648:14; 1653:11;1657:12; 1669:19;1674:9; 1697:2 Item (4) 1616:6;1638:15,16; 1668:24 items (1) 1630:9 IX (1) 1597:17
J				
JAY (6) 1600:3;1604:3,9,18; 1616:2;1673:15 jeopardy (1) 1670:21 job (3) 1621:1;1689:22,22 joined (2) 1702:8,8 Jon (2) 1598:12;1672:19 JOYCE (3) 1597:22;1712:4,21.5 judge (1) 1699:23 July (2) 1702:10,24 junior (4) 1639:1;1670:11; 1671:19;1697:19 jus (1) 1631:10 Justina (2) 1599:10.5;1670:5				
K				
Kane (43) 1630:1,6;1631:2; 1632:2,3,12;1633:1,3, 6,8;1636:3;1638:3,6,9, 12;1639:5,21;1641:5; 1659:7,10,19;1660:4, 10,11,13,18;1661:8; 1662:5,9,14,19;1663:3,				

14,18,21;1665:3,4,24, 24;1666:19;1683:9,18; 1686:9 Karen (5) 1599:13,5,22; 1608:14,19;1661:4 karst (1) 1620:22 keep (1) 1703:10 Kent (1) 1599:7 key (5) 1630:2,5;1640:21; 1641:10;1673:23 kind (8) 1619:14;1651:15; 1676:12;1684:21; 1698:21;1701:1; 1707:12;1710:20 King (18) 1599:19;1601:5; 1672:7,7,11;1690:16, 17;1691:2,11;1692:1, 18,21;1693:8,12,13; 1703:16,22;1704:1 KMV-1 (2) 1634:23;1636:8 KMW-1 (14) 1637:9,10,15,17,24; 1641:11,19;1643:19, 20,21,23,24;1644:1,3 knew (1) 1662:1 knowledge (5) 1632:11;1656:1; 1660:1,12;1705:12 known (2) 1649:12;1656:1 KPW-1 (6) 1632:23;1636:1; 1638:19;1641:4; 1665:22;1686:16 Kryder (5) 1598:10,5;1600:18; 1677:11,13;1678:12 KSV (1) 1639:16 KSVM (1) 1663:18 KSVM-4 (2) 1663:18,21 KSW-1 (1) 1665:4 KVW-1 (1) 1641:13	1645:19 Lake (5) 1618:12,22;1626:14, 18;1627:2 Lane (1) 1597:23 language (5) 1700:5,14,20; 1701:2,3 large (2) 1621:13,20 larger (1) 1619:8 largest (2) 1615:16;1705:4 Las (15) 1599:21;1604:21; 1623:21;1626:13,14, 17,18;1627:2,3; 1654:1;1666:10,13; 1680:7;1706:10; 1709:23 last (16) 1621:16;1622:17; 1623:7;1627:15; 1635:1;1646:21; 1660:3;1661:6,17; 1664:24;1671:18; 1688:14;1693:22; 1694:7;1695:6; 1708:10 lastly (1) 1633:5 late (1) 1628:20 later (1) 1637:13 law (3) 1670:8;1689:19,21 laws (1) 1694:2 lawyers (1) 1603:11 lay (1) 1687:19 LDS (1) 1708:16 least (3) 1619:12;1674:19; 1697:17 left (4) 1621:17;1624:6; 1625:10;1707:15 legislation (2) 1632:17;1655:6 Legislative (1) 1712:9 less (5) 1623:12;1625:20; 1645:5;1649:12; 1664:6 letter (2) 1696:19;1698:23	level (24) 1624:15;1636:2,21; 1637:18;1638:1; 1641:14,20;1651:22; 1652:2,11;1653:7; 1673:20,21;1676:5; 1677:4,7,21;1678:8; 1681:9,9,12,13; 1685:13;1709:8 leveled (3) 1676:24;1677:5; 1709:14 levels (24) 1620:5,7;1623:11, 13,24;1624:12;1625:2; 1627:14;1633:9; 1635:24;1641:10,11; 1647:2;1653:9; 1656:16,19,21;1675:7, 12,21;1682:23; 1685:15;1687:8,23 Levi (2) 1598:10,5;1677:13 light (1) 1687:17 likewise (1) 1614:3 limestone (1) 1621:10 limit (10) 1610:21;1618:1,3; 1640:18;1646:19; 1648:15;1657:6; 1668:4;1671:5;1704:4 limitations (2) 1632:16;1640:7 limited (2) 1610:6;1677:3 Lincoln (11) 1599:12;1608:10,20; 1613:12;1630:7; 1660:22;1661:5; 1680:4;1682:7; 1683:11;1709:22 Lincoln-Vidler (14) 1630:3,5;1631:22; 1632:20;1637:21; 1638:18;1639:1,6; 1641:3,13;1642:2; 1643:17,22;1664:5 Lincoln-Vidler's (2) 1630:14;1641:10 line (9) 1618:6;1626:12; 1665:20;1676:16; 1684:16,18;1689:16; 1692:3,10 linear (2) 1644:16;1677:16 list (1) 1671:22 liter (1) 1629:17	lithology (1) 1673:13 little (36) 1602:18;1603:15,18; 1604:16;1605:24; 1606:15;1607:8; 1614:15;1617:18; 1619:15,19;1620:23; 1622:1;1623:5,8; 1626:8;1631:11; 1637:13;1638:16; 1640:10,20;1642:9; 1643:3;1647:5; 1648:12;1649:11; 1658:2;1672:11,24; 1676:12;1680:22; 1685:24;1690:11; 1700:4;1708:24; 1709:14 local (2) 1672:21;1695:17 locate (1) 1637:12 located (4) 1626:15;1636:4; 1653:13,14 location (9) 1616:13;1618:9,20; 1622:9;1627:23; 1629:15;1646:7; 1686:15,16 Logandale (2) 1689:18;1695:21 long (3) 1674:10;1675:2; 1700:9 longer (2) 1645:23,24 long-term (5) 1641:1;1657:14,17; 1692:10;1708:6 long-time (1) 1705:22 look (13) 1617:4;1620:2,8; 1622:18,20;1623:1; 1627:16;1630:16; 1655:7;1658:14; 1665:20;1671:17; 1677:23 looked (4) 1614:24;1615:14; 1621:21;1677:19 looking (12) 1615:3;1622:10; 1629:20;1630:1; 1634:9,10;1658:24; 1659:4;1660:3; 1672:10;1676:13; 1678:11 looks (3) 1603:6;1621:22; 1622:2	Los (1) 1599:9,5 lot (6) 1615:5;1620:24; 1627:5;1677:19; 1707:15,15 lots (1) 1675:17 Low (5) 1599:6,5;1620:17; 1623:12;1627:13; 1675:22 LOWER (66) 1597:6,5;1602:5; 1604:22;1606:13; 1612:14;1625:15; 1627:10;1628:1; 1636:17,21,22; 1637:18,19;1638:1,3,6, 10,12,20,23;1639:3,4; 1641:2,7;1644:13; 1645:8,14,18,19; 1646:3,5,9,23;1647:11, 15,17;1648:7;1649:8, 13;1651:2;1655:16; 1656:1;1658:9;1659:3; 1666:2;1670:8,15,16; 1674:3,3;1676:14; 1682:22;1683:3; 1686:10;1692:12; 1693:5,20;1697:2; 1698:1,14;1699:12; 1701:13;1703:13; 1705:20,23;1708:7 Ltd (1) 1599:3 lunch (3) 1711:1,2,3 LWRFS (8) 1616:9,12;1622:14; 1627:13,24;1629:13; 1665:6;1679:17
M				
ma'am (1) 1682:15				
MacKenzie (1) 1599:13				
Madam (3) 1672:7;1693:8; 1703:17				
main (2) 1685:13,15				
mainly (2) 1607:21;1615:18				
maintain (6) 1641:3;1669:18; 1681:9,10;1707:17; 1709:8				
maintains (1) 1657:16				
maintenance (1)				

1681:8 majority (2) 1705:13;1706:16 maker (1) 1612:8 makes (5) 1630:8;1649:11; 1670:12,13;1671:24 making (4) 1611:6;1612:13,21; 1682:4 manage (9) 1647:1,3;1655:10, 11;1676:16;1681:17, 23;1682:2;1701:14 MANAGEMENT (15) 1597:6.5;1612:14; 1627:18;1629:19; 1638:20;1645:9; 1646:23;1659:11; 1660:4,18;1665:18; 1682:22;1683:18; 1693:5;1703:13 manner (3) 1648:19;1652:1; 1687:8 manually (2) 1620:6;1653:9 many (4) 1665:19;1694:12; 1696:13;1705:12 map (4) 1617:10;1618:6; 1619:10;1673:15 mapping (1) 1627:22 maps (2) 1673:9,17 mark (1) 1649:23 Marty (5) 1618:18;1619:7,22; 1620:24;1621:18 Master's (1) 1604:20 matches (1) 1628:3 material (1) 1628:15 MATTER (9) 1597:6;1605:1; 1609:7,19;1614:23; 1616:16;1658:8; 1669:1;1689:11 matters (9) 1602:12;1612:4; 1614:16,17,18;1616:7; 1640:11;1710:21; 1711:7 mature (1) 1648:14 max (1) 1656:3	maximum (1) 1640:24 May (23) 1608:6,17;1612:22; 1613:13,20;1614:14; 1617:6,6,16;1622:7,23; 1631:4;1641:1; 1642:12;1649:17; 1669:9;1673:2;1675:5; 1690:24;1692:11; 1696:17;1697:11,20 maybe (4) 1618:3;1635:13; 1674:20;1676:19 Mayer (1) 1623:6 Meadow (2) 1627:10;1628:1 mean (13) 1615:19;1623:4; 1640:1;1642:6;1648:4; 1651:13;1679:15; 1687:16;1697:12; 1707:10,20,22;1709:15 meaning (1) 1690:5 means (3) 1623:12;1645:3; 1687:20 measurable (1) 1645:20 measurements (5) 1675:1,6,8;1677:18; 1688:9 Melissa (1) 1598:7.5 member (1) 1694:22 members (1) 1686:8 membership (1) 1693:14 memorialized (1) 1610:12 mentioned (10) 1627:15;1656:7; 1658:13;1689:10; 1693:24;1702:12; 1704:24;1705:8,15; 1707:6 mentioning (1) 1684:19 met (1) 1683:1 MICHELINE (2) 1597:4;1598:3 Michelle (1) 1598:9 microphone (3) 1606:4,14;1608:16 middle (2) 1619:6;1641:18 Mifflin (1)	1618:18 Mifflin's (1) 1620:24 might (5) 1629:17;1645:14; 1664:13;1703:20; 1706:18 mile (2) 1625:20;1688:5 miles (3) 1625:18;1626:1; 1683:15 milligrams (1) 1629:16 millions (2) 1615:17;1670:20 mine (1) 1658:5 minimal (3) 1627:15;1629:5; 1673:22 minimum (1) 1647:1 minority (1) 1705:9 minute (4) 1664:1,7,11,14 minutes (10) 1603:14;1615:20; 1639:10;1650:16; 1679:22;1680:3,9; 1685:24;1703:23; 1704:4 missed (1) 1632:10 missing (2) 1692:3,5 MOAPA (14) 1597:11.5; 1599:16.5,17.5;1628:9; 1653:24;1658:18,23; 1681:12;1682:21; 1689:19;1695:12; 1705:9;1706:9; 1709:20 model (6) 1632:4;1683:24; 1684:6,8,19,21 modern (1) 1621:24 moment (4) 1603:22;1622:13; 1635:7,10 Monday (1) 1695:5 monitor (2) 1636:8;1673:23 monitoring (9) 1617:20;1620:1,19; 1625:4;1628:10,11,18; 1673:3;1674:18 months (10) 1625:2;1649:11,14;	1677:21;1678:5,6,7; 1709:1,4,5 more (22) 1613:15;1615:19; 1621:24;1622:21; 1623:8;1634:16; 1640:8;1645:3,21; 1658:2,16;1659:4,20; 1674:5,21;1680:22; 1681:4;1685:24; 1688:1;1694:7; 1699:17;1709:15 morning (3) 1602:9;1710:21; 1711:8 Morrison (5) 1599:18;1600:12; 1658:21,23;1660:21 most (4) 1650:23;1673:24; 1674:13;1689:16 mostly (2) 1659:13;1709:4 Mountain (9) 1617:5;1619:12; 1622:8;1623:3; 1644:19,24;1659:16, 20;1666:20 MOUNTAINS (13) 1597:8.5;1616:9; 1617:13;1618:15; 1623:23;1624:7,13; 1626:19;1653:3; 1678:19,21;1679:8,19 move (7) 1618:13;1626:8,16; 1643:14;1648:15; 1669:2;1693:8 movement (1) 1648:6 moving (3) 1620:11;1628:17; 1647:6 MRSA (1) 1665:7 much (14) 1603:23;1608:9; 1642:13;1658:9; 1664:6;1673:22,24; 1674:4;1677:6; 1680:16;1687:22; 1688:12;1706:2; 1710:16 MUDDY (80) 1597:11;1599:19; 1602:7;1617:7; 1618:15;1619:12; 1624:9;1628:9,24; 1644:18,24;1645:1,4, 22;1646:10;1647:8,10, 14;1648:2,18,20,21,23; 1653:1;1658:8,11; 1662:5,14,19;1666:7,	16;1672:8,12;1676:3; 1679:8,18;1682:24; 1683:1;1690:12,15,17, 19;1691:7,15,18; 1692:21;1693:1,6,9,16, 18,20;1694:13,16,17, 18,23;1695:2,9,18,23; 1696:8,18;1697:5; 1698:2,8,12;1699:2; 1700:1,12,14;1701:5,8, 13;1702:7;1703:18; 1705:23,23;1707:11; 1710:17 multi (1) 1644:16 multiple (2) 1615:14;1644:16 MVIC's (1) 1708:8 MVID (1) 1696:24 Myers (1) 1667:10 myself (1) 1615:6
N				
				name (3) 1604:18;1662:3; 1691:13 named (1) 1695:15 National (5) 1599:22;1636:7; 1653:21;1678:17; 1706:6 NATURAL (2) 1597:2;1712:6 NCA (49) 1599:15;1604:1,2, 24;1607:18;1616:4,15, 19,23;1617:15,19,23; 1619:5;1622:9; 1624:23;1626:15; 1630:1;1634:15; 1635:23;1636:1; 1637:6,23;1638:22; 1641:9;1643:20; 1644:12,15,23;1645:3, 7,13;1646:6,7,11,12, 22;1647:9,13;1648:5, 17;1649:6;1650:24; 1663:3,14;1664:24; 1665:8,18;1674:13; 1679:13 NCA's (3) 1618:1;1644:19; 1645:12 near (6) 1622:9;1626:14; 1628:18;1648:6; 1653:13;1656:20

<p>nearby (1) 1688:4</p> <p>nearest (2) 1653:10;1677:20</p> <p>nearby (2) 1615:4;1679:21</p> <p>necessarily (8) 1611:4,14,14; 1640:14;1648:8; 1673:10;1679:15; 1699:16</p> <p>necessary (4) 1605:11,15;1670:8; 1703:11</p> <p>need (11) 1608:6;1622:21; 1636:15;1645:6; 1669:8;1674:10,17,24; 1680:23;1686:2; 1687:1</p> <p>needs (2) 1644:15;1681:1</p> <p>nested (1) 1628:10</p> <p>Network (1) 1668:1</p> <p>NEVADA (68) 1597:1,22,5,23,5; 1599:4,7,5,11,14,15,5; 1602:6;1603:24; 1604:11,21;1605:19; 1607:3,13,13,16; 1610:15,23;1615:17; 1617:15;1618:19; 1635:4;1640:24; 1644:22;1647:3; 1651:1;1652:14; 1654:1,7;1657:5; 1660:8;1661:18; 1665:11,14,21; 1667:21;1668:2; 1669:4,5;1670:3,6; 1680:4,7;1690:5; 1693:19;1694:2,8; 1695:13,16,17,23; 1696:1,2;1699:22; 1701:23;1702:7,11; 1705:6;1706:10; 1710:4,8,15,24;1712:1, 5,10,17</p> <p>new (15) 1620:12;1635:16; 1639:16;1647:12; 1648:1;1649:7,8; 1654:9;1655:15,15; 1683:23,24;1684:9,14, 21</p> <p>next (17) 1616:5;1620:11; 1622:5,16;1625:7; 1633:11,14;1639:13; 1641:16,21;1645:10; 1662:12;1668:11;</p>	<p>1675:5;1698:6,10; 1706:19</p> <p>NGOs (2) 1668:19;1690:4</p> <p>nice (1) 1619:21</p> <p>nine (2) 1619:14;1643:5</p> <p>nineties (3) 1618:18;1621:2; 1627:4</p> <p>noise (6) 1625:5,12;1653:8; 1674:20;1686:20,23</p> <p>noisy (1) 1675:2</p> <p>none (3) 1679:24;1680:1; 1705:13</p> <p>non-governmental (2) 1667:16;1669:12</p> <p>non-profit (4) 1667:21;1693:19; 1694:1,9</p> <p>non-water (1) 1688:16</p> <p>North (10) 1599:21;1620:12,13; 1623:21;1624:24; 1666:10,13;1673:2; 1683:3;1686:17</p> <p>northeast (1) 1624:24</p> <p>northerly (1) 1621:6</p> <p>northern (5) 1636:3;1665:3,23, 24;1674:13</p> <p>note (1) 1614:2</p> <p>noted (4) 1611:2;1614:5; 1621:9;1643:10</p> <p>notes (2) 1712:11,14</p> <p>notice (1) 1603:19</p> <p>November (1) 1615:16</p> <p>nuances (1) 1648:12</p> <p>Number (14) 1603:24;1612:11; 1630:5,8;1641:16; 1645:13,14,14; 1649:21;1658:10; 1664:2,24;1691:19; 1704:24</p> <p>numbering (1) 1665:21</p> <p>numbers (1) 1654:17</p> <p>numeral (1)</p>	<p>1692:9</p> <p>NV (1) 1599:10.5</p> <p>Nye (1) 1597:23</p> <p style="text-align: center;">O</p> <p>object (3) 1608:20;1643:1; 1657:10</p> <p>objected (3) 1639:15;1641:21; 1659:5</p> <p>objecting (4) 1630:20,22;1633:15, 16</p> <p>objection (26) 1608:10;1611:2,16; 1612:9;1613:11,21; 1614:3,5;1630:13; 1631:4,7,18;1634:14; 1635:15,17;1640:15, 16;1642:11,17,20; 1643:10,12,13; 1657:20;1684:2,5</p> <p>objections (2) 1642:9;1686:1</p> <p>obligated (2) 1700:5,7</p> <p>obligation (2) 1696:13;1702:18</p> <p>obligations (1) 1683:1</p> <p>observation (1) 1624:15</p> <p>observations (1) 1686:14</p> <p>observed (4) 1617:7;1623:24; 1651:22;1652:10</p> <p>observing (1) 1627:13</p> <p>obtained (2) 1632:18;1653:9</p> <p>obvious (2) 1620:10;1687:7</p> <p>obviously (11) 1616:11;1617:12,17; 1618:20;1620:23; 1622:17;1623:21; 1634:21;1645:2; 1648:23;1709:9</p> <p>occur (1) 1681:1</p> <p>occurred (2) 1609:15;1628:13</p> <p>occurring (1) 1676:15</p> <p>O'Connor (1) 1599:5</p> <p>OCTOBER (6) 1597:18.5;1602:1;</p>	<p>1641:13;1660:2; 1712:8,18</p> <p>off (6) 1618:22;1620:7; 1650:12;1676:24; 1677:5;1685:18</p> <p>offer (2) 1616:21;1650:2</p> <p>offered (1) 1613:12</p> <p>office (1) 1610:9</p> <p>OFFICER (77) 1597:4;1598:3,5,8; 1602:3,20;1603:6,16, 21;1606:3;1608:6,14, 24;1609:3;1610:4; 1612:10,17;1614:2; 1616:23;1631:6; 1633:18,23;1634:18; 1635:7,10;1639:8,12, 18;1640:5,12;1642:10, 23;1643:9;1649:20; 1650:4,9,14;1653:19, 23;1657:11,19;1658:1, 5,18;1660:22;1666:9, 23;1669:9,15,24; 1670:2;1672:4,7,9; 1679:20;1682:7; 1684:4,7,11,24; 1685:22;1690:9,14; 1691:2;1692:1,14,19; 1693:8,11;1703:17,22; 1704:2;1706:4,8; 1709:20;1710:1,8,10</p> <p>Official (1) 1712:4</p> <p>old (1) 1707:12</p> <p>once (3) 1626:17;1633:24; 1634:11</p> <p>one (50) 1602:10;1604:24; 1609:21;1611:18; 1612:11;1613:21; 1614:16;1617:3; 1619:23;1626:2,2,2,4; 1630:3,6;1633:14,14; 1635:10;1637:3; 1638:8;1641:21; 1645:13,18;1647:4; 1649:24;1655:8,24; 1659:6;1661:22; 1664:24;1667:15; 1668:15,22;1669:3; 1671:2;1673:16; 1674:16;1678:16; 1681:21;1685:8; 1688:20;1690:21; 1692:3;1696:6; 1697:17;1702:12,17; 1707:6,7;1708:1</p>	<p>one-foot (2) 1681:11,13</p> <p>one-for-one (1) 1647:23</p> <p>one-hour (1) 1603:2</p> <p>one-month (1) 1664:13</p> <p>one-to-one (2) 1647:17;1665:17</p> <p>only (8) 1624:24;1625:1,15; 1627:17;1628:15; 1629:8;1678:9; 1699:19</p> <p>oOo- (2) 1597:5;1602:2</p> <p>open (12) 1602:14;1608:7; 1621:13;1627:23; 1672:5,13;1685:2,3,23; 1704:3;1710:11; 1711:1</p> <p>operated (1) 1701:9</p> <p>operates (1) 1693:19</p> <p>operating (1) 1708:11</p> <p>operational (1) 1709:7</p> <p>opine (1) 1610:6</p> <p>opinion (7) 1608:12;1655:5; 1656:14,18;1657:2; 1673:11;1675:16</p> <p>opinions (8) 1608:22;1622:7,18, 23;1634:20;1635:18; 1659:19;1675:17</p> <p>opportunity (7) 1603:9;1612:20,22; 1613:2;1674:19; 1682:2,4</p> <p>opposed (1) 1651:21</p> <p>option (1) 1660:5</p> <p>options (1) 1692:4</p> <p>ORDER (32) 1597:16;1602:5,12, 23;1615:11,23;1616:6; 1628:12;1636:9; 1637:22;1640:7; 1644:4;1648:8,15; 1649:16;1657:13; 1660:9,13;1661:12; 1667:9,12;1668:4,22, 24;1669:6;1670:24; 1679:11;1686:14; 1690:24;1692:23;</p>
---	--	--	---	---

<p>1697:3;1698:4 orders (2) 1613:2;1648:9 organizations (2) 1667:17;1669:12 original (1) 1614:21 originally (1) 1661:24 others (2) 1700:3;1705:8 otherwise (1) 1632:4 ourselves (1) 1636:8 out (34) 1612:5,9;1617:3; 1619:1,5,22;1620:21; 1621:1;1623:3;1624:3; 1627:5;1629:5; 1631:20;1642:21; 1646:5;1649:2;1650:1; 1654:18;1656:10; 1657:23;1664:13,16; 1673:16;1674:24; 1676:1,4;1677:2,8; 1679:21;1682:4; 1690:4;1698:23; 1709:8,14 outside (4) 1632:3;1640:14; 1669:6;1698:16 over (23) 1603:14;1604:19; 1613:18;1615:14; 1626:20;1629:22; 1630:7;1631:11; 1632:2;1635:24; 1649:10;1656:6; 1657:21;1664:8,13; 1671:18;1672:10; 1690:22;1697:9,16; 1707:15,16;1709:5 overall (2) 1645:20;1687:24 overrule (4) 1635:16;1640:16; 1642:17;1643:12 oversaw (1) 1619:24 Overton (4) 1689:18;1695:20,21; 1708:12 own (10) 1605:2,14;1609:16; 1647:3;1651:3,9; 1672:21;1695:9; 1703:6;1705:11 owned (5) 1638:22;1657:4; 1663:2,14;1694:20 owners (3) 1618:19;1657:8;</p>	<p>1694:17 owning (1) 1695:18 owns (2) 1696:14;1701:24 P Pacific (1) 1710:3 PAGE (21) 1600:2;1601:3; 1608:10;1609:19,24; 1618:8,8;1626:12; 1634:7,10,10,11; 1636:24;1637:5; 1664:23;1682:12,16; 1685:9,9;1692:2,9 Pages (11) 1597:17.5;1608:21; 1615:5;1630:13,17,17; 1632:8;1634:3; 1664:22;1667:15; 1712:13 Paiute (2) 1653:24;1706:9 Paiutes (1) 1599:16.5 PANEL (5) 1600:9;1612:5; 1677:14;1687:2; 1688:15 paragraph (1) 1692:3 pardon (1) 1634:2 Park (7) 1599:22;1616:8; 1636:7;1653:21; 1678:17;1689:21; 1706:6 Part (6) 1609:5,12;1617:12; 1624:12;1629:24; 1648:7 participant (1) 1704:4 participants (11) 1603:9;1610:9,20; 1612:24;1613:2; 1615:18;1650:5; 1680:3,5;1685:1; 1695:9 participation (1) 1693:2 particular (16) 1610:12;1611:1; 1612:13,17,21,23; 1613:4;1618:11,14; 1628:14,23;1653:6; 1657:22;1674:1; 1690:4;1702:24 Particularly (1)</p>	<p>1674:13 parties (2) 1657:4;1704:24 party (2) 1667:21;1668:2 pass (1) 1631:11 passed (1) 1632:17 past (2) 1667:22;1671:12 Patrick (2) 1599:23.5;1667:4 pattern (2) 1634:16;1635:24 Paul (3) 1599:3.5;1654:6; 1706:14 Pellegrino (1) 1627:15 pending (1) 1645:9 penetrated (1) 1621:10 people (6) 1665:19;1670:19; 1689:11,16,17,18 per (6) 1629:16;1664:1,7, 10;1704:4,18 percent (8) 1615:13;1639:2; 1641:6;1671:19; 1681:14;1687:6,12; 1688:20 percentage (1) 1675:24 perfect (1) 1618:20 perfected (1) 1617:24 perfectly (1) 1610:2 perform (2) 1651:3,24 performed (2) 1652:16;1666:18 Perhaps (4) 1652:12;1667:6; 1675:6;1679:9 period (10) 1625:1;1641:20; 1649:10,12,14;1656:6; 1664:13;1675:2; 1689:2;1709:5 periodic (1) 1675:1 periods (1) 1636:11 permission (1) 1692:14 person (1) 1707:20</p>	<p>personal (1) 1606:9 persons (1) 1687:19 perspective (3) 1616:11;1668:10; 1673:9 pertinent (1) 1669:5 Peterson (33) 1599:13.5;1600:13, 21;1608:8,19,19; 1609:2;1611:2,17; 1613:12;1630:20; 1631:4;1633:19; 1634:18,19;1639:15; 1641:22,24;1661:2,4; 1662:16,18,23;1663:1, 6,7;1664:22;1666:8; 1682:10;1684:9,13,20, 23 Peterson's (1) 1630:13 phase (2) 1645:10;1662:12 picture (5) 1621:17,17,23; 1622:1;1665:18 piece (1) 1673:16 pieces (2) 1651:16;1652:9 place (1) 1648:17 placed (1) 1699:8 places (1) 1634:5 placing (1) 1700:15 plan (2) 1664:15;1693:5 plant (3) 1708:11,15,20 please (21) 1604:17;1606:1; 1607:9;1615:10; 1617:14;1618:4,24; 1619:14;1630:5,11; 1632:15;1635:8,10; 1636:19;1641:9; 1691:12;1692:1; 1693:13;1695:10; 1697:5;1698:7 plot (3) 1624:4,6;1625:9 plotted (4) 1634:7,12;1636:10, 13 plug (2) 1620:20,21 plus (3) 1606:12;1646:15;</p>	<p>1671:17 PM (3) 1597:17.5;1602:1; 1711:9 point (49) 1608:1,5,9,11,21; 1609:6,10,12;1610:24; 1611:4,9,12,21,23; 1613:16,17;1614:15; 1628:5;1629:4,20; 1631:10;1639:19; 1640:17,19,23;1646:2, 21;1648:15;1659:1; 1661:17;1662:2,8,8,11; 1667:6;1676:6,17,21; 1679:7;1685:8,11; 1687:4,16;1698:12; 1699:20,24;1701:15; 1705:21;1706:22 pointed (1) 1619:5 Point-five (1) 1685:18 pointing (1) 1612:5 points (17) 1611:21;1613:21; 1615:19;1630:3; 1635:21,21;1639:22; 1640:16,21;1643:7,13; 1644:6;1686:7; 1698:11;1705:15,16,16 poking (1) 1619:23 policy (1) 1640:8 political (1) 1695:16 pop (1) 1648:11 PORTION (14) 1597:8;1618:1,6; 1624:15;1628:12; 1630:19,20,22;1665:3; 1679:9,12;1682:17,19; 1705:11 portions (1) 1650:24 posed (1) 1660:16 position (4) 1645:7;1659:2; 1662:8;1686:8 positions (1) 1702:23 possible (3) 1673:17;1699:17; 1703:12 possibly (1) 1671:13 potential (6) 1627:12;1632:22; 1641:6;1646:18;</p>
---	--	--	---	--

<p>1673:11;1707:16 power (19) 1608:1,5,8,11,21; 1609:6,12;1610:24; 1611:4,12;1613:16,17; 1614:15;1657:6; 1695:20;1708:11,14, 16,20 powers (1) 1654:23 practicing (1) 1604:19 precedent (2) 1697:9,16 precipitation (4) 1641:12,18;1643:19; 1644:2 precluded (1) 1610:19 predictor (2) 1623:11,13 predominantly (2) 1652:20,22 preparation (2) 1649:22;1691:18 prepare (4) 1607:24;1608:1; 1616:15;1691:17 prepared (6) 1603:2;1606:18; 1607:18;1650:24; 1667:9;1692:2 preparing (1) 1704:21 presence (2) 1613:22;1618:12 present (6) 1614:14;1667:8; 1677:16;1690:18; 1696:24;1712:9 presentation (14) 1602:11;1603:2; 1608:2;1610:24; 1611:4,12;1614:15,18; 1630:1;1637:1; 1649:18;1650:10; 1667:10;1711:4 presentations (2) 1602:6;1610:11 presented (4) 1617:11;1693:4; 1702:9;1703:12 preserve (1) 1694:24 president (7) 1691:15;1693:17; 1694:23;1696:7,21; 1701:20;1702:16 president/chairman (1) 1693:15 pre-test (4) 1656:16,20;1675:12, 21</p>	<p>pretty (5) 1620:17;1626:3; 1629:16;1656:3; 1659:21 prevent (1) 1628:6 preventing (1) 1647:2 previous (2) 1619:5;1662:8 previously (3) 1617:11;1635:22; 1668:1 primarily (1) 1627:9 primary (1) 1657:12 prior (2) 1603:22;1605:9 priorities (1) 1648:3 priority (11) 1629:12;1639:2; 1647:16,20,24; 1665:19;1666:4; 1670:9,17;1671:15; 1672:1 private (1) 1696:15 probably (6) 1603:17;1622:15; 1644:13;1671:5; 1672:20;1681:13 problem (3) 1603:20;1620:2; 1674:11 problems (1) 1698:15 procedural (3) 1649:19;1710:20; 1711:7 proceed (6) 1613:13;1615:8; 1643:11;1646:19; 1649:7;1650:15 proceeding (9) 1612:11,15;1613:10; 1657:10;1661:17; 1667:17;1690:23; 1693:2;1695:9 PROCEEDINGS (16) 1597:14;1610:20; 1642:14;1657:22; 1667:22;1668:2,4,16; 1669:7;1695:5; 1697:18;1703:11; 1704:16;1705:1; 1708:16;1710:17 process (3) 1648:7;1688:24; 1689:10 production (9) 1622:15;1628:7;</p>	<p>1636:1;1644:13,19; 1645:12;1673:1,24; 1683:13 productive (1) 1619:18 Professional (2) 1598:9.5;1606:8 profit (1) 1694:4 program (1) 1627:5 prohibition (1) 1700:21 projector (1) 1608:7 projects (2) 1604:22;1670:21 pronounced (1) 1680:21 propagate (1) 1683:3 proper (2) 1643:22;1659:14 proportional (1) 1624:8 proportionate (1) 1694:20 proposal (2) 1680:14,17 proposed (4) 1616:13;1617:18; 1646:18;1683:4 protect (4) 1694:24;1696:8; 1702:18;1703:1 protected (4) 1682:21,24;1689:21; 1703:11 protecting (1) 1698:24 protection (2) 1658:7;1696:12 protest (3) 1688:24;1689:1,11 provide (7) 1610:7;1611:8; 1622:6;1635:18; 1667:13;1674:19; 1693:14 provided (4) 1610:17;1611:12; 1679:2;1687:1 provides (1) 1673:16 providing (1) 1622:23 provisions (1) 1699:5 proximity (1) 1618:9 PUBLIC (8) 1597:15;1689:20; 1696:15;1711:2,3,3;</p>	<p>1712:11,14 publication (1) 1618:8 pull (2) 1620:21;1651:15 pulled (1) 1629:5 pump (20) 1615:13;1620:21; 1628:13;1636:9; 1641:3;1644:4; 1654:19;1656:3; 1657:8;1663:18,21,24; 1664:5,8,11;1673:21; 1675:19;1676:1; 1707:18,23 pumpage (18) 1632:18;1638:20; 1639:4;1641:6,7; 1644:18,23;1645:1,5; 1646:8,12;1647:16; 1648:15;1649:9,16; 1662:15;1665:23; 1666:5 pumped (14) 1629:8;1641:1; 1646:3;1648:21; 1657:15;1658:9; 1664:6;1665:23; 1674:14;1680:16; 1683:13;1686:17; 1692:12;1708:6 pumping (63) 1615:22;1617:5,15, 23;1618:1,2,2;1619:13, 17;1620:4,22;1622:8; 1623:16;1624:1,10,13, 14,16;1625:6,12; 1627:13,14;1628:16, 20;1629:4,6;1630:6; 1632:1,20,21;1636:1; 1645:12;1646:18; 1651:19;1652:7,20; 1656:11,13;1658:15; 1662:5,9;1663:3,14; 1665:2,10;1666:15; 1673:21;1674:1,20,23; 1678:1;1679:11,13; 1680:24;1682:23; 1683:12;1687:7,24; 1707:2,16;1708:14; 1709:12,12 pup (1) 1681:10 pure (1) 1676:18 purged (2) 1692:11,13 purple (1) 1618:6 purpose (7) 1610:5;1611:7; 1638:14;1662:21;</p>	<p>1669:20;1698:23; 1712:10 purposely (2) 1618:17;1619:7 purposes (2) 1610:23;1697:18 pursuant (1) 1692:22 put (15) 1611:19;1612:9; 1613:17;1619:6; 1622:11;1623:2; 1624:4;1644:7;1652:3; 1654:13;1661:23; 1668:10;1681:15; 1687:23;1700:8 putting (1) 1672:11 P-value (3) 1623:5,10,12 P-values (1) 1623:16</p> <hr/> <p style="text-align: center;">Q</p> <hr/> <p>qualified (4) 1612:1;1613:6; 1619:2;1704:15 quality (1) 1629:16 quantity (6) 1629:11;1641:1; 1657:15,17;1692:11; 1708:6 quarters (1) 1688:5 quick (2) 1639:9;1704:11 quickly (2) 1627:11;1679:21 quote (3) 1622:12;1632:5; 1694:9 quoting (1) 1634:8</p> <hr/> <p style="text-align: center;">R</p> <hr/> <p>R2 (2) 1636:17,19 raised (2) 1668:21;1698:9 ramifications (1) 1627:19 Range (1) 1618:23 rate (1) 1680:24 reach (3) 1612:2;1665:16; 1676:15 reached (2) 1676:8,10</p>
--	---	---	--	--

reaches (2) 1699:24;1701:15	1620:11;1694:7	references (3) 1634:11;1638:5; 1679:2	relevance (1) 1657:10	REPORTERS (2) 1597:21,21.5
reactivate (1) 1629:13	recharge (1) 1679:7	referred (2) 1678:23;1708:16	relevant (4) 1612:4,6,19;1681:4	reporting (1) 1712:10
read (2) 1635:5;1636:19	recognize (4) 1603:21;1611:3; 1642:15;1659:15	referring (3) 1619:8;1699:16,17	relied (2) 1644:1;1679:1	reports (17) 1603:10;1608:13; 1610:6,8,10,13,18; 1611:7;1634:22; 1650:6,6,10,10; 1654:18;1667:12; 1679:1;1711:5
readily (1) 1645:2	recollection (1) 1700:23	reflect (1) 1694:6	rely (3) 1651:1;1689:17; 1698:17	represent (1) 1702:20
reading (1) 1641:14	recommend (1) 1667:16	reflection (1) 1677:18	relying (3) 1611:6;1673:17; 1702:5	representative (2) 1618:5;1704:18
reads (1) 1692:10	recommendation (7) 1616:8;1619:3; 1661:8,18;1674:16; 1678:18;1682:20	regard (11) 1605:8,12;1606:17; 1607:17,19,19;1674:9; 1687:4;1696:13; 1701:9;1707:16	remaining (2) 1703:23;1711:7	representing (5) 1624:9;1661:4; 1666:13;1691:16; 1695:21
real (2) 1627:11;1656:4	recommended (1) 1659:19	regarding (13) 1602:4;1613:22; 1615:8;1616:7;1619:4; 1622:4,8;1627:6,8; 1646:4;1679:1;1684:8; 1693:4	remember (4) 1631:23;1684:19; 1686:21;1700:13	reproduce (3) 1651:8;1678:3,4
realize (3) 1633:14;1686:23,23	recommending (2) 1659:10;1670:9	regards (10) 1605:5;1614:18; 1632:17;1644:17; 1646:21,23;1647:6; 1670:14,17;1707:19	removed (2) 1679:16;1685:11	reproduced (1) 1624:19
really (12) 1615:1;1621:11; 1623:20;1625:2; 1628:11;1629:18; 1639:8;1640:3,7; 1643:5;1681:15; 1687:13	record (31) 1604:18;1608:15; 1611:13,19;1616:3; 1620:1,2,8;1625:1; 1628:11,12;1629:24; 1635:9,20;1636:11,15; 1643:16;1650:22; 1654:6;1667:4;1669:3; 1672:19;1675:2; 1677:13;1683:23; 1691:13,22;1692:15; 1694:6;1695:11; 1706:14	Regents (1) 1696:3	Reno (5) 1599:7.5,11,15.5; 1696:2;1712:17	reproduction (1) 1625:7
reason (9) 1620:15;1629:9; 1638:17;1660:10; 1669:16;1689:13,24; 1690:5;1702:12	recorded (1) 1620:5	regional (3) 1618:12,15;1633:10	repeat (1) 1706:18	Republic (1) 1710:3
reasonable (3) 1678:8;1679:4; 1683:17	recourse (1) 1671:14	registered (1) 1606:8	rephrase (2) 1684:9,10	request (1) 1613:1
reasoning (1) 1608:12	recover (2) 1656:9;1677:1	regression (7) 1624:19;1625:8; 1644:16;1651:9; 1662:22;1678:2; 1687:10	replaced (5) 1620:12,14,14; 1621:4,18	requests (1) 1612:24
reasons (1) 1620:19	recovered (5) 1656:6,7,15,20; 1676:4	regular (1) 1636:17	replacement (1) 1621:24	require (1) 1649:9
rebuttal (49) 1603:10;1605:1; 1607:18;1608:23; 1610:18;1611:21,22; 1613:24;1614:4; 1616:4,15;1622:11,12; 1623:2;1624:3;1627:8; 1630:8;1631:3;1634:2, 4,17,20;1635:2,3,6; 1640:13;1642:3; 1643:3,4,7;1650:6,10, 24;1667:16;1669:4,11; 1678:16;1685:8; 1689:14;1690:1,22; 1692:22;1696:18,19; 1697:6;1698:9; 1704:12,22;1711:5	recovery (11) 1645:24;1649:15; 1656:3,11;1675:8,10, 11,15,21;1676:21; 1677:3	regulate (1) 1670:10	report (86) 1604:2;1605:1,4,6; 1606:18;1607:18,18, 20;1608:23;1609:14, 20,23;1610:15,22; 1611:23;1613:24; 1614:4;1616:4,16; 1621:4;1622:11,12; 1623:2;1624:3;1627:8, 23;1630:3,8,16,20; 1631:3,5,9;1632:4,9; 1634:2,4,17,20,24; 1635:2,3,11,12,15; 1636:17,19;1639:19, 20,23;1640:1,3,14; 1642:13;1643:3,4; 1649:23;1650:24; 1652:4;1662:3; 1664:24;1667:7,9,15, 16;1668:20,22;1669:4, 17,20;1678:16; 1682:13;1685:8; 1689:14;1690:1,22; 1692:22;1696:19,19; 1697:1,6;1698:9; 1702:10,24;1704:12,22	required (8) 1615:13;1649:16; 1650:10;1658:13; 1681:22;1682:1; 1683:12;1689:19
rebuttals (1) 1650:9	recross (2) 1679:23;1680:3	regulation (2) 1670:7,9	republic (1) 1621:4,18	requirement (1) 1620:20
rebutted (1) 1630:17	red (1) 1641:17	rejection (1) 1613:4	replacement (1) 1621:24	requires (2) 1666:2;1670:9
recall (6) 1668:6;1684:16,18; 1688:19;1695:16; 1705:2	Redirect (7) 1600:23;1602:19; 1603:3;1669:17; 1685:23;1686:4; 1703:20	regulate (1) 1670:10	report (86) 1604:2;1605:1,4,6; 1606:18;1607:18,18, 20;1608:23;1609:14, 20,23;1610:15,22; 1611:23;1613:24; 1614:4;1616:4,16; 1621:4;1622:11,12; 1623:2;1624:3;1627:8, 23;1630:3,8,16,20; 1631:3,5,9;1632:4,9; 1634:2,4,17,20,24; 1635:2,3,11,12,15; 1636:17,19;1639:19, 20,23;1640:1,3,14; 1642:13;1643:3,4; 1649:23;1650:24; 1652:4;1662:3; 1664:24;1667:7,9,15, 16;1668:20,22;1669:4, 17,20;1678:16; 1682:13;1685:8; 1689:14;1690:1,22; 1692:22;1696:19,19; 1697:1,6;1698:9; 1702:10,24;1704:12,22	reserve (3) 1603:14;1703:20,24
recalling (2) 1694:1;1699:5	reduce (1) 1657:7	regulate (1) 1670:10	report (86) 1604:2;1605:1,4,6; 1606:18;1607:18,18, 20;1608:23;1609:14, 20,23;1610:15,22; 1611:23;1613:24; 1614:4;1616:4,16; 1621:4;1622:11,12; 1623:2;1624:3;1627:8, 23;1630:3,8,16,20; 1631:3,5,9;1632:4,9; 1634:2,4,17,20,24; 1635:2,3,11,12,15; 1636:17,19;1639:19, 20,23;1640:1,3,14; 1642:13;1643:3,4; 1649:23;1650:24; 1652:4;1662:3; 1664:24;1667:7,9,15, 16;1668:20,22;1669:4, 17,20;1678:16; 1682:13;1685:8; 1689:14;1690:1,22; 1692:22;1696:19,19; 1697:1,6;1698:9; 1702:10,24;1704:12,22	reservoir (2) 1709:3,8
recent (2)	reduced (4) 1676:2;1698:11,13, 22	regulation (2) 1670:7,9	report (86) 1604:2;1605:1,4,6; 1606:18;1607:18,18, 20;1608:23;1609:14, 20,23;1610:15,22; 1611:23;1613:24; 1614:4;1616:4,16; 1621:4;1622:11,12; 1623:2;1624:3;1627:8, 23;1630:3,8,16,20; 1631:3,5,9;1632:4,9; 1634:2,4,17,20,24; 1635:2,3,11,12,15; 1636:17,19;1639:19, 20,23;1640:1,3,14; 1642:13;1643:3,4; 1649:23;1650:24; 1652:4;1662:3; 1664:24;1667:7,9,15, 16;1668:20,22;1669:4, 17,20;1678:16; 1682:13;1685:8; 1689:14;1690:1,22; 1692:22;1696:19,19; 1697:1,6;1698:9; 1702:10,24;1704:12,22	residents (1) 1705:22
	refer (1) 1678:20	relation (2) 1662:12;1693:15	REPORTED (4) 1597:21;1627:22; 1653:10;1687:9	resolution (2) 1677:19;1687:8
	reference (3) 1621:5;1667:8,12	relative (6) 1619:12;1623:23; 1627:10;1693:3; 1699:6;1700:9	reporter (4) 1604:6;1664:20; 1684:3;1712:5	resolve (2) 1674:20,24
				resource (1) 1627:1
				RESOURCES (13) 1597:2,3;1606:11; 1607:11,14;1647:3; 1672:5,14;1685:4; 1689:17;1710:12; 1712:6,6
				respect (12) 1602:12;1611:12; 1612:13;1635:18;

<p>1642:11;1643:11; 1654:23;1672:24; 1673:8;1686:1;1697:1; 1707:11 respectfully (1) 1611:24 respond (4) 1609:10;1611:18; 1630:13;1669:8 responded (3) 1624:16;1643:11; 1678:9 responding (2) 1609:15;1678:17 responds (1) 1609:12 response (38) 1606:17;1607:17; 1609:4,5,6,14,17,20; 1610:1,1;1623:14,15; 1624:8;1625:16; 1628:14,16,19,21; 1629:3,4;1631:24; 1633:21;1651:19,19, 20;1652:7,7,7; 1669:16;1673:22; 1674:21;1675:22; 1677:23,24;1679:10; 1686:19;1687:24; 1688:12 responses (7) 1609:13;1615:22; 1628:8;1644:11; 1651:21;1652:8; 1653:2 responsibilities (1) 1693:15 responsibility (1) 1696:6 responsible (1) 1623:14 rest (1) 1626:9 restatement (1) 1635:13 result (12) 1623:24;1625:8,9; 1632:3;1645:19; 1646:24;1658:15; 1660:12;1666:4; 1675:18,18;1698:12 resulting (4) 1636:9,14;1644:18; 1646:24 results (5) 1624:20;1649:9; 1651:8;1678:4;1688:2 retained (1) 1657:6 retire (1) 1660:6 return (1) 1711:3</p>	<p>review (8) 1607:21;1622:6; 1627:11;1635:11; 1639:18,20;1663:17,20 reviewed (7) 1605:3,10,15; 1609:18,24;1651:5; 1652:15 reviewing (2) 1620:24;1655:20 Revised (1) 1694:8 RICCI (35) 1600:7;1604:3; 1605:7,8;1607:1,8; 1614:20;1615:6; 1646:15;1656:22,23; 1657:2;1658:6,12; 1659:23;1660:2,5; 1661:3,6,11,20; 1662:23,24;1663:5,8; 1667:19,20;1670:7; 1671:9,10;1680:13; 1681:18,20;1688:17,19 Richard (1) 1599:16.5 right (72) 1612:9,9;1614:21; 1617:14,18,22;1619:6, 21;1621:20,23; 1623:19;1624:3,4; 1625:19,22;1626:5; 1629:5,14;1631:15,23; 1633:11;1636:21; 1638:22,23;1641:3; 1650:14;1655:8; 1657:7,22;1660:1; 1661:8,15;1663:1; 1664:15,24;1667:7; 1670:18;1671:5,20; 1675:2;1681:7,9; 1682:6;1683:9; 1684:20,24;1687:9; 1688:11,16,23; 1689:11,11,12,15; 1695:2,22;1696:4,9,12; 1697:20;1698:20,24; 1700:7;1701:7;1704:2; 1706:18;1707:4; 1708:3,8,12,17; 1710:16 right-hand (1) 1677:14 rights (74) 1606:12;1615:13; 1617:24;1626:22; 1627:19;1629:7,12,13; 1639:1,3,6;1647:7,7,8, 10,14,21,22;1648:4,18, 20,21,22,24;1649:1,18; 1657:3,4,6;1658:7,11; 1665:8,19;1668:5; 1670:7,11,11,15,16;</p>	<p>1671:1,2,7,12;1674:15; 1681:6;1682:3,23; 1683:11,12;1689:6; 1693:3;1694:18; 1697:9,10,12,14,15,16, 21;1698:14,15;1699:1, 6,7,15,16;1700:11,16; 1701:10,24;1702:3,6; 1703:7,10 rigs (1) 1619:22 risen (1) 1698:16 RIVER (104) 1597:7,11;1602:5; 1604:22;1606:10,13; 1612:14;1617:7; 1624:10;1628:9; 1633:10;1636:21,23; 1637:18,20;1638:1,3,6, 10,12,21,24;1639:3,4; 1641:2,7;1644:14,18, 24;1645:2,4,8,18,22; 1646:3,5,9,10,23; 1647:8,10,11,14,15,17; 1648:2,7,18,20,21,23; 1649:2,8,13;1651:3; 1653:1;1655:16; 1656:1;1658:8,10,11; 1659:3;1662:5,14,19; 1666:7,16;1670:8,15, 16;1676:3,14;1682:22, 24;1683:1,3;1686:10; 1692:12;1693:6,6,20; 1694:18;1695:2; 1697:2;1698:1,12; 1699:3,12,16;1700:12, 14;1701:4,5,13; 1703:13;1706:21; 1707:2,3,11,18;1708:7, 21,24;1709:16 ROBERT (9) 1600:5;1605:17; 1606:2,5;1629:24; 1635:9,20;1643:16; 1659:8 Robison (15) 1599:6,7;1601:4; 1690:19,22;1691:5,12, 14,17;1692:16; 1693:13;1697:11; 1703:16,19;1704:8 R-o-b-i-s-o-n (1) 1691:14 rock (8) 1620:16;1621:16; 1622:2;1626:23; 1633:10;1679:13,14,14 rocks (1) 1632:23 Rogers (1) 1679:7 role (1)</p>	<p>1607:21 Roman (1) 1692:9 rounded (1) 1677:20 rounding (1) 1688:10 route (1) 1614:18 Rowley (1) 1618:6 R-squared (9) 1636:14,18,19; 1637:4,16;1653:4,7; 1687:10,21 ruled (1) 1661:23 Ruling (10) 1630:10,10;1632:19; 1654:10,15;1655:14; 1670:13,24;1683:10,20 rulings (3) 1654:11,12,20 run (2) 1650:1;1689:17</p>	<p>screened (1) 1628:15 se (1) 1704:18 sea (2) 1685:13,15 second (6) 1609:21;1631:5,7; 1634:21;1639:22; 1640:16 Section (18) 1598:8,11;1618:7; 1619:4;1626:7,15; 1634:17;1642:20; 1664:23;1668:22; 1669:3;1682:13,14,15, 16,24;1692:9;1694:8 sections (11) 1605:2,3,9,11,12,14; 1616:5;1678:17; 1699:12;1702:10,24 sediment (2) 1629:1,1 Seeing (13) 1653:20,23;1670:2; 1679:24;1680:1,5; 1706:5,8;1709:21,22; 1710:3,4,12 seem (3) 1636:16;1640:14; 1673:22 seeded (1) 1679:4 seems (3) 1640:8;1647:5; 1709:13 Senior (22) 1598:12,5;1629:13; 1638:22,23;1647:8,9, 13,22;1648:24; 1649:17;1658:7,11; 1670:10;1671:12; 1693:3;1695:1;1696:9; 1697:9,12,15,20; 1698:24 sense (1) 1649:11 sentence (2) 1664:24;1692:6 separate (1) 1641:4 separates (1) 1705:24 series (5) 1618:21;1619:16; 1621:9;1622:6; 1708:15 serve (1) 1693:17 served (1) 1693:21 Service (9) 1599:22;1614:22;</p>
S				
<p>salient (2) 1610:7;1611:8 same (16) 1624:20;1625:9; 1635:4;1645:9;1651:6; 1652:1;1653:2;1659:3; 1660:16;1671:3,11; 1676:8;1677:21; 1679:16;1683:20; 1707:16 samples (2) 1621:12;1641:20 saw (3) 1621:1,8;1678:4 saying (4) 1674:22;1676:8; 1687:3;1688:10 SB-47 (2) 1655:3;1658:13 scaled (1) 1615:16 scatter (2) 1637:2;1677:17 Schreck (1) 1599:8.5 science (3) 1606:6,6;1607:12 scientific (4) 1640:7;1697:1; 1702:23;1703:4 scope (11) 1610:5,15;1612:18; 1614:3;1640:6,15; 1642:13;1657:10,22; 1669:6;1698:16</p>	<p>seem (3) 1636:16;1640:14; 1673:22 seeded (1) 1679:4 seems (3) 1640:8;1647:5; 1709:13 Senior (22) 1598:12,5;1629:13; 1638:22,23;1647:8,9, 13,22;1648:24; 1649:17;1658:7,11; 1670:10;1671:12; 1693:3;1695:1;1696:9; 1697:9,12,15,20; 1698:24 sense (1) 1649:11 sentence (2) 1664:24;1692:6 separate (1) 1641:4 separates (1) 1705:24 series (5) 1618:21;1619:16; 1621:9;1622:6; 1708:15 serve (1) 1693:17 served (1) 1693:21 Service (9) 1599:22;1614:22;</p>			

1636:6,7;1653:20,21; 1689:21;1706:5,6 Services (2) 1678:17;1704:21 Service's (1) 1616:8 SESSION (2) 1597:17.5;1602:1 set (5) 1625:3;1635:14; 1657:12;1698:3; 1706:19 seven (6) 1618:4;1650:16; 1683:15;1685:9,24; 1704:4 several (5) 1618:4;1625:2; 1636:10;1677:21; 1694:7 shallow (1) 1629:15 share (2) 1707:7;1708:2 shareholder (5) 1696:14;1701:23; 1705:5;1706:16; 1709:10 shareholders (19) 1691:16;1694:13,16; 1695:11,14,19,23; 1696:4,5;1700:3; 1701:16;1702:1,19,20; 1705:1,10,13;1709:9, 11 shares (6) 1694:20;1695:9,18; 1696:14;1705:11; 1707:8 Sharp (1) 1599:6 shear (3) 1626:14,17,17 shelf (1) 1681:10 shortened (1) 1614:15 Shorthand (1) 1597:21.5 shoulders (1) 1650:13 shovel (2) 1707:7;1708:2 show (5) 1609:9;1621:16; 1622:13;1675:8; 1687:24 showed (1) 1636:8 showing (6) 1628:12;1634:6; 1641:17,19;1656:4; 1677:15	shown (8) 1614:17;1617:17,19; 1618:14;1627:23; 1644:11;1673:3,9 shows (2) 1624:7;1699:20 shuffling (1) 1648:3 side (4) 1618:22;1619:10,11; 1626:18 signals (1) 1678:1 signed (3) 1696:20;1704:12,19 significance (3) 1655:4;1656:8; 1659:18 significant (9) 1615:24;1623:17; 1625:13;1626:10; 1630:15;1632:6,13; 1649:21;1655:19 significantly (6) 1623:19;1624:16; 1625:14;1626:4; 1676:5;1688:4 similar (1) 1613:21 simple (3) 1637:2;1669:11; 1678:2 simplified (1) 1648:5 simply (5) 1611:23;1622:16; 1641:16;1649:23; 1681:7 single (1) 1609:18 Siri (1) 1619:1 sit (2) 1670:18;1671:7 site (1) 1641:5 sited (3) 1618:17,19;1619:7 siting (2) 1700:1;1709:1 sitting (2) 1614:21;1660:17 situation (3) 1689:5,9;1708:1 six (8) 1617:14;1649:10; 1656:9;1682:13,15,16; 1685:9;1692:3 six-month (1) 1649:12 skip (1) 1631:18 skipping (1)	1672:10 slide (46) 1613:22;1614:1,17; 1615:10;1616:2; 1617:14;1618:4,24; 1619:5,14;1621:15; 1622:3;1623:1;1624:2, 18;1625:7;1626:7; 1627:7;1628:17; 1629:2,22;1630:11,12, 19,22;1631:14,18; 1632:15;1634:4; 1635:2,13,19;1637:8; 1638:14;1639:13,15; 1641:9,16,24;1642:20; 1643:15;1646:2; 1659:1;1661:17; 1667:10;1677:14 slides (10) 1610:14;1611:1; 1616:10;1622:4,5,6,16; 1659:4,6;1673:3 slip (2) 1618:21;1645:17 slippery (1) 1612:4 slope (1) 1612:4 small (3) 1624:12,14;1698:19 Smith (1) 1623:21 SNWA (18) 1599:3;1615:18; 1622:7,20,23;1624:3; 1627:16;1632:4; 1635:2;1636:6;1637:8; 1653:5;1683:24; 1684:8,14,20;1702:23; 1706:15 SNWA's (7) 1624:19;1625:8; 1637:1;1644:12,16; 1645:7;1678:3 software (1) 1636:16 solution (1) 1621:14 somebody (2) 1648:22;1708:2 someone (1) 1647:19 sometime (2) 1641:15,15 sometimes (3) 1647:5;1653:10; 1708:15 somewhat (1) 1669:19 sorry (13) 1602:24;1623:15; 1648:4;1654:17; 1658:4;1663:10,18,19,	20;1665:3;1672:6; 1682:15;1685:3 sort (1) 1603:1 sound (1) 1629:17 source (1) 1647:12 sourced (1) 1679:7 sources (3) 1655:12;1658:14; 1700:22 south (9) 1618:16;1619:16,18; 1626:9,13,16;1628:8, 17,18 southeastern (1) 1616:12 southern (16) 1627:24;1636:4; 1651:1;1652:14; 1654:1,7;1657:4; 1660:8;1673:24; 1680:4,6;1695:13; 1702:11;1705:6; 1706:10;1710:15 southwestern (1) 1617:17 sparingly (1) 1619:19 speaking (1) 1622:24 specific (14) 1605:2,14;1618:11; 1630:23;1666:19; 1674:3,3;1678:22; 1686:16;1694:7; 1697:2,23;1700:14; 1702:22 specifically (18) 1604:21;1616:7,11; 1623:5;1626:9; 1630:14,24;1632:5; 1633:2,24;1634:3; 1638:9;1655:22; 1666:21;1692:2,4; 1695:1;1707:11 speed (1) 1603:4 spell (1) 1691:13 spells (1) 1698:23 spent (3) 1615:17;1620:24; 1670:20 split (1) 1670:24 spot (1) 1619:23 SPRING (32) 1597:7.5;1615:3,9;	1617:7;1624:6,14,16; 1628:9;1633:4,7; 1634:9;1636:4,4; 1647:1;1648:4,18,21; 1656:19;1657:5; 1662:5,19,19;1663:3, 14;1665:4,6;1666:1; 1676:2;1683:21; 1699:18;1700:22; 1701:4 SPRINGS (76) 1597:11;1614:22; 1615:14;1617:16; 1624:10;1627:6; 1630:1,6;1631:2; 1632:2,3,12;1633:1,2, 3,6,8;1636:3;1638:3,6, 9,12;1639:5,22; 1641:5;1644:18; 1645:1,2,4,22;1646:10; 1647:10,14;1648:2; 1650:17;1653:1; 1656:5,15,19;1659:7, 10,19;1660:4,7,9,10, 11,13,18;1662:5,9,14, 15;1663:18,21;1665:3, 4,11,15,24;1666:1,7, 16;1675:7;1676:3,7; 1679:11,23;1680:15, 23;1683:2,10,18; 1686:9;1704:5; 1710:13 ss (1) 1712:1.5 staff (5) 1613:5,6;1672:14; 1685:4;1710:12 stage (1) 1661:9 stakeholders (4) 1679:10;1689:15,20; 1711:5 stakeholders' (1) 1679:1 standing (3) 1669:13;1688:17; 1689:8 standpoint (1) 1709:7 start (9) 1608:8;1637:22; 1650:16;1654:8; 1660:1;1665:1;1667:6; 1680:6;1704:5 started (7) 1602:8;1615:15; 1655:13;1690:10,12; 1710:22,24 starting (2) 1606:10;1679:15 starts (1) 1680:13 STATE (96)
--	--	---	--	---

1597:1;1598:5,6,5; 1603:19;1606:7; 1607:15,16;1610:7,8, 11;1611:5,6,9,14,22; 1612:2,12,18;1613:5; 1614:16;1616:6,16; 1617:22;1622:19; 1628:6;1630:16,24; 1631:1;1632:4,5,11,16, 19,24;1638:9,15,19; 1640:24;1642:17; 1644:6,23;1646:19; 1647:2;1649:6;1650:7; 1654:9,22;1655:7,20; 1657:3,6,16,21;1658:8, 12;1660:2;1665:21; 1666:2;1667:21; 1668:2;1669:2,5; 1670:8,10,12,23; 1671:5,11,13,23; 1672:14;1681:22; 1682:5;1683:4,10,18, 23;1686:9;1689:22; 1691:13;1692:4,22; 1693:4;1694:2,10; 1695:22;1698:1,3,17; 1700:10;1702:5; 1703:9;1708:5; 1710:12;1712:1,5	1620:17 stenotype (2) 1712:11,14 step (2) 1624:21;1625:11 Steve (3) 1599:19;1672:7; 1690:16 sticking (1) 1640:23 still (9) 1612:23;1615:2; 1619:3;1632:19; 1641:12;1658:1; 1676:22;1677:4; 1687:1 stop (1) 1637:22 stopped (2) 1708:19;1709:13 storage (4) 1676:1,1,4;1677:3 storativity (1) 1675:22 store (1) 1709:3 stream (5) 1698:11,22;1707:17, 19;1709:6 stress (1) 1615:23 strike (1) 1618:21 strike-slip (4) 1619:7;1621:7,20; 1626:15 strong (2) 1633:1;1643:21 stronger (1) 1700:5 structure (4) 1621:14;1673:13,15, 16 structures (3) 1645:18;1673:18; 1679:18 study (1) 1651:7 stuff (2) 1632:11;1670:22 sub (1) 1692:10 subdivision (1) 1695:17 subdivisions (1) 1695:16 subject (3) 1610:22;1639:6; 1689:7 submit (3) 1611:24;1613:1,2 submitted (13) 1603:10;1610:8,10,	15,22;1611:7;1614:4; 1616:16;1634:23; 1635:4;1649:21; 1650:5;1711:5 subject (3) 1645:23;1689:1,1 subsequently (1) 1666:3 substance (2) 1639:21;1659:5 substantial (3) 1629:11;1646:4; 1659:24 successful (1) 1627:4 sufficiently (1) 1676:4 suggest (3) 1618:1;1635:5; 1673:4 suggested (3) 1673:1,7;1675:6 suggesting (1) 1683:2 suggestions (1) 1607:22 suggests (2) 1673:14,17 Suite (1) 1597:23 Sullivan (6) 1598:6;1600:19,22; 1678:14,16;1685:6 summarization (1) 1635:14 summarize (3) 1608:16;1622:4,6 summary (1) 1698:7 summer (2) 1709:1,5 Supervising (1) 1598:9.5 Supervisor (1) 1598:14 supplement (1) 1709:5 supplemental (2) 1610:18;1700:11 supply (1) 1647:12 support (4) 1647:9,13;1662:2; 1678:21 supportive (1) 1638:5 supports (5) 1611:10;1632:20,21; 1645:7;1648:17 supposed (1) 1659:13 sure (19) 1603:1,4,8;1606:4;	1608:17;1620:5; 1624:20;1634:1,14; 1650:3;1651:8,17; 1664:3;1667:5; 1669:13;1676:13,15; 1678:4;1687:17 surface (7) 1627:21;1654:24; 1697:13,14,21; 1702:12;1707:4 sur-rebuttal (2) 1642:3,3 sustain (5) 1613:11;1631:6; 1640:15;1643:13; 1657:19 sustainable (1) 1682:23 sustained (1) 1611:3 sweet (1) 1619:23 sworn (7) 1604:7,11;1605:19; 1607:3;1691:1,3,7 SYSTEM (79) 1597:7;1602:5; 1604:23;1606:10,13; 1612:14;1615:1,2; 1624:9,9;1633:10; 1636:21,23;1637:18, 20;1638:1,3,7,10,13, 21,24;1639:3,5;1641:2, 8;1644:14;1645:8,19; 1646:4,6,9,24;1647:11, 12,15,15,17;1648:7; 1649:8,13;1651:3; 1652:20,21;1655:16; 1656:2;1658:10; 1659:3;1665:18,20; 1666:18;1670:8,15,16; 1675:23;1676:2,10,13, 14,18;1677:1,7,24; 1678:1;1679:17; 1681:17,23;1682:22; 1686:10;1692:12; 1693:6,20;1697:2,16; 1698:2;1701:5; 1703:13;1708:3,7	1682:6;1684:2,6; 1706:13,14;1709:18 Taggart's (1) 1684:4 tail (2) 1707:8,12 talk (13) 1619:16;1623:10,22; 1624:22;1626:8; 1627:19;1631:8; 1637:13;1649:24; 1653:6;1674:16; 1705:22,22 talked (2) 1623:6;1705:19 talking (7) 1617:17;1621:15; 1623:7;1637:3; 1642:21;1679:17; 1685:14 talks (1) 1700:21 tap (1) 1671:6 targeted (1) 1626:21 targeting (1) 1621:8 task (1) 1709:3 TDS (1) 1629:16 team (1) 1608:1 technical (3) 1702:22;1703:4; 1704:21 telling (1) 1687:2 ten (1) 1707:8 ten-minute (2) 1603:2;1690:10 Tens (1) 1615:17 tenure (1) 1701:8 term (2) 1674:11;1684:8 terms (6) 1612:13;1629:10; 1643:4,6;1661:9; 1672:22 test (42) 1615:17,18,23; 1627:3;1628:13; 1632:21;1636:9; 1637:23;1644:4; 1649:7,8,9,12,16,17; 1654:19;1656:4,11,13, 19;1663:18,22,22,24; 1664:5,11;1665:1,2; 1674:7,8,11,13;1675:9,			
T							
<table border="1"> <tbody> <tr> <td>table (2) 1623:2;1660:1</td> <td>tables (1) 1635:12</td> <td>Taggart (30) 1599:3,3,3,5; 1600:11,20;1601:7; 1613:15,19;1642:5,10; 1654:4,6;1657:1,11,14, 23;1658:3,6,16;1680:9, 11,19;1681:18,21;</td> </tr> </tbody> </table>					table (2) 1623:2;1660:1	tables (1) 1635:12	Taggart (30) 1599:3,3,3,5; 1600:11,20;1601:7; 1613:15,19;1642:5,10; 1654:4,6;1657:1,11,14, 23;1658:3,6,16;1680:9, 11,19;1681:18,21;
table (2) 1623:2;1660:1	tables (1) 1635:12	Taggart (30) 1599:3,3,3,5; 1600:11,20;1601:7; 1613:15,19;1642:5,10; 1654:4,6;1657:1,11,14, 23;1658:3,6,16;1680:9, 11,19;1681:18,21;					

15,19;1676:1,20; 1677:5;1686:15; 1707:18,22,23 testified (7) 1604:12;1605:20; 1607:4;1610:3; 1611:20;1612:7; 1691:8 testify (1) 1610:2 testimony (20) 1602:11;1609:6,8, 10,14,15;1610:1,5,10, 17,19,21;1642:14,16; 1653:12,12;1661:15; 1680:19;1696:6; 1706:20 Thanks (3) 1641:23;1660:15,21 thereafter (1) 1690:11 therefore (2) 1637:9;1645:7 Therese (3) 1599:20,21;1666:12 thinking (1) 1602:18 third (3) 1619:17;1620:13; 1629:4 though (8) 1615:2;1619:2; 1620:2;1625:11; 1627:4;1629:6;1679:5; 1708:1 thought (6) 1602:16,17;1645:5; 1658:3;1659:21; 1661:22 thousand (1) 1683:11 thousands (3) 1615:5,19;1649:10 three (19) 1604:1,7;1619:17; 1621:3;1628:10; 1630:9;1635:22; 1649:14;1661:21; 1662:4;1663:1;1678:5, 7;1686:8;1688:5; 1692:9,10;1698:6,10 throughout (2) 1618:5;1642:6 thrust (4) 1618:12,15,16; 1619:12 THURSDAY (3) 1597:18.5;1602:1; 1712:8 thus (3) 1610:10;1647:2; 1669:6 tie (3)	1623:8;1673:10; 1674:5 Tim (3) 1598:4.5;1599:5; 1623:6 times (3) 1618:5;1656:7; 1707:15 today (13) 1602:5;1604:3; 1621:22;1655:20; 1656:16;1660:12,17; 1661:13,15;1662:1; 1667:8,10;1698:23 today's (1) 1608:1 TODD (4) 1601:4;1690:18; 1691:5,14 T-o-d-d (1) 1691:14 together (4) 1626:1;1672:11; 1673:10;1674:5 told (2) 1625:3;1645:17 Tom (1) 1667:9 tomorrow (2) 1710:21;1711:8 took (7) 1622:17;1624:19,21; 1625:11;1631:20; 1682:4;1709:3 tool (1) 1688:1 top (1) 1634:15 total (2) 1602:17;1641:6 totality (1) 1613:7 touch (1) 1617:10 tough (2) 1620:17;1671:23 Township (1) 1695:21 TRANSCRIPT (2) 1597:14;1712:12 transcription (1) 1712:14 transducers (2) 1620:6;1674:17 transfer (3) 1647:9,13,23 transmissivity (2) 1645:19;1674:2 transparent (1) 1689:10 travertine (1) 1621:13 tremendous (1)	1614:23 trend (3) 1634:16;1635:24; 1641:10 trending (1) 1621:6 trends (3) 1636:1,3;1688:1 tried (4) 1644:9;1647:4; 1650:1;1678:3 tries (1) 1620:4 true (4) 1637:23;1699:22; 1701:12;1712:13 trust (1) 1652:3 try (4) 1603:7;1620:6; 1623:8;1688:24 trying (3) 1619:23;1625:4; 1669:18 turn (5) 1608:5;1629:22; 1665:6;1682:12; 1696:17 two (37) 1602:17,21,23; 1603:10;1614:17; 1616:5;1619:20; 1621:16;1624:18,21; 1633:12;1634:19; 1635:21,21;1639:22; 1640:16;1643:7; 1652:19,21;1656:2; 1661:22;1667:15; 1674:13,18;1678:6; 1680:3,9;1687:9; 1688:7,12;1692:3,10; 1695:15;1696:1; 1699:12;1705:24; 1710:23 two-thirds (1) 1625:20 type (2) 1674:8;1678:10 typo (1) 1685:10 typographic (1) 1603:7 typographical (2) 1691:23;1692:8	uncertainty (2) 1674:4,9 under (7) 1607:21;1612:23; 1614:5;1634:21; 1683:14;1694:2; 1699:11 underflow (3) 1646:5,7,8 underground (2) 1629:7,12 understands (1) 1646:13 Understood (1) 1612:16 undoubtedly (1) 1622:13 unfortunate (1) 1670:19 Unfortunately (2) 1620:8;1679:5 unique (1) 1633:5 United (2) 1653:19;1706:4 units (1) 1685:11 University (5) 1604:20;1606:7,7; 1607:13;1696:2 unless (2) 1632:10;1670:12 unrelated (1) 1702:13 unusual (1) 1701:22 up (32) 1602:14,20;1603:4; 1607:11;1608:7,9; 1609:9;1612:9,18; 1632:7;1633:20; 1648:11;1655:6; 1660:1;1661:6;1672:5, 13;1676:5;1677:7; 1685:3,3,23;1686:8,17, 18;1699:20;1704:3; 1706:19;1709:2,6; 1710:11;1711:1 upgrade (2) 1647:16,24 upon (7) 1611:16;1613:7; 1635:11;1639:20; 1642:12;1644:1; 1658:10 UPPER (10) 1597:11.5;1621:5; 1698:14,21;1699:1,12, 15;1701:13;1705:20, 23 upstream (2) 1707:20;1708:2 Ure (9)	1599:20,21;1600:14; 1666:12,12,22;1670:1; 1709:24;1710:7 urge (1) 1646:19 usable (2) 1629:15,17 usage (1) 1707:16 use (20) 1604:2;1619:18; 1620:6;1631:18,21; 1648:17,19,19; 1651:12;1657:17,17; 1658:8;1674:14; 1678:19;1680:15; 1684:8;1695:2;1699:8; 1700:8,15 used (6) 1652:1;1671:12,13, 18,20;1708:20 user (2) 1648:21;1698:20 users (1) 1638:23 uses (1) 1647:12 USGS (1) 1627:22 using (2) 1652:10;1670:20 Utah (1) 1606:7 utilize (1) 1680:23 utilized (2) 1649:22;1668:17
V				
vacuum (1) 1627:17 Vagueness (2) 1684:6,8 validate (1) 1644:16 VALLEY (103) 1597:7.5,9,10,11.5; 1599:17.5,19;1602:7; 1614:22;1615:3,9,14; 1623:22;1624:5,6,15, 17;1627:2,10;1628:1, 9;1630:1,6;1631:2; 1632:2,3,12;1633:2,2, 3,4,6,7,8;1636:3,4,5; 1638:3,6,9,12;1639:5, 22;1641:5;1654:2; 1657:5;1658:18,23; 1659:7,10;1660:7; 1662:5,9,19;1663:3,15; 1665:3,4,4,24;1666:1, 15,20;1672:8,12; 1680:7;1683:10,18,21;				

1686:17;1689:19; 1690:12,15,17,19; 1691:7,15,18;1692:21; 1693:1,9,16,18; 1694:13,16,17,24; 1695:10,12,18,24; 1696:8,18;1697:5; 1698:2,8;1700:1; 1701:8;1702:7; 1703:18;1705:9; 1706:11;1709:20; 1710:17 valuable (1) 1696:8 value (9) 1623:13;1625:14; 1636:14;1637:4,16; 1653:5,8;1687:10,21 values (3) 1623:4;1636:9; 1645:19 variable (3) 1623:14,15,15 variations (1) 1628:21 various (4) 1604:22;1636:11; 1638:5;1645:18 Vegas (15) 1599:21;1604:21; 1623:22;1626:13,14, 17,18;1627:2,3; 1654:1;1666:10,13; 1680:7;1706:10; 1709:23 venue (2) 1659:14;1662:10 verbatim (2) 1634:5;1712:10 verifiable (1) 1649:9 versus (3) 1625:8;1678:3; 1688:3 vicinity (1) 1632:23 Vidler (13) 1599:13;1608:10,20; 1609:12;1610:9; 1613:13;1660:22; 1661:5;1682:8; 1683:11;1695:12; 1705:9;1709:22 Vidler's (4) 1609:8,16,20,22 view (1) 1692:4 virtually (2) 1634:3;1637:15 visual (3) 1637:9,11,14 VOLUME (2) 1597:17;1674:10	W	1709:4,10,15,20; 1710:11,15;1712:6 waters (3) 1641:11;1707:7,8 watershed (1) 1606:6 way (8) 1654:14;1671:22; 1676:19;1680:2; 1688:20;1698:8; 1701:7;1703:1 ways (1) 1701:22 weeds (2) 1642:9;1676:12 week (1) 1695:6 weeks (6) 1614:23;1615:4,11; 1621:16;1622:17; 1660:4 weight (4) 1611:11,15;1642:16; 1650:12 wells (64) 1615:20;1617:19,20, 21;1618:10,13,17,20; 1619:5,16,17;1620:11, 14,18,18,21;1621:4; 1622:9,15;1624:18,21; 1625:15,17;1627:3; 1628:10;1629:15; 1634:7,12;1636:3,4,10, 13,20;1637:17;1638:1; 1644:13,19;1652:19, 21;1653:13,14;1662:6, 20;1663:2,3,14,15; 1665:14,23;1671:6,6; 1672:21,23;1673:1,4, 12,21;1674:14,18,18; 1679:13,14;1688:12; 1700:1 weren't (1) 1622:10 west (6) 1618:13;1656:15,19; 1675:7;1680:15,23 what's (9) 1623:18;1625:16; 1655:4;1656:4,8,18; 1687:4;1698:22; 1707:15 Wherever (1) 1636:16 WHITE (52) 1597:7;1602:5; 1604:22;1606:10,13; 1612:14;1633:9; 1636:23;1637:18,19; 1638:1,3,6,10,12,21, 24;1639:3,4;1641:2,7; 1644:14;1645:8,18; 1646:3,5,9,23;1647:11,	15,17;1648:7;1649:8, 13;1651:3;1655:16; 1656:1;1658:10; 1659:3;1670:8,15,16; 1676:14;1682:22; 1683:3;1686:10; 1692:12;1693:6; 1697:2;1698:1; 1703:13;1708:7 whole (4) 1630:22;1665:18,20; 1666:19 Wildlife (6) 1636:6;1653:20; 1680:1;1689:21; 1696:2;1706:5 willing (1) 1643:14 Wilson (2) 1598:4.5;1660:17 winter (1) 1709:4 wish (2) 1674:4;1680:3 WITHIN (44) 1597:7;1610:12; 1611:13;1614:24; 1619:22;1620:15; 1622:14;1626:15; 1633:8;1635:12; 1636:22;1637:19; 1638:2,6,23;1639:3,4, 20,23;1640:1,13; 1642:13,13,16; 1644:13,23;1645:18; 1646:8;1647:10,11,14, 15,17;1648:6,16; 1649:7;1651:2; 1652:17;1665:4,5,7; 1669:18;1683:1; 1694:7 within-entitled (1) 1712:11 without (2) 1646:9;1708:7 WITNESS (12) 1600:2;1601:3; 1604:10;1605:18; 1606:5;1607:2; 1664:21;1690:24; 1691:3,6;1692:17; 1704:15 witnesses (11) 1602:12;1604:1,7; 1611:20;1612:1,6,20; 1642:2,7;1650:11; 1704:18 wives (1) 1707:12 wonder (1) 1687:19 wondering (4) 1675:13,14;1678:19;	1683:24 word (5) 1651:12;1692:3,5,6, 12 words (3) 1623:12;1645:11; 1692:4 work (8) 1603:7,17;1605:5,5; 1620:24;1625:4; 1644:15;1671:21 worked (5) 1607:10,13;1646:14, 15;1648:10 working (1) 1604:21 works (1) 1701:19 world (1) 1656:4 write (1) 1682:17 written (3) 1660:9;1667:15; 1668:22 wrong (2) 1602:19;1603:3 wrote (7) 1605:2;1622:10; 1632:10;1664:23; 1682:13,19;1683:7
	Y		Y-axis (2) 1685:9,11 year (4) 1617:24;1628:22; 1646:12;1674:15 years (25) 1604:19,23;1606:12; 1607:14;1614:20; 1615:15,21;1626:22; 1630:7,15;1631:3; 1632:3,7,14;1646:15; 1648:10;1656:2,9; 1671:19,21;1693:22, 22;1708:11,15,19 yep (2) 1685:18,21 yesterday (1) 1642:7 yield (3) 1651:22;1652:9; 1674:3	
	Z		zone (4) 1626:14,16,17,17 zones (2) 1653:13,15 zooming (1)	

1619:14	1597:17.5;1712:13	1905 (1) 1699:9	217 (1) 1597:10	1637:21;1667:10
0	15th (1) 1690:21	1920 (2) 1699:3;1702:7	218 (1) 1597:11	35 (1) 1606:11
05 (2) 1623:12,16	16 (5) 1625:7;1634:3,11; 1677:14;1693:22	1960s (2) 1629:12;1709:2	219 (1) 1597:12	36 (4) 1608:11,21;1609:1; 1639:15
1	1600 (1) 1628:15	1981 (1) 1607:14	22 (1) 1628:17	3600 (3) 1624:24;1625:15,23
1 (9) 1603:24;1616:19,19, 23;1637:6;1689:13; 1690:1;1691:19; 1693:9	1604 (1) 1600:4	1991 (1) 1607:14	2-2 (1) 1632:8	37 (1) 1641:9
10,318 (1) 1641:6	1605 (1) 1600:6	1992 (1) 1621:4	23 (1) 1629:2	38 (1) 1641:16
107 (1) 1597:23	1607 (1) 1600:8	1993 (1) 1620:1	2-3 (1) 1632:8	39 (6) 1608:11,21;1609:1; 1641:24;1643:15; 1659:4
11 (2) 1621:15;1641:6	1650 (1) 1600:10	2	25 (3) 1604:19;1629:22; 1659:4	3-MEMBER (1) 1600:9
1169 (20) 1615:11,23;1628:13, 16;1636:9;1637:22; 1644:4;1649:16; 1654:19;1656:3; 1660:13;1661:12; 1665:1;1674:8;1675:8; 1676:20;1677:4; 1679:11;1686:14; 1707:22	1654 (1) 1600:11	2 (1) 1603:24	25,000 (1) 1629:6	3rd (3) 1702:10,24;1712:8
12 (2) 1622:3;1630:13	1658 (1) 1600:12	2:45-ish (1) 1690:11	250 (2) 1694:15;1696:5	4
123 (1) 1597:23	1661 (1) 1600:13	20 (2) 1671:19,20	25-year (1) 1674:13	4 (1) 1685:19
13 (4) 1623:1;1630:13; 1634:3,8	1666 (1) 1600:14	2000 (3) 1607:15,15;1647:20	26 (2) 1607:14;1630:5	40 (6) 1639:9,11;1644:5; 1659:1;1661:17; 1703:23
1303 (13) 1597:16;1602:5,12; 1640:7;1657:13; 1667:9;1668:4,22; 1669:6;1692:23; 1697:3,18;1698:4	1667 (1) 1600:15	2001 (1) 1660:7	27 (7) 1608:10,21;1609:1, 19;1630:11,12; 1631:15	40-some-odd (1) 1649:24
1366 (1) 1622:1	1670 (1) 1600:16	2002 (2) 1625:1;1660:6	28 (4) 1631:18,19,21; 1632:15	41 (3) 1613:22;1614:1; 1642:20
14 (3) 1624:2;1634:3,10	1672 (1) 1600:17	2005 (5) 1641:12,13,18; 1643:18,23	29 (7) 1608:10,21;1609:1; 1631:11,15,20;1633:16	42 (1) 1646:2
1400 (1) 1622:1	1677 (1) 1600:18	2006 (2) 1607:14,16	3	44 (1) 1649:4
15 (8) 1604:23;1615:20; 1624:18;1634:3,10; 1637:6;1693:22; 1704:21	1678 (1) 1600:19	2006-1396 (1) 1627:23	3 (2) 1597:18.5;1602:1	4th (1) 1712:17
1500 (1) 1617:23	1680 (1) 1600:20	2007 (1) 1641:15	3,000 (1) 1629:16	5
1562 (1) 1685:16	1682 (1) 1600:21	2010 (1) 1615:16	3.2 (1) 1680:15	5 (1) 1685:20
1563 (2) 1685:16,16	1685 (1) 1600:22	2011 (2) 1618:8;1626:13	3:19 (1) 1711:9	5,000 (1) 1628:3
1563.5 (1) 1685:17	1686 (1) 1600:23	2012 (1) 1684:16	30 (14) 1608:11,21;1609:1; 1625:18;1626:1; 1631:11,15,20; 1633:17,18;1634:1; 1646:14,15;1693:22	50 (3) 1603:13;1615:13; 1681:13
1597 (2) 1627:7;1682:12,16	1691 (1) 1601:5	2014 (2) 1655:14,19	300 (1) 1619:22	50,000 (1) 1671:17
	17 (1) 1626:7	2015 (4) 1620:13;1621:18; 1629:5,8	31 (9) 1608:11,21;1609:1; 1633:18,21;1634:2; 1635:13,19;1667:10	500 (6) 1641:3,4;1664:5,16; 1683:12,13
	1704 (1) 1601:6	2017 (1) 1655:3	32 (1) 1636:24	52 (4) 1625:13;1653:8; 1688:3,3
	1706 (1) 1601:7	2019 (7) 1597:18.5;1602:1; 1660:2;1690:22; 1702:10;1712:9,18	33 (1) 1637:8	5712 (3) 1630:10;1632:19; 1683:10
	1711 (1) 1712:13	205 (1) 1629:13	34 (2)	59 (1) 1654:11
	1712 (1) 1597:17.5	210 (1) 1597:8		
	18 (2) 1614:20;1664:23	215 (1) 1597:9		
	1800 (5) 1629:8;1663:24; 1664:6,10,13	216 (1) 1597:9.5		
	1895 (1) 1694:3			
	19 (3) 1627:7;1682:12,16			

5B (1) 1653:1				
6				
60 (4) 1654:15,18;1655:14; 1681:14 600 (2) 1621:5,10 6254 (5) 1630:10;1654:10,15, 18;1655:14 64-65 (1) 1606:10				
7				
7 (1) 1687:21 775882-5322 (1) 1597:24				
8				
8 (1) 1687:21 81 (1) 1606:11 82 (2) 1636:14;1637:4 829 (1) 1628:16 8500 (1) 1689:18 89706 (1) 1597:23.5				
9				
9 (1) 1637:16 9,000 (1) 1671:18 9318 (5) 1618:1;1641:2; 1645:12,13;1646:12 95 (3) 1625:8;1653:5; 1688:2 98 (1) 1639:2				

In The Matter Of:

*DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES*

*Vol. x
October 04, 2019*

*Capitol Reporters
123 W. Nye Lane, Ste 107

Carson City, Nevada 89706*

Original File 100419finalWater.txt

Min-U-Script® with Word Index

SE ROA 53709

JA_18106

1 STATE OF NEVADA
2 DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
3 DIVISION OF WATER RESOURCES
4 BEFORE MICHELINE FAIRBANK, HEARING OFFICER
5 ---oOo---
6 IN THE MATTER OF THE ADMINISTRATION
7 AND MANAGEMENT OF THE LOWER
8 WHITE RIVER FLOW SYSTEM WITHIN
9 COYOTE SPRING VALLEY HYDROGRAPHIC
10 BASIN (210), A PORTION OF BLACK
11 MOUNTAIN'S AREA HYDROGRAPHIC
12 BASIN (215), GARNET VALLEY
13 HYDROGRAPHIC BASIN (216), HIDDEN
14 VALLEY HYDROGRAPHIC BASIN (217),
15 CALIFORNIA WASH HYDROGRAPHIC BASIN
16 (218), AND MUDDY RIVER SPRINGS AREA
17 (AKA UPPER MOAPA VALLEY HYDROGRAPHIC
18 BASIN (219).

13 _____ /
14 TRANSCRIPT OF PROCEEDINGS
15 PUBLIC HEARING
16 HEARING ON ORDER 1303
17 VOLUME X
18 (A.M. SESSION, Pages 1713 - 1823)

19 FRIDAY, OCTOBER 4, 2019

20 REPORTED BY: CAPITOL REPORTERS
21 Certified Shorthand Reporters
22 BY: CHRISTY Y. JOYCE, CCR
23 Nevada CCR #625
24 123 W. Nye Lane Suite 107
Carson City, Nevada 89706
(775)882-5322

1 A P P E A R A N C E S
(Continued)
2
3 For SNWA: Taggart & Taggart, Ltd.
4 By: Paul G. Taggart, Esq.
5 Carson City, Nevada
6 -and-
7 Tim O'Connor, Esq.
8 For CSI: Robison, Belaustegui, Sharp
9 & Low
10 By: Kent R. Robison, Esq.
11 Reno, Nevada
12
13 For CSI: Brownstein Hyatt Farber Schreck
14 By: Bradley J. Herrema, Esq.
15 Los Angeles, California
16
17 For NV Energy: Justina Caviglia, Esq.
18 Reno, Nevada
19 For Lincoln County
20 Water District/
21 Vidler Water Company: Allison MacKenzie
22 By: Karen Peterson, Esq.
23 Carson City, Nevada
24 For NCA: Alex Flangas, Esq.
Reno, Nevada
For Moapa Band of Paiutes: Richard Berley, Esq.
For Moapa Valley
Water District: Greg Morrison, Esq.
For Muddy Valley Irrigation: Steve King
For Bedroc: Therese Ure, Esq.
For City of North Las Vegas: Therese Ure, Esq.
For National Park Service: Karen Glasgow
For Center for Biologic
Diversity: Patrick Donnelly

1 A P P E A R A N C E S

2
3 Micheline N. Fairbank,
Hearing Officer
4
5 Tim Wilson,
Acting State Engineer
6 Adam Sullivan,
Deputy State Engineer
7
8 Melissa Flatley,
Chief of the Hearing Officer Section
9 Michelle Barnes,
Supervising Professional Engineer
10
11 Levi Kryder,
Chief of the Hydrology Section
12 Jon Benedict,
Senior Hydrologist
13
14 Christi Cooper,
Well Supervisor
15 Bridget Bliss,
Basin Engineer
16
17
18
19
20
21
22
23
24

1 I N D E X
2 WITNESS PAGE
3 JAY DIXON
4 Direct Examination by Ms. Ure 1718
5 Cross-Examination by Mr. Robison 1742
6 Cross-Examination by Mr. Taggart 1745
7 Cross-Examination by Ms. Peterson 1749
8 Examination by Ms. Barnes 1752
9 Cross-Examination by Mr. Taggart 1753
10 Examination by Ms. Cooper 1756
11 Examination by Ms. Barnes 1757
12 RICHARD FELLING
13 Direct Examination by Ms. Caviglia 1758
14 Cross-Examination by Mr. Herrema 1793
15 Cross-Examination by Mr. Taggart 1797
16 Cross-Examination by Ms. Peterson 1803
17 Cross-Examination by Mr. Donnelly 1803
18 Cross-Examination by Ms. Harrison 1805
19 Cross-Examination by Mr. King 1806
20 Examination by Mr. Sullivan 1808
21 Examination by Ms. Barnes 1809
22 Examination by Ms. Cooper 1810
23 Cross-Examination by Mr. Taggart 1815
24 Examination by Mr. Sullivan 1817

Page 1717

1 CARSON CITY, FRIDAY, OCTOBER 4, 2019, A.M. SESSION
 2 ---oOo---
 3 HEARING OFFICER FAIRBANK: Good morning. So this
 4 is the continuation of the hearing regarding the
 5 administration of the Lower White River Flow System and Order
 6 1303. And this morning we're going to go ahead and proceed
 7 with our final two participants and their presentations as
 8 well as cross-examination of those participants.
 9 And we'll start the day off with Bedroc. And so
 10 at this point I'll go ahead and turn it over to Ms. Ure.
 11 But before we get started, when we're concluded
 12 with the presentation of the participants, we'll go ahead and
 13 address some final administrative matters before we proceed
 14 to public comment.
 15 So, Ms. Ure.
 16 MS. URE: Thank you. Good morning. Thank you.
 17 Therese Ure representing Bedroc. And today Mr. Dixon is also
 18 here with me, so if we could swear him in, that would be
 19 great.
 20 (The witness was sworn in)
 21 ///
 22 ///
 23 ///
 24 ///

Page 1718

1 JAY DIXON
 2 Called as a witness on behalf of
 3 Bedroc, having been first duly sworn,
 4 Was examined and testified as follows:
 5
 6 DIRECT EXAMINATION
 7 By Ms. Ure:
 8 Q. Good morning, Mr. Dixon. Can you please, turning
 9 to Bedroc Exhibit 1, give us a brief background of yourself?
 10 A. As I mentioned yesterday, I've got a Master's
 11 degree in civil engineering from the University of Nevada,
 12 Las Vegas. Over 25 years experience as a hydrologist here in
 13 Nevada. I got a Nevada PE, a Nevada hydrologist, and I only
 14 work on Nevada projects.
 15 Q. And, Mr. Dixon, were you offered as an expert in
 16 hydrology and waters rights in this proceeding?
 17 A. Yes.
 18 Q. Have you been qualified before the State
 19 Engineer?
 20 A. Yes.
 21 MS. URE: Okay. And so we would offer to qualify
 22 for this proceeding Mr. Dixon as an expert in hydrology and
 23 water rights.
 24 HEARING OFFICER FAIRBANK: And as there were no

Page 1719

1 objections, I think we've resolved all of that, and so he'll
 2 be admitted.
 3 MS. URE: Thank you.
 4 Q. (By Ms. Ure) Mr. Dixon, turning to Bedroc
 5 Exhibit 2, did you assist in preparing the report on behalf
 6 of Bedroc?
 7 A. I did.
 8 Q. Okay. And did you prepare a presentation for
 9 today's proceeding?
 10 A. Yes.
 11 Q. Can you please walk us through that?
 12 A. Yes. Turning to slide two. I want to start off
 13 by tying this presentation to the rebuttal report issues that
 14 were identified in the Bedroc rebuttal report. I'll go in
 15 order as they are listed in the report.
 16 First off, exclusion of the White River Flow
 17 System north of Coyote Spring Valley. I'm not going to spend
 18 much time on that. It's been discussed by plenty of other
 19 stakeholders. I think it's pretty clear that there's no
 20 reason to include. Hydrology data doesn't support it. I
 21 think that was a recommendation based purely on an agenda to
 22 impede the SNWA project. There's really no basis for it.
 23 Moving on to the content that I'm going to spend
 24 most of my time talking about today in this presentation, as

Page 1720

1 identified in my rebuttal report. Number two, management
 2 considerations for certain areas with access to alluvial
 3 aquifers. Alluvial pumpage in the Muddy River Springs area
 4 versus basin fill alluvial pumpage in north Coyote Spring
 5 Valley. There is a difference and I will discuss that.
 6 Effects from carbonate in Muddy River Springs
 7 area alluvial pumping on basin fill alluvial wells on north
 8 Coyote Spring Valley.
 9 And, finally, I'll mention just in closing, I'll
 10 discuss in closing, movement of water rights between the
 11 Muddy River Spring area alluvial and carbonate wells in the
 12 LWRFS.
 13 Slide three. Quick overview for Bedroc. In
 14 terms of location, it is located just north of the Clark
 15 County line. We're in Lincoln County. Three parcels
 16 totalling 560 acres, obviously in Coyote Spring Valley, what
 17 we consider the northern part. Specifically it's situated
 18 near the western edge of the Pahrnatag Wash about a thousand
 19 feet north of the confluence of Pahrnatag and Kane Springs
 20 Washes.
 21 Slide four. Overview map. You see where we are
 22 relative to the northern part of the LWRFS, Coyote Spring
 23 Valley, specifically. And you'll see the magenta-colored
 24 outline. That is the three parcels totalling 560 acres

1 associated with Bedroc down at the -- You can see at the
2 mouth of the Kane Springs Wash just off of US 93.

3 Slide five. So, to begin with, we thought it was
4 important to acknowledge why Bedroc is here. Bedroc was not
5 a participant in the working group meetings that preceded
6 this administrative order. I think the reason for that is
7 Bedroc has the most senior underground rights in the LWRFS
8 with a priority of 1919.

9 A hundred percent of Bedroc's Coyote Spring
10 pumping is within the basin fill alluvium. That's very
11 clear. It's a fact.

12 Bedroc's water rights are a critical asset for
13 their business, multiple businesses. The business is
14 thriving and expansion plans are underway. So decisions that
15 are made in the LWRFS because of where this project is
16 situated could potentially impact Bedroc. And they really
17 need to have a seat at the table.

18 The outcome of management decisions in the LWRFS
19 may affect their ability to obtain additional water
20 resources. I want to be very clear about that. The business
21 is thriving. And, in order to expand, they're going to need
22 more water.

23 Next slide, slide six. So the image on the left
24 is a current aerial. And this ties in to the historical

1 Valley. In this area that I've outlined right here is where
2 I'm going to spend pretty much all of my time discussing
3 groundwater conditions.

4 Moving over to the image on the left, you can see
5 all the dots are the various -- And consistent throughout
6 this presentation, green dots represent alluvial monitoring
7 wells. The labels here, it's difficult to see, but those are
8 groundwater elevations. Blue dots are carbonate monitoring
9 wells and pretty decent coverage. There's very extensive
10 coverage of alluvial monitoring wells at the site. There's
11 more than 20 wells there, monitoring wells. And those wells
12 are associated with compliance requirements for their land
13 fill.

14 Wells, carbonate and alluvial monitoring well to
15 the north, that's CSVM-7 that we've heard a lot about. And
16 then carbonate and alluvial monitoring well a few miles to
17 the -- about five miles to the south right along US 93. So
18 that's the extent of where I'll be discussing groundwater
19 conditions today.

20 Q. And, Mr. Dixon, when you said this area, you're
21 talking about the dotted blue line that's delineated on the
22 left-hand side of the map and then it's blown up to the
23 right; is that correct?

24 A. That is correct. And I also want to point out

1 information that was filed on the vested claim. This claim
2 has not been adjudicated, so it is a claim. You can see
3 remnants of the historical tunnel that is described on the
4 proof, pipeline conveying water to a golden pond that is
5 there today. Image on the left is from August 1945. This is
6 the historical Butler Ranch from the old US 93, so it's a
7 little east of where the current US 93 is. But what you can
8 see there is land being worked, producing. Those are large
9 trees and those large trees got water from somewhere.

10 Q. And, Mr. Dixon, the image on the right is the
11 1945 picture; is that correct?

12 A. Correct, yes. Real briefly, the claim identified
13 on that proof is underground percolating water Sheep Range
14 Mountains. Claim diversion rate of .5 CFS.

15 Moving on to slide seven. So getting in to the
16 specifics of the groundwater conditions that I alluded to at
17 the beginning. I will spend most of the rest of the time
18 discussing north Coyote Spring Valley groundwater conditions
19 based on -- This is not based on any fancy modeling. This is
20 based on real data that is publically available to anyone.
21 Bedroc pumping and water level responses locally. And then
22 Bedroc's groundwater source, capture, and impacts.

23 Slide eight. Okay. The image on the left is the
24 LWRFS basins. You can see where we are within Coyote Spring

1 that using as a base map the Rowley 2017 geology map that
2 we've seen throughout this hearing. I'll reference several
3 times during this presentation the Gass Peak Thrust fault and
4 its effect on groundwater conditions here as well as the now
5 infamous highway fault, normal fault that's mapped parallel
6 to US 93 here. The Delamar thrust and the Kane Springs fault
7 zone coming down this way.

8 Slide eight -- or nine. Excuse me. This was
9 some information that was presented in the CSI July 2019
10 report. And I got to acknowledge I did not confirm their
11 delineation of recharge zones and their calculation of
12 elevation ranges pertaining to certain recharge coefficients.
13 So I just took their information as it was presented. I
14 focused -- This is the entire extent of their recharge
15 calculation. I focused on zones one, two, three, and four.
16 Just intuitively, it looks like those are the four zones that
17 could contribute recharge in this area of Coyote Spring
18 Valley. And, again, the magenta boundaries are Bedroc.

19 Moving on to slide ten, this is a table from
20 CSI's report. I've highlighted the four zones shown here.
21 I'm also showing the four methods used to estimate recharge.
22 I focused on Maxey-Eakin 1949. I assumed based on their
23 description and testimony, that it is, indeed, the
24 Maxey-Eakin recharge coefficients based on 1936 Hardman maps.

Page 1725

1 That is a valid method for calculating recharge. That's how
2 Eakin did it back in 1946. I ignored these two methods here.
3 And CSI did acknowledge this, their experts acknowledged this
4 during their presentation.
5 Q. And, Mr. Dixon, when you say you ignored these
6 two sets of data here, that's the middle that's been crossed
7 out on the table; is that correct?
8 A. Yes. So the first one that I ignored is
9 Maxey-Eakin 1949. And the reason I ignored it is because it
10 appears, based on what they put in here and what I heard them
11 say, that the precipitation was calculated using PRISM and
12 it's been widely accepted that that's not an acceptable
13 method for estimated recharge in the great basin.
14 Also, the second method that I ignored is Nichols
15 2001. That work has been discredited. It generally
16 overestimates, in some cases grossly overestimates, recharge
17 in some basins. So I ignored it.
18 I did include the Epstein. So it's still a
19 pretty wide range. And all I did, as you can see on the
20 right, is I just took the average for those four zones,
21 Maxey-Eakin, Epstein, 2004. It's 750. That seems
22 reasonable. But I want to tie it in to groundwater
23 conditions in the forthcoming slide.
24 So let's move on to slide 11. Okay. So the

Page 1726

1 image on the left is the same general area I've been
2 discussing, north part of Coyote Spring Valley. What I've
3 done here is put -- incorporated using the GIS data that was
4 published in the Wilson 2019, this is Bedroc Exhibit 21. He
5 mapped carbonate potentiometric head throughout Clark County.
6 Unfortunately, he stopped at Clark County. I wish he would
7 have gone further north, but he didn't.
8 So the image on the left was my interpretation.
9 All I did was simply, I took his contours and extended them
10 north. I didn't just do it blindly. As I mentioned earlier,
11 there is a carbonate monitoring well right here, there is a
12 carbonate monitoring well right here, and there's one to the
13 north. So I used that data current carbonate water levels to
14 influence where I terminated these contours.
15 Q. And that's the image on the right, the --
16 A. Correct. Yes, that's right. The labels as shown
17 are carbonate groundwater elevation.
18 All right. Moving on to slide 12. Again, this
19 is the Rowley geologic map. You can see where the Bedroc
20 property is relative to section LL. I'm going to talk a lot
21 about this section.
22 But before I get to that, I want to focus your
23 attention to about 18 miles south, section FF and section EE.
24 So the conceptual model here is that the recharge coming --

Page 1727

1 that we see that we are capturing that is driving the
2 groundwater conditions that we observed at Bedroc is
3 originating from the Sheep Range. There's reasons for that
4 and I'll put that altogether in the coming slides. But there
5 is -- based on groundwater observation.
6 But there's also a geologic reason for this. And
7 going back in time, you know, the first question I asked
8 myself is why would someone develop this land here. If
9 you've been in Coyote Spring Valley, there's not much
10 evidence of water, natural, except here. That's what they
11 saw in the early 1900s. There's a reason they stopped here
12 and settled here and worked this land. And there's a reason
13 it continues today. This is where shallow groundwater is
14 visibly present and obviously shown in the observation data
15 that is widely available.
16 Q. And here is being the area at Bedroc; is that
17 correct?
18 A. Correct.
19 Q. Okay.
20 A. So going back to section FF, what I've circled
21 here is this -- It's shown as a -- These are sedimentary
22 rocks. And basically, essentially, it's a lower clastic
23 confining unit and sedimentary rocks consist of quartzite and
24 shale. It comes out like a shelf. Now, if you remember,

Page 1728

1 there was a lot of discussion last week about CSVM-5. It's a
2 little further south of here and it is on the other side as
3 mapped here the Gass Peak Thrust. But this shelf that's
4 sitting out could be the reason why alluvial waters are
5 rising by seven feet down there since that well was put in.
6 It's capturing recharge and it's just sitting there. It
7 can't get through this shelf down in to the carbonate rocks.
8 That's very obvious down here.
9 As we move to the north, section EE, this shelf
10 is still present.
11 Q. And, Mr. Dixon, when you talk about this shelf
12 are you referring to the cross-sections and the area that's
13 shown in green?
14 A. Shown in green. It's identified as sedimentary
15 rocks.
16 Q. Thank you.
17 A. So, moving on to slide 13, this is section LL.
18 It goes right through Bedroc. This is the Sheep Range. This
19 shelf doesn't go out into the -- This is alluvial fill. This
20 shelf does not extend out to here. So the same processes are
21 occurring here as they are further to the south. But when
22 the recharge, mountain block recharge, gets in to the
23 alluvium, it has only one way to go, down and to the east.
24 And when it goes down, it doesn't encounter this relatively

1 impermeable confining unit. As it gets further to the valley
 2 margin, it daylights or almost daylights and it actually --
 3 There are springs. There have been springs through time.
 4 And this is where the Bedroc site is. This is where the
 5 water, alluvial water, daylights.
 6 Now I want to focus on groundwater conditions.
 7 I'm kind of building the conceptual model here, recharge from
 8 the Sheep Range, near surface groundwater at Bedroc, because
 9 of geologic conditions. This is a zoomed-in version of that,
 10 again, the Rowley base map, Wilson 2019 carbonate extended
 11 carbonate groundwater contours.
 12 Q. And you're on slide 14?
 13 A. Sorry. This is slide 14, yes. Again, the green
 14 dots are alluvial groundwater elevations. Blue dots are
 15 carbonate groundwater elevations.
 16 And the thing to note here is that carbonate
 17 groundwater elevation as mapped here is on the order of 2100
 18 feet above main sea level. However, at the Bedroc site, the
 19 alluvial groundwater lip, there's a sharp gradient in the
 20 alluvium and there's a reason for that and I'll get to that,
 21 25 to 2400. It's about a 350 foot difference. Alluvial
 22 groundwater levels are 350 feet higher than the underlying
 23 carbonate aquifer levels. Water doesn't go up.
 24 So let me advance to slide 15. Staying with this

1 feet deep. Through the Bedroc site, obviously. And then I
 2 continued south and I terminated this line down here at
 3 CV-VF-1 where there is an alluvial monitoring well and a
 4 carbonate monitoring well right next to each other.
 5 The second profile line goes from west to east.
 6 Obviously I don't have any alluvial groundwater elevation
 7 information here. So I had --
 8 Q. And here is the far west side of that line; is
 9 that correct?
 10 A. Yeah. From west of Bedroc. So I didn't try to
 11 interpret it or I just didn't show any alluvial water level
 12 elevations in that area. Of course I got a vast amount of
 13 data here and I connected it to two SNWA monitoring wells
 14 located on both sides north and south of the Kane Springs
 15 Wash fault zone. These are alluvial monitoring wells.
 16 Let's go to slide 18. This is, again, this is
 17 the north/south profile line. I started it at CSVN-7. So to
 18 the north we have the Pahranaagat shear zone at the north end
 19 of Coyote Spring Valley. This is not a model. All I did was
 20 connect dots. It's really simple. Alluvial groundwater
 21 elevation. It goes up. Water does not flow uphill.
 22 Recharge is not coming from Pahranaagat to the north in this
 23 area. It does not flow uphill. It can only be coming from
 24 one place. And I'll show you in the next profile.

1 theme of our conceptual model Sheep Range recharge west to
 2 east. These are alluvial, the red lines are locally derived
 3 alluvial groundwater levels, contours. And, as you can see,
 4 25 to 2400 feet over this short distance, a hundred-foot drop
 5 in alluvial groundwater levels. The reason -- And then once
 6 you get on the other side of US 93, they drop precipitously,
 7 a sharp drop. The reason is that water is hitting that
 8 highway fault and falling off west to east.
 9 Moving on to slide 16, these are groundwater
 10 contours that I generated from the 20, 25 or so, alluvial
 11 monitoring wells at the Bedroc site. And you see how they
 12 tie in with the regional level water levels. Again, 25 to
 13 2400 feet. Image on the left. And as you move to the right,
 14 350 feet higher groundwater elevation in the alluvium than
 15 the carbonate.
 16 Let's move on to slide 17. So now I got all of
 17 this groundwater contours, I've used existing information. I
 18 didn't create anything new. It was all data provided to me
 19 by Bedroc and publically available sources from DWR,
 20 generally. So I just drew two simple profile lines.
 21 The first one we'll talk about I call the
 22 north/south line. I started at CSVN-7 because I had known
 23 data. I take it through an old stock well, CS, Inc., they
 24 actually had water levels on DWR's site. It's only a hundred

1 The blue line is the carbonate groundwater level.
 2 Relatively flat, indicative of the very high transmissivity
 3 that has been well-documented here. But it flows from north
 4 to south. It's a fact that carbonate recharge comes from the
 5 north and goes to the south, generally. But the flow
 6 direction, as you saw in those contours, are from west to
 7 east. But this is a north/south line.
 8 Alluvial groundwater here at the Bedroc site very
 9 close to the surface. We cross the highway normal fault
 10 south of the site. And then it starts dropping off when you
 11 get down to the south end of that line where the two
 12 monitoring wells are. Again, I want to highlight 350 feet
 13 difference between alluvial and carbonate water levels.
 14 Go to slide 19. Same image. Just as a reminder
 15 I want to talk about the west line now. It starts here. It
 16 goes from west to east.
 17 Let's go to slide 20. I don't have any data on
 18 the alluvial water levels here, so I didn't connect any dots.
 19 I did extend the carbonate line from the Sheep Range. We get
 20 to the -- we cross the Gass Peak Thrust. I have water level
 21 information once we get to the Bedroc site starting to note
 22 the sharp drop in gradient. We cross -- This is a typo.
 23 This actually is the highway fault at the Kane -- not the
 24 Kane Springs. Not the Kane Springs strike slip is not even

1 what it is. It's just a typo. But there is a fault between
2 the Bedroc site and this SNWA monitoring well. And you can
3 see as a result the gradient gets even steeper as we go
4 across that fault.
5 It is very important to note what happens here.
6 So, obviously, alluvial water is recharging carbonate across
7 that Kane Springs and Delamar thrust fault zone.
8 Q. So, Mr. Dixon, just for the record, you had on
9 your slide where it said highway normal fault and then you
10 had Kane Springs strike-slip fault. So is your testimony
11 that where it says Kane Springs strike-slip fault should be
12 deleted?
13 A. Delamar thrust.
14 Q. Oh, it should be --
15 A. Yeah. That's a typo.
16 Q. Okay. And then the area that you're focusing on
17 is delineated in red around the horizontal distance around
18 25,000 feet is that correct?
19 A. Yes. So, obviously, I forgot to mention this.
20 The X-axis is distance from the start to the end of each
21 profile line in feet. Groundwater elevation or surface
22 elevation in this case and groundwater on the Y-axis.
23 Okay. So let's move on to slide 21. This is an
24 oblique view of Coyote Spring Valley just south of the Bedroc

1 to west -- or west to east. Excuse me.
2 Let's move on to slide 23. So now I'm focusing
3 on groundwater conditions locally at the Bedroc site. This
4 is Bedroc's pumping over time at the bottom. The hydrographs
5 are a composite of their observation wells for the industrial
6 facility with the longest period of record going back to
7 2003. So something happened between 2003 and 2006. Water
8 levels rose in the order of ten feet or so. Unfortunately
9 there's no data between '03 and '06. But there's two reasons
10 for this, I believe. You've heard one, throughout this
11 hearing, this 2005 recharge event.
12 Going back to what I talked about earlier, I
13 mentioned CSV-5, that alluvial monitoring well, and it
14 responded to that 2005 event. There was, I believe, it was
15 two or three foot rise in water level from that event in the
16 alluvium. And it's located about the same distance from the
17 Sheep Range as we are. So there's no reason -- I believe
18 that could have had an effect. But I think the other reason
19 for this is 2003 is when they put that unlined storage pond.
20 It's not a very good way to manage water. Because not only
21 was it evaporating, it was also infiltrating back in to the
22 ground. So they're recycling their water. But it probably
23 contributed to this sharp rise in water levels.
24 But more importantly here is how the water levels

1 site. And this simple Google Earth profile from west to
2 east. And I'm going to talk more about this feature, this
3 topographic feature on the west side of the site. It's
4 important because it plays a role in their water management
5 system, their ability to move water around. It's an elevated
6 area, embankment, natural embankment, where they put storage
7 ponds, two storage ponds. The first one was put in around
8 2004, 2003 time frame. It's unlined. So remember that,
9 unlined storage ponds, up here on this embankment. This is
10 the storage pond that I showed earlier about in the center of
11 the site at the toe of the embankment, moving to the east
12 where it becomes relatively flat until it goes up the other
13 side of 93, which I'm not showing here.
14 Okay. So let's -- One more thing I want to point
15 out. Note this area of white surface soils and green right
16 here. These are phreatophytes. And the white soil is an
17 indication of shallow groundwater evaporating. And these are
18 evaporites, the residual from shallow groundwater
19 evaporating. This is natural ET.
20 So let's move on to slide 22. Zoomed-in view of
21 what I just explained. This is, it's hard to see here, but
22 this is a huge pond. When it's full, it stores about 13.7
23 feet of water. That's the head in it. And the other older,
24 unlined, storage pond right here known as Lake Lindsey, east

1 have responded as the system has essentially reincorporated.
2 Over the last five years it's been relatively stable even
3 though their pumping has been fairly constant.
4 Q. Okay. So for the record it looks like you have
5 two data sets for, like, one for 2004 and one for 2006. And
6 then the gap of data is between 2006 and 2011-ish; is that
7 correct?
8 A. Yes.
9 Q. Thank you.
10 A. There are a few water level readings in 2005.
11 You know, that pond had been constructed in 2003. And then,
12 of course, the wet year of 2005. I think these water levels
13 were already rising because of the infiltration introduced
14 from the up gradient side of the site. But I can't rule out
15 that the alluvium didn't respond to that recharge event at
16 the same time. And we're just simply reaching -- going back
17 in to equilibrium from continued pumping as a result of those
18 two events, a wet year and an installation of an unlined
19 storage pond.
20 Okay. Slide 24. Close-up view of the Bedroc
21 site again. Same wells. Now I want to focus your attention
22 to this well right here, CSV-3000M. That's the SNWA
23 monitoring well north of the Kane Springs fault zone. And
24 then CSV-4, this is a carbonate well. You've heard a lot

1 about it on the other side. It's located right here. These
2 wells are pretty close to each other, as you can see.

3 So the orange plot is a hydrograph. And pay no
4 attention to this early data. That's when I was actually as
5 a consultant for SNWA, I oversaw the construction and
6 development of this well. We did a development test at the
7 beginning. And it had a very noticeable response, as you can
8 see. But it's continued to rise. But, again, it's on the
9 other side of the Kane Springs fault wash zone. Continuous
10 rise in water levels. No response, no obvious response, to
11 Order 1169 pumping.

12 CSVM-4 here. And you can see a completely
13 different response in the alluvial water levels on that side
14 of the fault versus carbonate water levels on this side of
15 the fault.

16 Q. And what is that and this?

17 A. This side is -- The monitoring well on the left
18 is the alluvial monitoring well. And then I guess that side
19 would be CSVM-4 carbonate well on the right.

20 Okay. Let's move on to slide 25. Same image on
21 the left. Now I'm showing CSVM-4 levels just like the
22 previous slide. Order 1169 pump test. CSVM-4, sorry. It's
23 blue shown right here. It's the bottom hydrograph.
24 Obviously this response has been well-documented and

1 used an ET range for phreatophytes incorporating the
2 influence from shallow groundwater evaporating .2 to .3 feet
3 per year, pretty low. If you were to multiply that range by
4 2200, you come up with an estimate of groundwater that could
5 be potentially captured without pulling water out of storage.
6 That's ET capture we hear a lot about, four to 600 acre-feet
7 of that 750 acre-feet of recharge. So that's my rough water
8 budget for this area.

9 Again, current and additional potential basin
10 fill alluvial pumping in north CSV would capture ET. It's
11 clearly demonstrated here. If we were pumping more than just
12 the ET, we would see water levels dropping west of Bedroc.
13 Excuse me. East of Bedroc. It's not happening. Water
14 levels are actually rising.

15 As soon as pumping exceeds what can be captured
16 with ET, you start pulling water out of storage, those water
17 levels down gradient will start declining. But they're
18 rising.

19 So let's -- I'll wrap up with my summary and
20 conclusions, slide 28. Again, the entire White River Flow
21 System should not be included in the LWRFS. I don't need to
22 spend any more time on that.

23 What I want to focus on is numbers two and three.
24 So, as indicated in Bedroc's rebuttal report, our position is

1 discussed extensively in this hearing. What I'm more
2 interested in is what happened up at the north. This is
3 CSVM-7, an alluvial monitoring well. It actually rose during
4 the test. Probably, you know, there's -- this well was put
5 in in, I think, 2004. You don't see much there in terms of
6 the wet year in 2005. But it rose and it looks like it's
7 pretty level since the end of the Order 1169 pump test.

8 Let's move on to slide 26. This is another
9 oblique view looking south at Coyote Spring Valley, US 93,
10 from north to south you can see Bedroc here just west of US
11 93 and extensive evaporites -- evapotrans -- ET is occurring
12 here near surface groundwater. A lot of salt residual here
13 basically encompasses the Bedroc site.

14 And I've mapped, just did a rough estimate of the
15 area that I believe is influenced by this evaporation and the
16 phreatophytes, 2200 acres. That's just a rough estimate in
17 GIS.

18 Let's move on to slide 27. So in terms of a
19 water budget at this local level, I explained how I arrived
20 at that 750 acre-feet from zones one, two, three, and four in
21 the CSI report.

22 Estimated current land area. As I mentioned with
23 phreatophytes and shallow groundwater that is evaporating
24 based on physical evidence at the surface, 2200 acres. I

1 that transfers of senior alluvial rights from the Muddy River
2 Springs area should only be considered on a case-by-case
3 basis so as to not impact senior existing rights. So in
4 theory, transfers could occur here. But, remember who has
5 the most senior rights. Location matters. And I'm talking
6 about alluvial basin fill. I'm not talking about carbonate.

7 Number three, alluvial pumping from north Coyote
8 Spring Valley does not appear to be connected with the Muddy
9 River Springs area. That was -- I didn't talk much about it,
10 but that should be obvious from the information that I
11 presented. Other stakeholders have indicated the same.

12 A significant portion of alluvial pumping
13 captures ET not recharging the carbonate aquifer. We
14 demonstrated why that is so. And if it weren't the case,
15 water levels would be dropping. And they're not. So I'll
16 conclude there. Thank you.

17 MS. URE: Thank you, Mr. Dixon. With that we
18 would move to admit all of Bedroc's exhibits.

19 HEARING OFFICER FAIRBANK: The exhibits outside
20 of Mr. Dixon's initial report at NCA Exhibit 1 have already
21 been admitted. And NCA Exhibit 1 rebuttal report is
22 admitted.

23 UNIDENTIFIED SPEAKER: Bedroc.

24 HEARING OFFICER FAIRBANK: Excuse me. Bedroc.

1 Thank you.
2 MS. URE: And one final matter, Mr. Dixon, before
3 this hearing started there was some notation of an objection
4 to your reports related to the differences in your opinions
5 for Nevada Cogen versus Bedroc. Can you explain how they are
6 not in conflict?

7 THE WITNESS: Yes. So obviously, as you heard
8 yesterday, and as you saw on the Bedroc -- Excuse me -- NCA
9 rebuttal report, we focused on carbonate pumping, carbonate
10 monitoring, and the effects in the Muddy River Springs area.
11 I didn't spend much time on that here because it's
12 irrelevant. I focused on the alluvial basin fill alluvium in
13 north Coyote Spring Valley, specifically how that affects
14 Bedroc's pumping now and in to the future. So there's no
15 conflict. In fact, I didn't even sign Bedroc's report. I
16 was busy with NCA. I didn't have time. I did review it and
17 edit it. I contributed to it, absolutely. And I support a
18 hundred percent what was put in that report.

19 MS. URE: Thank you. And with that we will
20 reserve the remainder of our time for redirect.

21 HEARING OFFICER FAIRBANK: Okay. You have about
22 39 minutes left. So with that we will go ahead -- And just
23 as a -- just for a correction on the record and make sure
24 that the record is clear. It is Bedroc Exhibit Number 2,

1 A. Oh, yeah. Lincoln County line is, it might be
2 right around in here.
3 Q. I think you got it. And then the northern
4 portion of the CSI property almost comes up to the Bedroc
5 properties; correct, sir?

6 A. Actually I do not know that.

7 Q. All right. The red arrow reflecting the Sheep
8 Range recharge, it's true, is it not, that the highway fault,
9 as it's been called, causes an impediment to the groundwater
10 flow in an east/west direction?

11 A. It definitely influences groundwater flow. Our
12 groundwater levels drop off precipitously as they go across
13 that fault. So it definitely affects groundwater flow.

14 MR. ROBISON: Thank you. I would like to show
15 you exhibit, State Engineer Exhibit 50. May I approach?

16 HEARING OFFICER FAIRBANK: Yes, you may.

17 MS. URE: Do you have one for me?

18 Q. (By Mr. Robison) Are you familiar with State
19 Engineer Exhibit 50?

20 A. Yes, sir.

21 Q. And turning to page 12 of that -- And the numbers
22 are hard to read on the bottom -- it's the groundwater
23 pumpage inventory, Coyote Springs Valley, number 210, do you
24 see that, sir?

1 which was the rebuttal report that's been admitted.

2 MS. URE: Thank you.

3 HEARING OFFICER FAIRBANK: And so we will go
4 ahead and move on to cross-examination. And first is Coyote
5 Springs Investment. And there's seven minutes.

6 CROSS-EXAMINATION

7 By Mr. Robison:

8 Q. Good morning, Mr. Dixon. My name is Kent
9 Robison. I'm co-counsel for CSI.

10 A. Good morning.

11 Q. Could you bring up slide 15, please. Well, I've
12 got 15 as a map showing a Sheep Range recharge. There we go.
13 Would you tell us, Mr. Dixon, how close neighbors we are by
14 depicting where CSI development is relative to Bedroc
15 property?

16 We just lost the map. There you go. Your
17 property is basically on the northwest corner of the CSI
18 development? There we go.

19 A. There we go. Jay Dixon for the record. So
20 Bedroc is located right here. Are you talking about the
21 current development for CSI?

22 Q. Yes, sir. The Lincoln County corner northwest.

23 A. Well, the golf course is down here.

24 Q. Right. And CSI property goes up to the north?

1 A. Yes, sir.

2 Q. And the acres or duty allotted to Bedroc is 315?

3 MS. URE: I'm going to object to this line of
4 questioning as it's outside the scope of his presentation.

5 MR. ROBISON: We've been talking all day about
6 the pumpage from Bedroc and that's what I'm addressing.

7 MS. URE: We did not talk about the water rights
8 or the duties.

9 HEARING OFFICER FAIRBANK: So the objection is
10 based upon it being outside the scope of the direct
11 examination on the basis that the specific question is
12 relating to specific water rights and duties?

13 MS. URE: Correct.

14 HEARING OFFICER FAIRBANK: Mr. Robison.

15 MR. ROBISON: Excuse me. I believe the witness
16 has testified extensively about the pumpage at the Bedroc
17 facility with regard to alluvial wells and this is directly
18 pertinent to that testimony.

19 HEARING OFFICER FAIRBANK: I'll go ahead and
20 permit it based upon that association.

21 Q. (By Mr. Robison) Does State Engineer Exhibit 50
22 indicate that there's been some over pumping by about 200
23 acre-feet per year?

24 A. So that's water pumped based on meter readings.

1 We -- We believe our duty from the unadjudicated vested claim
 2 is 343. And we -- Some of that, you saw those fields there.
 3 Q. Yes, sir.
 4 A. There is a net irrigation there. That's not what
 5 we consume. That's what we pump. The State Engineer's
 6 office has the results of a water balance model showing what
 7 the net consumptive use is.
 8 Q. Is that the 559.5?
 9 A. No, it's not. That's what's pumped. That
 10 includes recycled water from the ponds as well as what is
 11 going back in to the ground.
 12 MR. ROBISON: Very well. Thank you much. That's
 13 all we have.
 14 HEARING OFFICER FAIRBANK: Thank you.
 15 United States Fish and Wildlife service? Seeing
 16 no questions.
 17 National Park Service? Seeing no questions.
 18 Moapa Band of Paiute Indians? No questions.
 19 Las Vegas Valley Water District and Southern
 20 Nevada Water Authority?
 21 CROSS-EXAMINATION
 22 By Mr. Taggart:
 23 Q. Good morning, Mr. Dixon. My name is Paul
 24 Taggart. I represent the Southern Nevada Water Authority and

1 direct testimony was relating solely to the water budget of
 2 the alluvial aquifer.
 3 MR. HERREMA: I think both the direct testimony
 4 and his rebuttal report, the scope.
 5 HEARING OFFICER FAIRBANK: Mr. Taggart.
 6 MR. TAGGART: Yes. I'll rephrase and I think it
 7 will be clear. How much time do I get?
 8 HEARING OFFICER FAIRBANK: You have five and a
 9 half minutes right now.
 10 MR. TAGGART: Okay. Thank you.
 11 Q. (By Mr. Taggart) Mr. Dixon, part of your
 12 testimony was the estimates of recharge in the Sheep Range
 13 and how much of that recharge hinders the alluvial system; is
 14 that correct?
 15 A. Yes.
 16 Q. And that information that you talked about, that
 17 recharge value was based on a water budget approach to
 18 determining the availability of water in that alluvial basin;
 19 is that correct?
 20 A. Yes.
 21 Q. And so I guess my question is do you think that
 22 same water budget approach that you used and are relying on
 23 in the alluvial system should also apply in the carbonate
 24 system or shouldn't the carbonate system rely on water level

1 the Las Vegas Valley Water District.
 2 A. Good morning.
 3 Q. Do you consider the alluvial system that your
 4 client's wells are located in to be a separate aquifer from
 5 the carbonate aquifer?
 6 A. I do.
 7 Q. And do you -- have you heard discussions in these
 8 hearings about the use of water budgets to manage the
 9 carbonate aquifer?
 10 A. Yes.
 11 Q. Do you believe that water level data and response
 12 data is a more appropriate type of evidence to use than water
 13 budget data for the carbonate aquifer itself?
 14 MR. HERREMA: Brad Herrema on behalf of CSI. I
 15 don't believe Mr. Dixon particularly in his testimony for
 16 Bedroc touched on anything other than the alluvial aquifer in
 17 the Bedroc area. He didn't get in to carbonate aquifer water
 18 budgets.
 19 MS. URE: And on behalf of Bedroc I'll join in
 20 that objection.
 21 HEARING OFFICER FAIRBANK: So the objection is
 22 that the question was outside the scope of the direct
 23 examination in that it is discussing water budgets of the
 24 carbonate aquifer, whereas the original testimony or the

1 data?
 2 MR. HERREMA: Same objection.
 3 MS. URE: And we will join in that.
 4 MR. TAGGART: I think it goes directly to your
 5 question about the impact of the 1169 pump test on the
 6 aquifer, the second inquiry that you asked.
 7 MR. HERREMA: Whether the question is relevant to
 8 the four questions is not what our objection is in regard to.
 9 Our objection is that this is beyond the scope of what his
 10 rebuttal report and his testimony here today cover.
 11 MR. TAGGART: Well, and this is not a death
 12 penalty case. It's an informal proceeding that I'm asking
 13 the witness a simple question that we're wasting more time on
 14 objections than we are on simple answers.
 15 HEARING OFFICER FAIRBANK: So to the extent that
 16 Mr. Dixon can go ahead and answer the question, I'll permit
 17 the question.
 18 THE WITNESS: So the reason I talked about
 19 geology before I arrived at that number is because geology
 20 matters. And recharge in some areas contributes more to
 21 alluvium than carbonate rock. I think I laid the foundation
 22 for that. I have no opinion on a basin scale what influence
 23 Sheep Range recharge may or may not have on the regional
 24 carbonate system. I focused on this area because the water

1 specifically observable its measurements support it. And
2 I'll leave it at that.
3 Q. (By Mr. Taggart) Thank you. Do you believe
4 there's sufficient water in the alluvial system for the
5 quantity of water rights that your client owns?
6 A. Yes.
7 Q. Do you believe there's more water in the alluvial
8 system than what your client owns or requires?
9 A. Yes.
10 MR. TAGGART: Okay. That's all I have. Thank
11 you.
12 HEARING OFFICER FAIRBANK: Moapa Valley Water
13 District? Seeing no questions.
14 Lincoln County, Vidler Water Company?
15 CROSS-EXAMINATION
16 By Ms. Peterson:
17 Q. Hello, Mr. Dixon.
18 A. Hello.
19 Q. So this is just a housekeeping matter. Are you
20 signing the report for Bedroc under your PE? I thought all
21 expert reports had to be signed.
22 A. Did you see the report?
23 Q. I did.
24 A. I didn't sign it.

1 Is it Bedroc's intention to have this
2 presentation admitted in to evidence?
3 MS. URE: I believe all the presentations, the
4 slides, were admitted as demonstrative exhibits and that the
5 reports are in as exhibits. And then Mr. Dixon's testimony
6 will be part of the record. That's my understanding of these
7 proceedings.
8 MS. HARRISON: So this will simply be considered
9 as demonstrative?
10 HEARING OFFICER FAIRBANK: The -- As with all of
11 the power point presentations that weren't submitted in
12 advance of the hearing and marked as exhibits, those will be
13 retained in the hearing record. And these are the
14 proceedings of the State Engineer and for the purposes of
15 either the testimony or presentation of information will be
16 considered by the State Engineer. And what weight to assign
17 to it will be within his discretion.
18 MS. HARRISON: Okay. Thank you.
19 HEARING OFFICER FAIRBANK: Nevada Cogeneration
20 and Associates? Seeing no questions.
21 Muddy Valley Irrigation Company?
22 MR. KING: No questions.
23 HEARING OFFICER FAIRBANK: Seeing no questions.
24 Nevada Energy?

1 Q. I know. So I'm just kind of wondering why you
2 are allowed to, I guess -- You're not going to sign the
3 report on your opinions that you expressed today?
4 A. If I were asked to sign it now I would.
5 Q. Okay. And then you just had a question from
6 Mr. Taggart about if there was more water in the alluvial
7 than what your clients needed. Do you remember that?
8 A. Yes.
9 Q. And would you say that that water supply, I
10 guess, or source in the alluvial is an adequate and
11 sustainable supply of water?
12 A. It appears to be, based on water levels.
13 Q. For Bedroc's use and possibly other uses?
14 A. Correct.
15 MS. PETERSON: That's all I have. Thank you.
16 HEARING OFFICER FAIRBANK: City of North Las
17 Vegas?
18 MS. URE: No questions.
19 HEARING OFFICER FAIRBANK: No questions.
20 Center for Biological Diversity? No questions.
21 Georgia Pacific Republic?
22 MS. HARRISON: Good morning, Mr. Dixon. This is
23 actually a question for counsel. Sylvia Harrison on behalf
24 of Republic and Georgia Pacific.

1 MS. CAVIGLIA: No questions.
2 HEARING OFFICER FAIRBANK: No questions.
3 So at this time I will open it up to the State
4 Engineer and Division of Water Resources staff.
5 EXAMINATION
6 By Ms. Barnes:
7 Q. Michelle Barnes for the record. Can we go to
8 slide 24. And I just want to make sure that I heard you
9 correctly when you were talking about this slide. I believe
10 you mentioned CSVM-4 in your testimony, but the graph on the
11 right is labeled CSVM-7.
12 A. Yes, you are correct. It's the next slide that
13 was CSVM-4. This is, right, the blue line is CSVM-4. CSVM-7
14 up here north of the site. Thank you for allowing me to
15 clarify that. Obviously it's in the alluvium, as we have
16 seen throughout this hearing, carbonate levels generally
17 decline during this time. The only levels rising are in the
18 alluvium and certain areas like this.
19 Q. Looking at your figure on the left, the CSVM --
20 Okay. That is alluvium.
21 Can we go to slide 25? Thank you for clarifying
22 that. Did you happen to compare CSVM-3 to CSVM-4 in your
23 analysis? I was just curious since they're both alluvium --
24 or they're both carbonate.

Page 1753

1 A. Carbonate. I did not. I recall seeing CSV-3
2 shown in other presentations during this hearing. And it
3 showed a similar response, although rather muted and delayed.
4 Q. Okay.
5 A. Because of the structure between it and Muddy
6 River Spring area. And there's a lag present in both wells.
7 MS. BARNES: Okay.
8 HEARING OFFICER FAIRBANK: All right. So we have
9 time still available. We'll open it back up for additional
10 questions by the participants. Are there any other
11 participants, rather than going through the list? I see
12 Southern Nevada Water Authority and Las Vegas Valley Water
13 District. Are there any other participants that have further
14 questions?
15 Not seeing any other, so Mr. Taggart.
16 MR. TAGGART: How much time?
17 HEARING OFFICER FAIRBANK: I'll give you five
18 minutes.
19 MR. TAGGART: Okay. Thank you.
20 CROSS-EXAMINATION
21 By Mr. Taggart:
22 Q. Good morning again, Mr. Dixon.
23 A. Good morning.
24 Q. Slide 23 of your power point, do you have that?

Page 1754

1 A. Yes.
2 Q. So this depicts the wells in the alluvium that
3 are pumped by your client; is that correct?
4 A. Yes. These are not pumping wells. These are
5 observation wells, shallow observation wells, associated with
6 the commercial operation.
7 Q. What would you consider to be the average annual
8 amount of groundwater depletion from your client's wells?
9 A. Groundwater depletion?
10 Q. I want to get past the question that you were
11 asked about pumpage versus secondary recharge. What do you
12 think that pumping is actually taking out of the system at
13 the moment?
14 A. At the moment?
15 Q. In net.
16 A. Yep. So based on my water balance model total
17 consumed 349 acre-feet. And that is because they took 20
18 acres out of production.
19 Q. Okay. But groundwater levels in the alluvial are
20 declining during that time period; correct?
21 A. This goes up through 2018. The last label on the
22 X-axis is 2019. But that's a shift. I don't have 2019
23 pumping data in there yet.
24 Q. Okay. But from 2013 to 2019 there's declining

Page 1755

1 water levels in the alluvial aquifer; correct?
2 A. That's right.
3 Q. Okay.
4 A. Do you want to know why?
5 Q. No. And then let's go back to page ten. And I
6 would love to, but I only have five minutes or probably three
7 now. The original estimate of recharge of Maxey-Eakin for
8 the recharge zones that are where your client is was 130
9 acre-feet; is that right?
10 A. That's right.
11 Q. But you believe that a reliable recharge estimate
12 for that same area is ten times that amount, 1370 by Epstein?
13 A. No. I think that's a bounding range. I think
14 the Maxey-Eakin numbers are probably too low. If that were
15 the case, we would see water levels dropping.
16 Q. Okay. So 750 is your -- you've averaged the two?
17 A. Yeah. Because I think Epstein is too high and
18 Maxey-Eakin is too low.
19 Q. Okay. And so 750 is the maximum amount of
20 recharge you think is available in the area where your
21 client's pumping could occur; is that true?
22 A. That's my estimate, yes.
23 MR. TAGGART: That's all. Thank you.
24 HEARING OFFICER FAIRBANK: At this time I will go

Page 1756

1 ahead and open it back up to Division of Water Resources
2 staff and the State Engineer.
3 MS. COOPER: Christi Cooper for the record. Can
4 you guys hear me okay?
5 HEARING OFFICER FAIRBANK: We can hear you,
6 Christi. Thank you.
7 MS. COOPER: Okay.
8 EXAMINATION
9 By Ms. Cooper:
10 Q. Did you look at any other alluvial well water
11 levels in the Lower White River Flow System to see if those
12 water levels may be declining or not?
13 A. I mentioned CSV-5. It's about 16 or 17 miles
14 south on the west side of 93. I know you know where that is.
15 It's an alluvial well and it has rising groundwater levels.
16 I didn't put it in here. It's pretty far from the site. But
17 that's another area that I looked. Beyond that, I didn't
18 look at -- There's not much alluvial monitoring beyond this
19 area in the LWRFS right now.
20 Q. CSV-5 is carbonate?
21 A. No. It's alluvium, I believe.
22 MS. COOPER: Okay. Thank you.
23 ///
24 ///

1 EXAMINATION
 2 By Ms. Barnes:
 3 Q. Michelle Barnes for the record. Can we go back
 4 to slide 24. Based on our previous questions I just want to
 5 make sure I'm still on the same page as you, Mr. Dixon.
 6 A. Sure.
 7 Q. So now understanding that this graph is for
 8 CSVN-7 and CSV-3009M and slide 24 is CSVN-4 and CSVN-7,
 9 you're trying to demonstrate that -- I guess, are you trying
 10 to demonstrate that flows on the west side of the fault are
 11 trending similarly as opposed to wells for groundwater
 12 elevations on the east side and west side of the fault?
 13 A. Showing a disconnect between the alluvium and the
 14 carbonate there.
 15 Q. Okay.
 16 A. And a connection similar responses on that side
 17 of the fault in north Coyote Spring Valley for the alluvium.
 18 MS. BARNES: Okay. Thank you for clarifying.
 19 HEARING OFFICER FAIRBANK: All right. Ms. Ure, I
 20 will go ahead and open it back up to you for redirect if you
 21 have any.
 22 MS. URE: Can I have a moment to confer with my
 23 co-counsel?
 24 HEARING OFFICER FAIRBANK: You may.

1 redo that with your microphone on?
 2 THE WITNESS: Thank you. Felling, F-e-l-l-i-n-g.
 3 Q. And, Mr. Felling, were you retained by Nevada
 4 Energy to complete a rebuttal report?
 5 A. Yes, I was.
 6 Q. And in preparation for this hearing did you
 7 create a power point?
 8 A. Yes, I did.
 9 Q. Can you please go through your power point?
 10 A. Yes.
 11 Madam Hearing Officer, State Engineer staff, I'm
 12 happy to be here at the end of this very long hearing. I
 13 know you've heard a lot of evidence. Most of it I think
 14 very, very good. I'll try to be succinct and clear in
 15 presenting my four answers to your questions.
 16 The questions were, the geographic boundary of
 17 the flow system, what was the information that was obtained
 18 from the Order 1169 aquifer test, the effects of movement of
 19 the water from the alluvial to the carbonate aquifer. And at
 20 the end of it the total amount of groundwater that could be
 21 pumped manually from the Lower White River Flow System.
 22 So I'll start with the geographic boundary of the
 23 connected groundwater surface water systems compiled in the
 24 Lower White River Flow System. I'll talk about the pros and

1 MS. URE: We have no further questions on
 2 redirect.
 3 HEARING OFFICER FAIRBANK: Okay. All right.
 4 Well, then let's go ahead and take about a ten-minute break
 5 and we will reconvene at 9:40 with the Nevada Energy
 6 presentation. Thank you.
 7 (Break was taken)
 8 HEARING OFFICER FAIRBANK: Okay. We will
 9 continue the hearing with Nevada Energy. Ms. Caviglia.
 10 MS. CAVIGLIA: Justina Caviglia on behalf of NV
 11 Energy. May I please have Mr. Felling sworn?
 12 (The witness was sworn in)
 13
 14 RICHARD FELLING
 15 Called as a witness on behalf of
 16 NV Energy, having been first duly sworn,
 17 Was examined and testified as follows:
 18
 19 DIRECT EXAMINATION
 20 By Ms. Caviglia:
 21 Q. Mr. Felling, can you state and spell your last
 22 name for the record?
 23 A. Richard Felling. Last name F-e-l-l-i-n-g.
 24 HEARING OFFICER FAIRBANK: Mr. Felling, will you

1 cons for Kane Springs Valley, Lower Meadow Valley Wash, and
 2 the Black Mountains area in the Las Vegas Valley shear zone.
 3 This is an image modified from SNWA Exhibit 22.
 4 This is Rowley geologic map and my modifications here. This
 5 shows Kane Spring Valley. And all I did here was I drafted
 6 on top of the existing geologic map the Kane Springs Wash
 7 fault zone. And then I also drafted in this basin bounding
 8 fault that was basically interpreted from the two geophysical
 9 surveys, the CSAMT survey, which had lines that ran parallel
 10 to the northeast and to the southwest of that inferred fault.
 11 And then there was a gravity survey that showed that there
 12 was a gravity well just to the southwest of the mouth of Kane
 13 Spring Valley. And I agree that that evidence is fairly
 14 compelling that there is a range front structure there.
 15 To the succinct figure I added this big blue
 16 arrow. This is the direction of groundwater flow in Kane
 17 Springs Valley pretty much agreed to by all the experts.
 18 Vidler's expert agreed to it. Other experts agree that water
 19 flows from northeast to southwest and that would be the
 20 recharge in the basin. It would flow in carbonate rocks. It
 21 would flow in the volcanic rocks. It might flow in the
 22 alluvium.
 23 We have range-fed boundary structures on both
 24 sides of Kane Springs Valley clear down to the center of the

1 valley. The geologic map indicates that many of them also
2 have left lateral strike-slip fault like the Kane Springs
3 Wash fault.

4 The basin boundary is down here just at the edge
5 of this last outcrop on the southwest part of Kane Springs
6 Valley. And that's where Vidler-Lincoln County's production
7 well is.

8 So the question is, is this recharge in Kane
9 Spring Valley flows from northeast to southwest. And however
10 much flow that is, it ultimately makes it in to Coyote Spring
11 Valley where it joins the regional flow and heads southward
12 towards the Muddy River Springs.

13 And this cross-structure here, it may impede
14 flow, but it's not a barrier to flow. Whatever the recharge
15 is in Kane Springs Valley is going to make it over, around,
16 or through that fault. There's no other option. It doesn't
17 go anywhere else. No one is suggesting that it goes anywhere
18 else. So that water ultimately makes it in to the Lower
19 White River Flow System.

20 So in terms of pros and cons, can Kane Springs
21 Valley -- can it be managed without including it in to the
22 Lower White River Flow System joint management area? And in
23 our rebuttal report, I suggest that yes, it could be.

24 Alternatively, we've heard a lot of evidence this

1 there was flow in the carbonate. And although it's hard to
2 see on this slide, this area here from where I have this blue
3 area and my laser, to the west is carbonate. And it has been
4 suggested that there might be flow from north to south in the
5 carbonate in the Lower Meadow Valley Wash and that might
6 contribute to discharge of the Muddy River.

7 Now, there is a monitoring well north of the
8 Muddy River Springs. That is CSV-2. And water levels there
9 are about 18 feet lower than at Pederson Spring. But still
10 those water levels are higher than the Big Muddy Springs. So
11 is there a potential for a flow? Yes. Are we certain that
12 flow exists? There's really nothing close to enough
13 evidence.

14 But if one of the parties that owned the water
15 rights in the Lower Meadow Valley Wash wanted to go up on the
16 carbonate and pump water, then the State Engineer would have
17 to then consider would that be conflicting with existing
18 rights.

19 These are very old groundwater rights relative to
20 the Lower White River Flow System, as the expert for Nevada
21 Cogen pointed out, including the joint management area could
22 bring about some issues.

23 Finally, the Black Mountains area and the Las
24 Vegas Valley shear zone. So this is the same basin map. I

1 week that is, you know, fairly compelling evidence to include
2 it in to the White River Flow System joint management area,
3 considering that it's in a shared carbonate aquifer, it
4 responded to the 1169 aquifer test, it's right on the
5 boundary, and pumping there would in fact, we could argue,
6 ultimately capture water that flows south in the Lower White
7 River Flow System. So there's some compelling arguments both
8 ways.

9 I want to talk about the Lower Meadow Valley
10 Wash. Now, this figure is from the base map that I got off
11 of NDWR's website. And I just -- I needed to have something
12 that had basin boundaries on it and kind of showed where
13 things were. So this is Lower Meadow Valley Wash is this
14 basin here bounded by this green line. This big spring
15 symbol is the headwaters at the Muddy River springs area.
16 And water flows from north to south.

17 And in the water budget that the State Engineer
18 accepted for the Delamar, Dry Lake, and Cave Valley hearing,
19 it was recognized that there is some flow from Lower Meadow
20 Valley Wash that flow south and ultimately probably
21 contributes to the Muddy River above Glendale to the extent
22 that that water contributes to the Muddy River, capture of
23 that water might conflict with existing rights.

24 There was also discussion about whether or not

1 got it from the State Engineer's website. And it shows in
2 blue, carbonate rocks. In tan, sedimentary rocks. And then
3 in very light color, alluvial rocks.

4 I also drafted on, liberally, the basin
5 boundaries. So the north center part of the slide, and this
6 is slide ten, that's Garnet Valley. To the southwest Las
7 Vegas Valley. To the east is California Wash. And to the
8 southeast is the Black Mountains area. And then I also
9 drafted on the Dry Lake thrust fault and the Las Vegas Valley
10 share zone, which isn't exposed because it's covered by
11 alluvium.

12 I have shown on here BM-DL-2 and that's the
13 monitoring well near Nevada Cogen's pumping center. BM-DL-2
14 tracks very well with the rest of the carbonate. Many of the
15 other carbonate wells, including EH-4, clearly shows that at
16 BM-DL-2 you're part of the Lower White River Flow System.

17 KBN-4, that data it's difficult to determine
18 really what they're measuring. I would not recommend that
19 you separate that pumping center from the Lower White River
20 Flow System unless somebody could prove to you that it was
21 not connected. And that evidence doesn't exist.

22 As far as the carbonate rocks in Las Vegas
23 Valley, I'm not recommending that you extend the system down
24 to Las Vegas Valley shear zone, but there really is no data

1 in the carbonate terrain in Las Vegas Valley. Now, should
2 someone with a water right in the Las Vegas Valley want to
3 move it up in to these carbonates, then you would have some
4 data and you would have to make a decision on what to do
5 here. Now, again, you could manage it without including it
6 in the Lower White River Flow System management area. But at
7 this point in time I don't think that it's necessary. But
8 it's something that we may -- you may need to look at in the
9 future.

10 So now I'll get in to the information obtained
11 from the aquifer test and subsequent to the test and the
12 Muddy River headwater spring flow as it relates to recovery
13 since the completion of the test.

14 So I have six bullets here. I'm going to kind of
15 talk about all of them together. I agree that maximum
16 recovery to the extent that it could occur was reached two or
17 three years after completion of the aquifer test, certainly
18 by 2016. Water levels continue to decline in most areas.
19 Coyote Spring Valley, Garnet Valley, California Wash, the
20 Black Mountains area, the water levels continue to decline.
21 Water levels in the Muddy River Spring area or at least at
22 EH-4, which is most closely tied to surface water discharge,
23 are approaching or have reached steady state at least for a
24 period of time. And we'll look at that in detail because

1 you can judge for yourself whether that line matches the data
2 steeper at first and then lowering out a little bit at the
3 end.

4 Then we have 2005 recharge event where water
5 levels recovered and then you basically have a recovery from
6 that impulse. But over the next five years water levels
7 continued to decline. And I drew a line through that data.
8 But I think that line is that west steep angle than the first
9 line. Then we have the Order 1169 aquifer test and 2011-12
10 finished in early 2013. And then a couple years of recovery.

11 And then we have this last few years of water levels at EH-4
12 that we've had so much discussion about. The staff can judge
13 for themselves whether those water levels are rising, falling
14 or flat. But we'll take another closer look at it.

15 So I drew these line segments in here and
16 discussed what were the main effects on the system. By no
17 means is this everything that's gone on. We have other
18 recharge events. We have pumping that has -- We have pumping
19 that is not steady. We have pumping locations that are
20 moving all over the place. But, nevertheless, these line
21 segments pretty much match that data.

22 So, just for curiosity, I plotted flows at Warm
23 Springs West. And I just laid it on top of that same
24 hydrograph. You know, these line segments. I did not -- I

1 that's been discussed quite a bit.
2 Warm Springs West over that same period of time
3 approaching steady state. Muddy River Spring area total
4 discharge steady or in the last few years for measurements
5 increasing. All of that said, we need more time to observe
6 the system to really be certain that we are in fact reaching
7 equilibrium in the Muddy River Springs area. There is
8 evidence, but it's not compelling one way or the other. But
9 we'll go through it and take a look at it.

10 So this is a hydrograph of EH-4. That's the blue
11 line. And this extends all the way back to 1987. And then
12 the orange bars, that's carbonate aquifer pumping. And so
13 this is the hydrograph. And then I took the liberty of
14 drawing line segments through portions of this data. And
15 I'll talk about -- I'll talk about each of those segments.

16 So this first segment, this flat line here, that
17 was before there was really any significant pumping. We'll
18 call that -- I call it dynamic equilibrium. Dr. Myers
19 thought that there was a decline early and then we had a
20 recharge event and then it recovered. And dynamic
21 equilibrium, more or less pretty flat.

22 Pumping really accelerated in about 19 -- I
23 believe that's 1990. And then for ten years we see a decline
24 in EH-4 and a decline -- I drew a line through the data and

1 did not change those line segments. I just laid the data on
2 there and I scaled it so that it would not be -- so it scaled
3 appropriately.

4 And, you know, the data, it matches fairly well.
5 We see initial pumping. We see recovery from the recharge
6 event. We see another decline. Although here we see quite a
7 bit of deviation between 2005 and 2012 than the Order 1169
8 aquifer test and you see recovery and now you see Warm
9 Springs West with the same line segment I drew through EH-4
10 and it matches that data fairly well also.

11 So then I said, well, what is this telling us.
12 So I just -- I took those line segments and I said, well,
13 what if I just lined them up. So I took the steady state
14 segment prior to pumping, the initial pumping signal between
15 the recharge event of 2005 and the Order 1169. I did -- I
16 simply took my mouse and copied that segment and I dragged it
17 down to kind of line up with the previous segment. I did the
18 same for the post Order 1169 aquifer test. I simply copied
19 that line and I dragged it down and then I drew that dashed
20 line that kind of mimics all of that data. To me that looks
21 like, you know, that looks like the drawdown from a long-term
22 aquifer test. And in effect I think that's what we're
23 seeing.

24 I'm not saying that this represents all the data.

1 But it does match fairly well with the data. And I think in
2 the long term it tells us something very important about
3 capture.

4 We had a long discussion about EH-4 since
5 completion of the test. In the upper right corner I have
6 taken a screen shot from SNWA's Exhibit 81. And you can see
7 that there is a trend line that was drafted by SNWA through
8 that same data. And counsel made a point of asking many of
9 the expert witnesses whether that showed a decline. And many
10 just said, yeah, yeah, that looks like a decline. Well, I'm
11 saying that I don't think that that line represents that data
12 for a couple of reasons. There is high annual periodicity
13 here, almost a foot from annual highs to annual lows. And
14 it's a short record. It's just a few years. But if you want
15 to draw a line through that data, you have to start it and
16 end it in the same month because of that annual periodicity.

17 This little line segment starts in April, April
18 of 2016. April is the high point in each and every one of
19 these years in water levels. But at the end of that line,
20 and it's shown in this little legend up here, that was
21 January. January isn't the low. But January is about
22 midway. So if you wanted to draw a trend line through these
23 data, you need to start it and end it in the same month. And
24 that line doesn't. But, again, staff can see the data and

1 Finally, we had a lot of talk about drought and
2 climate signals. I think in the Lower White River Flow
3 System all of our climate signals are due to precipitation
4 just in Climate Division 4 and not in Climate Division 3.
5 Climate Division 3 supplies most of the water to the Lower
6 White River Flow System. But because in Climate Division 3,
7 which is in Pahranaagat Valley and Delamar Valley, the heads
8 there are about 900 feet higher than they are at our northern
9 most well in Coyote Spring Valley. So there's a 900-foot
10 head gradient between Climate Division 3 in Pahranaagat Valley
11 and in Coyote Spring Valley. So we've got 900 feet of head.

12 Now, let's say we have a drought in Climate
13 Division 3 and water levels drop two feet, let's say. We
14 have water level data and we don't see that. But if it did
15 drop two feet, well, then instead of having a 900-foot
16 gradient, there would be an 898-foot gradient. If water
17 flowed through that whole section uniformly, then we would
18 see whatever that is, two over 900, that would be the loss of
19 contribution from the northern basin, which is essentially
20 nothing.

21 This figure shows -- And this is out of a
22 previous hearing. But it's in the Nevada State Engineer
23 Exhibit 250. SNWA also had a similar exhibit and they showed
24 just winter precipitation, which I think even -- works even

1 they can see whether or not they believe that that trend line
2 or my trend line adequately represent the data.

3 So we see that, I believe anyway, that water
4 levels and the Muddy River Spring flows look like they're
5 kind of equilibrating. This figure is from SNWA's Exhibit
6 22, although I think it's in their primary exhibit as well,
7 their initial report. And it shows flow of the Muddy River
8 at the Moapa gage. And what they did is they simply measured
9 flow at the Moapa gage and then they added to it what the
10 diversions were to get at what the real discharge of the
11 system is. And a lot of those diversions were groundwater
12 pumping by NV Energy and exported from the region so that
13 there is no recharge. It's literally taken straight out of
14 the system.

15 And we can see here that since 20 -- since the
16 end of the Order 1169 aquifer test, flows recovered like we
17 would expect, but then they kept recovering so that in 2018
18 flow of the Muddy River at Moapa when you consider diversions
19 was 32,000 acre-feet compared to the long-term average of
20 34,000 acre-feet. So that's just 2,000 acre-feet less than
21 pre-development. So this also supports the other data that,
22 you know, maybe we're getting close to steady state. Again,
23 it's a short record. And I think we need more time to know
24 for sure. All of these data are telling us the same story.

1 better. But this is EH-4 again. This is precipitation in
2 the orange bars. And you can see in wet years you have a
3 rise in water levels. In dry years you don't see that much
4 of a decline or any I think measurable decline. But you do
5 see a wet year signal. And I think that explains, you know,
6 all of the climate signal in the Lower White River Flow
7 System. That is precipitation in the Lower White River Flow
8 System.

9 So the third question -- I think this is the
10 third one -- is the effects of moving the water rights
11 between alluvial wells and carbonate wells and deliveries of
12 senior decreed rights to Muddy River, verbatim that's the
13 question. Many parties answered this question and said, oh,
14 you can't move these alluvial wells, we'll have too much
15 pumping. But that's not the question.

16 The question is what will happen when you move
17 the alluvial wells to the carbonate and its effect on senior
18 decreed rights. We agree that alluvial pumping captures
19 river flows quickly, almost one to one, but certainly not
20 totally one to one. That just hardly ever occurs. Alluvial
21 pumping lowers the water table in the alluvium in the ET
22 areas and so some ET is captured. But I don't want to dwell
23 on that point. It's a small amount.

24 But the model simulations and our observations

Page 1773

1 indicate that carbonate pumping captures less river flow than
 2 alluvial pumping at all points in time. That's the question
 3 and that's the answer. The effect of moving water rights
 4 from alluvial wells to carbonate wells will have a less --
 5 will have less of an effect on senior decreed rights.
 6 So I have worked and evaluated many of these when
 7 I was a staff of the State Engineer's office and our criteria
 8 was always the same. What is the effect of pumping at the
 9 current point of diversion and compare it to pumping at the
 10 proposed point of diversion and affects our existing rights.
 11 That was the criteria. That's what we used.
 12 So the answer to this question is moving alluvial
 13 pumping to the carbonate will have less of an effect on
 14 senior decreed rights in the Muddy River. We're not talking
 15 about flows in, or contributions to, or endangerment of the
 16 habitat of Moapa dace. That's not one of the questions.
 17 We're not talking about having more pumping than there was
 18 before. That's not part of the question.
 19 Anyway, our observations on the effects of flow
 20 also support this conclusion. So I'll look at the modeling
 21 result of Dr. Waddell. He had three simulations: Simulation
 22 one on the left, simulation two in the middle, and three on
 23 the right. And I'll just go through it briefly.
 24 In simulation one, most of the pumping was in

Page 1774

1 Coyote Spring Valley and the Muddy River Springs area. But,
 2 most importantly, 6900 acre-feet of that pumping was
 3 alluvial.
 4 In the middle simulation, the alluvial pumping
 5 was reduced to 2200 acre-feet. And then simulation number
 6 three, alluvial pumping was 1300 acre-feet. And most of the
 7 pumping was moved south in to California Wash, Garnet Valley,
 8 and the Black Mountains area.
 9 And for each of these simulations in the model,
 10 flow of the Muddy River at Glendale increased with when you
 11 go from simulation one to simulation two to simulation three.
 12 So these simulations support my conclusion moving water to
 13 the carbonate will have less of an effect on senior decreed
 14 rights.
 15 And just, you know, on the X-axis, this goes out
 16 to 500 years.
 17 So, the long-term annual quantity of groundwater
 18 that may be pumped from the flow system, including the
 19 relationships between the location of the pumping and
 20 discharge of the Muddy River Springs and the capture of the
 21 Muddy River flow.
 22 So the state has always had a perennial yield.
 23 We have one for every basin. Unfortunately, perennial yield
 24 is no longer applicable in the Lower White River Flow System.

Page 1775

1 And I think you've heard that from many of the experts.
 2 Water can't be pumped without impacting senior rights, so
 3 really the perennial yield approach no longer works.
 4 Conjunctive management approach could work. Others have
 5 proposed a safe yield or a system yield. But I think
 6 conjunctively you have to look at how much water is there.
 7 And at some point you have to ensure that senior water rights
 8 are protected. Water budgets still matter. And I'll talk
 9 about that quite a bit.
 10 All carbonate pumping will capture spring
 11 discharge and Muddy River flow. There is no getting away
 12 from that.
 13 Counsel asked several of the experts can you
 14 capture -- can you capture discharge without affecting the
 15 Muddy River? And they said no. I absolutely agree. I don't
 16 know how one would go about capturing any subsurface
 17 discharge to the extent that it exists. I wouldn't know
 18 where to place it. I don't know where it occurs. All
 19 carbonate pumping is going to capture some Muddy River flow
 20 and spring flow as well.
 21 Current pumping regime may have reached
 22 equilibrium in the Muddy River Springs area. I think we need
 23 more time for sure to know, because we just don't have any
 24 room for error at this point in time.

Page 1776

1 So I want to talk a little bit about --
 2 HEARING OFFICER FAIRBANK: Mr. Felling, if I may
 3 interrupt you for just one moment.
 4 MR. HERREMA: Brad Herrema on behalf of CSI. If
 5 we go back to slide 21, there are a couple of bullets at the
 6 bottom there which Mr. Felling didn't touch on but you can
 7 read them on the handouts that have been passed out. They
 8 get in to the 3.2 CFS trigger under the 2006 MOA. And there
 9 wasn't anything in Mr. Felling's rebuttal report that talked
 10 about that the MOA or the 3.2 CFS trigger or even pumping in
 11 the carbonate beyond current pumping. His opinion was that
 12 if pumping continued at the levels that, it related to
 13 pumping continuing at the levels it's at right now.
 14 HEARING OFFICER FAIRBANK: To summarize your
 15 objection for those that are listening remotely and from
 16 afar, it was that the last two bullet points on slide 21 are
 17 beyond the scope of the analysis and opinions proffered in
 18 the rebuttal report; correct?
 19 MR. HERREMA: Yes. And I think we get to those
 20 points at slide 34 as well.
 21 HEARING OFFICER FAIRBANK: Okay. So, at this
 22 point, your objection is noted and we'll address those when
 23 we get to those further slides. Thank you.
 24 MR. HERREMA: Thank you.

1 THE WITNESS: Okay. So the question of whether
2 all groundwater discharges at the Muddy River Springs, if
3 that is in fact the case, this hydrograph shows this is
4 really the source of water to wells. And when you only have
5 only a river to capture that waterfront and on the Y-axis
6 it's the fraction of pumping and on the X-axis it's time.
7 And we can see here that when water is initially pumped, all
8 of the water comes out of storage and that's this red line.
9 And that over time water captured from storage decreases
10 until essentially water levels maintain, they're steady. And
11 that over time inversely you have groundwater -- you have
12 river capture. That's water from capture. And that would be
13 in this case the Muddy River.

14 If all the water that discharges in the White
15 River Flow System discharges at the Muddy River Springs area
16 and the Muddy River, this is -- this is -- this is the
17 hydrograph that one would use. You would have a one-to-one
18 capture. There would be no getting away from it. Absolutely
19 no way around it. It would be one to one and just be a
20 matter of when.

21 However, I think the data is showing us that
22 there's something else going on. This hydrograph, which is a
23 little bit difficult to read. Again, it shows storage
24 capture in the line that starts on the top and it goes to the

1 I do want to point out that this is not the
2 boundary of the Lower White River Flow System. The boundary
3 is up here around -- at the east side of California Wash.

4 But the Recon recharge at least in the Black
5 Mountains area is less than a hundred acre-feet. So there's
6 really not a lot of local contribution.

7 So down here at the lower end of this table from
8 the same exhibit, Mr. Harrill estimates what the discharge
9 is. So for the Lower Meadow Valley it's a thousand. For
10 Black Mountain area one, three, four, and five. And that
11 would be one here is north of Rogers and Blue Point and then
12 three is most of the eastern end. Four is the southeast.
13 And five is southwest. He estimates essentially no boundary
14 flux, just from local recharge.

15 And these were -- these were data that
16 Dr. Waddell tried to match in his groundwater flow model.
17 That's why he included them in his molding report. So these
18 are the boundary fluxes from Dr. Waddell's model. They don't
19 match one for one. He doesn't label them the same way. But
20 it's in the same area.

21 So for the Muddy River he estimates 580
22 acre-feet. We'll ignore the Virgin River. East of Rogers
23 fault, 250. Rogers fault to Black Mountains, 560. East of
24 Black Mountains, that big area was only 47. South 1200. And

1 bottom. And then there are three lines that start in the
2 lower left and go to the upper right.

3 The top line is total capture from all resources.
4 And this is just demonstrative. It's not intended to
5 represent our system. It's just to show you what I think
6 could be going on.

7 The next, the middle line that rises from the
8 lower left, that's river capture. And on this particular
9 figure, it says evapotranspiration, but it could be any other
10 capture. It could be capture of subsurface outflow. It
11 could be induced recharge. It could be, you know, whatever
12 else is there to capture. The sum of the captures will add
13 up to the total capture. And that's the top line.

14 What I believe is that the evidence is showing us
15 that there is more than one capture occurring.

16 So let's just look and see what kind of evidence
17 do we have for subsurface discharge in the Lower White River
18 Flow System. So this figure is from Dr. Waddell's
19 groundwater flow model that was submitted as State Engineer
20 Exhibit 280. But it was for a previous hearing. And it
21 shows the segments. And they would be Lower Meadow Valley.
22 There's a Virgin River Valley. And then Black Mountains
23 area, one, two, three, four, and five. And for each of these
24 segments Mr. Harrill estimated boundary flux.

1 bottom of lake is 300. And the total number is 3,000
2 acre-feet. It's not a big number, but it doesn't quite match
3 Harrill's estimate.

4 But you can see that the model shows that there's
5 some water discharging. He did not believe it was
6 significant. And perhaps it is not. We really still don't
7 know.

8 This figure, and I'll touch on this, we're just
9 looking at -- I just want to point out what kind of evidence
10 we've seen in the past. This is from SNWA's report four, the
11 Delamar, Dry Lake, and Cave Valley hearings.

12 And just as a background, in order to try to
13 estimate recharge in all of the basins, first SNWA went and
14 to the extent that they could, they measured discharge and
15 estimated discharge and then had a discharge water budget.
16 And then from that they distributed recharge based on a
17 precipitation and a recharge coefficient that they felt was
18 appropriate for the White River Flow System, and the state
19 agreed.

20 As part of that hearing, they introduced a --
21 evidence to support flow south from the Muddy River Springs
22 and the Muddy River area, south from the Muddy River Springs
23 area to California Wash and bypassing the Muddy River. And
24 they brought in evidence. They had a number of wells in the

1 area. They had a transmissivity estimate, not so much from
2 the local wells because they didn't really have that data.
3 So they brought in estimates from elsewhere. So they had
4 transmissivity, they had width, they had a thickness, and
5 they had a gradient. And that's all you need to estimate
6 flux. And they estimated 9900 acre-feet.

7 Andrew Burns testified last week and I think he
8 kind of walked it back a little bit and said he wasn't that
9 confident with the transmissivity estimates. I don't
10 disagree. But the state accepted that discharge. And this
11 discharge was then in the recharge estimate spread out
12 through the Lower White River Flow System.

13 Ironically, to the west of that segment, there is
14 a section of carbonate rock with a lot of north/south
15 structure. And I thought, and I think now, that if
16 subsurface flow occurred, it would have occurred through the
17 carbonate rock. But there's no data there, so there's
18 nothing to support how much flow that might have been. So,
19 anyway, that was the number was 9900 acre-feet.

20 I just want to look here at -- this is the south
21 and eastern boundary of the Lower White River Flow System. I
22 drew this red line in on top of the Harrill boundary fluxes.
23 That red line -- There's a scale bar. That scale bar is 30
24 miles. That red line is 35 or 40 miles long. There's a head

1 that there wouldn't be some subsurface outflow. We don't
2 know how much it is. Nobody knows how much it is. But there
3 is likely some. And I think that our water level and flow
4 data are telling us that perhaps there is -- at least there's
5 something else that's being captured.

6 So, again, these were the figures. This is
7 capture. Currently, we're still losing water from storage in
8 the Lower White River Flow System. As we lose more and more
9 water from storage, we capture more and more subsurface
10 outflow. That's -- That's what these hydrographs tell us.

11 We have -- This upper figure, it doesn't match
12 our observations. Our water levels -- Our water level trend
13 in EH-4, we're down here, we're down here, which tells us we
14 should have captured most of our pumping from discharge but
15 we don't. What we see is that the discharge capture is
16 leveling or even decreasing. We've seen an increase in flow
17 of the Muddy River. That's not the way the system should
18 behave, according to these rules.

19 What I am suggesting is that we're perhaps out
20 in -- I'm showing the lower right figure. We're showing
21 water levels at least in the Muddy River area leveling out
22 but our capture of the river isn't up here at this high
23 number. It's somewhere else. It's something less.

24 So this is the hydrograph. This is EH-4. It

1 difference from the Lower White River Flow System carbonate
2 to Lake Mead. Heads in the Lower White River Flow System
3 carbonate are about 1800 feet above sea level. Lake Mead is
4 about 1100 feet above sea level and dropping. Nobody has --
5 So that's 700 feet of head differential.

6 MR. TAGGART: We're just going to lodge an
7 objection that none of this information is in the report.
8 This exhibit is not in his report. The line that he's drawn
9 on it is not on the report. The section on Harrill is not in
10 the report. None of this information is coming from his
11 report. It's all been generated for this power point. So on
12 this particular slide we object to testimony being offered
13 with respect to opinions that are opined in the report.

14 HEARING OFFICER FAIRBANK: Thank you,
15 Mr. Taggart. So your objection is that the slide and the
16 testimony associated with the slide is beyond the scope of
17 the report that was submitted. And your objection is noted.
18 And the State Engineer will assign the weight of the
19 testimony when the totality of the evidence is considered in
20 this matter.

21 THE WITNESS: Okay. I'll continue. Anyway,
22 there's 700 feet of head differential. There's no evidence
23 that the rocks around the periphery of the Lower White River
24 Flow System are impermeable. There's no reason to believe

1 shows that our capture, at least in the Muddy River Springs
2 area, which is our area of primary concern, is leveling out.
3 Our river flow of the Muddy River at Glendale, we're not
4 seeing that -- Our pumpage is seven or 8,000 acre-feet a
5 year. We're not seeing that capture. In the Muddy River our
6 waters levels are leveling out, but we're not seeing the
7 capture and we should be seeing it. Something else is being
8 captured.

9 There is a time factor here. But we do see that
10 the system has responded relatively quickly. And I don't
11 think that we're seeing something happening in one area and
12 not seeing it in another area.

13 Other areas are still -- Our other areas are
14 still losing storage. So in the top we've got Coyote Spring
15 Valley. In the top figure we see -- we are seeing continued
16 decline. The next line down, that's EH-4. We can argue
17 about that forever. The middle line of that is TH-2. Then
18 we see Garnet Valley and then BM-DL-2 in the Black Mountains
19 area. And we still see a bit of a decline. We're still
20 losing storage in those areas.

21 These are two figures from SNWA's report and I'll
22 just touch on them real quickly. The bottom one is a
23 computed capture of the Muddy River based on Warm Springs
24 West discharge. So they use their regression analysis to try

1 to estimate what capture of the Muddy River would be. And in
2 their evidence they showed a very high correlation between
3 Warm Springs West flow and Muddy River flow. And you can see
4 that capture, which is this green part of the Muddy River, is
5 increasing over time.

6 So I actually went to their table and I saw what
7 that capture was computed at. And I typed them on here. And
8 you can see from 2010, 2,000 acre-feet. In 2011 it's 3,000.
9 And then as you get up to 2015, it's 5,000, 5,000, 5600,
10 5400. And that's capture. That's computed from Warm Springs
11 West flow.

12 But when you look at their actual measurements,
13 that's not what you see. So I agree that the regression has
14 a high correlation, but the computed numbers don't match the
15 measured numbers. And when you have that disagreement in
16 information, I would always go with the measurement over a
17 calculation.

18 And this is the -- SNWA's multiple linear
19 regression. This goes to the question that none of the
20 party -- none of the other parties tried to answer this
21 question. So they tried. And I think there are issues with
22 it. But, nevertheless, it still needs to be done. And
23 nobody else tried to do this.

24 So I'll -- There was an issue with it and we

1 important for the state to answer that question about what
2 are the effects of pumping in all of these different areas.
3 Because right now we really don't know.

4 Q. (By Ms. Ure) Mr. Felling, you're about 45
5 minutes in.

6 A. Thank you. Okay.

7 MR. HERREMA: Brad Herrema for CSI. These are
8 the conclusions that we think are beyond the scope of
9 Mr. Felling's rebuttal report.

10 HEARING OFFICER FAIRBANK: Ms. Caviglia.

11 MS. CAVIGLIA: While we don't say the 3.2 CFS, we
12 do in our report on page seven state that Nevada Energy does
13 not rebut the arguments of SNWA and US Fish and Wildlife
14 Service and it's likely that all pumping in the Lower White
15 River Flow System, perhaps Kane Springs, and Lower Meadow
16 Valley Wash will ultimately impact the springs.

17 So, the spring number of 3.2 is not in our
18 report, however, the impact to those springs has been stated
19 in our report.

20 MR. HERREMA: The conclusion at the bottom of
21 page five is that future pumping at current rates and
22 location will result in minimal future water level decline in
23 the Muddy River Springs area or significant decrease, and
24 it's minimal significant decrease in the flow of Warm Springs

1 brought it up on cross and I just want to get it on the
2 record here. This is the multiple linear regression for
3 California Wash. It shows 1.7 feet of decline in 2015 when
4 pumping the California Wash was 411 acre-feet. The
5 regression line on the bottom shows water levels in EH-4 to
6 flows of the Muddy River Spring. And there's a slope here.
7 That slope is .157. So you simply multiply 1.7 times 1.7.
8 And that number .267 would be the expected decrease in
9 discharge at Warm Springs West.

10 Well, they have another regression for Warm
11 Springs West flow to Muddy River flow. And they have it in
12 their table, 6.1 in Exhibit 7. And the ratios are here on
13 the right and they range from .074 I think to .081. But in
14 their own analysis they ended up using Tom Eakin's ratio of
15 .076. And that's what I used here.

16 So, when you add it all up, this .267 decrease in
17 flow at Warm Springs West should translate in to 2500. 3.51
18 CFS decrease or 2500 acre-feet of decrease in discharge of
19 the Muddy River due to that 400 acre-feet of pumping. Well,
20 we know that can't happen. The capture can't be more than a
21 hundred percent. So there was a mistake somewhere. I don't
22 know where. I don't know about any of the other regression
23 analyses or about any in the other basins. However, I will
24 say that this is approach is important and it would -- it's

1 West or in Muddy River. The MOA is never mentioned nor is
2 the 3.2 trigger.

3 HEARING OFFICER FAIRBANK: Well, I agree that the
4 MOA or the 3.2 trigger is not specifically addressed in the
5 report. There's been some liberty in terms of participants
6 testifying as to particular matters. And, again, as I stated
7 before, the State Engineer will make a determination as to
8 what, if any, weight to assign to this.

9 So for the purposes of this particular line of
10 testimony, we'll permit it and any weight will be determined
11 whether or not it's assigned any value by the State Engineer.

12 MR. HERREMA: Thank you.

13 HEARING OFFICER FAIRBANK: Your objection is
14 noted. Thank you.

15 THE WITNESS: Okay. So I'll continue. Currently
16 flows at Warm Spring West are just a little more than 3.2
17 CFS. Those are provisional data. And we are at a low time
18 of the year. So we would expect them to increase. But there
19 is really not much more room to decrease flow at Warm Springs
20 West. And we think that any significant additional pumping
21 from the carbonate aquifer will likely result in that trigger
22 being reached. And it's possible that with the current
23 pumping that trigger will be reached. That we don't know for
24 sure.

1 That 3.2 CFS trigger may not be appropriate if
2 pumping occurs from less well-connected areas. Some of the
3 parties have various that are probably less well-connected.
4 If your trigger is at your discharge point, by the time you
5 reach that trigger and your pumping has taken a long -- your
6 signal has taken a long time to get there, that trigger is
7 not properly placed. It's too late.

8 Finally, the memorandum of agreement probably
9 needs to include all water users to be of real benefit in the
10 future.

11 So I'll just go to my summary. There are pros
12 and cons to adding the various basins to the joint management
13 in the Lower White River Flow System. There has been a lot
14 of evidence on Kane Springs Valley. We put in our report
15 that the State Engineer could manage Kane Springs Valley
16 without including it in the Lower White River Flow System.
17 There has been an abundance of very compelling evidence. And
18 we now say that we should include Kane Springs Valley in the
19 joint management area.

20 As far as the Lower Meadow Valley Wash, that
21 evidence is less compelling. Recovery from the Order 1169
22 aquifer test was complete within two or three years after
23 pumping. Water levels continue to decline every where except
24 perhaps in the Muddy River Springs area, where that water

1 area and flow data are telling us that we're not having
2 one-to-one capture. But I want to put it in to context of
3 the big picture. SNWA has made an argument that perhaps the
4 most that you could pump is 6,000 acre-feet and keep the
5 trigger level at Warm Springs West about -- above 3.2 CFS.
6 Our current pumping is rate is whatever, 7500 to 8,000
7 acre-feet of carbonate pumping. That's not a lot more. I
8 don't think that these data disagree with SNWA's conclusion
9 all that much. But I do think that we need a little more
10 time to know for sure.

11 If future pumping occurs in less well-connected
12 areas along the periphery of the main carbonate aquifer,
13 pumping effects, drawdown, and stream capture will be delayed
14 in the Muddy River Spring area as will recovery.

15 We need to continue to monitor flows and water
16 levels during under the current pumping regime for at least a
17 year or more. Warm Springs West flows are just over 3.2 CFS.
18 There is no room for additional stresses in the system at
19 this time.

20 Lastly, it is in the state's interest, contrary
21 to the opinion of an expert for US Fish and Wildlife Service,
22 it is absolutely in the state's interest and all of the water
23 users to protect the Moapa dace. I think it's very important
24 to honor that 3.2 CFS trigger at Warm Springs West. And it

1 level decline is imperceptible, we'll call it, over the last
2 two years.

3 Flow at Warm Springs West and the Muddy River
4 appear at the time being to be stabilized under this current
5 pumping regime. There have been changes. But for the most
6 part it's been fairly steady at about 8,000 acre-feet of
7 carbonate pumping.

8 We agree that more time is needed to make sure.
9 Pumping from the carbonate anywhere in the Lower White River
10 Flow System will capture Muddy River flows. With that, we
11 also agree.

12 Subsurface outflow is likely, given the vast
13 extent of the southern and eastern perimeter of the flow
14 system.

15 No evidence has been put forward that rocks
16 bounding the Lower White River Flow System are impermeable.
17 The subsurface flows exist. It is possible to capture a
18 portion of this outflow resulting in less than a
19 drop-for-drop capture of the Muddy River.

20 And I think our data is actually showing us that.
21 We have many lines of evidence. And I think they're showing
22 us that maybe that drop-for-drop capture of the Muddy River
23 is not occurring.

24 Observed water levels in the Muddy River Spring

1 is very much like the Devil's Hole issue. Water levels in
2 Devil's Hole dropped. The habitat of the Devil's Hole pup
3 fish was imperiled. And a federal district court judge
4 decided how much water needs to be in Devil's Hole. We could
5 very easily have the same situation in the Muddy River
6 Springs area if flows in the Muddy River Springs dropped and
7 imperiled the Moapa dace. And then we would have a federal
8 district judge managing water in Nevada and not the state.
9 And I think it's for the benefit of all of the users that the
10 state continue to manage these water resources and not a
11 federal court judge. And that's all I have. Thank you.

12 MS. CAVIGLIA: We would request that Nevada
13 Energy Exhibit 1 be admitted in to evidence.

14 HEARING OFFICER FAIRBANK: Exhibit 1 is so
15 admitted.

16 MS. CAVIGLIA: And we would also echo SNWA's
17 request for additional briefing. As Mr. Felling indicated,
18 one of our opinions has changed through the course of this
19 hearing.

20 HEARING OFFICER FAIRBANK: Excellent. Thank you.

21 All right. We'll go ahead and commence
22 cross-examination, starting with Coyote Spring Investments.
23 You have seven minutes.

24 ///

1 CROSS-EXAMINATION
 2 By Mr. Herrema:
 3 Q. Thank you. Brad Herrema with CSI for the record.
 4 Good morning, Mr. Felling.
 5 A. Good morning.
 6 Q. A few questions. Hopefully I'll be brief.
 7 Figure one of your rebuttal report.
 8 A. I don't have that report.
 9 Q. I think you do if you just scroll down. It's
 10 slide 12.
 11 A. Okay.
 12 Q. This shows carbonate pumping in the Lower White
 13 River Flow System. Does this include carbonate pumping in
 14 Garnet Valley that occurred in the 1990s?
 15 A. It may not. We heard evidence earlier that there
 16 might be some pumping in Garnet Valley. I took this pumping
 17 data from SNWA's exhibit.
 18 Q. Okay. Based on your statements that climate
 19 doesn't play a large role in groundwater level decline, do
 20 you have an opinion as to the drop in groundwater levels at
 21 EH-4 prior to pumping in Coyote Spring Valley?
 22 A. I'm sorry. But I don't see a drop. Oh,
 23 beginning -- And I'll point to -- This is slide 12. At this
 24 point in -- I'm sorry. But I can't read the date, but

1 pumping in other portions of the Lower White River Flow
 2 System with respect to the Muddy River Springs area be
 3 considered when assessing impacts to groundwater levels in
 4 the Muddy River Springs area?
 5 A. I'll say that -- I'll say that ultimately they
 6 should, but that evidence is not in existence at this time.
 7 Q. Could we go to your hypothetical hydrograph.
 8 This is figure three in the rebuttal report. Based on the
 9 dotted line shown in this figure and the groundwater level
 10 declines that occurred prior to 2005 -- And 2005 is an
 11 important demarcation here because that's when pumping in
 12 Coyote Spring Valley began. It appears that steady state is
 13 being reached due only to carbonate pumping in the Muddy
 14 River Springs area. Would you agree?
 15 A. No.
 16 Q. And why is that?
 17 A. I think that -- Well, the way you stated the
 18 question, it was due to pumping only in the Muddy River
 19 Springs area. If that question is as you posed it, I think
 20 it's due to -- I disagree. I think it's the effect in the
 21 Muddy River Springs area due to pumping everywhere.
 22 Q. Whatever carbonate pumping there was in the Lower
 23 White River Flow System at the time?
 24 A. Yes.

1 it's 1996. This drop that starts in 1996?
 2 Q. Yes.
 3 A. I believe that's from all regional carbonate
 4 pumping.
 5 Q. Whatever pumping was happening at that time
 6 including pumping in Muddy River Springs area?
 7 A. Absolutely.
 8 Q. If the EH-4 declines prior to 2005 were due to
 9 that existing carbonate pumping, do you have an opinion as to
 10 whether steady state conditions existed prior to 2005?
 11 A. Yes, I do have an opinion.
 12 Q. And what is that?
 13 A. I don't believe steady state conditions had been
 14 reached prior to 2005.
 15 Q. Based on the impact of pumping Arrow Canyon wells
 16 on groundwater levels in spring flow, did you determine the
 17 relative impact of groundwater level decline due to pumping
 18 in Muddy River Springs area versus pumping in Coyote Spring
 19 Valley?
 20 A. No.
 21 Q. In Muddy River Springs area versus pumping in
 22 Garnet Valley?
 23 A. No.
 24 Q. In your opinion should location and magnitude of

1 Q. Okay. And so then would you answer then that if
 2 you look at all of the Lower White River Flow System
 3 carbonate pumping that steady state was being reached at that
 4 time?
 5 A. Only in the Muddy River Springs area.
 6 Q. And how does this conclusion or this what we've
 7 just discussed here, how does this relate to your opinion
 8 that all carbonate pumping, or your disagreement, I guess,
 9 with the water authority's conclusion that all carbonate
 10 pumping in the system will have a one-to-one impact on
 11 springs in the Muddy River Springs area?
 12 A. To the extent of the one-to-one impact, I
 13 disagree that the evidence does not support that at this
 14 time.
 15 Q. Okay. And I'd like to shift gears a little bit
 16 to the quantity of water that is leaving the system as
 17 subflow.
 18 A. Okay.
 19 Q. Your statement in your report is that it's
 20 possible that 10,000 acre-feet per year could exit the system
 21 to the Las Vegas Valley or to lower portions of the Black
 22 Mountains area or Lake Mead. Do you recall that?
 23 A. I do.
 24 Q. Does that statement also support your opinion

1 that not all pumping has a one-to-one impact -- not all
2 carbonate pumping within the Lower White River Flow System
3 has a one-to-one impact on the springs in the Muddy River
4 Springs area?
5 A. Yes. That was part of the basis for that
6 conclusion.
7 MR. HERREMA: Thank you. No further questions.
8 HEARING OFFICER FAIRBANK: United States Fish and
9 Wildlife Service? Seeing no questions.
10 National Park Service? Seeing no questions.
11 Moapa Band of Paiute Indians? No questions.
12 Southern Nevada Water Authority and Las Vegas
13 Valley Water District?
14 CROSS-EXAMINATION
15 By Mr. Taggart:
16 Q. Good morning, Mr. Felling.
17 A. Good morning.
18 Q. I understand your opinion regarding the system
19 and whether it's in equilibrium or not. Is the increasing
20 flows or decreasing flow deficit in the Muddy River in recent
21 years one of the factors that you used in making that
22 determination?
23 A. It was one of the pieces of evidence, yes.
24 Q. Okay. And if you could turn to slide 16, please.

1 Q. Okay. I want to ask you about a statement that
2 you made regarding the standard that was used when -- This
3 was about moving alluvial rights to carbonates, okay.
4 A. Uh-huh.
5 Q. So the standard that was used when you move a
6 water right is to look at the impacts from pumping at the
7 existing point of diversion versus impacts at the proposed
8 point of diversion. And I think you said that moving some
9 alluvial rights to carbonate pumping may have less of an
10 impact on existing rights than the existing pumping. Is that
11 a fair statement?
12 A. Yes.
13 Q. Okay. And isn't it true though that the standard
14 for a -- standard in Nevada is whether there is an impact to
15 existing rights at all, not whether there's less of an
16 impact?
17 A. I don't believe so.
18 Q. Okay. When you were talking about the 9900
19 acre-feet of underflow or subflow or whatever we call it --
20 I'm looking for a slide here -- you're aware, are you not,
21 that the analysis that SNWA did at the time and the one that
22 you're relying upon, and it's shown on page 26, slide 26,
23 that was a water budget approach for the entire White River
24 Flow System in order to determine the recharge and discharge

1 Would you agree with me that the declining MR flow deficit in
2 2017 to today is depicted on that chart where the red section
3 gets smaller towards the right end of the graph; correct?
4 A. Correct.
5 Q. And you're aware that the -- your client, the
6 power company, has decommissioned a power plant and there's
7 significantly less pumping in the alluvial system during that
8 time period; right?
9 A. Yes, I am.
10 Q. So would you agree with me that part of the
11 reason for the increased flows in the river or the decreased
12 flow deficit is the reduction in the pumping in the alluvial
13 aquifer by the power company?
14 A. I really wouldn't -- I think that you've taken
15 that diversion in to consideration. And that is that blue
16 area. So I don't -- I don't agree with that as a factor in
17 those estimates of discharge of the Muddy River at Moapa.
18 Q. Okay. Do you agree that the reduction of
19 groundwater pumping for the power plant has resulted in
20 increased Muddy River flows?
21 A. Yes, I do.
22 Q. And would you agree with me that -- Were you
23 present during Mr. Robison's testimony yesterday for MVIC?
24 A. No.

1 amounts in 15 plus groundwater basins; correct?
2 A. Yes.
3 Q. And so it was not an analysis that was done to
4 determine the impact of the 1169 pump test; correct?
5 A. It was not.
6 Q. Okay. And at that time there were two separate
7 Darcy flow calculations that were proposed by SNWA, one that
8 was accepted by the State Engineer and one that was rejected;
9 correct?
10 A. Yes, that's correct.
11 Q. And the 9900 acre-foot cross-section that you
12 described in Darcy flow calculation, that was based upon an
13 alluvial transmissivity calculation; correct?
14 A. Uh-huh, yes.
15 Q. And the cross-section that was postulated by SNWA
16 to be a carbonate subflow with carbonate transmissivity of
17 8600 acre-feet, that was denied by the State Engineer;
18 correct?
19 A. Yes. That was flow from the Coyote Spring Valley
20 to Hidden Valley. And the evidence showed that there was a
21 water level at the south end of Coyote Spring Valley that was
22 higher and it looked like there was a groundwater divide. So
23 it wasn't accepted.
24 Q. All right. Do you -- New topic now. What is

1 your view on whether the State Engineer needs a groundwater
2 model constructed now in order to make the determinations
3 that are required or that are asked under Order 1303? Can
4 the 1303 increase be answered without a groundwater model and
5 just based upon the stress data from the Order 1169 pumping
6 test and the recovery data from that pumping test?
7 A. So there is a groundwater flow model that was
8 constructed by federal agencies. And, try as they might,
9 they really weren't able to replicate the system very well.
10 They underestimated a lot of the effects. And it wasn't
11 because they didn't try. I just think it's a very difficult
12 system to model. I think at this stage our observations are
13 enough to make future decisions. And so, no, I don't agree
14 that a model is necessary.
15 Q. Okay. Could you turn to slide number 32, please.
16 And just quickly, you made a comment during your testimony
17 that the -- And I don't remember exactly what it was. But I
18 wanted -- it had to do with the difference between these two
19 charts and the values depicted on the charts. Do you
20 recognize that in the lower pane, which is Figure 6-3,
21 there's a symbology there that indicates MRSA discharge
22 capture. And so this is showing discharge, which is more
23 than just stream flow. And then do you notice that up in the
24 top panel that that is just showing stream flow? Does that

1 estimates like this, I think the actual data are somewhat
2 ambiguous and then you need a longer period of record.
3 MR. TAGGART: Thank you.
4 HEARING OFFICER FAIRBANK: Moapa Valley Water
5 District? Seeing no questions.
6 Lincoln County, Vidler?
7 CROSS-EXAMINATION
8 By Ms. Peterson:
9 Q. Thank you. Mr. Felling, Karen Peterson
10 representing Lincoln County Water District and Vidler Water
11 Company. Did you calculate drawdown to the Muddy River
12 Spring area from pumping Kane Spring Valley wells?
13 A. No, I did not.
14 MS. PETERSON: Thank you. That's all the
15 questions I have.
16 HEARING OFFICER FAIRBANK: Center for Biological
17 Diversity?
18 MR. DONNELLY: Thank you.
19 CROSS-EXAMINATION
20 By Mr. Donnelly:
21 Q. Patrick Donnelly, Center for Biological
22 Diversity. Mr. Felling, is there a commonly-accepted
23 definition of steady state?
24 A. I have never really thought about it in those

1 make sense?
2 A. I see that.
3 Q. One last question at least for now is on the
4 slide before that. Do I get to ask it?
5 HEARING OFFICER FAIRBANK: Ask your question.
6 MR. TAGGART: Okay.
7 You testified about slide number 15 and I want to
8 ask you, you indicated that a trend line should be based upon
9 a -- using the same value from each month if you want to
10 develop a trend line. And so I have two questions, I guess.
11 Well, I can't have two questions. Did you do that and did --
12 and would it be appropriate in your view if the high point in
13 the hydrograph in a given year were used as the recovery
14 point, if you will, in that year and then the trend line
15 based upon that high point in the data set in a given year?
16 THE WITNESS: So, I'll answer the first question
17 first, did I do it. I drew the line in general through the
18 middle of the data. Perhaps I should have angled it up more
19 I think to match that data.
20 And your second question, could you draw a line
21 across the high point is no more valid than drawing a line
22 across the low point, in which case you would have opposing
23 trend lines. So you can draw the line anywhere you want.
24 When you have a short period of record and a high period of

1 terms of whether there's a commonly-accepted definition or
2 not.
3 Q. Is there any definition that you use to define
4 steady state?
5 A. Well, I would use the definition of that things
6 are steady, that they are neither increasing nor decreasing.
7 Q. What things would be neither increasing or
8 decreasing?
9 A. Whatever is -- Whatever you're trying to assign
10 that term to.
11 Q. So, in this case in your usage of it, in your
12 presentation, what did you mean?
13 A. That in this particular case of the Warm Springs
14 West area that we were no longer seeing the change in water
15 levels, we were no longer seeing a change in Warm Springs
16 West discharge, and we were no longer seeing a appreciable
17 change in flows of the Muddy River over the last two or three
18 years.
19 Q. How long of a steady measurement would be
20 necessary to qualify as steady state?
21 A. I don't know.
22 Q. But it is less than three years worth of data?
23 Let me rephrase the question. You were using less than three
24 years worth of data to say this system is in a steady state?

Page 1805

1 A. I am saying that a system appears to be reaching
2 steady state over -- and over the last two or three years is
3 roughly at steady state. But that is not to say that it will
4 continue that way in the future. And that's why I say I
5 think we actually need to observe the system for a bit
6 longer.
7 Q. So, I mean, I guess I'm a little confused. If
8 it's in a steady state that implies that the decision is
9 made, it's steady and will not be changing based on current
10 conditions. But you're saying we need to get more data to
11 ascertain that?
12 A. I'm saying that if we want to be certain that
13 steady state conditions are in fact occurring now and forever
14 in to the future under the current pumping regime, two or
15 three years of observations aren't enough.
16 MR. DONNELLY: Thank you. No further questions.
17 HEARING OFFICER FAIRBANK: And I neglected to ask
18 City of North Las Vegas.
19 MS. URE: No questions.
20 HEARING OFFICER FAIRBANK: No questions.
21 Georgia Pacific Republic?
22 CROSS-EXAMINATION
23 By Ms. Harrison:
24 Q. Sylvia Harrison for Republic Environmental

Page 1806

1 Technologies and Georgia Pacific. Good morning, Mr. Felling.
2 I think it's still morning.
3 A. Good morning.
4 Q. Just one quick question. Referring to your
5 summary of conclusions and recommendations, I think slide 35
6 and 36. 35, you note that subsurface outflow is likely. So
7 my question is hypothetically if pumping captured only at
8 that subsurface outflow how would that square with your final
9 conclusion in the previous slide that pumping from the
10 carbonate aquifer anywhere in the Lower White River Flow
11 System would capture Muddy River flows?
12 A. So I'll answer that question strictly as it was
13 posed. If pumping could just capture subsurface outflow,
14 then that's what it would capture and it wouldn't capture
15 anything else.
16 MS. HARRISON: Okay. Thank you.
17 HEARING OFFICER FAIRBANK: Nevada Cogeneration
18 Associates? Not seeing any questions.
19 Muddy Valley Irrigation Company?
20 CROSS-EXAMINATION
21 By Mr. King:
22 Q. Hello, Mr. Felling. Steve King for Muddy Valley
23 Irrigation Company.
24 A. Hello.

Page 1807

1 Q. Slide 11 of your presentation, the first bullet,
2 maximum recovery reached in 2016.
3 A. Yes.
4 Q. So I have a question. I think it's a
5 clarification in answer to a question to your presentation on
6 this slide. And I believe what I heard was along the lines
7 that after the 1169 pump test the maximum recovery was
8 reached in 2016 to the extent it could recover or to the
9 extent it could something else. And I wasn't clear as to
10 that, the latter part of that sentence. And could you please
11 tell us what you meant by that statement, please?
12 A. Yes. And I'll use slide 12 to explain. We see a
13 long-term trend of decline beginning in 1996 or 1995
14 continuing through today. And that is due to, I believe,
15 regional carbonate pumping. We have the Order 1169 aquifer
16 test. And the Order 1169 aquifer test couldn't recover the
17 pre-pumping levels because there's a regional decline. So
18 you have to superimpose your recovery on the regional trend.
19 So we can't -- You basically -- We don't go above that line.
20 And that helps us define that regional trend. So full
21 recovery didn't occur and couldn't occur because we have this
22 regional decline.
23 MR. KING: Thank you.
24 HEARING OFFICER FAIRBANK: Bedroc?

Page 1808

1 MS. URE: No questions.
2 HEARING OFFICER FAIRBANK: Seeing no questions,
3 then we'll go ahead and open it up to Division of Water
4 Resources staff and the State Engineer.
5 EXAMINATION
6 By Mr. Sullivan:
7 Q. Regarding some of the uncertainties about bypass
8 flow and the potential for capturing that versus the effect
9 on the Muddy River Springs area, how important do you think
10 it is to know exactly the amount and the location of this
11 subsurface that started out in the Lower White River Flow
12 System for the State Engineer to effectively manage the LWRFS
13 over time?
14 A. Well, I don't think it's important, and that is
15 in part fortuitous, because I don't think one will ever know
16 the amount or the location. It's just simply -- The studies
17 that would be required would be prohibitive. I don't think
18 we'll ever know.
19 We may know that some occurs if with more time we
20 see that capture is not at one to one. It's just something
21 that we could observe. And in that case we could just simply
22 say it looks like we're capturing something else. The
23 evidence I think currently supports that. But I wouldn't
24 go -- go too far afield with it. I just think that would

1 be -- we need to be certain, and particularly in this flow
2 system where we're already right at the limit of what we
3 think, you know, we can pump just based on the Warm Springs
4 West.

1 determinations. But we've also seen hydrographs that other
2 scales saw. So I'm actually using that knowledge to make
3 this description. So we have Coyote Spring Valley. I think
4 we see a continued decline in water levels.

5 MR. SULLIVAN: Okay.

5 The next panel down is EH-4. We've had that
6 discussion. Hard to see a decline over the last few years.

6 EXAMINATION

7 The next one is TH-2. TH-2 compares so closely
8 with EH-4 that it's scary. I don't know that I see a decline
9 in the last few years at TH-2. But I think we have looked at
10 other California Wash levels and we still see that decline.

7 By Ms. Barnes:

8 Q. Michelle Barnes for the record. On slide 18 you
9 show a figure with I believe the Division 4 Climate. And I
10 had a question for you. In your opinion and experience do
11 you think it's better to identify impacts of climate and
12 precip using the annual totals or, you know, intensity and
13 duration of specific storms, understanding we have data
14 limitations with that?

11 The next one down that's Garnet Valley. I don't
12 think there's any question that we see a continued decline
13 there.

15 A. We've had evidence presented in previous hearings
16 and in this hearing a little bit about that very issue. And
17 there's been, I think, good evidence presented that a winter
18 season precipitation may be a better indicator than annual
19 precipitation just in terms of the observed effect on water
20 levels.

14 And the last one at the very bottom, that's
15 BM-DL-2. I actually had it in my presentation, BM-DL-2 and
16 EH-4 hydrograph on the same figure. And one can really see
17 they separate after the Order 1169 aquifer test where BM-DL-2
18 is continuing to decline. Even if you don't see it that well
19 here, when you place this hydrograph, BM-DL-2, on top of
20 EH-4, you can really see that they separate after the test.
21 And it's still declining.

21 MS. BARNES: Thank you.

22 HEARING OFFICER FAIRBANK: Ms. Cooper.

22 Q. So follow up to the same question, GV-1 and
23 BM-DL-2 still declining, what is your opinion on the reason
24 for that?

23 ///

24 ///

1 EXAMINATION

1 A. I think that water levels are declining
2 everywhere because of groundwater pumping.

2 By Ms. Cooper:

3 Q. Hi. Christi Cooper for the record. Mr. Felling,
4 I have a couple of questions, please. On slide four of your
5 presentation, you overlaid what you agree with as evidence
6 for the Kane Springs range front fault. Is that true?

3 Q. Carbonate and alluvial pumping?

7 A. That's correct.

4 A. I don't think that alluvial pumping is having any
5 effect on the carbonate aquifer, at least not in the Muddy
6 River Springs area. I think that Coyote Spring Valley it
7 could be a little more complicated.

8 Q. Sorry. I didn't hear the response.

8 Q. Okay. My last question kind of going and tying
9 all of this in, so in your report you talk about this

9 A. Yes.

10 Q. Okay. Thank you. What is your opinion on the
11 so-called highway fault?

10 carbonate pumping rate of seven to 8,000, maybe you mentioned
11 differently in your presentation, but something similar to
12 that. Do you have an opinion on your -- the total alluvial
13 and carbonate pumping that should -- that should be nearly
14 steady state as you would say?

12 A. I'll just have to say that I didn't really
13 research it, so I really don't have an opinion.

14 Q. Okay. So going to slide 31, please. You say in
15 your presentation that water levels in general in the Lower
16 White River Flow System have continued to decline in most
17 areas. Could you just walk me through these five hydrographs
18 to tell me your opinion on each one and what you think?

15 A. Well, in terms of pumping from the alluvium in
16 the Muddy River Springs area, evidence is that that pumping
17 doesn't affect the Muddy River Springs but it does affect the
18 Muddy River. And the evidence is also very clear that it
19 captures river flow. And to the extent of, you know, how
20 much you can pump, I think you could pump as much as you're
21 prepared to mitigate. I think mitigation ultimately is
22 necessary.

19 A. Well, I can't read my slide, so I'll have to look
20 up here. And, as I recall, the upper -- the upper hydrograph
21 I believe is Coyote Spring Valley. And I just look at the
22 last four years since the recovery of the Order 1169 aquifer
23 test. And I think that there is a decline there. From this
24 figure, the scale is really not good for making these small

23 Q. Well, like, the 9,000 in the order from, total,
24 the Lower White River from 2017, do you believe that the

1 total number needs to be drastically lower than that?
 2 A. I'm sorry. I didn't really understand that
 3 question.
 4 Q. So in the Order 1303 there's the appendix table
 5 that shows in 2017 there was a little over 9,000 total
 6 acre-feet --
 7 A. Yes.
 8 Q. -- of pumpage in the Lower White River. So would
 9 your number total be drastically lower than that or is
 10 that -- is that number okay at this point?
 11 A. Well, there's two areas pumped. So, again, the
 12 pumping is from the alluvium. It shows -- conflicts in very
 13 short order with senior certificated rights. And to the
 14 extent that that conflicts with those rights, ultimately I
 15 think it may need to be mitigated.
 16 Carbonate pumping also will need to be mitigated
 17 to the extent of that conflict. Like I said, I don't think
 18 you can pump anything without basically capturing river flow.
 19 So, to the extent that there is that conflict, it would need
 20 to be mitigated.
 21 I think ultimately the amount of water that can
 22 be pumped isn't so much a function of conflict. It's a
 23 function of what effect will it have on habitat of the Moapa
 24 dace. So to that extent I don't know. I don't think we have

1 CROSS-EXAMINATION
 2 By Mr. Taggart:
 3 Q. I just want to pick up on what's on the screen,
 4 Figure 5-5. You were asked about Garnet. And that was
 5 compared to Muddy River Springs area. There is a
 6 significantly different pumping stress in those basins in
 7 recent years, specifically in Garnet. There's continuing to
 8 be pumping for power generation whereas in Muddy River
 9 Springs area there's been a considerable decrease in pumping;
 10 right?
 11 A. Well, as I recall, pumping in the Muddy River
 12 Springs area decreased last year. That's carbonate pumping.
 13 And I'm not -- I'm addressing alluvial pumping. But in
 14 Garnet Valley I think the number has been -- it's bounced
 15 around a little bit. But I think it's been fairly steady the
 16 last few years or several years. There was an increase maybe
 17 four years ago. But since then I think it's been relatively
 18 steady.
 19 Q. Okay. And in your report you make a statement
 20 that picks up on some of the things that were just being
 21 discussed. This is on page eight. And it has to do with
 22 depletions of the Muddy River. It says a depletion of the
 23 Muddy River with this amount of pumping, and it's reflecting
 24 the seven to 8,000 acre-feet of carbonate pumping that you

1 that number yet. We have an estimate from SNWA that's it's
 2 four to 6,000. We have my evidence that suggests it might be
 3 a bit more. And I think we need to observe the system longer
 4 and try to make the right call.
 5 MS. COOPER: Thank you. That's all.
 6 HEARING OFFICER FAIRBANK: Okay. We have a
 7 little bit of time for recross. Coyote Springs Investment,
 8 do you have any recross? Seeing no.
 9 US Fish and Wildlife Service? Seeing none.
 10 National Park Service? None.
 11 Moapa Band? None.
 12 Southern Nevada Water Authority, Las Vegas Valley
 13 Water District?
 14 MR. TAGGART: One.
 15 HEARING OFFICER FAIRBANK: That's it. You get
 16 one.
 17 MR. TAGGART: Did I just say that? How will I
 18 build this in to one question?
 19 HEARING OFFICER FAIRBANK: To be fair, I'll give
 20 you four minutes.
 21 MR. TAGGART: I don't think I'll need that much
 22 time.
 23 ///
 24 ///

1 just talked about. The depletion of the Muddy River with
 2 this amount of pumping appears to be on the order of 2300 to
 3 3750 acre-feet and is not increasing. And my question is,
 4 one, is that -- would you agree with me that that value is,
 5 even if at steady state, that would be a consistent impact or
 6 conflict with water rights on the Muddy River and that it has
 7 to be mitigated?
 8 A. I do agree.
 9 MR. TAGGART: All right. Thank you.
 10 HEARING OFFICER FAIRBANK: Moapa Valley Water
 11 District? Seeing no questions.
 12 Lincoln County, Vidler? No further questions.
 13 City of North Las Vegas?
 14 MS. URE: No questions.
 15 HEARING OFFICER FAIRBANK: Center for Biological
 16 Diversity? No questions.
 17 Georgia Pacific Republic? No further questions.
 18 Nevada Cogeneration Associates? Seeing no
 19 questions.
 20 Muddy Valley Irrigation Company? No questions.
 21 And Bedroc?
 22 MS. URE: No questions.
 23 HEARING OFFICER FAIRBANK: No questions, okay.
 24 And then I'll just open it back up to Division of Water

1 Resources and staff.

2 EXAMINATION

3 By Mr. Sullivan:

4 Q. You mentioned in your testimony about using EH-4
5 as a trigger and the possibility that it's, in a sense, too
6 late to use that as a trigger because it's too close to the
7 area to be protected. But looking at the hydrographs and the
8 close hydraulic connectivity throughout the region, there
9 is -- EH-4 is no closer in a sense than, say, TH-2 or some
10 other sites. So do you have any more thoughts on that
11 comment to elaborate on the effective triggers?

12 A. So I think that EH-4 or Warm Springs West flow
13 and the trigger at 3.2 would still work under the current
14 pumping regime whether -- I think all the wells that we
15 currently pump from they were in areas that had an immediate
16 effect or impact seen from the Order 1169 pumping test. And
17 I think the reverse is also true. That pumping affects the
18 Muddy River Springs area in a relatively and equal amount of
19 time.

20 That said, I think that pumping in less
21 well-connected areas, it might be appropriate to have
22 triggers that are wells that measure water levels that are
23 between Warm Springs West and where those pumping centers
24 might be so that you then do have an advanced warning instead

1 of the solver used by and replied upon by the Division of
2 Water Resources and the State Engineer in Ruling 6165 through
3 6167. This exhibit serves to replace Nevada State Engineer
4 Exhibit 222, which we've removed, as that was an earlier
5 version of the Excel solver but it was not the actual solver
6 utilized by the Division of Water Resources in making those
7 decisions relating to those particular rulings.

8 Additionally, the sign-in sheets from these
9 proceedings for the last ten days will be marked as Nevada
10 State Engineer Exhibits 336 through 346, which will include
11 today's sign-in sheet from Las Vegas.

12 And then also all the presentations, all the
13 power point presentations that were provided as demonstrative
14 exhibits, will be on line in the State Engineer's website at
15 water dot NV dot gov under the news tab. And then there
16 under the Lower White River Flow System tab. And then it
17 will be contained within the folder Order 1303 hearing
18 documents.

19 And, finally, there were requests that, by the
20 Southern Nevada Water Authority and Las Vegas Valley Water
21 District, that were joined by the Coyote Springs Investments
22 participants and the Nevada Energy seeking permission for the
23 State Engineer to entertain written closing statements and
24 proposed orders.

1 of waiting until the effects are seen at Warm Springs West,
2 at which time turning off the wells may not have an immediate
3 effect and those effects might be delayed for some period of
4 time.

5 So that you want to put your -- you want to put
6 your trigger level or your monitoring point somewhere between
7 that pumping in Warm Springs. Did that answer your question?

8 MR. SULLIVAN: Yes. Thank you.

9 HEARING OFFICER FAIRBANK: Okay. We'll go ahead
10 and open it up for redirect if there's any further. So no
11 further redirect.

12 All right. Well, then we will go ahead and
13 conclude the taking of presentation and information from the
14 participants in these proceedings. And so we'll go ahead and
15 address a few administrative matters.

16 First, we -- And one of those administrative
17 matter is, Mr. Felling, you were proffered as an expert,
18 without objection. And so on that basis you've been
19 qualified as an expert in these proceedings. And so that
20 qualification will be limited to these proceedings based upon
21 the fact that there was no objection.

22 So we also want to address that there is a new
23 exhibit, Nevada State Engineer Exhibit 335, which is an Excel
24 solver for the White River Flow System. That was the version

1 So the State Engineer will accept written closing
2 statements, not to exceed 20 pages, from the participants.
3 And the State Engineer will further accept written public
4 comment from members of the public whom have not participated
5 in these proceedings. And any closing statement or written
6 public comment must be received by the State Engineer by the
7 close of business or 5:00 p.m. on Monday, November 4th, 2019.
8 So that's essentially 30 days from today. The State Engineer
9 is got going to solicit or accept proposed draft orders.

10 MR. HERREMA: Thank you. One question on that.
11 Do we know when the transcripts will be final?

12 HEARING OFFICER FAIRBANK: I anticipate the
13 transcripts will be final -- I don't have a final question or
14 final answer to that question, but I estimate that they
15 should be available within the next couple of weeks. And it
16 sounds like it might be as soon as the end of next week.

17 MR. HERREMA: Thank you.

18 MR. TAGGART: Would the State Engineer be willing
19 to consider at all 60 days? We have an argument in Ely of
20 the groundwater project on the 15th of November that we're
21 going to be spending a lot of time getting ready for. And so
22 I would just like to make that request.

23 HEARING OFFICER FAIRBANK: That will be fine.
24 We'll be similarly-situated. We're not going to be writing

1 anything.
2 MR. DONNELLY: Did you say there's archive video
3 available that I can look up?

4 HEARING OFFICER FAIRBANK: Yes. So the video
5 archives from these proceedings are also available on that
6 same folder where the power point presentations will be
7 located. So that's the LWRFS tab under the news tab in the
8 Order 1303 hearing documents folder. And that document is
9 titled LWRFS recording links. And it's a PDF document. And
10 then imbedded in the PDF document are hyperlinks to the video
11 recordings.

12 And 60 days. So that will extend the time for
13 the submission of the written closing statements to December
14 3rd. So close of business on December 3rd. And we'll do
15 that for both written public comment as well as those written
16 closing statements.

17 And so, finally, before we conclude this
18 proceeding, we will go ahead and open it to public comment.
19 Ask we'll start by asking Ms. Christi Cooper in Las Vegas if
20 there is anyone present in Las Vegas for public comment.

21 MS. COOPER: There is no one present.

22 HEARING OFFICER FAIRBANK: Is there anyone
23 present in Carson City for public comment? Not seeing
24 anybody jumping up for such.

1 STATE OF NEVADA)
)ss.
2 COUNTY OF WASHOE)
3

4 I, CHRISTY Y. JOYCE, Official Certified Court
5 Reporter for the State of Nevada, Department of Conservation
6 and Natural Resources, Division of Water Resources, do hereby
7 certify:

8 That on Friday, the 4th day of October, 2019,
9 I was present at the Legislative Counsel Bureau, Carson City,
10 Nevada, for the purpose of reporting in verbatim stenotype
11 notes the within-entitled public hearing;

12 That the foregoing transcript, consisting of
13 pages 1713 through 1822, inclusive, includes a full, true and
14 correct transcription of my stenotype notes of said public
15 hearing.

16
17 Dated at Reno, Nevada, this 4th day of
18 October, 2019.
19
20
21

CHRISTY Y. JOYCE, CCR #625

1 Then we will go ahead and conclude these
2 proceedings. And we thank everyone for their cooperation and
3 participation and we appreciate the time. Thank you.

4 (Hearing concluded at 11:18 a.m.)
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

#	across (5) 1733:4,6;1743:12; 1802:21,22	1721:19;1812:17,17	1731:3,6,11,15,20; 1732:8,13,18;1733:6; 1735:13;1737:13,18; 1738:3;1739:10; 1740:1,6,7,12;1741:12; 1744:17;1746:3,16; 1747:2,13,18,23; 1749:4,7;1750:6,10; 1754:19;1755:1; 1756:10,15,18; 1759:19;1764:3; 1772:11,14,17,18,20; 1773:2,4,12;1774:3,4, 6;1798:7,12;1799:3,9; 1800:13;1812:3,4,12; 1815:13	1715:9.5 angle (1) 1767:8 angled (1) 1802:18 annual (8) 1754:7;1769:12,13, 13,16;1774:17; 1809:12,18 answered (2) 1772:13;1801:4 anticipate (1) 1820:12 appear (2) 1740:8;1790:4 appears (5) 1725:10;1750:12; 1795:12;1805:1; 1816:2 appendix (1) 1813:4 applicable (1) 1774:24 apply (1) 1747:23 appreciable (1) 1804:16 appreciate (1) 1822:3 approach (7) 1743:15;1747:17,22; 1775:3,4;1786:24; 1799:23 approaching (2) 1765:23;1766:3 appropriate (5) 1746:12;1780:18; 1789:1;1802:12; 1817:21 appropriately (1) 1768:3 April (3) 1769:17,17,18 aquifer (34) 1729:23;1740:13; 1746:4,5,9,13,16,17, 24;1747:2;1748:6; 1755:1;1759:18,19; 1762:3,4;1765:11,17; 1766:12;1767:9; 1768:8,18,22;1770:16; 1788:21;1789:22; 1791:12;1798:13; 1806:10;1807:15,16; 1810:22;1811:17; 1812:5 aquifers (1) 1720:3 archive (1) 1821:2 archives (1) 1821:5 AREA (90)
#625 (2) 1713:22.5;1823:21.5	Acting (1) 1714:5 actual (3) 1785:12;1803:1; 1819:5 actually (14) 1729:2;1730:24; 1732:23;1737:4; 1738:3;1739:14; 1743:6;1750:23; 1754:12;1785:6; 1790:20;1805:5; 1811:2,15	affecting (1) 1775:14 affects (4) 1741:13;1743:13; 1773:10;1817:17 afield (1) 1808:24 again (20) 1724:18;1726:18; 1729:10,13;1730:12; 1731:16;1732:12; 1736:21;1737:8; 1739:9,20;1753:22; 1765:5;1769:24; 1770:22;1772:1; 1777:23;1783:6; 1788:6;1813:11 agencies (1) 1801:8 agenda (1) 1719:21 ago (1) 1815:17 agree (19) 1760:13,18;1765:15; 1772:18;1775:15; 1785:13;1788:3; 1790:8,11;1795:14; 1798:1,10,16,18,22; 1801:13;1810:5; 1816:4,8 agreed (3) 1760:17,18;1780:19 agreement (1) 1789:8 ahead (17) 1717:6,10,12; 1741:22;1742:4; 1744:19;1748:16; 1756:1;1757:20; 1758:4;1792:21; 1808:3;1818:9,12,14; 1821:18;1822:1	alluvium (21) 1721:10;1728:23; 1729:20;1730:14; 1735:16;1736:15; 1741:12;1748:21; 1752:15,18,20,23; 1754:2;1756:21; 1757:13,17;1760:22; 1764:11;1772:21; 1812:15;1813:12 almost (4) 1729:2;1743:4; 1769:13;1772:19 along (3) 1723:17;1791:12; 1807:6 Alternatively (1) 1761:24 although (4) 1753:3;1763:1; 1768:6;1770:6 altogether (1) 1727:4 always (3) 1773:8;1774:22; 1785:16 ambiguous (1) 1803:2 amount (12) 1731:12;1754:8; 1755:12,19;1759:20; 1772:23;1808:10,16; 1813:21;1815:23; 1816:2;1817:18 amounts (1) 1800:1 analyses (1) 1786:23 analysis (6) 1752:23;1776:17; 1784:24;1786:14; 1799:21;1800:3 and- (1) 1715:4.5 Andrew (1) 1781:7 Angeles (1)	
/	Adam (1) 1714:6 add (2) 1778:12;1786:16 added (2) 1760:15;1770:9 adding (1) 1789:12 additional (6) 1721:19;1739:9; 1753:9;1788:20; 1791:18;1792:17 Additionally (1) 1819:8 address (4) 1717:13;1776:22; 1818:15,22 addressed (1) 1788:4 addressing (2) 1744:6;1815:13 adequate (1) 1750:10 adequately (1) 1770:2 adjudicated (1) 1722:2 ADMINISTRATION (2) 1713:6;1717:5 administrative (4) 1717:13;1721:6; 1818:15,16 admit (1) 1740:18 admitted (8) 1719:2;1740:21,22; 1742:1;1751:2,4; 1792:13,15 advance (2) 1729:24;1751:12 advanced (1) 1817:24 aerial (1) 1721:24 afar (1) 1776:16 affect (3)	AKA (1) 1713:11.5 Alex (1) 1715:15 Allison (1) 1715:13 allotted (1) 1744:2 allowed (1) 1750:2 allowing (1) 1752:14 alluded (1) 1722:16 alluvial (77) 1720:2,3,4,7,7,11; 1723:6,10,14,16; 1728:4,19;1729:5,14, 19,21;1730:2,3,5,10;		
/// (11) 1717:21,22,23,24; 1756:23,24;1792:24; 1809:23,24;1814:23,24				
A				
ability (2) 1721:19;1734:5 able (1) 1801:9 above (6) 1729:18;1762:21; 1782:3,4;1791:5; 1807:19 absolutely (5) 1741:17;1775:15; 1777:18;1791:22; 1794:7 abundance (1) 1789:17 accelerated (1) 1766:22 accept (3) 1820:1,3,9 acceptable (1) 1725:12 accepted (5) 1725:12;1762:18; 1781:10;1800:8,23 access (1) 1720:2 according (1) 1783:18 acknowledge (3) 1721:4;1724:10; 1725:3 acknowledged (1) 1725:3 acre-feet (31) 1738:20;1739:6,7; 1744:23;1754:17; 1755:9;1770:19,20,20; 1774:2,5,6;1779:5,22; 1780:2;1781:6,19; 1784:4;1785:8;1786:4, 18,19;1790:6;1791:4, 7;1796:20;1799:19; 1800:17;1813:6; 1815:24;1816:3 acre-foot (1) 1800:11 acres (6) 1720:16,24;1738:16, 24;1744:2;1754:18				

<p>1713:8.5,11;1720:3, 7,11;1723:1,20; 1724:17;1726:1; 1727:16;1728:12; 1731:12,23;1733:16; 1734:6,15;1738:15,22; 1739:8;1740:2,9; 1741:10;1746:17; 1748:24;1753:6; 1755:12,20;1756:17, 19;1760:2;1761:22; 1762:2,15;1763:2,3,21, 23;1764:8;1765:6,20, 21;1766:3,7;1774:1,8; 1775:22;1777:15; 1778:23;1779:5,10,20, 24;1780:22,23;1781:1; 1783:21;1784:2,2,11, 12,19;1787:23; 1789:19,24;1791:1,14; 1792:6;1794:6,18,21; 1795:2,4,14,19,21; 1796:5,11,22;1797:4; 1798:16;1803:12; 1804:14;1808:9; 1812:6,16;1815:5,9,12; 1817:7,18</p> <p>areas (15) 1720:2;1748:20; 1752:18;1765:18; 1772:22;1784:13,13, 20;1787:2;1789:2; 1791:12;1810:17; 1813:11;1817:15,21</p> <p>argue (2) 1762:5;1784:16</p> <p>argument (2) 1791:3;1820:19</p> <p>arguments (2) 1762:7;1787:13</p> <p>around (10) 1733:17,17;1734:5, 7;1743:2;1761:15; 1777:19;1779:3; 1782:23;1815:15</p> <p>arrived (2) 1738:19;1748:19</p> <p>arrow (3) 1743:7;1760:16; 1794:15</p> <p>ascertain (1) 1805:11</p> <p>assessing (1) 1795:3</p> <p>asset (1) 1721:12</p> <p>assign (4) 1751:16;1782:18; 1788:8;1804:9</p> <p>assigned (1) 1788:11</p> <p>assist (1) 1719:5</p>	<p>associated (4) 1721:1;1723:12; 1754:5;1782:16</p> <p>Associates (3) 1751:20;1806:18; 1816:18</p> <p>association (1) 1744:20</p> <p>assumed (1) 1724:22</p> <p>attention (3) 1726:23;1736:21; 1737:4</p> <p>August (1) 1722:5</p> <p>Authority (6) 1745:20,24;1753:12; 1797:12;1814:12; 1819:20</p> <p>authority's (1) 1796:9</p> <p>availability (1) 1747:18</p> <p>available (8) 1722:20;1727:15; 1730:19;1753:9; 1755:20;1820:15; 1821:3,5</p> <p>average (3) 1725:20;1754:7; 1770:19</p> <p>averaged (1) 1755:16</p> <p>aware (2) 1798:5;1799:20</p> <p>away (2) 1775:11;1777:18</p>	<p>bars (2) 1766:12;1772:2</p> <p>base (3) 1724:1;1729:10; 1762:10</p> <p>based (28) 1719:21;1722:19,19, 20;1724:22,24; 1725:10;1727:5; 1738:24;1744:10,20, 24;1747:17;1750:12; 1754:16;1757:4; 1780:16;1784:23; 1793:18;1794:15; 1795:8;1800:12; 1801:5;1802:8,15; 1805:9;1809:3; 1818:20</p> <p>basically (7) 1727:22;1738:13; 1742:17;1760:8; 1767:5;1807:19; 1813:18</p> <p>BASIN (25) 1713:8,9,9.5,10,10.5, 12;1714:15.5;1720:4, 7;1721:10;1725:13; 1739:9;1740:6; 1741:12;1747:18; 1748:22;1760:7,20; 1761:4;1762:12,14; 1763:24;1764:4; 1771:19;1774:23</p> <p>basins (7) 1722:24;1725:17; 1780:13;1786:23; 1789:12;1800:1; 1815:6</p> <p>basis (5) 1719:22;1740:3; 1744:11;1797:5; 1818:18</p> <p>becomes (1) 1734:12</p> <p>Bedroc (55) 1715:20;1717:9,17; 1718:3,9;1719:4,6,14; 1720:13;1721:1,4,4,7, 16;1722:21;1724:18; 1726:4,19;1727:2,16; 1728:18;1729:4,8,18; 1730:11,19;1731:1,10; 1732:8,21;1733:2,24; 1735:3;1736:20; 1738:10,13;1739:12, 13;1740:23,24;1741:5, 8,24;1742:14,20; 1743:4;1744:2,6,16; 1746:16,17,19; 1749:20;1807:24; 1816:21</p> <p>Bedroc's (10) 1721:9,12;1722:22;</p>	<p>1735:4;1739:24; 1740:18;1741:14,15; 1750:13;1751:1</p> <p>began (1) 1795:12</p> <p>begin (1) 1721:3</p> <p>beginning (4) 1722:17;1737:7; 1793:23;1807:13</p> <p>behalf (8) 1718:2;1719:5; 1746:14,19;1750:23; 1758:10,15;1776:4</p> <p>behave (1) 1783:18</p> <p>Belaustegui (1) 1715:6</p> <p>Benedict (1) 1714:12</p> <p>benefit (2) 1789:9;1792:9</p> <p>Berley (1) 1715:16.5</p> <p>better (3) 1772:1;1809:11,18</p> <p>beyond (7) 1748:9;1756:17,18; 1776:11,17;1782:16; 1787:8</p> <p>big (6) 1760:15;1762:14; 1763:10;1779:24; 1780:2;1791:3</p> <p>Biologic (1) 1715:23</p> <p>Biological (4) 1750:20;1803:16,21; 1816:15</p> <p>bit (14) 1766:1;1767:2; 1768:7;1775:9;1776:1; 1777:23;1781:8; 1784:19;1796:15; 1805:5;1809:16; 1814:3,7;1815:15</p> <p>BLACK (13) 1713:8;1760:2; 1763:23;1764:8; 1765:20;1774:8; 1778:22;1779:4,10,23, 24;1784:18;1796:21</p> <p>blindly (1) 1726:10</p> <p>Bliss (1) 1714:15</p> <p>block (1) 1728:22</p> <p>blown (1) 1723:22</p> <p>Blue (12) 1723:8,21;1729:14; 1732:1;1737:23;</p>	<p>1752:13;1760:15; 1763:2;1764:2; 1766:10;1779:11; 1798:15</p> <p>BM-DL-2 (9) 1764:12,13,16; 1784:18;1811:15,15, 17,19,23</p> <p>both (8) 1731:14;1747:3; 1752:23,24;1753:6; 1760:23;1762:7; 1821:15</p> <p>bottom (10) 1735:4;1737:23; 1743:22;1776:6; 1778:1;1780:1; 1784:22;1786:5; 1787:20;1811:14</p> <p>bounced (1) 1815:14</p> <p>boundaries (3) 1724:18;1762:12; 1764:5</p> <p>boundary (12) 1759:16,22;1760:23; 1761:4;1762:5; 1778:24;1779:2,2,13, 18;1781:21,22</p> <p>bounded (1) 1762:14</p> <p>bounding (3) 1755:13;1760:7; 1790:16</p> <p>Brad (4) 1746:14;1776:4; 1787:7;1793:3</p> <p>Bradley (1) 1715:9</p> <p>break (2) 1758:4,7</p> <p>Bridget (1) 1714:15</p> <p>brief (2) 1718:9;1793:6</p> <p>briefing (1) 1792:17</p> <p>briefly (2) 1722:12;1773:23</p> <p>bring (2) 1742:11;1763:22</p> <p>brought (3) 1780:24;1781:3; 1786:1</p> <p>Brownstein (1) 1715:8.5</p> <p>budget (9) 1738:19;1739:8; 1746:13;1747:1,17,22; 1762:17;1780:15; 1799:23</p> <p>budgets (4) 1746:8,18,23;1775:8</p>
---	--	---	--	---

build (1) 1814:18	1761:20,21;1767:1,12; 1769:6,24;1770:1,15; 1772:2;1775:13,14; 1776:6;1777:7;1780:4;	1806:10;1807:15; 1812:3,5,10,13; 1813:16;1815:12,24	1805:9	1736:20
building (1) 1729:7	1784:16;1785:3,8; 1801:3;1802:23; 1809:3;1811:16,20; 1812:20;1813:18,21; 1821:3	carbonates (2) 1765:3;1799:3	chart (1) 1798:2	closing (7) 1720:9,10;1819:23; 1820:1,5;1821:13,16
bullet (2) 1776:16;1807:1	Canyon (1) 1794:15	Carson (6) 1713:23.5;1715:4, 14;1717:1;1821:23; 1823:9	charts (2) 1801:19,19	co-counsel (2) 1742:9;1757:23
bullets (2) 1765:14;1776:5	CAPITOL (1) 1713:21	case (10) 1733:22;1740:14; 1748:12;1755:15; 1777:3,13;1802:22; 1804:11,13;1808:21	Chief (2) 1714:8,11	coefficient (1) 1780:17
Bureau (1) 1823:9	capture (48) 1722:22;1739:6,10; 1762:6,22;1769:3; 1774:20;1775:10,14, 14,19;1777:5,12,12,18, 24;1778:3,8,10,10,12, 13,15;1783:7,9,15,22; 1784:1,5,7,23;1785:1, 4,7,10;1786:20; 1790:10,17,19,22; 1791:2,13;1801:22; 1806:11,13,14,14; 1808:20	case-by-case (1) 1740:2	Christi (5) 1714:13.5;1756:3,6; 1810:3;1821:19	coefficients (2) 1724:12,24
Burns (1) 1781:7	captured (8) 1739:5,15;1772:22; 1777:9;1783:5,14; 1784:8;1806:7	cases (1) 1725:16	CHRISTY (3) 1713:22;1823:4,21.5	Cogen (2) 1741:5;1763:21
business (5) 1721:13,13,20; 1820:7;1821:14	captures (5) 1740:13;1772:18; 1773:1;1778:12; 1812:19	causes (1) 1743:9	circled (1) 1727:20	Cogeneration (3) 1751:19;1806:17; 1816:18
businesses (1) 1721:13	capturing (6) 1727:1;1728:6; 1775:16;1808:8,22; 1813:18	Cave (2) 1762:18;1780:11	City (10) 1713:23.5;1715:4, 14,21;1717:1;1750:16; 1805:18;1816:13; 1821:23;1823:9	Cogen's (1) 1764:13
busy (1) 1741:16	carbonate (97) 1720:6,11;1723:8, 14,16;1726:5,11,12,13, 17;1728:7;1729:10,11, 15,16,23;1730:15; 1731:4;1732:1,4,13,19; 1733:6;1736:24; 1737:14,19;1740:6,13; 1741:9,9;1746:5,9,13, 17,24;1747:23,24; 1748:21,24;1752:16, 24;1753:1;1756:20; 1757:14;1759:19; 1760:20;1762:3; 1763:1,3,5,16;1764:2, 14,15,22;1765:1; 1766:12;1772:11,17; 1773:1,4,13;1774:13; 1775:10,19;1776:11; 1781:14,17;1782:1,3; 1788:21;1790:7,9; 1791:7,12;1793:12,13; 1794:3,9;1795:13,22; 1796:3,8,9;1797:2; 1799:9;1800:16,16;	CCR (3) 1713:22,22.5; 1823:21.5	civil (1) 1718:11	color (1) 1764:3
Butler (1) 1722:6		Caviglia (11) 1715:10.5;1716:13; 1752:1;1758:9,10,10, 20;1787:10,11; 1792:12,16	claim (6) 1722:1,1,2,12,14; 1745:1	coming (6) 1724:7;1726:24; 1727:4;1731:22,23; 1782:10
bypass (1) 1808:7		Center (10) 1715:23;1734:10; 1750:20;1760:24; 1764:5,13,19;1803:16, 21;1816:15	clarification (1) 1807:5	commence (1) 1792:21
bypassing (1) 1780:23		centers (1) 1817:23	clarify (1) 1752:15	comment (9) 1717:14;1801:16; 1817:11;1820:4,6; 1821:15,18,20,23
C		certain (7) 1720:2;1724:12; 1752:18;1763:11; 1766:6;1805:12; 1809:1	clarifying (2) 1752:21;1757:18	commercial (1) 1754:6
calculate (1) 1803:11		certainly (2) 1765:17;1772:19	Clark (3) 1720:14;1726:5,6	commonly-accepted (2) 1803:22;1804:1
calculated (1) 1725:11		certificated (1) 1813:13	clastic (1) 1727:22	Company (9) 1715:13;1749:14; 1751:21;1798:6,13; 1803:11;1806:19,23; 1816:20
calculating (1) 1725:1		Certified (2) 1713:21.5;1823:4	clear (9) 1719:19;1721:11,20; 1741:24;1747:7; 1759:14;1760:24; 1807:9;1812:18	compare (2) 1752:22;1773:9
calculation (5) 1724:11,15;1785:17; 1800:12,13		certify (1) 1823:7	clearly (2) 1739:11;1764:15	compared (2) 1770:19;1815:5
calculations (1) 1800:7		CFS (10) 1722:14;1776:8,10; 1786:18;1787:11; 1788:17;1789:1; 1791:5,17,24	client (5) 1749:5,8;1754:3; 1755:8;1798:5	compares (1) 1811:7
CALIFORNIA (10) 1713:10.5;1715:9.5; 1764:7;1765:19; 1774:7;1779:3; 1780:23;1786:3,4; 1811:10		change (4) 1768:1;1804:14,15, 17	clients (1) 1750:7	compelling (6) 1760:14;1762:1,7; 1766:8;1789:17,21
call (6) 1730:21;1766:18,18; 1790:1;1799:19; 1814:4		changed (1) 1792:18	client's (3) 1746:4;1754:8; 1755:21	compiled (1) 1759:23
Called (3) 1718:2;1743:9; 1758:15		changes (1) 1790:5	climate (12) 1771:2,3,4,4,5,6,10, 12;1772:6;1793:18; 1809:9,11	complete (2) 1759:4;1789:22
Can (53) 1718:8;1719:11; 1721:1;1722:2,7,24; 1723:4;1725:19; 1726:19;1730:3; 1731:23;1733:2; 1737:2,7,12;1738:10; 1739:15;1741:5; 1748:16;1752:7,21; 1756:3,5;1757:3,22; 1758:21;1759:9;		changing (1)	close (9) 1732:9;1737:2; 1742:13;1763:12; 1770:22;1817:6,8; 1820:7;1821:14	completely (1) 1737:12

<p>14 conceptual (3) 1726:24;1729:7; 1730:1 concern (1) 1784:2 conclude (4) 1740:16;1818:13; 1821:17;1822:1 concluded (2) 1717:11;1822:4 conclusion (8) 1773:20;1774:12; 1787:20;1791:8; 1796:6,9;1797:6; 1806:9 conclusions (3) 1739:20;1787:8; 1806:5 conditions (14) 1722:16,18;1723:3, 19;1724:4;1725:23; 1727:2;1729:6,9; 1735:3;1794:10,13; 1805:10,13 confer (1) 1757:22 confident (1) 1781:9 confining (2) 1727:23;1729:1 confirm (1) 1724:10 conflict (7) 1741:6,15;1762:23; 1813:17,19,22;1816:6 conflicting (1) 1763:17 conflicts (2) 1813:12,14 confluence (1) 1720:19 confused (1) 1805:7 Conjunctive (1) 1775:4 conjunctively (1) 1775:6 connect (2) 1731:20;1732:18 connected (4) 1731:13;1740:8; 1759:23;1764:21 connection (1) 1757:16 connectivity (1) 1817:8 cons (3) 1760:1;1761:20; 1789:12 CONSERVATION (2) 1713:2;1823:5 consider (6)</p>	<p>1720:17;1746:3; 1754:7;1763:17; 1770:18;1820:19 considerable (1) 1815:9 consideration (1) 1798:15 considerations (1) 1720:2 considered (5) 1740:2;1751:8,16; 1782:19;1795:3 considering (1) 1762:3 consist (1) 1727:23 consistent (2) 1723:5;1816:5 consisting (1) 1823:12 constant (1) 1736:3 constructed (3) 1736:11;1801:2,8 construction (1) 1737:5 consultant (1) 1737:5 consume (1) 1745:5 consumed (1) 1754:17 consumptive (1) 1745:7 contained (1) 1819:17 content (1) 1719:23 context (1) 1791:2 continuation (1) 1717:4 continue (9) 1758:9;1765:18,20; 1782:21;1788:15; 1789:23;1791:15; 1792:10;1805:4 Continued (10) 1715:1.5;1731:2; 1736:17;1737:8; 1767:7;1776:12; 1784:15;1810:16; 1811:4,12 continues (1) 1727:13 continuing (4) 1776:13;1807:14; 1811:18;1815:7 Continuous (1) 1737:9 contours (7) 1726:9,14;1729:11; 1730:3,10,17;1732:6</p>	<p>contrary (1) 1791:20 contribute (2) 1724:17;1763:6 contributed (2) 1735:23;1741:17 contributes (3) 1748:20;1762:21,22 contribution (2) 1771:19;1779:6 contributions (1) 1773:15 conveying (1) 1722:4 Cooper (14) 1714:13.5;1716:10, 22;1756:3,3,7,9,22; 1809:22;1810:2,3; 1814:5;1821:19,21 cooperation (1) 1822:2 copied (2) 1768:16,18 corner (3) 1742:17,22;1769:5 correction (1) 1741:23 correctly (1) 1752:9 correlation (2) 1785:2,14 counsel (4) 1750:23;1769:8; 1775:13;1823:9 County (12) 1715:12;1720:15,15; 1726:5,6;1742:22; 1743:1;1749:14; 1803:6,10;1816:12; 1823:2 County's (1) 1761:6 couple (5) 1767:10;1769:12; 1776:5;1810:4; 1820:15 course (4) 1731:12;1736:12; 1742:23;1792:18 court (3) 1792:3,11;1823:4 cover (1) 1748:10 coverage (2) 1723:9,10 covered (1) 1764:10 COYOTE (37) 1713:7.5;1719:17; 1720:4,8,16,22;1721:9; 1722:18,24;1724:17; 1726:2;1727:9; 1731:19;1733:24;</p>	<p>1738:9;1740:7; 1741:13;1742:4; 1743:23;1757:17; 1761:10;1765:19; 1771:9,11;1774:1; 1784:14;1792:22; 1793:21;1794:18; 1795:12;1800:19,21; 1810:21;1811:3; 1812:6;1814:7; 1819:21 create (2) 1730:18;1759:7 criteria (2) 1773:7,11 critical (1) 1721:12 cross (4) 1732:9,20,22;1786:1 crossed (1) 1725:6 Cross-Examination (25) 1716:5,6,7,9,14,15, 16,17,18,19,23;1717:8; 1742:4,6;1745:21; 1749:15;1753:20; 1792:22;1793:1; 1797:14;1803:7,19; 1805:22;1806:20; 1815:1 cross-section (2) 1800:11,15 cross-sections (1) 1728:12 cross-structure (1) 1761:13 CS (1) 1730:23 CSAMT (1) 1760:9 CSI (15) 1715:6,8.5;1724:9; 1725:3;1738:21; 1742:9,14,17,21,24; 1743:4;1746:14; 1776:4;1787:7;1793:3 CSI's (1) 1724:20 CSV (1) 1739:10 CSV-2 (1) 1763:8 CSV-3000M (1) 1736:22 CSV-3009M (1) 1757:8 CSVM (1) 1752:19 CSVM-3 (2) 1752:22;1753:1 CSVM-4 (10) 1736:24;1737:12,19, 21,22;1752:10,13,13,</p>	<p>22;1757:8 CSVM-5 (4) 1728:1;1735:13; 1756:13,20 CSVM-7 (8) 1723:15;1730:22; 1731:17;1738:3; 1752:11,13;1757:8,8 curiosity (1) 1767:22 curious (1) 1752:23 current (17) 1721:24;1722:7; 1726:13;1738:22; 1739:9;1742:21; 1773:9;1775:21; 1776:11;1787:21; 1788:22;1790:4; 1791:6,16;1805:9,14; 1817:13 Currently (4) 1783:7;1788:15; 1808:23;1817:15 CV-VF-1 (1) 1731:3</p>
D				
<p>dace (4) 1773:16;1791:23; 1792:7;1813:24 Darcy (2) 1800:7,12 dashed (1) 1768:19 data (62) 1719:20;1722:20; 1725:6;1726:3,13; 1727:14;1730:18,23; 1731:13;1732:17; 1735:9;1736:5,6; 1737:4;1746:11,12,13; 1748:1;1754:23; 1764:17,24;1765:4; 1766:14,24;1767:1,7, 21;1768:1,4,10,20,24; 1769:1,8,11,15,23,24; 1770:2,21,24;1771:14; 1777:21;1779:15; 1781:2,17;1783:4; 1788:17;1790:20; 1791:1,8;1793:17; 1801:5,6;1802:15,18, 19;1803:1;1804:22,24; 1805:10;1809:13 date (1) 1793:24 Dated (1) 1823:17 day (4) 1717:9;1744:5; 1823:8,17</p>				

daylights (3) 1729:2,2,5	Delamar (6) 1724:6;1733:7,13; 1762:18;1771:7; 1780:11	1737:6,6;1742:14, 18,21	discussing (5) 1722:18;1723:2,18; 1726:2;1746:23	dot (2) 1819:15,15
days (4) 1819:9;1820:8,19; 1821:12	delayed (3) 1753:3;1791:13; 1818:3	deviation (1) 1768:7	discussion (5) 1728:1;1762:24; 1767:12;1769:4; 1811:6	dots (7) 1723:5,6,8;1729:14, 14;1731:20;1732:18
death (1) 1748:11	deleted (1) 1733:12	Devil's (4) 1792:1,2,2,4	discussions (1) 1746:7	dotted (2) 1723:21;1795:9
December (2) 1821:13,14	delineated (2) 1723:21;1733:17	difference (5) 1720:5;1729:21; 1732:13;1782:1; 1801:18	distance (4) 1730:4;1733:17,20; 1735:16	down (23) 1721:1;1724:7; 1728:5,7,8,23,24; 1731:2;1732:11; 1739:17;1742:23; 1760:24;1761:4; 1764:23;1768:17,19; 1779:7;1783:13,13; 1784:16;1793:9; 1811:5,11
decent (1) 1723:9	delineation (1) 1724:11	differences (1) 1741:4	distributed (1) 1780:16	Dr (5) 1766:18;1773:21; 1778:18;1779:16,18
decided (1) 1792:4	deliveries (1) 1772:11	different (3) 1737:13;1787:2; 1815:6	District (13) 1715:18;1745:19; 1746:1;1749:13; 1753:13;1792:3,8; 1797:13;1803:5,10; 1814:13;1816:11; 1819:21	draft (1) 1820:9
decision (2) 1765:4;1805:8	demarcation (1) 1795:11	differentially (1) 1812:11	District/ (1) 1715:12.5	drafted (5) 1760:5,7;1764:4,9; 1769:7
decisions (4) 1721:14,18;1801:13; 1819:7	demonstrate (2) 1757:9,10	difficult (4) 1723:7;1764:17; 1777:23;1801:11	diversion (6) 1722:14;1773:9,10; 1798:15;1799:7,8	dragged (2) 1768:16,19
decline (31) 1752:17;1765:18,20; 1766:19,23,24;1767:7; 1768:6;1769:9,10; 1772:4,4;1784:16,19; 1786:3;1787:22; 1789:23;1790:1; 1793:19;1794:17; 1807:13,17,22; 1810:16,23;1811:4,6,8, 10,12,18	demonstrated (2) 1739:11;1740:14	Direct (8) 1716:4,13;1718:6; 1744:10;1746:22; 1747:1,3;1758:19	diversions (3) 1770:10,11,18	drastically (2) 1813:1,9
declines (2) 1794:8;1795:10	demonstrative (4) 1751:4,9;1778:4; 1819:13	direction (3) 1732:6;1743:10; 1760:16	Diversity (5) 1715:23.5;1750:20; 1803:17,22;1816:16	draw (4) 1769:15,22;1802:20, 23
declining (8) 1739:17;1754:20,24; 1756:12;1798:1; 1811:21,23;1812:1	depicted (2) 1798:2;1801:19	directly (2) 1744:17;1748:4	divide (1) 1800:22	drawdown (3) 1768:21;1791:13; 1803:11
decommissioned (1) 1798:6	depicting (1) 1742:14	disagree (4) 1781:10;1791:8; 1795:20;1796:13	DIVISION (15) 1713:3;1752:4; 1756:1;1771:4,4,5,6, 10,13;1808:3;1809:9; 1816:24;1819:1,6; 1823:6	drawing (2) 1766:14;1802:21
decrease (8) 1786:8,16,18,18; 1787:23,24;1788:19; 1815:9	depicts (1) 1754:2	disagreement (2) 1785:15;1796:8	DIXON (25) 1716:3;1717:17; 1718:1,8,15,22;1719:4; 1722:10;1723:20; 1725:5;1728:11; 1733:8;1740:17; 1741:2;1742:8,13,19; 1745:23;1746:15; 1747:11;1748:16; 1749:17;1750:22; 1753:22;1757:5	drawn (1) 1782:8
decreased (2) 1798:11;1815:12	depletions (1) 1815:22	discharge (26) 1763:6;1765:22; 1766:4;1770:10; 1774:20;1775:11,14, 17;1778:17;1779:8; 1780:14,15,15; 1781:10,11;1783:14, 15;1784:24;1786:9,18; 1789:4;1798:17; 1799:24;1801:21,22; 1804:16	Dixon's (2) 1740:20;1751:5	drew (8) 1730:20;1766:24; 1767:7,15;1768:9,19; 1781:22;1802:17
decreasing (4) 1783:16;1797:20; 1804:6,8	Deputy (1) 1714:6.5	discharges (3) 1777:2,14,15	document (3) 1821:8,9,10	driving (1) 1727:1
decreed (5) 1772:12,18;1773:5, 14;1774:13	derived (1) 1730:2	discharging (1) 1780:5	documents (2) 1819:18;1821:8	drop (10) 1730:4,6,7;1732:22; 1743:12;1771:13,15; 1793:20,22;1794:1
deep (1) 1731:1	described (2) 1722:3;1800:12	disconnect (1) 1757:13	done (3) 1726:3;1785:22; 1800:3	drop-for-drop (2) 1790:19,22
deficit (3) 1797:20;1798:1,12	description (2) 1724:23;1811:3	discredited (1) 1725:15	Donnelly (7) 1715:23.5;1716:17; 1803:18,20,21; 1805:16;1821:2	dropped (2) 1792:2,6
define (2) 1804:3;1807:20	detail (1) 1765:24	discretion (1) 1751:17		dropping (5) 1732:10;1739:12; 1740:15;1755:15; 1782:4
definitely (2) 1743:11,13	determination (2) 1788:7;1797:22	discuss (2) 1720:5,10		drought (2) 1771:1,12
definition (4) 1803:23;1804:1,3,5	determinations (2) 1801:2;1811:1	discussed (6) 1719:18;1738:1; 1766:1;1767:16; 1796:7;1815:21		Dry (4) 1762:18;1764:9; 1772:3;1780:11
degree (1) 1718:11	determine (4) 1764:17;1794:16; 1799:24;1800:4			due (9)
	determined (1) 1788:10			
	determining (1) 1747:18			
	develop (2) 1727:8;1802:10			
	development (5)			

1771:3;1786:19; 1794:8,17;1795:13,18, 20,21;1807:14 duly (2) 1718:3;1758:16 duration (1) 1809:13 during (10) 1724:3;1725:4; 1738:3;1752:17; 1753:2;1754:20; 1791:16;1798:7,23; 1801:16 duties (2) 1744:8,12 duty (2) 1744:2;1745:1 dwelt (1) 1772:22 DWR (1) 1730:19 DWR's (1) 1730:24 dynamic (2) 1766:18,20	effect (16) 1724:4;1735:18; 1768:22;1772:17; 1773:3,5,8,13;1774:13; 1795:20;1808:8; 1809:19;1812:5; 1813:23;1817:16; 1818:3 effective (1) 1817:11 effectively (1) 1808:12 Effects (11) 1720:6;1741:10; 1759:18;1767:16; 1772:10;1773:19; 1787:2;1791:13; 1801:10;1818:1,3 EH-4 (21) 1764:15;1765:22; 1766:10,24;1767:11; 1768:9;1769:4;1772:1; 1783:13,24;1784:16; 1786:5;1793:21; 1794:8;1811:5,8,16,20; 1817:4,9,12 eight (3) 1722:23;1724:8; 1815:21 either (1) 1751:15 elaborate (1) 1817:11 elevated (1) 1734:5 elevation (8) 1724:12;1726:17; 1729:17;1730:14; 1731:6,21;1733:21,22 elevations (5) 1723:8;1729:14,15; 1731:12;1757:12 else (11) 1761:17,18;1777:22; 1778:12;1783:5,23; 1784:7;1785:23; 1806:15;1807:9; 1808:22 elsewhere (1) 1781:3 Ely (1) 1820:19 embankment (4) 1734:6,6,9,11 encompasses (1) 1738:13 encounter (1) 1728:24 end (16) 1731:18;1732:11; 1733:20;1738:7; 1759:12,20;1767:3; 1769:16,19,23;	1770:16;1779:7,12; 1798:3;1800:21; 1820:16 endangerment (1) 1773:15 ended (1) 1786:14 Energy (11) 1715:10,5;1751:24; 1758:5,9,11,16;1759:4; 1770:12;1787:12; 1792:13;1819:22 Engineer (36) 1714:5,6,5,9,5,15,5; 1718:19;1743:15,19; 1744:21;1751:14,16; 1752:4;1756:2; 1759:11;1762:17; 1763:16;1771:22; 1778:19;1782:18; 1788:7,11;1789:15; 1800:8,17;1801:1; 1808:4,12;1818:23; 1819:2,3,10,23;1820:1, 3,6,8,18 engineering (1) 1718:11 Engineer's (4) 1745:5;1764:1; 1773:7;1819:14 enough (3) 1763:12;1801:13; 1805:15 ensure (1) 1775:7 entertain (1) 1819:23 entire (3) 1724:14;1739:20; 1799:23 Environmental (1) 1805:24 Epstein (4) 1725:18,21;1755:12, 17 equal (1) 1817:18 equilibrating (1) 1770:5 equilibrium (6) 1736:17;1766:7,18, 21;1775:22;1797:19 error (1) 1775:24 Esq (11) 1715:3,5,5,7,9,10,5, 13,5,15,16,5,18,20,21 essentially (6) 1727:22;1736:1; 1771:19;1777:10; 1779:13;1820:8 estimate (15) 1724:21;1738:14,16;	1739:4;1755:7,11,22; 1780:3,13;1781:1,5,11; 1785:1;1814:1; 1820:14 estimated (5) 1725:13;1738:22; 1778:24;1780:15; 1781:6 estimates (8) 1747:12;1779:8,13, 21;1781:3,9;1798:17; 1803:1 ET (10) 1734:19;1738:11; 1739:1,6,10,12,16; 1740:13;1772:21,22 evaluated (1) 1773:6 evaporating (5) 1734:17,19;1735:21; 1738:23;1739:2 evaporation (1) 1738:15 evaporites (2) 1734:18;1738:11 evapotrans (1) 1738:11 evapotranspiration (1) 1778:9 even (10) 1732:24;1733:3; 1736:2;1741:15; 1771:24,24;1776:10; 1783:16;1811:18; 1816:5 event (8) 1735:11,14,15; 1736:15;1766:20; 1767:4;1768:6,15 events (2) 1736:18;1767:18 everyone (1) 1822:2 everywhere (1) 1812:2 evidence (37) 1727:10;1738:24; 1746:12;1751:2; 1759:13;1760:13; 1761:24;1762:1; 1763:13;1764:21; 1766:8;1778:14,16; 1780:9,21,24;1782:19, 22;1785:2;1789:14,17, 21;1790:15,21; 1792:13;1793:15; 1795:6;1796:13; 1797:23;1800:20; 1808:23;1809:15,17; 1810:5;1812:16,18; 1814:2 exactly (2) 1801:17;1808:10	Examination (20) 1716:4,8,10,11,13, 20,21,22,24;1718:6; 1744:11;1746:23; 1752:5;1756:8;1757:1; 1758:19;1808:5; 1809:6;1810:1;1817:2 examined (2) 1718:4;1758:17 exceed (1) 1820:2 exceeds (1) 1739:15 Excel (2) 1818:23;1819:5 Excellent (1) 1792:20 except (2) 1727:10;1789:23 exclusion (1) 1719:16 Excuse (6) 1724:8;1735:1; 1739:13;1740:24; 1741:8;1744:15 Exhibit (27) 1718:9;1719:5; 1726:4;1740:20,21; 1741:24;1743:15,15, 19;1744:21;1760:3; 1769:6;1770:5,6; 1771:23,23;1778:20; 1779:8;1782:8; 1786:12;1792:13,14; 1793:17;1818:23,23; 1819:3,4 exhibits (7) 1740:18,19;1751:4, 5,12;1819:10,14 exist (2) 1764:21;1790:17 existed (1) 1794:10 existence (1) 1795:6 existing (11) 1730:17;1740:3; 1760:6;1762:23; 1763:17;1773:10; 1794:9;1799:7,10,10, 15 exists (2) 1763:12;1775:17 exit (1) 1796:20 expand (1) 1721:21 expansion (1) 1721:14 expect (2) 1770:17;1788:18 expected (1) 1786:8
E				
Eakin (1) 1725:2 Eakin's (1) 1786:14 earlier (5) 1726:10;1734:10; 1735:12;1793:15; 1819:4 early (4) 1727:11;1737:4; 1766:19;1767:10 Earth (1) 1734:1 easily (1) 1792:5 east (17) 1722:7;1728:23; 1730:2,8;1731:5; 1732:7,16;1734:2,11, 24;1735:1;1739:13; 1757:12;1764:7; 1779:3,22,23 east/west (1) 1743:10 eastern (3) 1779:12;1781:21; 1790:13 echo (1) 1792:16 edge (2) 1720:18;1761:4 edit (1) 1741:17 EE (2) 1726:23;1728:9				

<p>experience (2) 1718:12;1809:10</p> <p>expert (9) 1718:15,22;1749:21; 1760:18;1763:20; 1769:9;1791:21; 1818:17,19</p> <p>experts (5) 1725:3;1760:17,18; 1775:1,13</p> <p>explain (2) 1741:5;1807:12</p> <p>explained (2) 1734:21;1738:19</p> <p>explains (1) 1772:5</p> <p>exported (1) 1770:12</p> <p>exposed (1) 1764:10</p> <p>expressed (1) 1750:3</p> <p>extend (4) 1728:20;1732:19; 1764:23;1821:12</p> <p>extended (2) 1726:9;1729:10</p> <p>extends (1) 1766:11</p> <p>extensive (2) 1723:9;1738:11</p> <p>extensively (2) 1738:1;1744:16</p> <p>extent (16) 1723:18;1724:14; 1748:15;1762:21; 1765:16;1775:17; 1780:14;1790:13; 1796:12;1807:8,9; 1812:19;1813:14,17, 19,24</p> <hr/> <p style="text-align: center;">F</p> <hr/> <p>facility (2) 1735:6;1744:17</p> <p>fact (8) 1721:11;1732:4; 1741:15;1762:5; 1766:6;1777:3; 1805:13;1818:21</p> <p>factor (2) 1784:9;1798:16</p> <p>factors (1) 1797:21</p> <p>fair (2) 1799:11;1814:19</p> <p>FAIRBANK (63) 1713:4;1714:3; 1717:3;1718:24; 1740:19,24;1741:21; 1742:3;1743:16; 1744:9,14,19;1745:14;</p>	<p>1746:21;1747:5,8; 1748:15;1749:12; 1750:16,19;1751:10, 19,23;1752:2;1753:8, 17;1755:24;1756:5; 1757:19,24;1758:3,8, 24;1776:2,14,21; 1782:14;1787:10; 1788:3,13;1792:14,20; 1797:8;1802:5;1803:4, 16;1805:17,20; 1806:17;1807:24; 1808:2;1809:22; 1814:6,15,19;1816:10, 15,23;1818:9;1820:12, 23;1821:4,22</p> <p>fairly (8) 1736:3;1760:13; 1762:1;1768:4,10; 1769:1;1790:6; 1815:15</p> <p>falling (2) 1730:8;1767:13</p> <p>familiar (1) 1743:18</p> <p>fancy (1) 1722:19</p> <p>far (5) 1731:8;1756:16; 1764:22;1789:20; 1808:24</p> <p>Farber (1) 1715:8.5</p> <p>fault (34) 1724:3,5,5,6;1730:8; 1731:15;1732:9,23; 1733:1,4,7,9,10,11; 1736:23;1737:9,14,15; 1743:8,13;1757:10,12, 17;1760:7,8,10;1761:2, 3,16;1764:9;1779:23, 23;1810:6,11</p> <p>feature (2) 1734:2,3</p> <p>federal (4) 1792:3,7,11;1801:8</p> <p>feet (23) 1720:19;1728:5; 1729:18,22;1730:4,13, 14;1731:1;1732:12; 1733:21;1734:23; 1735:8;1739:2;1763:9; 1771:8,11,13,15; 1782:3,4,5,22;1786:3</p> <p>FELLING (20) 1716:12;1758:11,14, 21,23,24;1759:2,3; 1776:2,6;1787:4; 1792:17;1793:4; 1797:16;1803:9,22; 1806:1,22;1810:3; 1818:17</p> <p>F-e-l-l-i-n-g (2)</p>	<p>1758:23;1759:2</p> <p>Felling's (2) 1776:9;1787:9</p> <p>felt (1) 1780:17</p> <p>few (10) 1723:16;1736:10; 1766:4;1767:11; 1769:14;1793:6; 1811:6,9;1815:16; 1818:15</p> <p>FF (2) 1726:23;1727:20</p> <p>fields (1) 1745:2</p> <p>figure (19) 1752:19;1760:15; 1762:10;1770:5; 1771:21;1778:9,18; 1780:8;1783:11,20; 1784:15;1793:7; 1795:8,9;1801:20; 1809:9;1810:24; 1811:16;1815:4</p> <p>figures (2) 1783:6;1784:21</p> <p>filed (1) 1722:1</p> <p>fill (8) 1720:4,7;1721:10; 1723:13;1728:19; 1739:10;1740:6; 1741:12</p> <p>final (8) 1717:7,13;1741:2; 1806:8;1820:11,13,13, 14</p> <p>finally (6) 1720:9;1763:23; 1771:1;1789:8; 1819:19;1821:17</p> <p>fine (1) 1820:23</p> <p>finished (1) 1767:10</p> <p>first (16) 1718:3;1719:16; 1725:8;1727:7; 1730:21;1734:7; 1742:4;1758:16; 1766:16;1767:2,8; 1780:13;1802:16,17; 1807:1;1818:16</p> <p>Fish (6) 1745:15;1787:13; 1791:21;1792:3; 1797:8;1814:9</p> <p>five (12) 1721:3;1723:17; 1736:2;1747:8; 1753:17;1755:6; 1767:6;1778:23; 1779:10,13;1787:21;</p>	<p>1810:17</p> <p>Flangas (1) 1715:15</p> <p>flat (5) 1732:2;1734:12; 1766:16,21;1767:14</p> <p>Flatley (1) 1714:7.5</p> <p>FLOW (113) 1713:7;1717:5; 1719:16;1731:21,23; 1732:5;1739:20; 1743:10,11,13; 1756:11;1759:17,21, 24;1760:16,20,21,21; 1761:10,11,14,14,19, 22;1762:2,7,19,20; 1763:1,4,11,12,20; 1764:16,20;1765:6,12; 1770:7,9,18;1771:2,6, 1772:6,7;1773:1,19; 1774:10,18,21,24; 1775:11,19,20; 1777:15;1778:18,19; 1779:2,16;1780:18,21; 1781:12,16,18,21; 1782:1,2,24;1783:3,8, 16;1784:3;1785:3,3, 11;1786:11,11,17; 1787:15,24;1788:19; 1789:13,16;1790:3,10, 13,16;1791:1;1793:13; 1794:16;1795:1,2,3; 1796:2;1797:2,20; 1798:1,12;1799:24; 1800:7,12,19;1801:7, 23,24;1806:10;1808:8, 11;1809:1;1810:16; 1812:19;1813:18; 1817:12;1818:24; 1819:16</p> <p>flowed (1) 1771:17</p> <p>flows (23) 1732:3;1757:10; 1760:19;1761:9; 1762:6,16;1767:22; 1770:4,16;1772:19; 1773:15;1786:6; 1788:16;1790:10,17; 1791:15,17;1792:6; 1797:20;1798:11,20; 1804:17;1806:11</p> <p>flux (3) 1778:24;1779:14; 1781:6</p> <p>fluxes (2) 1779:18;1781:22</p> <p>focus (4) 1726:22;1729:6; 1736:21;1739:23</p> <p>focused (6) 1724:14,15,22;</p>	<p>1741:9,12;1748:24</p> <p>focusing (2) 1733:16;1735:2</p> <p>folder (3) 1819:17;1821:6,8</p> <p>follow (1) 1811:22</p> <p>follows (2) 1718:4;1758:17</p> <p>foot (3) 1729:21;1735:15; 1769:13</p> <p>foregoing (1) 1823:12</p> <p>forever (2) 1784:17;1805:13</p> <p>forgot (1) 1733:19</p> <p>forthcoming (1) 1725:23</p> <p>fortuitous (1) 1808:15</p> <p>forward (1) 1790:15</p> <p>foundation (1) 1748:21</p> <p>four (19) 1720:21;1724:15,16, 20,21;1725:20; 1738:20;1739:6; 1748:8;1759:15; 1778:23;1779:10,12; 1780:10;1810:4,22; 1814:2,20;1815:17</p> <p>fraction (1) 1777:6</p> <p>frame (1) 1734:8</p> <p>FRIDAY (3) 1713:18.5;1717:1; 1823:8</p> <p>front (2) 1760:14;1810:6</p> <p>full (3) 1734:22;1807:20; 1823:13</p> <p>function (2) 1813:22,23</p> <p>further (14) 1726:7;1728:2,21; 1729:1;1753:13; 1758:1;1776:23; 1797:7;1805:16; 1816:12,17;1818:10, 11;1820:3</p> <p>future (9) 1741:14;1765:9; 1787:21,22;1789:10; 1791:11;1801:13; 1805:4,14</p> <hr/> <p style="text-align: center;">G</p> <hr/>
---	--	---	--	--

<p>gage (2) 1770:8,9</p> <p>gap (1) 1736:6</p> <p>GARNET (12) 1713:9;1764:6; 1765:19;1774:7; 1784:18;1793:14,16; 1794:22;1811:11; 1815:4,7,14</p> <p>Gass (3) 1724:3;1728:3; 1732:20</p> <p>gears (1) 1796:15</p> <p>general (3) 1726:1;1802:17; 1810:15</p> <p>generally (4) 1725:15;1730:20; 1732:5;1752:16</p> <p>generated (2) 1730:10;1782:11</p> <p>generation (1) 1815:8</p> <p>geographic (2) 1759:16,22</p> <p>geologic (6) 1726:19;1727:6; 1729:9;1760:4,6; 1761:1</p> <p>geology (3) 1724:1;1748:19,19</p> <p>geophysical (1) 1760:8</p> <p>Georgia (5) 1750:21,24;1805:21; 1806:1;1816:17</p> <p>gets (4) 1728:22;1729:1; 1733:3;1798:3</p> <p>GIS (2) 1726:3;1738:17</p> <p>given (3) 1790:12;1802:13,15</p> <p>Glasgow (1) 1715:22</p> <p>Glendale (3) 1762:21;1774:10; 1784:3</p> <p>goes (14) 1728:18,24;1731:5, 21;1732:5,16;1734:12; 1742:24;1748:4; 1754:21;1761:17; 1774:15;1777:24; 1785:19</p> <p>golden (1) 1722:4</p> <p>golf (1) 1742:23</p> <p>Good (20) 1717:3,16;1718:8;</p>	<p>1735:20;1742:8,10; 1745:23;1746:2; 1750:22;1753:22,23; 1759:14;1793:4,5; 1797:16,17;1806:1,3; 1809:17;1810:24</p> <p>Google (1) 1734:1</p> <p>gov (1) 1819:15</p> <p>gradient (9) 1729:19;1732:22; 1733:3;1736:14; 1739:17;1771:10,16, 16;1781:5</p> <p>graph (3) 1752:10;1757:7; 1798:3</p> <p>gravity (2) 1760:11,12</p> <p>great (2) 1717:19;1725:13</p> <p>green (7) 1723:6;1728:13,14; 1729:13;1734:15; 1762:14;1785:4</p> <p>Greg (1) 1715:18</p> <p>grossly (1) 1725:16</p> <p>ground (2) 1735:22;1745:11</p> <p>groundwater (72) 1722:16,18,22; 1723:3,8,18;1724:4; 1725:22;1726:17; 1727:2,5,13;1729:6,8, 11,14,15,17,19,22; 1730:3,5,9,14,17; 1731:6,20;1732:1,8; 1733:21,22;1734:17, 18;1735:3;1738:12,23; 1739:2,4;1743:9,11,12, 13,22;1754:8,9,19; 1756:15;1757:11; 1759:20,23;1760:16; 1763:19;1770:11; 1774:17;1777:2,11; 1778:19;1779:16; 1793:19,20;1794:16, 17;1795:3,9;1798:19; 1800:1,22;1801:1,4,7; 1812:2;1820:20</p> <p>group (1) 1721:5</p> <p>guess (8) 1737:18;1747:21; 1750:2,10;1757:9; 1796:8;1802:10; 1805:7</p> <p>guys (1) 1756:4</p> <p>GV-1 (1)</p>	<p>1811:22</p> <p style="text-align: center;">H</p> <p>habitat (3) 1773:16;1792:2; 1813:23</p> <p>half (1) 1747:9</p> <p>handouts (1) 1776:7</p> <p>happen (3) 1752:22;1772:16; 1786:20</p> <p>happened (2) 1735:7;1738:2</p> <p>happening (3) 1739:13;1784:11; 1794:5</p> <p>happens (1) 1733:5</p> <p>happy (1) 1759:12</p> <p>hard (4) 1734:21;1743:22; 1763:1;1811:6</p> <p>hardly (1) 1772:20</p> <p>Hardman (1) 1724:24</p> <p>Harrill (4) 1778:24;1779:8; 1781:22;1782:9</p> <p>Harrill's (1) 1780:3</p> <p>Harrison (8) 1716:18;1750:22,23; 1751:8,18;1805:23,24; 1806:16</p> <p>head (7) 1726:5;1734:23; 1771:10,11;1781:24; 1782:5,22</p> <p>heads (3) 1761:11;1771:7; 1782:2</p> <p>headwater (1) 1765:12</p> <p>headwaters (1) 1762:15</p> <p>hear (4) 1739:6;1756:4,5; 1810:8</p> <p>heard (12) 1723:15;1725:10; 1735:10;1736:24; 1741:7;1746:7;1752:8; 1759:13;1761:24; 1775:1;1793:15; 1807:6</p> <p>HEARING (90) 1713:4,15,16; 1714:3,5,8;1717:3,4;</p>	<p>1718:24;1724:2; 1735:11;1738:1; 1740:19,24;1741:3,21; 1742:3;1743:16; 1744:9,14,19;1745:14; 1746:21;1747:5,8; 1748:15;1749:12; 1750:16,19;1751:10, 12,13,19,23;1752:2,16; 1753:2,8,17;1755:24; 1756:5;1757:19,24; 1758:3,8,9,24;1759:6, 11,12;1762:18; 1771:22;1776:2,14,21; 1778:20;1780:20; 1782:14;1787:10; 1788:3,13;1792:14,19, 20;1797:8;1802:5; 1803:4,16;1805:17,20; 1806:17;1807:24; 1808:2;1809:16,22; 1814:6,15,19;1816:10, 15,23;1818:9;1819:17; 1820:12,23;1821:4,8, 22;1822:4;1823:11,15</p> <p>hearings (3) 1746:8;1780:11; 1809:15</p> <p>Hello (4) 1749:17,18;1806:22, 24</p> <p>helps (1) 1807:20</p> <p>hereby (1) 1823:6</p> <p>Herrema (20) 1715:9;1716:14; 1746:14,14;1747:3; 1748:2,7;1776:4,4,19, 24;1787:7,7,20; 1788:12;1793:2,3; 1797:7;1820:10,17</p> <p>Hi (1) 1810:3</p> <p>HIDDEN (2) 1713:9.5;1800:20</p> <p>high (11) 1732:2;1755:17; 1769:12,18;1783:22; 1785:2,14;1802:12,15, 21,24</p> <p>higher (5) 1729:22;1730:14; 1763:10;1771:8; 1800:22</p> <p>highlight (1) 1732:12</p> <p>highlighted (1) 1724:20</p> <p>highs (1) 1769:13</p> <p>highway (7) 1724:5;1730:8;</p>	<p>1732:9,23;1733:9; 1743:8;1810:11</p> <p>hinders (1) 1747:13</p> <p>historical (3) 1721:24;1722:3,6</p> <p>hitting (1) 1730:7</p> <p>Hole (4) 1792:1,2,2,4</p> <p>honor (1) 1791:24</p> <p>Hopefully (1) 1793:6</p> <p>horizontal (1) 1733:17</p> <p>housekeeping (1) 1749:19</p> <p>huge (1) 1734:22</p> <p>hundred (5) 1721:9;1730:24; 1741:18;1779:5; 1786:21</p> <p>hundred-foot (1) 1730:4</p> <p>Hyatt (1) 1715:8.5</p> <p>hydraulic (1) 1817:8</p> <p>hydrograph (14) 1737:3,23;1766:10, 13;1767:24;1777:3,17, 22;1783:24;1795:7; 1802:13;1810:20; 1811:16,19</p> <p>HYDROGRAPHIC (6) 1713:7.5,8.5,9.5,10, 10.5,11.5</p> <p>hydrographs (5) 1735:4;1783:10; 1810:17;1811:1; 1817:7</p> <p>Hydrologist (3) 1714:12.5;1718:12, 13</p> <p>Hydrology (4) 1714:11;1718:16,22; 1719:20</p> <p>hyperlinks (1) 1821:10</p> <p>hypothetical (1) 1795:7</p> <p>hypothetically (1) 1806:7</p> <p style="text-align: center;">I</p> <p>identified (4) 1719:14;1720:1; 1722:12;1728:14</p> <p>identify (1) 1809:11</p>
---	---	---	--	--

<p>ignore (1) 1779:22</p> <p>ignored (6) 1725:2,5,8,9,14,17</p> <p>image (12) 1721:23;1722:5,10,23;1723:4;1726:1,8,15;1730:13;1732:14;1737:20;1760:3</p> <p>imbedded (1) 1821:10</p> <p>immediate (2) 1817:15;1818:2</p> <p>impact (17) 1721:16;1740:3;1748:5;1787:16,18;1794:15,17;1796:10,12;1797:1,3;1799:10,14,16;1800:4;1816:5;1817:16</p> <p>impacting (1) 1775:2</p> <p>impacts (5) 1722:22;1795:3;1799:6,7;1809:11</p> <p>impede (2) 1719:22;1761:13</p> <p>impediment (1) 1743:9</p> <p>imperceptible (1) 1790:1</p> <p>imperiled (2) 1792:3,7</p> <p>impermeable (3) 1729:1;1782:24;1790:16</p> <p>implies (1) 1805:8</p> <p>important (10) 1721:4;1733:5;1734:4;1769:2;1786:24;1787:1;1791:23;1795:11;1808:9,14</p> <p>importantly (2) 1735:24;1774:2</p> <p>impulse (1) 1767:6</p> <p>Inc (1) 1730:23</p> <p>include (7) 1719:20;1725:18;1762:1;1789:9,18;1793:13;1819:10</p> <p>included (2) 1739:21;1779:17</p> <p>includes (2) 1745:10;1823:13</p> <p>including (7) 1761:21;1763:21;1764:15;1765:5;1774:18;1789:16;1794:6</p>	<p>inclusive (1) 1823:13</p> <p>incorporated (1) 1726:3</p> <p>incorporating (1) 1739:1</p> <p>increase (4) 1783:16;1788:18;1801:4;1815:16</p> <p>increased (3) 1774:10;1798:11,20</p> <p>increasing (6) 1766:5;1785:5;1797:19;1804:6,7;1816:3</p> <p>indeed (1) 1724:23</p> <p>Indians (2) 1745:18;1797:11</p> <p>indicate (2) 1744:22;1773:1</p> <p>indicated (4) 1739:24;1740:11;1792:17;1802:8</p> <p>indicates (2) 1761:1;1801:21</p> <p>indication (1) 1734:17</p> <p>indicative (1) 1732:2</p> <p>indicator (1) 1809:18</p> <p>induced (1) 1778:11</p> <p>industrial (1) 1735:5</p> <p>infamous (1) 1724:5</p> <p>inferred (1) 1760:10</p> <p>infiltrating (1) 1735:21</p> <p>infiltration (1) 1736:13</p> <p>influence (3) 1726:14;1739:2;1748:22</p> <p>influenced (1) 1738:15</p> <p>influences (1) 1743:11</p> <p>informal (1) 1748:12</p> <p>information (15) 1722:1;1724:9,13;1730:17;1731:7;1732:21;1740:10;1747:16;1751:15;1759:17;1765:10;1782:7,10;1785:16;1818:13</p> <p>initial (4) 1740:20;1768:5,14;</p>	<p>1770:7</p> <p>initially (1) 1777:7</p> <p>inquiry (1) 1748:6</p> <p>installation (1) 1736:18</p> <p>instead (2) 1771:15;1817:24</p> <p>intended (1) 1778:4</p> <p>intensity (1) 1809:12</p> <p>intention (1) 1751:1</p> <p>interest (2) 1791:20,22</p> <p>interested (1) 1738:2</p> <p>interpret (1) 1731:11</p> <p>interpretation (1) 1726:8</p> <p>interpreted (1) 1760:8</p> <p>interrupt (1) 1776:3</p> <p>into (1) 1728:19</p> <p>introduced (2) 1736:13;1780:20</p> <p>intuitively (1) 1724:16</p> <p>inventory (1) 1743:23</p> <p>inversely (1) 1777:11</p> <p>Investment (2) 1742:5;1814:7</p> <p>Investments (2) 1792:22;1819:21</p> <p>Ironically (1) 1781:13</p> <p>irrelevant (1) 1741:12</p> <p>Irrigation (6) 1715:19;1745:4;1751:21;1806:19,23;1816:20</p> <p>issue (3) 1785:24;1792:1;1809:16</p> <p>issues (3) 1719:13;1763:22;1785:21</p>	<p>join (2) 1746:19;1748:3</p> <p>joined (1) 1819:21</p> <p>joins (1) 1761:11</p> <p>joint (5) 1761:22;1762:2;1763:21;1789:12,19</p> <p>Jon (1) 1714:12</p> <p>JOYCE (3) 1713:22;1823:4,21.5</p> <p>judge (5) 1767:1,12;1792:3,8,11</p> <p>July (1) 1724:9</p> <p>jumping (1) 1821:24</p> <p>Justina (2) 1715:10.5;1758:10</p>	<p style="text-align: center;">L</p> <p>label (2) 1754:21;1779:19</p> <p>labeled (1) 1752:11</p> <p>labels (2) 1723:7;1726:16</p> <p>lag (1) 1753:6</p> <p>laid (3) 1748:21;1767:23;1768:1</p> <p>Lake (8) 1734:24;1762:18;1764:9;1780:1,11;1782:2,3;1796:22</p> <p>land (5) 1722:8;1723:12;1727:8,12;1738:22</p> <p>Lane (1) 1713:23</p> <p>large (3) 1722:8,9;1793:19</p> <p>Las (23) 1715:21;1718:12;1745:19;1746:1;1750:16;1753:12;1760:2;1763:23;1764:6,9,22,24;1765:1,2;1796:21;1797:12;1805:18;1814:12;1816:13;1819:11,20;1821:19,20</p> <p>laser (1) 1763:3</p> <p>last (22) 1728:1;1736:2;1754:21;1758:21,23;1761:5;1766:4;1767:11;1776:16;1781:7;1790:1;1802:3;1804:17;1805:2;1810:22;1811:6,9,14;1812:8;1815:12,16;1819:9</p> <p>Lastly (1) 1791:20</p> <p>late (2) 1789:7;1817:6</p> <p>lateral (1) 1761:2</p> <p>latter (1) 1807:10</p> <p>least (9) 1765:21,23;1779:4;1783:4,21;1784:1;1791:16;1802:3;1812:5</p> <p>leave (1) 1749:2</p> <p>leaving (1)</p>
		J	K	
		<p>January (3) 1769:21,21,21</p> <p>JAY (3) 1716:3;1718:1;1742:19</p>	<p>Kane (29) 1720:19;1721:2;1724:6;1731:14;1732:23,24,24;1733:7,10,11;1736:23;1737:9;1760:1,5,6,12,16,24;1761:2,5,8,15,20;1787:15;1789:14,15,18;1803:12;1810:6</p> <p>Karen (3) 1715:13.5,22;1803:9</p> <p>KBN-4 (1) 1764:17</p> <p>keep (1) 1791:4</p> <p>Kent (2) 1715:7;1742:8</p> <p>kept (1) 1770:17</p> <p>kind (11) 1729:7;1750:1;1762:12;1765:14;1768:17,20;1770:5;1778:16;1780:9;1781:8;1812:8</p> <p>King (6) 1715:19;1716:19;1751:22;1806:21,22;1807:23</p> <p>knowledge (1) 1811:2</p> <p>known (2) 1730:22;1734:24</p> <p>knows (1) 1783:2</p> <p>Kryder (1) 1714:10.5</p>	

1796:16 left (15) 1721:23;1722:5,23; 1723:4;1726:1,8; 1730:13;1737:17,21; 1741:22;1752:19; 1761:2;1773:22; 1778:2,8 left-hand (1) 1723:22 legend (1) 1769:20 Legislative (1) 1823:9 less (20) 1766:21;1770:20; 1773:1,4,5,13;1774:13; 1779:5;1783:23; 1789:2,3,21;1790:18; 1791:11;1798:7; 1799:9,15;1804:22,23; 1817:20 level (25) 1722:21;1729:18; 1730:12;1731:11; 1732:1,20;1735:15; 1736:10;1738:7,19; 1746:11;1747:24; 1771:14;1782:3,4; 1783:3,12;1787:22; 1790:1;1791:5; 1793:19;1794:17; 1795:9;1800:21; 1818:6 leveling (4) 1783:16,21;1784:2,6 levels (66) 1726:13;1729:22,23; 1730:3,5,12,24; 1732:13,18;1735:8,23, 24;1736:12;1737:10, 13,14,21;1739:12,14, 17;1740:15;1743:12; 1750:12;1752:16,17; 1754:19;1755:1,15; 1756:11,12,15;1763:8, 10;1765:18,20,21; 1767:5,6,11,13; 1769:19;1770:4; 1771:13;1772:3; 1776:12,13;1777:10; 1783:12,21;1784:6; 1786:5;1789:23; 1790:24;1791:16; 1792:1;1793:20; 1794:16;1795:3; 1804:15;1807:17; 1809:20;1810:15; 1811:4,10;1812:1; 1817:22 Levi (1) 1714:10.5 liberally (1)	1764:4 liberty (2) 1766:13;1788:5 light (1) 1764:3 likely (5) 1783:3;1787:14; 1788:21;1790:12; 1806:6 limit (1) 1809:2 limitations (1) 1809:14 limited (1) 1818:20 Lincoln (8) 1715:12;1720:15; 1742:22;1743:1; 1749:14;1803:6,10; 1816:12 Lindsey (1) 1734:24 line (66) 1720:15;1723:21; 1730:22;1731:2,5,8,17; 1732:1,7,11,15,19; 1733:21;1743:1; 1744:3;1752:13; 1762:14;1766:11,14, 16,24;1767:1,7,8,9,15, 20,24;1768:1,9,12,17, 19,20;1769:7,11,15,17, 19,22,24;1770:1,2; 1777:8,24;1778:3,7,13; 1781:22,23,24;1782:8; 1784:16,17;1786:5; 1788:9;1795:9;1802:8, 10,14,17,20,21,23; 1807:19;1819:14 linear (2) 1785:18;1786:2 lined (1) 1768:13 lines (7) 1730:2,20;1760:9; 1778:1;1790:21; 1802:23;1807:6 links (1) 1821:9 lip (1) 1729:19 list (1) 1753:11 listed (1) 1719:15 listening (1) 1776:15 literally (1) 1770:13 little (17) 1722:7;1728:2; 1767:2;1769:17,20; 1776:1;1777:23;	1781:8;1788:16; 1791:9;1796:15; 1805:7;1809:16; 1812:7;1813:5;1814:7; 1815:15 LL (2) 1726:20;1728:17 local (4) 1738:19;1779:6,14; 1781:2 locally (3) 1722:21;1730:2; 1735:3 located (7) 1720:14;1731:14; 1735:16;1737:1; 1742:20;1746:4; 1821:7 location (7) 1720:14;1740:5; 1774:19;1787:22; 1794:24;1808:10,16 locations (1) 1767:19 lodge (1) 1782:6 long (7) 1759:12;1769:2,4; 1781:24;1789:5,6; 1804:19 longer (8) 1774:24;1775:3; 1803:2;1804:14,15,16; 1805:6;1814:3 longest (1) 1735:6 long-term (4) 1768:21;1770:19; 1774:17;1807:13 look (17) 1756:10,18;1765:8, 24;1766:9;1767:14; 1770:4;1773:20; 1775:6;1778:16; 1781:20;1785:12; 1796:2;1799:6; 1810:19,21;1821:3 looked (3) 1756:17;1800:22; 1811:9 looking (5) 1738:9;1752:19; 1780:9;1799:20; 1817:7 looks (7) 1724:16;1736:4; 1738:6;1768:20,21; 1769:10;1808:22 Los (1) 1715:9.5 lose (1) 1783:8 losing (3)	1783:7;1784:14,20 loss (1) 1771:18 lost (1) 1742:16 lot (16) 1723:15;1726:20; 1728:1;1736:24; 1738:12;1739:6; 1759:13;1761:24; 1770:11;1771:1; 1779:6;1781:14; 1789:13;1791:7; 1801:10;1820:21 love (1) 1755:6 Low (7) 1715:6.5;1739:3; 1755:14,18;1769:21; 1788:17;1802:22 LOWER (61) 1713:6.5;1717:5; 1727:22;1756:11; 1759:21,24;1760:1; 1761:18,22;1762:6,9, 13,19;1763:5,9,15,20; 1764:16,19;1765:6; 1771:2,5;1772:6,7; 1774:24;1778:2,8,17, 21;1779:2,7,9;1781:12, 21;1782:1,2,23;1783:8, 20;1787:14,15; 1789:13,16,20;1790:9, 16;1793:12;1795:1,22; 1796:2,21;1797:2; 1801:20;1806:10; 1808:11;1810:15; 1812:24;1813:1,8,9; 1819:16 lowering (1) 1767:2 lowers (1) 1772:21 lows (1) 1769:13 Ltd (1) 1715:3 LWRFS (11) 1720:12,22;1721:7, 15,18;1722:24; 1739:21;1756:19; 1808:12;1821:7,9	magnitude (1) 1794:24 main (3) 1729:18;1767:16; 1791:12 maintain (1) 1777:10 makes (2) 1761:10,18 making (3) 1797:21;1810:24; 1819:6 manage (6) 1735:20;1746:8; 1765:5;1789:15; 1792:10;1808:12 managed (1) 1761:21 MANAGEMENT (11) 1713:6.5;1720:1; 1721:18;1734:4; 1761:22;1762:2; 1763:21;1765:6; 1775:4;1789:12,19 managing (1) 1792:8 manually (1) 1759:21 many (8) 1761:1;1764:14; 1769:8,9;1772:13; 1773:6;1775:1; 1790:21 map (13) 1720:21;1723:22; 1724:1,1;1726:19; 1729:10;1742:12,16; 1760:4,6;1761:1; 1762:10;1763:24 mapped (5) 1724:5;1726:5; 1728:3;1729:17; 1738:14 maps (1) 1724:24 margin (1) 1729:2 marked (2) 1751:12;1819:9 Master's (1) 1718:10 match (8) 1767:21;1769:1; 1779:16,19;1780:2; 1783:11;1785:14; 1802:19 matches (3) 1767:1;1768:4,10 MATTER (7) 1713:6;1741:2; 1749:19;1775:8; 1777:20;1782:20; 1818:17
M				
MacKenzie (1) 1715:13 Madam (1) 1759:11 magenta (1) 1724:18 magenta-colored (1) 1720:23				

matters (5) 1717:13;1740:5; 1748:20;1788:6; 1818:15	1752:10;1756:13; 1788:1;1812:10; 1817:4	1730:1;1731:19; 1745:6;1754:16; 1772:24;1774:9; 1778:19;1779:16,18; 1780:4;1801:2,4,7,12, 14	mountain (2) 1728:22;1779:10 MOUNTAINS (13) 1713:8.5;1722:14; 1760:2;1763:23; 1764:8;1765:20; 1774:8;1778:22; 1779:5,23,24;1784:18; 1796:22	1787:23;1788:1; 1789:24;1790:3,10,19, 22,24;1791:14;1792:5, 6;1794:6,18,21;1795:2, 4,13,18,21;1796:5,11; 1797:3,20;1798:17,20; 1803:11;1804:17; 1806:11,19,22;1808:9; 1812:5,16,17,18; 1815:5,8,11,22,23; 1816:1,6,20;1817:18
Maxey-Eakin (7) 1724:22,24;1725:9, 21;1755:7,14,18	meter (1) 1744:24	modeling (2) 1722:19;1773:20	mouse (1) 1768:16	multiple (3) 1721:13;1785:18; 1786:2
maximum (4) 1755:19;1765:15; 1807:2,7	method (3) 1725:1,13,14	modified (1) 1760:4	mouth (2) 1721:2;1760:12	multiply (2) 1739:3;1786:7
may (21) 1721:19;1743:15,16; 1748:23,23;1756:12; 1757:24;1758:11; 1761:13;1765:8,8; 1774:18;1775:21; 1776:2;1789:1; 1793:15;1799:9; 1808:19;1809:18; 1813:15;1818:2	methods (2) 1724:21;1725:2	modifications (1) 1760:4	move (17) 1725:24;1728:9; 1730:13,16;1733:23; 1734:5,20;1735:2; 1737:20;1738:8,18; 1740:18;1742:4; 1765:3;1772:14,16; 1799:5	must (1) 1820:6
maybe (4) 1770:22;1790:22; 1812:10;1815:16	MICHELINE (2) 1713:4;1714:3	Monday (1) 1820:7	movement (2) 1720:10;1759:18	muted (1) 1753:3
Mead (3) 1782:2,3;1796:22	Michelle (4) 1714:9;1752:7; 1757:3;1809:8	monitor (1) 1791:15	Moving (15) 1719:23;1722:15; 1723:4;1724:19; 1726:18;1728:17; 1730:9;1734:11; 1767:20;1772:10; 1773:3,12;1774:12; 1799:3,8	MVIC (1) 1798:23
Meadow (10) 1760:1;1762:9,13, 19;1763:5,15;1778:21; 1779:9;1787:15; 1789:20	microphone (1) 1759:1	monitoring (25) 1723:6,8,10,11,14, 16;1726:11,12; 1730:11;1731:3,4,13, 15;1732:12;1733:2; 1735:13;1736:23; 1737:17,18;1738:3; 1741:10;1756:18; 1763:7;1764:13; 1818:6	myself (1) 1727:8	
mean (2) 1804:12;1805:7	middle (6) 1725:6;1773:22; 1774:4;1778:7; 1784:17;1802:18	month (3) 1769:16,23;1802:9	N	
means (1) 1767:17	midway (1) 1769:22	more (38) 1721:22;1723:11; 1734:2,14;1735:24; 1738:1;1739:11,22; 1746:12;1748:13,20; 1749:7;1750:6;1766:5, 21;1770:23;1773:17; 1775:23;1778:15; 1783:8,8,9,9;1786:20; 1788:16,19;1790:8; 1791:7,9,17;1801:22; 1802:18,21;1805:10; 1808:19;1812:7; 1814:3;1817:10	name (4) 1742:8;1745:23; 1758:22,23	
meant (1) 1807:11	might (13) 1743:1;1760:21; 1762:23;1763:4,5; 1781:18;1793:16; 1801:8;1814:2; 1817:21,24;1818:3; 1820:16	MORRISON (1) 1715:18	National (4) 1715:22;1745:17; 1797:10;1814:10	
measurable (1) 1772:4	miles (6) 1723:16,17;1726:23; 1756:13;1781:24,24	morning (18) 1717:3,6,16;1718:8; 1742:8,10;1745:23; 1746:2;1750:22; 1753:22,23;1793:4,5; 1797:16,17;1806:1,2,3	NATURAL (5) 1713:2;1727:10; 1734:6,19;1823:6	
measure (1) 1817:22	mimics (1) 1768:20	Morrison (1) 1715:18	NCA (5) 1715:15;1740:20,21; 1741:8,16	
measured (3) 1770:8;1780:14; 1785:15	minimal (2) 1787:22,24	most (17) 1719:24;1721:7; 1722:17;1740:5; 1759:13;1765:18,22; 1771:5,9;1773:24; 1774:2,6;1779:12; 1783:14;1790:5; 1791:4;1810:16	NDWR's (1) 1762:11	
measurement (2) 1785:16;1804:19	minutes (8) 1741:22;1742:5; 1747:9;1753:18; 1755:6;1787:5; 1792:23;1814:20		near (4) 1720:18;1729:8; 1738:12;1764:13	
measurements (3) 1749:1;1766:4; 1785:12	mistake (1) 1786:21		nearly (1) 1812:13	
measuring (1) 1764:18	mitigate (1) 1812:21		necessary (4) 1765:7;1801:14; 1804:20;1812:22	
meetings (1) 1721:5	mitigated (4) 1813:15,16,20; 1816:7		need (20) 1721:17,21;1739:21; 1765:8;1766:5; 1769:23;1770:23; 1775:22;1781:5; 1791:9,15;1803:2; 1805:5,10;1809:1; 1813:15,16,19;1814:3, 21	
Melissa (1) 1714:7.5	mitigation (1) 1812:21		needed (3) 1750:7;1762:11; 1790:8	
members (1) 1820:4	MOA (4) 1776:8,10;1788:1,4			
memorandum (1) 1789:8	MOAPA (17) 1713:11.5; 1715:16.5,17.5; 1745:18;1749:12; 1770:8,9,18;1773:16; 1791:23;1792:7; 1797:11;1798:17; 1803:4;1813:23; 1814:11;1816:10			
mention (2) 1720:9;1733:19	model (17) 1726:24;1729:7;			
mentioned (9) 1718:10;1726:10; 1735:13;1738:22;				

<p>needs (5) 1785:22;1789:9; 1792:4;1801:1;1813:1</p> <p>neglected (1) 1805:17</p> <p>neighbors (1) 1742:13</p> <p>neither (2) 1804:6,7</p> <p>net (3) 1745:4,7;1754:15</p> <p>NEVADA (42) 1713:1,2,5,23,5; 1715:4,7,5,11,14,15,5; 1718:11,13,13,13,14; 1741:5;1745:20,24; 1751:19,24;1753:12; 1758:5,9;1759:3; 1763:20;1764:13; 1771:22;1787:12; 1792:8,12;1797:12; 1799:14;1806:17; 1814:12;1816:18; 1818:23;1819:3,9,20, 22;1823:1,5,10,17</p> <p>nevertheless (2) 1767:20;1785:22</p> <p>new (3) 1730:18;1800:24; 1818:22</p> <p>news (2) 1819:15;1821:7</p> <p>Next (12) 1721:23;1731:4,24; 1752:12;1767:6; 1778:7;1784:16; 1811:5,7,11;1820:15, 16</p> <p>Nichols (1) 1725:14</p> <p>nine (1) 1724:8</p> <p>Nobody (3) 1782:4;1783:2; 1785:23</p> <p>none (7) 1782:7,10;1785:19, 20;1814:9,10,11</p> <p>nor (2) 1788:1;1804:6</p> <p>normal (3) 1724:5;1732:9; 1733:9</p> <p>North (36) 1715:21;1719:17; 1720:4,7,14,19; 1722:18;1723:15; 1726:2,7,10,13;1728:9; 1731:14,18,18,22; 1732:3,5;1736:23; 1738:2,10;1739:10; 1740:7;1741:13; 1742:24;1750:16;</p>	<p>1752:14;1757:17; 1762:16;1763:4,7; 1764:5;1779:11; 1805:18;1816:13</p> <p>north/south (4) 1730:22;1731:17; 1732:7;1781:14</p> <p>northeast (3) 1760:10,19;1761:9</p> <p>northern (5) 1720:17,22;1743:3; 1771:8,19</p> <p>northwest (2) 1742:17,22</p> <p>notation (1) 1741:3</p> <p>note (5) 1729:16;1732:21; 1733:5;1734:15; 1806:6</p> <p>noted (3) 1776:22;1782:17; 1788:14</p> <p>notes (2) 1823:11,14</p> <p>notice (1) 1801:23</p> <p>noticeable (1) 1737:7</p> <p>November (2) 1820:7,20</p> <p>Number (20) 1720:1;1740:7; 1741:24;1743:23; 1748:19;1774:5; 1780:1,2,24;1781:19; 1783:23;1786:8; 1787:17;1801:15; 1802:7;1813:1,9,10; 1814:1;1815:14</p> <p>numbers (5) 1739:23;1743:21; 1755:14;1785:14,15</p> <p>NV (5) 1715:10,5;1758:10, 16;1770:12;1819:15</p> <p>Nye (1) 1713:23</p>	<p>observable (1) 1749:1</p> <p>observation (5) 1727:5,14;1735:5; 1754:5,5</p> <p>observations (5) 1772:24;1773:19; 1783:12;1801:12; 1805:15</p> <p>observe (4) 1766:5;1805:5; 1808:21;1814:3</p> <p>observed (3) 1727:2;1790:24; 1809:19</p> <p>obtain (1) 1721:19</p> <p>obtained (2) 1759:17;1765:10</p> <p>obvious (3) 1728:8;1737:10; 1740:10</p> <p>obviously (9) 1720:16;1727:14; 1731:1,6;1733:6,19; 1737:24;1741:7; 1752:15</p> <p>occur (5) 1740:4;1755:21; 1765:16;1807:21,21</p> <p>occurred (4) 1781:16,16;1793:14; 1795:10</p> <p>occurring (5) 1728:21;1738:11; 1778:15;1790:23; 1805:13</p> <p>occurs (5) 1772:20;1775:18; 1789:2;1791:11; 1808:19</p> <p>O'Connor (1) 1715:5</p> <p>OCTOBER (4) 1713:18,5;1717:1; 1823:8,18</p> <p>off (9) 1717:9;1719:12,16; 1721:2;1730:8; 1732:10;1743:12; 1762:10;1818:2</p> <p>offer (1) 1718:21</p> <p>offered (2) 1718:15;1782:12</p> <p>office (2) 1745:6;1773:7</p> <p>OFFICER (65) 1713:4;1714:3,5,8; 1717:3;1718:24; 1740:19,24;1741:21; 1742:3;1743:16; 1744:9,14,19;1745:14;</p>	<p>1746:21;1747:5,8; 1748:15;1749:12; 1750:16,19;1751:10, 19,23;1752:2;1753:8, 17;1755:24;1756:5; 1757:19,24;1758:3,8, 24;1759:11;1776:2,14, 21;1782:14;1787:10; 1788:3,13;1792:14,20; 1797:8;1802:5;1803:4, 16;1805:17,20; 1806:17;1807:24; 1808:2;1809:22; 1814:6,15,19;1816:10, 15,23;1818:9;1820:12, 23;1821:4,22</p> <p>Official (1) 1823:4</p> <p>old (3) 1722:6;1730:23; 1763:19</p> <p>older (1) 1734:23</p> <p>once (2) 1730:5;1732:21</p> <p>one (65) 1724:15;1725:8; 1726:12;1728:23; 1730:21;1731:24; 1734:7,14;1735:10; 1736:5,5;1738:20; 1741:2;1743:17; 1761:17;1763:14; 1766:8;1769:18; 1772:10,19,19,20,20; 1773:16,22,24; 1774:11,23;1775:16; 1776:3;1777:17,19,19; 1778:15,23;1779:10, 11,19,19;1784:11,22; 1792:18;1793:7; 1797:21,23;1799:21; 1800:7,8;1802:3; 1806:4;1808:15,20,20; 1810:18;1811:7,11,14, 16;1814:14,16,18; 1816:4;1818:16; 1820:10;1821:21</p> <p>one-to-one (6) 1777:17;1791:2; 1796:10,12;1797:1,3</p> <p>only (15) 1718:13;1728:23; 1730:24;1731:23; 1735:20;1740:2; 1752:17;1755:6; 1777:4,5;1779:24; 1795:13,18;1796:5; 1806:7</p> <p>oOo- (2) 1713:5;1717:2</p> <p>open (8) 1752:3;1753:9;</p>	<p>1756:1;1757:20; 1808:3;1816:24; 1818:10;1821:18</p> <p>operation (1) 1754:6</p> <p>opined (1) 1782:13</p> <p>opinion (16) 1748:22;1776:11; 1791:21;1793:20; 1794:9,11,24;1796:7, 24;1797:18;1809:10; 1810:10,13,18; 1811:23;1812:12</p> <p>opinions (5) 1741:4;1750:3; 1776:17;1782:13; 1792:18</p> <p>opposed (1) 1757:11</p> <p>opposing (1) 1802:22</p> <p>option (1) 1761:16</p> <p>orange (3) 1737:3;1766:12; 1772:2</p> <p>ORDER (33) 1713:16;1717:5; 1719:15;1721:6,21; 1729:17;1735:8; 1737:11,22;1738:7; 1759:18;1767:9; 1768:7,15,18;1770:16; 1780:12;1789:21; 1799:24;1801:2,3,5; 1807:15,16;1810:22; 1811:17;1812:23; 1813:4,13;1816:2; 1817:16;1819:17; 1821:8</p> <p>orders (2) 1819:24;1820:9</p> <p>original (2) 1746:24;1755:7</p> <p>originating (1) 1727:3</p> <p>Others (1) 1775:4</p> <p>out (27) 1723:24;1725:7; 1727:24;1728:4,19,20; 1734:15;1736:14; 1739:5,16;1754:12,18; 1763:21;1767:2; 1770:13;1771:21; 1774:15;1776:7; 1777:8;1779:1;1780:9; 1781:11;1783:19,21; 1784:2,6;1808:11</p> <p>outcome (1) 1721:18</p> <p>outcrop (1)</p>
---	---	--	--	--

1761:5 outflow (8) 1778:10;1783:1,10; 1790:12,18;1806:6,8, 13 outline (1) 1720:24 outlined (1) 1723:1 outside (4) 1740:19;1744:4,10; 1746:22 over (24) 1717:10;1718:12; 1723:4;1730:4;1735:4; 1736:2;1744:22; 1761:15;1766:2; 1767:6,20;1771:18; 1777:9,11;1785:5,16; 1790:1;1791:17; 1804:17;1805:2,2; 1808:13;1811:6; 1813:5 overestimates (2) 1725:16,16 overlaid (1) 1810:5 oversaw (1) 1737:5 overview (2) 1720:13,21 own (1) 1786:14 owned (1) 1763:14 owns (2) 1749:5,8	1724:5;1760:9 parcels (2) 1720:15,24 Park (4) 1715:22;1745:17; 1797:10;1814:10 part (16) 1720:17,22;1726:2; 1747:11;1751:6; 1761:5;1764:5,16; 1773:18;1780:20; 1785:4;1790:6;1797:5; 1798:10;1807:10; 1808:15 participant (1) 1721:5 participants (10) 1717:7,8,12; 1753:10,11,13;1788:5; 1818:14;1819:22; 1820:2 participated (1) 1820:4 participation (1) 1822:3 particular (6) 1778:8;1782:12; 1788:6,9;1804:13; 1819:7 particularly (2) 1746:15;1809:1 parties (4) 1763:14;1772:13; 1785:20;1789:3 party (1) 1785:20 passed (1) 1776:7 past (2) 1754:10;1780:10 Patrick (2) 1715:23.5;1803:21 Paul (2) 1715:3.5;1745:23 pay (1) 1737:3 PDF (2) 1821:9,10 PE (2) 1718:13;1749:20 Peak (3) 1724:3;1728:3; 1732:20 Pederson (1) 1763:9 penalty (1) 1748:12 per (3) 1739:3;1744:23; 1796:20 percent (3) 1721:9;1741:18; 1786:21	percolating (1) 1722:13 perennial (3) 1774:22,23;1775:3 perhaps (7) 1780:6;1783:4,19; 1787:15;1789:24; 1791:3;1802:18 perimeter (1) 1790:13 period (9) 1735:6;1754:20; 1765:24;1766:2; 1798:8;1802:24,24; 1803:2;1818:3 periodicity (2) 1769:12,16 periphery (2) 1782:23;1791:12 permission (1) 1819:22 permit (3) 1744:20;1748:16; 1788:10 pertaining (1) 1724:12 pertinent (1) 1744:18 Peterson (8) 1715:13.5;1716:7, 16;1749:16;1750:15; 1803:8,9,14 phreatophytes (4) 1734:16;1738:16,23; 1739:1 physical (1) 1738:24 pick (1) 1815:3 picks (1) 1815:20 picture (2) 1722:11;1791:3 pieces (1) 1797:23 pipeline (1) 1722:4 place (4) 1731:24;1767:20; 1775:18;1811:19 placed (1) 1789:7 plans (1) 1721:14 plant (2) 1798:6,19 play (1) 1793:19 plays (1) 1734:4 please (11) 1718:8;1719:11; 1742:11;1758:11;	1759:9;1797:24; 1801:15;1807:10,11; 1810:4,14 plenty (1) 1719:18 plot (1) 1737:3 plotted (1) 1767:22 plus (1) 1800:1 pm (1) 1820:7 point (34) 1717:10;1723:24; 1734:14;1751:11; 1753:24;1759:7,9; 1765:7;1769:8,18; 1772:23;1773:9,10; 1775:7,24;1776:22; 1779:1,11;1780:9; 1782:11;1789:4; 1793:23,24;1799:7,8; 1802:12,14,15,21,22; 1813:10;1818:6; 1819:13;1821:6 pointed (1) 1763:21 points (3) 1773:2;1776:16,20 pond (7) 1722:4;1734:10,22, 24;1735:19;1736:11, 19 ponds (4) 1734:7,7,9;1745:10 PORTION (4) 1713:8;1740:12; 1743:4;1790:18 portions (3) 1766:14;1795:1; 1796:21 posed (2) 1795:19;1806:13 position (1) 1739:24 possibility (1) 1817:5 possible (3) 1788:22;1790:17; 1796:20 possibly (1) 1750:13 post (1) 1768:18 postulated (1) 1800:15 potential (3) 1739:9;1763:11; 1808:8 potentially (2) 1721:16;1739:5 potentiometric (1)	1726:5 power (12) 1751:11;1753:24; 1759:7,9;1782:11; 1798:6,6,13,19;1815:8; 1819:13;1821:6 preceded (1) 1721:5 precip (1) 1809:12 precipitation (8) 1725:11;1771:3,24; 1772:1,7;1780:17; 1809:18,19 precipitously (2) 1730:6;1743:12 pre-development (1) 1770:21 preparation (1) 1759:6 prepare (1) 1719:8 prepared (1) 1812:21 preparing (1) 1719:5 pre-pumping (1) 1807:17 present (8) 1727:14;1728:10; 1753:6;1798:23; 1821:20,21,23;1823:9 presentation (19) 1717:12;1719:8,13, 24;1723:6;1724:3; 1725:4;1744:4;1751:2, 15;1758:6;1804:12; 1807:1,5;1810:5,15; 1811:15;1812:11; 1818:13 presentations (7) 1717:7;1751:3,11; 1753:2;1819:12,13; 1821:6 presented (5) 1724:9,13;1740:11; 1809:15,17 presenting (1) 1759:15 pretty (11) 1719:19;1723:2,9; 1725:19;1737:2; 1738:7;1739:3; 1756:16;1760:17; 1766:21;1767:21 previous (7) 1737:22;1757:4; 1768:17;1771:22; 1778:20;1806:9; 1809:15 primary (2) 1770:6;1784:2 prior (6)
P				
Pacific (5) 1750:21,24;1805:21; 1806:1;1816:17 PAGE (8) 1716:2;1743:21; 1755:5;1757:5; 1787:12,21;1799:22; 1815:21 Pages (3) 1713:17.5;1820:2; 1823:13 Pahrnagat (6) 1720:18,19;1731:18, 22;1771:7,10 Paiute (2) 1745:18;1797:11 Paiutes (1) 1715:16.5 pane (1) 1801:20 panel (2) 1801:24;1811:5 parallel (2)				

1768:14;1793:21; 1794:8,10,14;1795:10 priority (1) 1721:8 PRISM (1) 1725:11 probably (7) 1735:22;1738:4; 1755:6,14;1762:20; 1789:3,8 proceed (2) 1717:6,13 proceeding (5) 1718:16,22;1719:9; 1748:12;1821:18 PROCEEDINGS (10) 1713:14;1751:7,14; 1818:14,19,20;1819:9; 1820:5;1821:5;1822:2 processes (1) 1728:20 producing (1) 1722:8 production (2) 1754:18;1761:6 Professional (1) 1714:9.5 proffered (2) 1776:17;1818:17 profile (6) 1730:20;1731:5,17, 24;1733:21;1734:1 prohibitive (1) 1808:17 project (3) 1719:22;1721:15; 1820:20 projects (1) 1718:14 proof (2) 1722:4,13 properly (1) 1789:7 properties (1) 1743:5 property (5) 1726:20;1742:15,17, 24;1743:4 proposed (6) 1773:10;1775:5; 1799:7;1800:7; 1819:24;1820:9 pros (3) 1759:24;1761:20; 1789:11 protect (1) 1791:23 protected (2) 1775:8;1817:7 prove (1) 1764:20 provided (2) 1730:18;1819:13	provisional (1) 1788:17 PUBLIC (11) 1713:15;1717:14; 1820:3,4,6;1821:15,18, 20,23;1823:11,14 publically (2) 1722:20;1730:19 published (1) 1726:4 pulling (2) 1739:5,16 pump (13) 1737:22;1738:7; 1745:5;1748:5; 1763:16;1791:4; 1800:4;1807:7;1809:3; 1812:20,20;1813:18; 1817:15 pumpage (8) 1720:3,4;1743:23; 1744:6,16;1754:11; 1784:4;1813:8 pumped (9) 1744:24;1745:9; 1754:3;1759:21; 1774:18;1775:2; 1777:7;1813:11,22 pumping (136) 1720:7;1721:10; 1722:21;1735:4; 1736:3,17;1737:11; 1739:10,11,15;1740:7, 12;1741:9,14;1744:22; 1754:4,12,23;1755:21; 1762:5;1764:13,19; 1766:12,17,22; 1767:18,18,19;1768:5, 14,14;1770:12; 1772:15,18,21;1773:1, 2,8,9,13,17,24;1774:2, 4,6,7,19;1775:10,19, 21;1776:10,11,12,13; 1777:6;1783:14; 1786:4,19;1787:2,14, 21;1788:20,23;1789:2, 5,23;1790:5,7,9; 1791:6,7,11,13,16; 1793:12,13,16,16,21; 1794:4,5,6,9,15,17,18, 21;1795:1,11,13,18,21, 22;1796:3,8,10;1797:1, 2;1798:7,12,19;1799:6, 9,10;1801:5,6; 1803:12;1805:14; 1806:7,9,13;1807:15; 1812:2,3,4,10,13,15, 16;1813:12,16;1815:6, 8,9,11,12,13,23,24; 1816:2;1817:14,16,17, 20,23;1818:7 pup (1) 1792:2	purely (1) 1719:21 purpose (1) 1823:10 purposes (2) 1751:14;1788:9 put (15) 1725:10;1726:3; 1727:4;1728:5;1734:6, 7;1735:19;1738:4; 1741:18;1756:16; 1789:14;1790:15; 1791:2;1818:5,5	ratio (1) 1786:14 ratios (1) 1786:12 reach (1) 1789:5 reached (10) 1765:16,23;1775:21; 1788:22,23;1794:14; 1795:13;1796:3; 1807:2,8 reaching (3) 1736:16;1766:6; 1805:1 read (5) 1743:22;1776:7; 1777:23;1793:24; 1810:19 readings (2) 1736:10;1744:24 ready (1) 1820:21 Real (5) 1722:12,20;1770:10; 1784:22;1789:9 really (25) 1719:22;1721:16; 1731:20;1763:12; 1764:18,24;1766:6,17, 22;1775:3;1777:4; 1779:6;1780:6;1781:2; 1787:3;1788:19; 1798:14;1801:9; 1803:24;1810:12,13, 24;1811:16,20;1813:2 reason (16) 1719:20;1721:6; 1725:9;1727:6,11,12; 1728:4;1729:20; 1730:5,7;1735:17,18; 1748:18;1782:24; 1798:11;1811:23 reasonable (1) 1725:22 reasons (3) 1727:3;1735:9; 1769:12 rebut (1) 1787:13 rebuttal (16) 1719:13,14;1720:1; 1739:24;1740:21; 1741:9;1742:1;1747:4; 1748:10;1759:4; 1761:23;1776:9,18; 1787:9;1793:7;1795:8 recall (4) 1753:1;1796:22; 1810:20;1815:11 received (1) 1820:6 recent (2) 1797:20;1815:7	recharge (49) 1724:11,12,14,17,21, 24;1725:1,13,16; 1726:24;1728:6,22,22; 1729:7;1730:1; 1731:22;1732:4; 1735:11;1736:15; 1739:7;1742:12; 1743:8;1747:12,13,17; 1748:20,23;1754:11; 1755:7,8,11,20; 1760:20;1761:8,14; 1766:20;1767:4,18; 1768:5,15;1770:13; 1778:11;1779:4,14; 1780:13,16,17; 1781:11;1799:24 recharging (2) 1733:6;1740:13 recognize (1) 1801:20 recognized (1) 1762:19 recommend (1) 1764:18 recommendation (1) 1719:21 recommendations (1) 1806:5 recommending (1) 1764:23 Recon (1) 1779:4 reconvene (1) 1758:5 record (20) 1733:8;1735:6; 1736:4;1741:23,24; 1742:19;1751:6,13; 1752:7;1756:3;1757:3; 1758:22;1769:14; 1770:23;1786:2; 1793:3;1802:24; 1803:2;1809:8;1810:3 recording (1) 1821:9 recordings (1) 1821:11 recover (2) 1807:8,16 recovered (3) 1766:20;1767:5; 1770:16 recovering (1) 1770:17 recovery (15) 1765:12,16;1767:5, 10;1768:5,8;1789:21; 1791:14;1801:6; 1802:13;1807:2,7,18, 21;1810:22 recross (2) 1814:7,8
		Q		
		qualification (1) 1818:20 qualified (2) 1718:18;1818:19 qualify (2) 1718:21;1804:20 quantity (3) 1749:5;1774:17; 1796:16 quartzite (1) 1727:23 Quick (2) 1720:13;1806:4 quickly (4) 1772:19;1784:10,22; 1801:16 quite (4) 1766:1;1768:6; 1775:9;1780:2		
		R		
		ran (1) 1760:9 Ranch (1) 1722:6 Range (18) 1722:13;1725:19; 1727:3;1728:18; 1729:8;1730:1; 1732:19;1735:17; 1739:1,3;1742:12; 1743:8;1747:12; 1748:23;1755:13; 1760:14;1786:13; 1810:6 range-fed (1) 1760:23 ranges (1) 1724:12 rate (3) 1722:14;1791:6; 1812:10 rates (1) 1787:21 rather (2) 1753:3,11		

recycled (1) 1745:10	1784:10;1815:17; 1817:18	represent (4) 1723:6;1745:24; 1770:2;1778:5	review (1) 1741:16	17,21,22;1784:1,3,3,5, 23;1785:1,3,4;1786:6, 11,19;1787:15,23;
recycling (1) 1735:22	relevant (1) 1748:7	representing (2) 1717:17;1803:10	Richard (4) 1715:16.5;1716:12; 1758:14,23	1788:1;1789:13,16,24; 1790:3,9,10,16,19,22, 24;1791:14;1792:5,6; 1793:13;1794:6,18,21; 1795:1,2,4,14,18,21, 23;1796:2,5,11;1797:2, 3,20;1798:11,17,20; 1799:23;1803:11; 1804:17;1806:10,11; 1808:9,11;1810:16; 1812:6,16,17,18,19,24; 1813:8,18;1815:5,8,11, 22,23;1816:1,6; 1817:18;1818:24; 1819:16
red (8) 1730:2;1733:17; 1743:7;1777:8; 1781:22,23,24;1798:2	reliable (1) 1755:11	represents (2) 1768:24;1769:11	right (52) 1722:10;1723:1,17, 23;1725:20;1726:11, 12,15,16,18;1728:18; 1730:13;1731:4; 1734:15,24;1736:22; 1737:1,19,23;1742:20, 24;1743:2,7;1747:9; 1752:11,13;1753:8; 1755:2,9,10;1756:19; 1757:19;1758:3; 1762:4;1765:2;1769:5; 1773:23;1776:13; 1778:2;1783:20; 1786:13;1787:3; 1792:21;1798:3,8; 1799:6;1800:24; 1809:2;1814:4; 1815:10;1816:9; 1818:12	1799:2;1808:7
redirect (5) 1741:20;1757:20; 1758:2;1818:10,11	rely (1) 1747:24	Republic (5) 1750:21,24;1805:21, 24;1816:17	rights (32) 1718:16,23;1720:10; 1721:7,12;1740:1,3,5; 1744:7,12;1749:5; 1762:23;1763:15,18, 19;1772:10,12,18; 1773:3,5,10,14; 1774:14;1775:2,7; 1799:3,9,10,15; 1813:13,14;1816:6	1799:23;1803:11; 1804:17;1806:10,11; 1808:9,11;1810:16; 1812:6,16,17,18,19,24; 1813:8,18;1815:5,8,11, 22,23;1816:1,6; 1817:18;1818:24; 1819:16
redo (1) 1759:1	relying (2) 1747:22;1799:22	request (3) 1792:12,17;1820:22	Robison (12) 1715:6,7;1716:5; 1742:7,9;1743:14,18; 1744:5,14,15,21; 1745:12	
reduced (1) 1774:5	remainder (1) 1741:20	requests (1) 1819:19	Robison's (1) 1798:23	
reduction (2) 1798:12,18	remember (5) 1727:24;1734:8; 1740:4;1750:7; 1801:17	required (2) 1801:3;1808:17	rock (3) 1748:21;1781:14,17	
reference (1) 1724:2	reminder (1) 1732:14	requirements (1) 1723:12	rocks (12) 1727:22,23;1728:7, 15;1760:20,21;1764:2, 2,3,22;1782:23; 1790:15	
referring (2) 1728:12;1806:4	remnants (1) 1722:3	requires (1) 1749:8	Rogers (3) 1779:11,22,23	
reflecting (2) 1743:7;1815:23	remotely (1) 1776:15	research (1) 1810:13	role (2) 1734:4;1793:19	
regard (2) 1744:17;1748:8	removed (1) 1819:4	reserve (1) 1741:20	room (3) 1775:24;1788:19; 1791:18	
regarding (4) 1717:4;1797:18; 1799:2;1808:7	Reno (4) 1715:7.5,11,15.5; 1823:17	residual (2) 1734:18;1738:12	rose (3) 1735:8;1738:3,6	
regime (5) 1775:21;1790:5; 1791:16;1805:14; 1817:14	rephrase (2) 1747:6;1804:23	resolved (1) 1719:1	rough (3) 1738:14,16;1739:7	
region (2) 1770:12;1817:8	replace (1) 1819:3	RESOURCES (13) 1713:2,3;1721:20; 1752:4;1756:1;1778:3; 1792:10;1808:4; 1817:1;1819:2,6; 1823:6,6	roughly (1) 1805:3	
regional (9) 1730:12;1748:23; 1761:11;1794:3; 1807:15,17,18,20,22	replicate (1) 1801:9	respect (2) 1782:13;1795:2	Rowley (4) 1724:1;1726:19; 1729:10;1760:4	
regression (7) 1784:24;1785:13,19; 1786:2,5,10,22	replied (1) 1819:1	respond (1) 1736:15	rule (1) 1736:14	
reincorporated (1) 1736:1	report (47) 1719:5,13,14,15; 1720:1;1724:10,20; 1738:21;1739:24; 1740:20,21;1741:9,15, 18;1742:1;1747:4; 1748:10;1749:20,22; 1750:3;1759:4; 1761:23;1770:7; 1776:9,18;1779:17; 1780:10;1782:7,8,9,10, 11,13,17;1784:21; 1787:9,12,18,19; 1788:5;1789:14; 1793:7,8;1795:8; 1796:19;1812:9; 1815:19	responded (4) 1735:14;1736:1; 1762:4;1784:10	rules (1) 1783:18	
rejected (1) 1800:8	REPORTED (1) 1713:21	response (8) 1737:7,10,10,13,24; 1746:11;1753:3; 1810:8	Ruling (1) 1819:2	
relate (1) 1796:7	Reporter (1) 1823:5	responses (2) 1722:21;1757:16	rulings (1) 1819:7	
related (2) 1741:4;1776:12	REPORTERS (2) 1713:21,21.5	rest (2) 1722:17;1764:14		
relates (1) 1765:12	reporting (1) 1823:10	result (5) 1733:3;1736:17; 1773:21;1787:22; 1788:21		
relating (3) 1744:12;1747:1; 1819:7	reports (3) 1741:4;1749:21; 1751:5	resulted (1) 1798:19		
relationships (1) 1774:19		resulting (1) 1790:18		
relative (5) 1720:22;1726:20; 1742:14;1763:19; 1794:17		results (1) 1745:6		
relatively (7) 1728:24;1732:2; 1734:12;1736:2;		retained (2) 1751:13;1759:3		
		reverse (1) 1817:17		

S

safe (1)
1775:5
salt (1)
1738:12

<p>same (30) 1726:1;1728:20; 1732:14;1735:16; 1736:16,21;1737:20; 1740:11;1747:22; 1748:2;1755:12; 1757:5;1763:24; 1766:2;1767:23; 1768:9,18;1769:8,16, 23;1770:24;1773:8; 1779:8,19,20;1792:5; 1802:9;1811:16,22; 1821:6</p> <p>saw (6) 1727:11;1732:6; 1741:8;1745:2;1785:6; 1811:2</p> <p>saying (5) 1768:24;1769:11; 1805:1,10,12</p> <p>scale (4) 1748:22;1781:23,23; 1810:24</p> <p>scaled (2) 1768:2,2</p> <p>scales (1) 1811:2</p> <p>scary (1) 1811:8</p> <p>Schreck (1) 1715:8.5</p> <p>scope (8) 1744:4,10;1746:22; 1747:4;1748:9; 1776:17;1782:16; 1787:8</p> <p>screen (2) 1769:6;1815:3</p> <p>scroll (1) 1793:9</p> <p>sea (2) 1782:3,4</p> <p>season (1) 1809:18</p> <p>seat (1) 1721:17</p> <p>second (4) 1725:14;1731:5; 1748:6;1802:20</p> <p>secondary (1) 1754:11</p> <p>Section (13) 1714:8,11;1726:20, 21,23,23;1727:20; 1728:9,17;1771:17; 1781:14;1782:9; 1798:2</p> <p>sedimentary (4) 1727:21,23;1728:14; 1764:2</p> <p>Seeing (28) 1745:15,17;1749:13; 1751:20,23;1753:1,15;</p>	<p>1768:23;1784:4,5,6,7, 11,12,15;1797:9,10; 1803:5;1804:14,15,16; 1806:18;1808:2; 1814:8,9;1816:11,18; 1821:23</p> <p>seeking (1) 1819:22</p> <p>seems (1) 1725:21</p> <p>segment (7) 1766:16;1768:9,14, 16,17;1769:17; 1781:13</p> <p>segments (9) 1766:14,15;1767:15, 21,24;1768:1,12; 1778:21,24</p> <p>Senior (13) 1714:12.5;1721:7; 1740:1,3,5;1772:12,17; 1773:5,14;1774:13; 1775:2,7;1813:13</p> <p>sense (3) 1802:1;1817:5,9</p> <p>sentence (1) 1807:10</p> <p>separate (5) 1746:4;1764:19; 1800:6;1811:17,20</p> <p>serves (1) 1819:3</p> <p>Service (9) 1715:22;1745:15,17; 1787:14;1791:21; 1797:9,10;1814:9,10</p> <p>SESSION (2) 1713:17.5;1717:1</p> <p>set (1) 1802:15</p> <p>sets (2) 1725:6;1736:5</p> <p>settled (1) 1727:12</p> <p>seven (8) 1722:15;1728:5; 1742:5;1784:4; 1787:12;1792:23; 1812:10;1815:24</p> <p>several (3) 1724:2;1775:13; 1815:16</p> <p>shale (1) 1727:24</p> <p>shallow (6) 1727:13;1734:17,18; 1738:23;1739:2; 1754:5</p> <p>share (1) 1764:10</p> <p>shared (1) 1762:3</p> <p>Sharp (5)</p>	<p>1715:6;1729:19; 1730:7;1732:22; 1735:23</p> <p>shear (4) 1731:18;1760:2; 1763:24;1764:24</p> <p>Sheep (11) 1722:13;1727:3; 1728:18;1729:8; 1730:1;1732:19; 1735:17;1742:12; 1743:7;1747:12; 1748:23</p> <p>sheet (1) 1819:11</p> <p>sheets (1) 1819:8</p> <p>shelf (7) 1727:24;1728:3,7,9, 11,19,20</p> <p>shift (2) 1754:22;1796:15</p> <p>short (5) 1730:4;1769:14; 1770:23;1802:24; 1813:13</p> <p>Shorthand (1) 1713:21.5</p> <p>shot (1) 1769:6</p> <p>show (5) 1731:11,24;1743:14; 1778:5;1809:9</p> <p>showed (8) 1734:10;1753:3; 1760:11;1762:12; 1769:9;1771:23; 1785:2;1800:20</p> <p>showing (14) 1724:21;1734:13; 1737:21;1742:12; 1745:6;1757:13; 1777:21;1778:14; 1783:20,20;1790:20, 21;1801:22,24</p> <p>shown (12) 1724:20;1726:16; 1727:14,21;1728:13, 14;1737:23;1753:2; 1764:12;1769:20; 1795:9;1799:22</p> <p>shows (15) 1760:5;1764:1,15; 1770:7;1771:21; 1777:3,23;1778:21; 1780:4;1784:1;1786:3, 5;1793:12;1813:5,12</p> <p>side (19) 1723:22;1728:2; 1730:6;1731:8;1734:3, 13;1736:14;1737:1,9, 13,14,17,18;1756:14; 1757:10,12,12,16;</p>	<p>1779:3</p> <p>sides (2) 1731:14;1760:24</p> <p>sign (4) 1741:15;1749:24; 1750:2,4</p> <p>signal (4) 1768:14;1772:5,6; 1789:6</p> <p>signals (2) 1771:2,3</p> <p>signed (1) 1749:21</p> <p>significant (6) 1740:12;1766:17; 1780:6;1787:23,24; 1788:20</p> <p>significantly (2) 1798:7;1815:6</p> <p>sign-in (2) 1819:8,11</p> <p>signing (1) 1749:20</p> <p>similar (4) 1753:3;1757:16; 1771:23;1812:11</p> <p>similarly (1) 1757:11</p> <p>similarly-situated (1) 1820:24</p> <p>simple (5) 1730:20;1731:20; 1734:1;1748:13,14</p> <p>simply (9) 1726:9;1736:16; 1751:8;1768:16,18; 1770:8;1786:7; 1808:16,21</p> <p>Simulation (8) 1773:21,22,24; 1774:4,5,11,11,11</p> <p>simulations (4) 1772:24;1773:21; 1774:9,12</p> <p>site (19) 1723:10;1729:4,18; 1730:11,24;1731:1; 1732:8,10,21;1733:2; 1734:1,3,11;1735:3; 1736:14,21;1738:13; 1752:14;1756:16</p> <p>sites (1) 1817:10</p> <p>sitting (2) 1728:4,6</p> <p>situated (2) 1720:17;1721:16</p> <p>situation (1) 1792:5</p> <p>six (2) 1721:23;1765:14</p> <p>slide (66) 1719:12;1720:13,21;</p>	<p>1721:3,23,23;1722:15, 23;1724:8,19;1725:23, 24;1726:18;1728:17; 1729:12,13,24;1730:9, 16;1731:16;1732:14, 17;1733:9,23;1734:20; 1735:2;1736:20; 1737:20,22;1738:8,18; 1739:20;1742:11; 1752:8,9,12,21; 1753:24;1757:4,8; 1763:2;1764:5,6; 1776:5,16,20;1782:12, 15,16;1793:10,23; 1797:24;1799:20,22; 1801:15;1802:4,7; 1806:5,9;1807:1,6,12; 1809:8;1810:4,14,19</p> <p>slides (3) 1727:4;1751:4; 1776:23</p> <p>slip (1) 1732:24</p> <p>slope (2) 1786:6,7</p> <p>small (2) 1772:23;1810:24</p> <p>smaller (1) 1798:3</p> <p>SNWA (16) 1715:3;1719:22; 1731:13;1733:2; 1736:22;1737:5; 1760:3;1769:7; 1771:23;1780:13; 1787:13;1791:3; 1799:21;1800:7,15; 1814:1</p> <p>SNWA's (8) 1769:6;1770:5; 1780:10;1784:21; 1785:18;1791:8; 1792:16;1793:17</p> <p>so-called (1) 1810:11</p> <p>soil (1) 1734:16</p> <p>soils (1) 1734:15</p> <p>solely (1) 1747:1</p> <p>solicit (1) 1820:9</p> <p>solver (4) 1818:24;1819:1,5,5</p> <p>somebody (1) 1764:20</p> <p>someone (2) 1727:8;1765:2</p> <p>somewhat (1) 1803:1</p> <p>somewhere (4) 1722:9;1783:23;</p>
---	---	---	---	---

<p>1786:21;1818:6 soon (2) 1739:15;1820:16 Sorry (6) 1729:13;1737:22; 1793:22,24;1810:8; 1813:2 sounds (1) 1820:16 source (3) 1722:22;1750:10; 1777:4 sources (1) 1730:19 south (24) 1723:17;1726:23; 1728:2,21;1731:2,14; 1732:4,5,10,11; 1733:24;1738:9,10; 1756:14;1762:6,16,20; 1763:4;1774:7; 1779:24;1780:21,22; 1781:20;1800:21 southeast (2) 1764:8;1779:12 Southern (7) 1745:19,24;1753:12; 1790:13;1797:12; 1814:12;1819:20 southward (1) 1761:11 southwest (7) 1760:10,12,19; 1761:5,9;1764:6; 1779:13 SPEAKER (1) 1740:23 specific (3) 1744:11,12;1809:13 Specifically (6) 1720:17,23;1741:13; 1749:1;1788:4;1815:7 specifics (1) 1722:16 spell (1) 1758:21 spend (6) 1719:17,23;1722:17; 1723:2;1739:22; 1741:11 spending (1) 1820:21 spread (1) 1781:11 SPRING (54) 1713:7.5;1719:17; 1720:4,8,11,16,22; 1721:9;1722:18,24; 1724:17;1726:2; 1727:9;1731:19; 1733:24;1738:9; 1740:8;1741:13; 1753:6;1757:17;</p>	<p>1760:5,13;1761:9,10; 1762:14;1763:9; 1765:12,19,21;1766:3; 1770:4;1771:9,11; 1774:1;1775:10,20; 1784:14;1786:6; 1787:17;1788:16; 1790:24;1791:14; 1792:22;1793:21; 1794:16,18;1795:12; 1800:19,21;1803:12, 12;1810:21;1811:3; 1812:6 SPRINGS (98) 1713:11;1720:3,6, 19;1721:2;1724:6; 1729:3,3;1731:14; 1732:24,24;1733:7,10, 11;1736:23;1737:9; 1740:2,9;1741:10; 1742:5;1743:23; 1760:1,6,17,24;1761:2, 5,12,15,20;1762:15; 1763:8,10;1766:2,7; 1767:23;1768:9; 1774:1,20;1775:22; 1777:2,15;1780:21,22; 1784:1,23;1785:3,10; 1786:9,11,17;1787:15, 16,18,23,24;1788:19; 1789:14,15,18,24; 1790:3;1791:5,17,24; 1792:6,6;1794:6,18,21; 1795:2,4,14,19,21; 1796:5,11,11;1797:3,4; 1804:13,15;1808:9; 1809:3;1810:6;1812:6, 16,17;1814:7;1815:5,9, 12;1817:12,18,23; 1818:1,7;1819:21 square (1) 1806:8 ss (1) 1823:1.5 stabilized (1) 1790:4 stable (1) 1736:2 staff (8) 1752:4;1756:2; 1759:11;1767:12; 1769:24;1773:7; 1808:4;1817:1 stage (1) 1801:12 stakeholders (2) 1719:19;1740:11 standard (4) 1799:2,5,13,14 start (10) 1717:9;1719:12; 1733:20;1739:16,17; 1759:22;1769:15,23;</p>	<p>1778:1;1821:19 started (5) 1717:11;1730:22; 1731:17;1741:3; 1808:11 starting (2) 1732:21;1792:22 starts (5) 1732:10,15;1769:17; 1777:24;1794:1 STATE (67) 1713:1;1714:5,6,5; 1718:18;1743:15,18; 1744:21;1745:5; 1751:14,16;1752:3; 1756:2;1758:21; 1759:11;1762:17; 1763:16;1764:1; 1765:23;1766:3; 1768:13;1770:22; 1771:22;1773:7; 1774:22;1778:19; 1780:18;1781:10; 1782:18;1787:1,12; 1788:7,11;1789:15; 1792:8,10;1794:10,13; 1795:12;1796:3; 1800:8,17;1801:1; 1803:23;1804:4,20,24; 1805:2,3,8,13;1808:4, 12;1812:14;1816:5; 1818:23;1819:2,3,10, 14,23;1820:1,3,6,8,18, 1823:1,5 stated (3) 1787:18;1788:6; 1795:17 statement (7) 1796:19,24;1799:1, 11;1807:11;1815:19; 1820:5 statements (5) 1793:18;1819:23; 1820:2;1821:13,16 States (2) 1745:15;1797:8 state's (2) 1791:20,22 Staying (1) 1729:24 steady (27) 1765:23;1766:3,4; 1767:19;1768:13; 1770:22;1777:10; 1790:6;1794:10,13; 1795:12;1796:3; 1803:23;1804:4,6,19, 20,24;1805:2,3,8,9,13; 1812:14;1815:15,18; 1816:5 steep (1) 1767:8 steeper (2)</p>	<p>1733:3;1767:2 stenotype (2) 1823:10,14 Steve (2) 1715:19;1806:22 still (18) 1725:18;1728:10; 1753:9;1757:5;1763:9; 1775:8;1780:6;1783:7; 1784:13,14,19,19; 1785:22;1806:2; 1811:10,21,23;1817:13 stock (1) 1730:23 stopped (2) 1726:6;1727:11 storage (16) 1734:6,7,9,10,24; 1735:19;1736:19; 1739:5,16;1777:8,9,23; 1783:7,9;1784:14,20 stores (1) 1734:22 storms (1) 1809:13 story (1) 1770:24 straight (1) 1770:13 stream (3) 1791:13;1801:23,24 stress (2) 1801:5;1815:6 stresses (1) 1791:18 strictly (1) 1806:12 strike (1) 1732:24 strike-slip (3) 1733:10,11;1761:2 structure (3) 1753:5;1760:14; 1781:15 structures (1) 1760:23 studies (1) 1808:16 subflow (3) 1796:17;1799:19; 1800:16 submission (1) 1821:13 submitted (3) 1751:11;1778:19; 1782:17 subsequent (1) 1765:11 subsurface (12) 1775:16;1778:10,17; 1781:16;1783:1,9; 1790:12,17;1806:6,8, 13;1808:11</p>	<p>succinct (2) 1759:14;1760:15 sufficient (1) 1749:4 suggest (1) 1761:23 suggested (1) 1763:4 suggesting (2) 1761:17;1783:19 suggests (1) 1814:2 Suite (1) 1713:23 Sullivan (7) 1714:6;1716:20,24; 1808:6;1809:5;1817:3; 1818:8 sum (1) 1778:12 summarize (1) 1776:14 summary (3) 1739:19;1789:11; 1806:5 superimpose (1) 1807:18 Supervising (1) 1714:9.5 Supervisor (1) 1714:14 supplies (1) 1771:5 supply (2) 1750:9,11 support (9) 1719:20;1741:17; 1749:1;1773:20; 1774:12;1780:21; 1781:18;1796:13,24 supports (2) 1770:21;1808:23 sure (9) 1741:23;1752:8; 1757:5,6;1770:24; 1775:23;1788:24; 1790:8;1791:10 surface (8) 1729:8;1732:9; 1733:21;1734:15; 1738:12,24;1759:23; 1765:22 survey (2) 1760:9,11 surveys (1) 1760:9 sustainable (1) 1750:11 swear (1) 1717:18 sworn (5) 1717:20;1718:3; 1758:11,12,16</p>
--	--	--	---	---

<p>Sylvia (2) 1750:23;1805:24</p> <p>symbol (1) 1762:15</p> <p>symbology (1) 1801:21</p> <p>SYSTEM (82) 1713:7;1717:5; 1719:17;1734:5; 1736:1;1739:21; 1746:3;1747:13,23,24, 24;1748:24;1749:4,8; 1754:12;1756:11; 1759:17,21,24; 1761:19,22;1762:2,7; 1763:20;1764:16,20, 23;1765:6;1766:6; 1767:16;1770:11,14; 1771:3,6;1772:7,8; 1774:18,24;1775:5; 1777:15;1778:5,18; 1779:2;1780:18; 1781:12,21;1782:1,2, 24;1783:8,17;1784:10; 1787:15;1789:13,16; 1790:10,14,16; 1791:18;1793:13; 1795:2,23;1796:2,10, 16,20;1797:2,18; 1798:7;1799:24; 1801:9,12;1804:24; 1805:1,5;1806:11; 1808:12;1809:2; 1810:16;1814:3; 1818:24;1819:16</p> <p>systems (1) 1759:23</p>	<p>1765:15;1766:15,15; 1771:1;1775:8;1776:1; 1812:9</p> <p>talked (5) 1735:12;1747:16; 1748:18;1776:9; 1816:1</p> <p>talking (10) 1719:24;1723:21; 1740:5,6;1742:20; 1744:5;1752:9; 1773:14,17;1799:18</p> <p>tan (1) 1764:2</p> <p>Technologies (1) 1806:1</p> <p>telling (4) 1768:11;1770:24; 1783:4;1791:1</p> <p>tells (2) 1769:2;1783:13</p> <p>ten (7) 1724:19;1735:8; 1755:5,12;1764:6; 1766:23;1819:9</p> <p>ten-minute (1) 1758:4</p> <p>term (2) 1769:2;1804:10</p> <p>terminated (2) 1726:14;1731:2</p> <p>terms (8) 1720:14;1738:5,18; 1761:20;1788:5; 1804:1;1809:19; 1812:15</p> <p>terrain (1) 1765:1</p> <p>test (28) 1737:6,22;1738:4,7; 1748:5;1759:18; 1762:4;1765:11,11,13, 17;1767:9;1768:8,18, 22;1769:5;1770:16; 1789:22;1800:4; 1801:6,6;1807:7,16,16; 1810:23;1811:17,20; 1817:16</p> <p>testified (5) 1718:4;1744:16; 1758:17;1781:7; 1802:7</p> <p>testifying (1) 1788:6</p> <p>testimony (19) 1724:23;1733:10; 1744:18;1746:15,24; 1747:1,3,12;1748:10; 1751:5,15;1752:10; 1782:12,16,19; 1788:10;1798:23; 1801:16;1817:4</p> <p>TH-2 (5)</p>	<p>1784:17;1811:7,7,9; 1817:9</p> <p>theme (1) 1730:1</p> <p>theory (1) 1740:4</p> <p>Therese (3) 1715:20,21;1717:17</p> <p>thickness (1) 1781:4</p> <p>third (2) 1772:9,10</p> <p>though (2) 1736:3;1799:13</p> <p>thought (5) 1721:3;1749:20; 1766:19;1781:15; 1803:24</p> <p>thoughts (1) 1817:10</p> <p>thousand (2) 1720:18;1779:9</p> <p>three (25) 1720:13,15,24; 1724:15;1735:15; 1738:20;1739:23; 1740:7;1755:6; 1765:17;1773:21,22; 1774:6,11;1778:1,23; 1779:10,12;1789:22; 1795:8;1804:17,22,23; 1805:2,15</p> <p>thriving (2) 1721:14,21</p> <p>throughout (6) 1723:5;1724:2; 1726:5;1735:10; 1752:16;1817:8</p> <p>Thrust (7) 1724:3,6;1728:3; 1732:20;1733:7,13; 1764:9</p> <p>tie (2) 1725:22;1730:12</p> <p>tied (1) 1765:22</p> <p>ties (1) 1721:24</p> <p>Tim (2) 1714:4.5;1715:5</p> <p>times (3) 1724:3;1755:12; 1786:7</p> <p>titled (1) 1821:9</p> <p>today (10) 1717:17;1719:24; 1722:5;1723:19; 1727:13;1748:10; 1750:3;1798:2; 1807:14;1820:8</p> <p>today's (2) 1719:9;1819:11</p>	<p>toe (1) 1734:11</p> <p>together (1) 1765:15</p> <p>Tom (1) 1786:14</p> <p>took (9) 1724:13;1725:20; 1726:9;1754:17; 1766:13;1768:12,13, 16;1793:16</p> <p>top (10) 1760:6;1767:23; 1777:24;1778:3,13; 1781:22;1784:14,15; 1801:24;1811:19</p> <p>topic (1) 1800:24</p> <p>topographic (1) 1734:3</p> <p>total (11) 1754:16;1759:20; 1766:3;1778:3,13; 1780:1;1812:12,23; 1813:1,5,9</p> <p>totality (1) 1782:19</p> <p>totalling (2) 1720:16,24</p> <p>totally (1) 1772:20</p> <p>totals (1) 1809:12</p> <p>touch (3) 1776:6;1780:8; 1784:22</p> <p>touched (1) 1746:16</p> <p>towards (2) 1761:12;1798:3</p> <p>tracks (1) 1764:14</p> <p>TRANSCRIPT (2) 1713:14;1823:12</p> <p>transcription (1) 1823:14</p> <p>transcripts (2) 1820:11,13</p> <p>transfers (2) 1740:1,4</p> <p>translate (1) 1786:17</p> <p>transmissivity (6) 1732:2;1781:1,4,9; 1800:13,16</p> <p>trees (2) 1722:9,9</p> <p>trend (12) 1769:7,22;1770:1,2; 1783:12;1802:8,10,14, 23;1807:13,18,20</p> <p>trending (1) 1757:11</p>	<p>tried (4) 1779:16;1785:20,21, 23</p> <p>trigger (16) 1776:8,10;1788:2,4, 21,23;1789:1,4,5,6; 1791:5,24;1817:5,6,13; 1818:6</p> <p>triggers (2) 1817:11,22</p> <p>true (6) 1743:8;1755:21; 1799:13;1810:6; 1817:17;1823:13</p> <p>try (7) 1731:10;1759:14; 1780:12;1784:24; 1801:8,11;1814:4</p> <p>trying (3) 1757:9,9;1804:9</p> <p>tunnel (1) 1722:3</p> <p>turn (3) 1717:10;1797:24; 1801:15</p> <p>turning (5) 1718:8;1719:4,12; 1743:21;1818:2</p> <p>two (37) 1717:7;1719:12; 1720:1;1724:15; 1725:2,6;1730:20; 1731:13;1732:11; 1734:7;1735:9,15; 1736:5,18;1738:20; 1739:23;1755:16; 1760:8;1765:16; 1771:13,15,18; 1773:22;1774:11; 1776:16;1778:23; 1784:21;1789:22; 1790:2;1800:6; 1801:18;1802:10,11; 1804:17;1805:2,14; 1813:11</p> <p>tying (2) 1719:13;1812:8</p> <p>type (1) 1746:12</p> <p>typed (1) 1785:7</p> <p>typo (3) 1732:22;1733:1,15</p>
T				
<p>tab (4) 1819:15,16;1821:7,7</p> <p>table (8) 1721:17;1724:19; 1725:7;1772:21; 1779:7;1785:6; 1786:12;1813:4</p> <p>Taggart (34) 1715:3,3,3,5;1716:6, 9,15,23;1745:22,24; 1747:5,6,10,11;1748:4, 11;1749:3,10;1750:6; 1753:15,16,19,21; 1755:23;1782:6,15; 1797:15;1802:6; 1803:3;1814:14,17,21; 1815:2;1816:9; 1820:18</p> <p>talk (16) 1726:20;1728:11; 1730:21;1732:15; 1734:2;1740:9;1744:7; 1759:24;1762:9;</p>	<p>1737:6,22;1738:4,7; 1748:5;1759:18; 1762:4;1765:11,11,13, 17;1767:9;1768:8,18, 22;1769:5;1770:16; 1789:22;1800:4; 1801:6,6;1807:7,16,16; 1810:23;1811:17,20; 1817:16</p> <p>testified (5) 1718:4;1744:16; 1758:17;1781:7; 1802:7</p> <p>testifying (1) 1788:6</p> <p>testimony (19) 1724:23;1733:10; 1744:18;1746:15,24; 1747:1,3,12;1748:10; 1751:5,15;1752:10; 1782:12,16,19; 1788:10;1798:23; 1801:16;1817:4</p> <p>TH-2 (5)</p>	<p>1724:3,6;1728:3; 1732:20;1733:7,13; 1764:9</p> <p>tie (2) 1725:22;1730:12</p> <p>tied (1) 1765:22</p> <p>ties (1) 1721:24</p> <p>Tim (2) 1714:4.5;1715:5</p> <p>times (3) 1724:3;1755:12; 1786:7</p> <p>titled (1) 1821:9</p> <p>today (10) 1717:17;1719:24; 1722:5;1723:19; 1727:13;1748:10; 1750:3;1798:2; 1807:14;1820:8</p> <p>today's (2) 1719:9;1819:11</p>	<p>tracks (1) 1764:14</p> <p>TRANSCRIPT (2) 1713:14;1823:12</p> <p>transcription (1) 1823:14</p> <p>transcripts (2) 1820:11,13</p> <p>transfers (2) 1740:1,4</p> <p>translate (1) 1786:17</p> <p>transmissivity (6) 1732:2;1781:1,4,9; 1800:13,16</p> <p>trees (2) 1722:9,9</p> <p>trend (12) 1769:7,22;1770:1,2; 1783:12;1802:8,10,14, 23;1807:13,18,20</p> <p>trending (1) 1757:11</p>	<p>ultimately (9) 1761:10,18;1762:6, 20;1787:16;1795:5; 1812:21;1813:14,21</p> <p>unadjudicated (1) 1745:1</p> <p>uncertainties (1)</p>
U				

<p>1808:7 under (10) 1749:20;1776:8; 1790:4;1791:16; 1801:3;1805:14; 1817:13;1819:15,16; 1821:7 underestimated (1) 1801:10 underflow (1) 1799:19 underground (2) 1721:7;1722:13 underlying (1) 1729:22 underway (1) 1721:14 Unfortunately (3) 1726:6;1735:8; 1774:23 UNIDENTIFIED (1) 1740:23 uniformly (1) 1771:17 unit (2) 1727:23;1729:1 United (2) 1745:15;1797:8 University (1) 1718:11 unless (1) 1764:20 unlined (5) 1734:8,9,24; 1735:19;1736:18 up (41) 1723:22;1729:23; 1731:21;1734:9,12; 1736:14;1738:2; 1739:4,19;1742:11,24; 1743:4;1752:3,14; 1753:9;1754:21; 1756:1;1757:20; 1763:15;1765:3; 1768:13,17;1769:20; 1778:13;1779:3; 1783:22;1785:9; 1786:1,14,16;1801:23; 1802:18;1808:3; 1810:20;1811:22; 1815:3,20;1816:24; 1818:10;1821:3,24 uphill (2) 1731:21,23 upon (9) 1744:10,20;1799:22; 1800:12;1801:5; 1802:8,15;1818:20; 1819:1 UPPER (6) 1713:11.5;1769:5; 1778:2;1783:11; 1810:20,20</p>	<p>Ure (31) 1715:20,21;1716:4; 1717:10,15,16,17; 1718:7,21;1719:3,4; 1740:17;1741:2,19; 1742:2;1743:17; 1744:3,7,13;1746:19; 1748:3;1750:18; 1751:3;1757:19,22; 1758:1;1787:4; 1805:19;1808:1; 1816:14,22 usage (1) 1804:11 use (10) 1745:7;1746:8,12; 1750:13;1777:17; 1784:24;1804:3,5; 1807:12;1817:6 used (12) 1724:21;1726:13; 1730:17;1739:1; 1747:22;1773:11; 1786:15;1797:21; 1799:2,5;1802:13; 1819:1 users (3) 1789:9;1791:23; 1792:9 uses (1) 1750:13 using (9) 1724:1;1725:11; 1726:3;1786:14; 1802:9;1804:23; 1809:12;1811:2; 1817:4 utilized (1) 1819:6</p>	<p>1774:1,7;1778:21,22; 1779:9;1780:11; 1784:15,18;1787:16; 1789:14,15,18,20; 1793:14,16,21; 1794:19,22;1795:12; 1796:21;1797:13; 1800:19,20,21;1803:4, 12;1806:19,22; 1810:21;1811:3,11; 1812:6;1814:12; 1815:14;1816:10,20; 1819:20 value (4) 1747:17;1788:11; 1802:9;1816:4 values (1) 1801:19 various (3) 1723:5;1789:3,12 vast (2) 1731:12;1790:12 Vegas (23) 1715:21;1718:12; 1745:19;1746:1; 1750:17;1753:12; 1760:2;1763:24; 1764:7,9,22,24;1765:1, 2;1796:21;1797:12; 1805:18;1814:12; 1816:13;1819:11,20; 1821:19,20 verbatim (2) 1772:12;1823:10 version (3) 1729:9;1818:24; 1819:5 versus (8) 1720:4;1737:14; 1741:5;1754:11; 1794:18,21;1799:7; 1808:8 vested (2) 1722:1;1745:1 video (3) 1821:2,4,10 Vidler (5) 1715:13;1749:14; 1803:6,10;1816:12 Vidler-Lincoln (1) 1761:6 Vidler's (1) 1760:18 view (6) 1733:24;1734:20; 1736:20;1738:9; 1801:1;1802:12 Virgin (2) 1778:22;1779:22 visibly (1) 1727:14 volcanic (1) 1760:21</p>	<p>VOLUME (1) 1713:17 W Waddell (2) 1773:21;1779:16 Waddell's (2) 1778:18;1779:18 waiting (1) 1818:1 walk (2) 1719:11;1810:17 walked (1) 1781:8 Warm (23) 1766:2;1767:22; 1768:8;1784:23; 1785:3,10;1786:9,10, 17;1787:24;1788:16, 19;1790:3;1791:5,17, 24;1804:13,15;1809:3; 1817:12,23;1818:1,7 warning (1) 1817:24 WASH (23) 1713:10.5;1720:18; 1721:2;1731:15; 1737:9;1760:1,6; 1761:3;1762:10,13,20; 1763:5,15;1764:7; 1765:19;1774:7; 1779:3;1780:23; 1786:3,4;1787:16; 1789:20;1811:10 Washes (1) 1720:20 WASHOE (1) 1823:2 wasting (1) 1748:13 WATER (180) 1713:3;1715:12.5, 13,18;1718:23; 1720:10;1721:12,19, 22;1722:4,9,13,21; 1726:13;1727:10; 1729:5,5,23;1730:7,12, 24;1731:11,21; 1732:13,18,20;1733:6; 1734:4,5,23;1735:7,15, 20,22,23,24;1736:10, 12;1737:10,13,14; 1738:19;1739:5,7,12, 13,16,16;1740:15; 1744:7,12,24;1745:6, 10,19,20,24;1746:1,8, 11,12,17,23;1747:1,17, 18,22,24;1748:24; 1749:4,5,7,12,14; 1750:6,9,11,12;1752:4; 1753:12,12;1754:16; 1755:1,15;1756:1,10,</p>	<p>12;1759:19,23; 1760:18;1761:18; 1762:6,16,17,22,23; 1763:8,10,14,16; 1765:2,18,20,21,22; 1767:4,6,11,13; 1769:19;1770:3; 1771:5,13,14,16; 1772:3,10,21;1773:3; 1774:12;1775:2,6,7,8; 1777:4,7,8,9,10,12,14; 1780:5,15;1783:3,7,9, 12,12,21;1786:5; 1787:22;1789:9,23,24; 1790:24;1791:15,22; 1792:1,4,8,10;1796:9, 16;1797:12,13;1799:6, 23;1800:21;1803:4,10, 10;1804:14;1808:3; 1809:19;1810:15; 1811:4;1812:1; 1813:21;1814:12,13; 1816:6,10,24;1817:22; 1819:2,6,15,20,20; 1823:6 waterfront (1) 1777:5 waters (3) 1718:16;1728:4; 1784:6 way (10) 1724:7;1728:23; 1735:20;1766:8,11; 1777:19;1779:19; 1783:17;1795:17; 1805:4 ways (1) 1762:8 website (3) 1762:11;1764:1; 1819:14 week (4) 1728:1;1762:1; 1781:7;1820:16 weeks (1) 1820:15 weight (4) 1751:16;1782:18; 1788:8,10 well-connected (4) 1789:2,3;1791:11; 1817:21 well-documented (2) 1732:3;1737:24 wells (40) 1720:7,11;1723:7,9, 10,11,11,11,14; 1730:11;1731:13,15; 1732:12;1735:5; 1736:21;1737:2; 1744:17;1746:4; 1753:6;1754:2,4,5,5,8; 1757:11;1764:15;</p>
V		<p>valid (2) 1725:1;1802:21 VALLEY (100) 1713:7.5,9,10,11.5; 1715:17.5,19;1719:17; 1720:5,8,16,23; 1722:18;1723:1; 1724:18;1726:2; 1727:9;1729:1; 1731:19;1733:24; 1738:9;1740:8; 1741:13;1743:23; 1745:19;1746:1; 1749:12;1751:21; 1753:12;1757:17; 1760:1,1,2,5,13,17,24; 1761:1,6,9,11,15,21; 1762:9,13,18,20; 1763:5,15,24;1764:6,7, 9,23,24;1765:1,2,19, 19;1771:7,7,9,10,11;</p>	<p>1774:1,7;1778:21,22; 1779:9;1780:11; 1784:15,18;1787:16; 1789:14,15,18,20; 1793:14,16,21; 1794:19,22;1795:12; 1796:21;1797:13; 1800:19,20,21;1803:4, 12;1806:19,22; 1810:21;1811:3,11; 1812:6;1814:12; 1815:14;1816:10,20; 1819:20 value (4) 1747:17;1788:11; 1802:9;1816:4 values (1) 1801:19 various (3) 1723:5;1789:3,12 vast (2) 1731:12;1790:12 Vegas (23) 1715:21;1718:12; 1745:19;1746:1; 1750:17;1753:12; 1760:2;1763:24; 1764:7,9,22,24;1765:1, 2;1796:21;1797:12; 1805:18;1814:12; 1816:13;1819:11,20; 1821:19,20 verbatim (2) 1772:12;1823:10 version (3) 1729:9;1818:24; 1819:5 versus (8) 1720:4;1737:14; 1741:5;1754:11; 1794:18,21;1799:7; 1808:8 vested (2) 1722:1;1745:1 video (3) 1821:2,4,10 Vidler (5) 1715:13;1749:14; 1803:6,10;1816:12 Vidler-Lincoln (1) 1761:6 Vidler's (1) 1760:18 view (6) 1733:24;1734:20; 1736:20;1738:9; 1801:1;1802:12 Virgin (2) 1778:22;1779:22 visibly (1) 1727:14 volcanic (1) 1760:21</p>	<p>12;1759:19,23; 1760:18;1761:18; 1762:6,16,17,22,23; 1763:8,10,14,16; 1765:2,18,20,21,22; 1767:4,6,11,13; 1769:19;1770:3; 1771:5,13,14,16; 1772:3,10,21;1773:3; 1774:12;1775:2,6,7,8; 1777:4,7,8,9,10,12,14; 1780:5,15;1783:3,7,9, 12,12,21;1786:5; 1787:22;1789:9,23,24; 1790:24;1791:15,22; 1792:1,4,8,10;1796:9, 16;1797:12,13;1799:6, 23;1800:21;1803:4,10, 10;1804:14;1808:3; 1809:19;1810:15; 1811:4;1812:1; 1813:21;1814:12,13; 1816:6,10,24;1817:22; 1819:2,6,15,20,20; 1823:6 waterfront (1) 1777:5 waters (3) 1718:16;1728:4; 1784:6 way (10) 1724:7;1728:23; 1735:20;1766:8,11; 1777:19;1779:19; 1783:17;1795:17; 1805:4 ways (1) 1762:8 website (3) 1762:11;1764:1; 1819:14 week (4) 1728:1;1762:1; 1781:7;1820:16 weeks (1) 1820:15 weight (4) 1751:16;1782:18; 1788:8,10 well-connected (4) 1789:2,3;1791:11; 1817:21 well-documented (2) 1732:3;1737:24 wells (40) 1720:7,11;1723:7,9, 10,11,11,11,14; 1730:11;1731:13,15; 1732:12;1735:5; 1736:21;1737:2; 1744:17;1746:4; 1753:6;1754:2,4,5,5,8; 1757:11;1764:15;</p>

1772:11,11,14,17; 1773:4,4;1777:4; 1780:24;1781:2; 1794:15;1803:12; 1817:14,22;1818:2	willing (1) 1820:18	1736:12,18;1738:6; 1739:3;1744:23; 1772:5;1784:5; 1788:18;1791:17; 1796:20;1802:13,14, 15;1815:12	11 (2) 1725:24;1807:1	1716:9
weren't (3) 1740:14;1751:11; 1801:9	Wilson (3) 1714:4.5;1726:4; 1729:10	years (28) 1718:12;1736:2; 1765:17;1766:4,23; 1767:6,10,11;1769:14, 19;1772:2,3;1774:16; 1789:22;1790:2; 1797:21;1804:18,22, 24;1805:2,15;1810:22; 1811:6,9;1815:7,16,16, 17	11:18 (1) 1822:4	1756 (1) 1716:10
west (42) 1730:1,8;1731:5,8, 10;1732:6,15,16; 1734:1,3;1735:1,1; 1738:10;1739:12; 1756:14;1757:10,12; 1763:3;1766:2;1767:8, 23;1768:9;1781:13; 1784:24;1785:3,11; 1786:9,11,17;1788:1, 16,20;1790:3;1791:5, 17,24;1804:14,16; 1809:4;1817:12,23; 1818:1	winter (2) 1771:24;1809:17	Yep (1) 1754:16	1100 (1) 1782:4	1757 (1) 1716:11
western (1) 1720:18	wish (1) 1726:6	yesterday (3) 1718:10;1741:8; 1798:23	1169 (20) 1737:11,22;1738:7; 1748:5;1759:18; 1762:4;1767:9;1768:7, 15,18;1770:16; 1789:21;1800:4; 1801:5;1807:7,15,16; 1810:22;1811:17; 1817:16	1758 (1) 1716:13
wet (5) 1736:12,18;1738:6; 1772:2,5	WITHIN (8) 1713:7;1721:10; 1722:24;1751:17; 1789:22;1797:2; 1819:17;1820:15	yield (5) 1774:22,23;1775:3, 5,5	12 (5) 1726:18;1743:21; 1793:10,23;1807:12	1793 (1) 1716:14
what's (2) 1745:9;1815:3	within-entitled (1) 1823:11	zone (11) 1724:7;1731:15,18; 1733:7;1736:23; 1737:9;1760:2,7; 1763:24;1764:10,24	1200 (1) 1779:24	1797 (1) 1716:15
whereas (2) 1746:24;1815:8	without (9) 1739:5;1761:21; 1765:5;1775:2,14; 1789:16;1801:4; 1813:18;1818:18	zones (7) 1724:11,15,16,20; 1725:20;1738:20; 1755:8	123 (1) 1713:23	18 (4) 1726:23;1731:16; 1763:9;1809:8
WHITE (50) 1713:7;1717:5; 1719:16;1734:15,16; 1739:20;1756:11; 1759:21,24;1761:19, 22;1762:2,6;1763:20; 1764:16,19;1765:6; 1771:2,6;1772:6,7; 1774:24;1777:14; 1778:17;1779:2; 1780:18;1781:12,21; 1782:1,2,23;1783:8; 1787:14;1789:13,16; 1790:9,16;1793:12; 1795:1,23;1796:2; 1797:2;1799:23; 1806:10;1808:11; 1810:16;1812:24; 1813:8;1818:24; 1819:16	WITNESS (14) 1716:2;1717:20; 1718:2;1741:7; 1744:15;1748:13,18; 1758:12,15;1759:2; 1777:1;1782:21; 1788:15;1802:16	zoomed-in (2) 1729:9;1734:20	13 (1) 1728:17	1800 (1) 1782:3
whole (1) 1771:17	witnesses (1) 1769:9	0	13.7 (1) 1734:22	1803 (2) 1716:16,17
wide (1) 1725:19	wondering (1) 1750:1	03 (1) 1735:9	130 (1) 1755:8	1805 (1) 1716:18
widely (2) 1725:12;1727:15	work (4) 1718:14;1725:15; 1775:4;1817:13	06 (1) 1735:9	1300 (1) 1774:6	1806 (1) 1716:19
width (1) 1781:4	worked (3) 1722:8;1727:12; 1773:6	074 (1) 1786:13	1303 (7) 1713:16;1717:6; 1801:3,4;1813:4; 1819:17;1821:8	1808 (1) 1716:20
Wildlife (5) 1745:15;1787:13; 1791:21;1797:9; 1814:9	working (1) 1721:5	076 (1) 1786:15	14 (2) 1755:12	1809 (1) 1716:21
	works (2) 1771:24;1775:3	081 (1) 1786:13	15 (5) 1729:12,13	1810 (1) 1716:22
	worth (2) 1804:22,24	1	157 (1) 1786:7	1815 (1) 1716:23
	wrap (1) 1739:19	1 (5) 1718:9;1740:20,21; 1792:13,14	15th (1) 1820:20	1817 (1) 1716:24
	writing (1) 1820:24	1.7 (3) 1786:3,7,7	16 (3) 1730:9;1756:13; 1797:24	1822 (1) 1823:13
	written (7) 1819:23;1820:1,3,5; 1821:13,15,15	10,000 (1) 1796:20	17 (2) 1730:16;1756:13	1823 (1) 1713:17.5
	Y-axis (2) 1733:22;1777:5	107 (1) 1713:23	1713 (2) 1713:17.5;1823:13	19 (2) 1732:14;1766:22
	year (14)		1718 (1) 1716:4	1900s (1) 1727:11
			1742 (1) 1716:5	1919 (1) 1721:8
			1745 (1) 1716:6	1936 (1) 1724:24
			1749 (1) 1716:7	1945 (2) 1722:5,11
			1752 (1) 1716:8	1946 (1) 1725:2
			1753 (1)	1949 (2) 1724:22;1725:9
				1987 (1) 1766:11
				1990 (1) 1766:23
				1990s (1) 1793:14
				1995 (1) 1807:13
				1996 (3) 1794:1,1;1807:13
				2

<p>2 (3) 1719:5;1739:2; 1741:24 2,000 (2) 1770:20;1785:8 20 (6) 1723:11;1730:10; 1732:17;1754:17; 1770:15;1820:2 200 (1) 1744:22 2001 (1) 1725:15 2003 (5) 1734:8;1735:7,7,19; 1736:11 2004 (4) 1725:21;1734:8; 1736:5;1738:5 2005 (13) 1735:11,14;1736:10, 12;1738:6;1767:4; 1768:7,15;1794:8,10, 14;1795:10,10 2006 (4) 1735:7;1736:5,6; 1776:8 2010 (1) 1785:8 2011 (1) 1785:8 2011-12 (1) 1767:9 2011-ish (1) 1736:6 2012 (1) 1768:7 2013 (2) 1754:24;1767:10 2015 (2) 1785:9;1786:3 2016 (4) 1765:18;1769:18; 1807:2,8 2017 (4) 1724:1;1798:2; 1812:24;1813:5 2018 (2) 1754:21;1770:17 2019 (11) 1713:18.5;1717:1; 1724:9;1726:4; 1729:10;1754:22,22, 24;1820:7;1823:8,18 21 (4) 1726:4;1733:23; 1776:5,16 210 (2) 1713:8;1743:23 2100 (1) 1729:17 215 (1) 1713:9</p>	<p>216 (1) 1713:9.5 217 (1) 1713:10 218 (1) 1713:11 219 (1) 1713:12 22 (3) 1734:20;1760:3; 1770:6 2200 (4) 1738:16,24;1739:4; 1774:5 222 (1) 1819:4 23 (2) 1735:2;1753:24 2300 (1) 1816:2 24 (4) 1736:20;1752:8; 1757:4,8 2400 (3) 1729:21;1730:4,13 25 (7) 1718:12;1729:21; 1730:4,10,12;1737:20; 1752:21 25,000 (1) 1733:18 250 (2) 1771:23;1779:23 2500 (2) 1786:17,18 26 (3) 1738:8;1799:22,22 267 (2) 1786:8,16 27 (1) 1738:18 28 (1) 1739:20 280 (1) 1778:20</p>	<p>1780:1 31 (1) 1810:14 315 (1) 1744:2 32 (1) 1801:15 32,000 (1) 1770:19 335 (1) 1818:23 336 (1) 1819:10 34 (1) 1776:20 34,000 (1) 1770:20 343 (1) 1745:2 346 (1) 1819:10 349 (1) 1754:17 35 (3) 1781:24;1806:5,6 350 (4) 1729:21,22;1730:14; 1732:12 36 (1) 1806:6 3750 (1) 1816:3 39 (1) 1741:22 3rd (2) 1821:14,14</p>	<p>50 (3) 1743:15,19;1744:21 500 (1) 1774:16 5400 (1) 1785:10 5-5 (1) 1815:4 559.5 (1) 1745:8 560 (3) 1720:16,24;1779:23 5600 (1) 1785:9 580 (1) 1779:21</p>	<p>1771:16 <hr/> 9 <hr/> 9,000 (2) 1812:23;1813:5 9:40 (1) 1758:5 900 (3) 1771:8,11,18 900-foot (2) 1771:9,15 93 (10) 1721:2;1722:6,7; 1723:17;1724:6; 1730:6;1734:13; 1738:9,11;1756:14 9900 (4) 1781:6,19;1799:18; 1800:11</p>
				6
				6,000 (2) 1791:4;1814:2 6.1 (1) 1786:12 60 (2) 1820:19;1821:12 600 (1) 1739:6 6165 (1) 1819:2 6167 (1) 1819:3 6-3 (1) 1801:20 6900 (1) 1774:2
				7
				7 (1) 1786:12 700 (2) 1782:5,22 750 (5) 1725:21;1738:20; 1739:7;1755:16,19 7500 (1) 1791:6 775882-5322 (1) 1713:24
				8
				8,000 (5) 1784:4;1790:6; 1791:6;1812:10; 1815:24 81 (1) 1769:6 8600 (1) 1800:17 89706 (1) 1713:23.5 898-foot (1)
				3
				4
				4 (4) 1713:18.5;1717:1; 1771:4;1809:9 40 (1) 1781:24 400 (1) 1786:19 411 (1) 1786:4 45 (1) 1787:4 47 (1) 1779:24 4th (3) 1820:7;1823:8,17
				5
				5 (1) 1722:14 5,000 (2) 1785:9,9 5:00 (1) 1820:7
				4
				5

Laura A. Schroeder
Oregon, Idaho,
Nevada, Washington & Utah

Therese A. Ure
Oregon & Nevada

Sarah R. Liljefelt
Oregon,
California & Utah



SCHROEDER
LAW OFFICES, P.C.

William F. Schroeder
(1928 - 2015)

Wyatt E. Rolfe
Of Counsel
Oregon & Washington

James Browitt
Of Counsel
Idaho & Washington

February 18, 2020

VIA US MAIL

Capitol Reporters
123 W. Nye Lane, Ste. 107
Carson City, Nevada 89706

RE: 9/23/2019 – 10/3/2019 NDWR Hearing Transcript Corrections

To Whom it May Concern:

Our office represents the City of North Las Vegas (“City”) in the matter currently before Nevada Division of Water Resources and titled *In the Matter of the Administration and Management of the Lower White River Flow System Within Coyote Spring Valley Hydrographic Basin (210), a Portion of Black Mountains Area Hydrographic Basin (215), Garnet Valley Hydrographic Basin (216), Hidden Valley Hydrographic Basin (217), California Wash Hydrographic Basin (218), and Muddy River Springs Area (AKA Upper Moapa Valley Hydrographic Basin (219))*.

A hearing was held by the Nevada Division of Water Resources from September 23, 2019 through October 4, 2019 to which your office provided transcription services. Our client’s expert, Dwight Smith’s testimony was taken on October 1, 2019. Mr. Smith offers corrections to the transcript relating to his testimony as outlined in Attachment A.

If you have any questions, please contact our office at (775) 786-8800.

Very truly yours,
SCHROEDER LAW OFFICES, P.C.

A handwritten signature in blue ink that reads "Therese Ure". The signature is fluid and cursive, written in a professional style.

Therese A. Ure

TAU:lmg
Enclosures

cc: NDWR – *via US Mail*
Clients – *via email*
Courtesy Copy to Service List – *via email*

1915 NE Cesar E. Chavez Boulevard, Portland, Oregon 97212 (503) 281-4100

10615 Double R Boulevard, Suite 100, Reno, Nevada 89521 (775) 786-8800

www.water-law.com counsel@water-law.com

(P0468751; 1577.00 LMM)

SE ROA 53759

JA_18156

Attachment A

Page No.	Lines	Currently Reads	Suggested Changes ¹	Clean Copy
1420	6-7	I'm not going to offer an opinion on why a perennial yield would be...	I'm not going to offer an opinion on why what a perennial yield would be...	I'm not going to offer an opinion on what a perennial yield would be...
1420	23-24	And that that is basically four principal components.	And that that is basically four principal components.	And that is basically four principal components.
1421	8-9	It's scheduled to be completed in April of 2021 under construction currently.	It's scheduled to be completed in April of 2021 and is under construction currently.	It's scheduled to be completed in April of 2021 and is under construction currently.
1422	2-3	But as I will express, the City is interested in giving senior water rights down to these wells...	But as I will express, the City is interested in giving getting senior water rights down to these wells...	But as I will express, the City is interested in getting senior water rights down to these wells...
1422	21-23	...we've talked about having the stress and test aquifer systemswe've talked about having the stress and test of aquifer systemswe've talked about having the stress test of aquifer systems ...
1423	1-2	...do a long-term injection test of a high rate, we can do that fairly easily.	...do a long-term injection test of at a high rate, we can do that fairly easily.	...do a long-term injection test at a high rate, we can do that fairly easily.
1423	11-12	...utilization of reclaimed water in the basin, the centralized wastewater treatment plant...	...utilization of reclaimed water in the basin, the a centralized wastewater treatment plant...	...utilization of reclaimed water in the basin, a centralized wastewater treatment plant...
1423	18-19	...how this looks and planned, the dashed black line along...	...how this looks and is planned, the dashed black line along...	...how this looks and is planned, the dashed black line along...
1424	2-3	...just at the lower center part of the overuse at blue point.	...just at the lower center part of the overuse overview at blue point.	...just at the lower center part of the overview at blue point.
1424	14	...pipeline around the northern end of Apex end.	...pipeline around the northern end of Apex endpipeline around the northern end of Apex.
1425	6-7	This may not be shown up too well on the overview, but it should...	This may not be showing ing up too well on the overview, but it should...	This may not be showing up too well on the overview, but it should...

¹ Suggested deletions are noted with strike-throughs and suggested additions are noted in bold.

Page No.	Lines	Currently Reads	Suggested Changes ¹	Clean Copy
1425	9-10	So that the constitutes a large amount of area and incorporates...	So that the constitutes a large amount of area and incorporates...	So that constitutes a large amount of area and incorporates...
1427	4-5	...also a number of normal faults that are run generally parallel to that..	...also a number of normal faults that are run generally parallel to that...	...also a number of normal faults that run generally parallel to that...
1427	8-9	We're lacking any data to from which to interpret that.	We're lacking any data to from which to interpret that.	We're lacking any data from which to interpret that.
1427	20-21	...two of the geologic cross sections by page numbers --	...two of the geologic cross sections by page numbers Page and others, 2011.	...two of the geologic cross sections by Page and others, 2011.
1428	2-3	...and the greener shades are the plastic rock types and a major...	...and the greener shades are the plastic clastic rock types and a major...	...and the greener shades are the clastic rock types and a major...
1428	13-15	...rocks exceeding 17,000 interpreted to be on the order of 20 to 25,000 thick in Garnet Valley.	...rocks exceeding 17,000 ft interpreted to be on the order of 20 to 25,000 ft thick in Garnet Valley.	...rocks exceeding 17,000 ft interpreted to be on the order of 20 to 25,000 ft thick in Garnet Valley.
1428	16-17	...there's some testimony by Rick Waddell from the National Park Service about...	...there's some testimony by Rick Waddell from for the National Park Service about...	...there's some testimony by Rick Waddell for the National Park Service about...
1428	22-23	And the considerable geologic discontinuities in the carbonate...	And the that considerable geologic discontinuities in the carbonate...	And that considerable geologic discontinuities in the carbonate...
1430	2	...level in the basin occurs at the GB-1 well.	...level in the basin occurs at the GB-1 GV-1 well.	...level in the basin occurs at the GV-1 well.
1430	4-5	...levels are relatively flat in that 1808 to 1814 altitude range...	...levels are relatively flat in that the 1808 to 1814 altitude range...	...levels are relatively flat in the 1808 to 1814 altitude range...
1430	12-13	...our data evaluation back there is potential flow from Las Vegas Valley...	...our data evaluation back that there is potential flow from Las Vegas Valley...	...our data evaluation that there is potential flow from Las Vegas Valley...
1430	20-21	...the lowest water level tying in the northern arm of...	...the lowest water level tying lying in the northern arm of...	...the lowest water level lying in the northern arm of...
1431	2	...southernmost tip of that arrow is GB-2, that's consistently...	...southernmost tip of that arrow is GB-2 GV-2 , that's consistently...	...southernmost tip of that arrow is GV-2, that's consistently...

Page No.	Lines	Currently Reads	Suggested Changes ¹	Clean Copy
1431	4-5	...higher than the water levels of Seradep at Moapa down in Paiutes area included.	...higher than the water levels of Seradep at Moapa down in the center of the valley and the Paiutes area included.	...higher than the water levels of the center of the valley and the Paiutes area included.
1431	12-13	...some of the wells on record are done in the logs, about a third of them.	...some of the wells on record are done in the plugging logs, about a third of them.	...some of the wells on record are plugging logs, about a third of them.
1431	22-23	...I mentioned the GB-2 well, you'll see that that as a light green...	...I mentioned the GB-2 GV-2 well, you'll see that that as a light green...	...I mentioned the GV-2 well, you'll see that that as a light green...
1432	3-4	...right on the basin boundary we put in Hidden Valley is well GB-1.	... right on the basin boundary we put in with Hidden Valley is well GB-1 GV-1 right on the basin boundary with Hidden Valley is well GV-1.
1433	5-6	For reference to Playa Well that the City owns...	For reference to the Playa Well that the City owns...	For reference the Playa Well that the City owns...
1433	6-7	...to 2,000 feet. As a static water level it's down around 800 or 850...	...to 2,000 feet. As and a static water level it's that's down around 800 or 850...	...to 2,000 feet, and a static water level that's down around 800 or 850...
1433	10-11	That Kapex Well was drilled in 1990.	That The Kapex Well was drilled in 1990.	The Kapex Well was drilled in 1990.
1433	11	It was called the Krut (ph.) Well for a long time.	It was called the Krut Kerr Mcgee (ph.) Well for a long time.	It was called the Kerr Mcgee (ph.) Well for a long time.
1434	3-4	...confirm that that ten inches is not ten feet or we're...	...confirm that that the ten inches is not ten feet or we're...	...confirm that the ten inches is not ten feet or we're...
1434	4	...trusting that that information on the well log...	...trusting that that the information on the well log...	...trusting that the information on the well log...
1434	7	...northern area there that GBR-1 also had a notably higher...	...northern area there that GBR-1 GV-RW1 also had a notably higher...	...northern area there that GV-RW1 also had a notably higher...
1434	9-10	...located along fault and structure that projects along the east side...	...located along fault and structures that projects along the east side...	...located along fault structures that project along the east side...

Page No.	Lines	Currently Reads	Suggested Changes ¹	Clean Copy
1434	15-16	...in Garnet Valley is I would just say moderate.	...in Garnet Valley is I would say just say moderate.	...Garnet Valley is I would say just moderate.
1435	6-7	...the GB-1 Well to the north with water level elevation and average water...	...the GB-1 GV-1 Well to the north with water level elevation, and an average water...	...the GV-1 Well to the north with water level elevation, an average water...
1435	7-8	...elevation year 2015 of 1,808 feet as contrasted to the water level at GB-2 at 1,114 feet.	...elevation in year 2015 of 1,808 feet as contrasted to the water level at GB-2 GU-2 at 1,114 1,814 feet.	...elevation in year 2015 of 1,808 feet as contrasted to the water level at GU-2 at 1,814 feet.
1435	10	And again, GB-2 being the highest water level that's observed.	And again, GB-2 GV-2 being the highest water level that's observed.	And again, GV-2 being the highest water level that's observed.
1435	14-15	...fact that GB-1 - - GB-2, excuse me, has the highest observed...	...fact that GB-1 GV-1 - - GB-2 GV-1 , excuse me, has the highest observed...	...fact that GV-1 - - GV-2, excuse me, has the highest observed...
1436	10	...water, we can draw elevation for the water tables.	...water, we can draw determine the elevation for the water tables.	...water, we can determine the elevation for the water table.
1436	15-16	So generally answered the questions is could groundwater be coming...	So generally this did not answered the questions is could groundwater be coming...	So this did not answer the question could groundwater be coming...
1436	16-17	...in from Las Vegas Valley and the Garnet Valley?	...in from Las Vegas Valley and to the Garnet Valley?	...in from Las Vegas Valley to Garnet Valley?
1436	24	So we know it would be lance our elevation more...	So we know it would be lance our the land surface elevation more...	So we know the land surface elevation more...
1437	5-6	...Las Vegas Valley than Garnet Valley or GB-2.	...Las Vegas Valley than Garnet Valley or GB-2 GV-2Las Vegas Valley than Garnet Valley or GV-2.
1437	14-15	...really can only be answered with a more accurate on the ground data.	...really can only be answered with a more accurate on the ground data.	...really can only be answered with more accurate on the ground data.
1437	20-21	...understand better, especially for composing to try some AR just...	...understand better, especially for composing proposing to try some AR just...	...understand better, especially for proposing to try some AR just...
1438	14-15	...really I've turned this and I want to be careful, this is...	...really I've turned termed this and I want to be careful, this is...	...really I've termed this and I want to be careful, this is...

Page No.	Lines	Currently Reads	Suggested Changes ¹	Clean Copy
1438	19-20	...where we hypothesize there there potentially could be inflows...	...where we hypothesize there potentially could be inflows...	...where we hypothesize there potentially could be inflows...
1439	4-5	...effort of wanting to calibrate the models.	...effort of wanting to calibrate the models.	...effort of wanting to calibrate the model.
1439	22	..water level date that we have.	..water level date data that we have.	.. water level data that we have.
1440	8	...the optimal with the boundary conductances that regulate flow...	...the optimal with the boundary conductances that regulate flow...	...the optimal boundary conductances that regulate flow...
1440	10	And we also attempt sensitivity of each of those boundaries.	And we also attempt present sensitivity of each of those boundaries.	And we also present sensitivity of each of those boundaries.
1440	16	...scenarios, conversely a models boundary with high...	...scenarios, conversely a models boundary with high...	...scenarios, conversely a model boundary with high...
1440	22	...slide 16. To take up messages as our boundary's on the east...	...slide 16. To take up The take home messages as on our boundary's on the east...	...slide 16. The take home messages on our boundary's on the east...
1441	4-5	...was derived at a good model solution, a good match to the data.	...was derived at as a good model solution, a good match to the data.	...was derived as a good model solution, a good match to the data.
1441	20-21	...given that GB-1 is the most opportune water right in the system.	...given that GB-1 GV-1 is the most lowest water right level in the system.	...given that GU-1 is the lowest water level in the system.
1441-1442	24-1	...definitive, but it was trying to help me assess through as an assess what are...	...definitive, but it help me assess through as an I was trying to assess what are...	...definitive, but I was trying to assess what are...
1442	18-19	...the interpretation on that 2006 pumping inventory was that...	...the interpretation on that the 2006 pumping inventory was that...	...the interpretation on the 2006 pumping inventory was that...
1443	6-7	...in Garnet Valley really began in earnest in the 1980s...	...in Garnet Valley, it really began in earnest in the 1980s...	...in Garnet Valley, it really began in earnest in the 1980s...
1443	9	...on through actually, you can tell current and you'll notice...	...on through actually, you can tell until current and you'll notice...	...on through actually, until current and you'll notice...

Page No.	Lines	Currently Reads	Suggested Changes ¹	Clean Copy
1443	17-18	...that water was done under temporary transfers of SNWA's..	...that water was done pumped under temporary transfers of SNWA's..	...that water was pumped under temporary transfers of SNWA's..
1444	5-6	...all the green is the newer leased at the newer lease granted to SNWA in...	...all the green is the newer leased at the newer lease use of water rights granted to SNWA in...	...all the green is the use of water rights granted to SNWA in...
1444	7-8	So, water level pumping, pumped amounts in 2016, 2017 approached...	So, water level groundwater pumping, pumped amounts in 2016, 2017 approached...	So, groundwater pumping, pumped amounts in 2016, 2017 approached...
1444	9	...for about ten years was a plus or minus around 15,000.	...for about ten years was a plus or minus around 15,000.	...for about ten years was plus or minus around 15,000.
1444	10-11	Prior to 2006, which we had additional power generate...	Prior to 2006, which when we had additional power generate...	Prior to 2006, when we had additional power generate...
1444	20-21	...be taking out chemical line and western gypsum pumping, which I...	...be taking out Chemical line Lime and Western Gypsum pumping, which I...	...be taking out Chemical Lime and Western Gypsum pumping, which I...
1445	6	This was compiled from EWR's electronic database online.	This was compiled from EWR's NDWR'S electronic database online.	This was compiled from NDWR'S electronic database online.
1446	23-24	...all the values and input in are not consistent within NDWR pumping...	...all the values and input in are not consistent within NDWR pumping...	...all the values and input are not consistent within NDWR pumping...
1447	2	...available from - - from reporting 1169 in agreements that they...	...available from - - from reporting order 1169 reporting in agreements that they...	...available from - - from order 1169 reporting in agreements that they...
1447	9	...reporting under 1169 that have different values.	...reporting under order 1169 that have different values.	...reporting under order 1169 that have different values.
1447	10	...believe the 1169 dataset is incomplete.	...believe the order 1169 dataset is incomplete.	...believe the order 1169 dataset is incomplete.
1447	16-17	...agreements from reporting our pumping totals.	...agreements from reporting our of pumping totals.	...agreements from reporting of pumping totals.

Page No.	Lines	Currently Reads	Suggested Changes ¹	Clean Copy
1449	17-18	...suspect could be explained some of the relationship...	...suspect could be explained some of the relationship...	...suspect could explain some of the relationship...
1450	5	...decline in trend about 23 feet per year.	...decline in trend about 23 0.3 feet per year.	...decline in trend about 0.3 feet per year.
1450	11-12	...period where a lot of those are stable at EH-4.	...period where a lot of those water levels are stable at EH-4.	...period where water levels are stable at EH-4.
1450	23-24	...mixture of pumping and climbing in our hydrologic...	...mixture of pumping and climbing climate in our hydrologic...	...mixture of pumping and climate in our hydrologic...
1452	4	...for broader water management in Jackson Valley.	...for broader water management in Jackson Garnet Valley.	...for broader water management in Garnet Valley.
1453	2-3	...pressure cycle and it's significant, it's in Nevada.	...pressure cycle and it's significant, it's in southern Nevada.	...pressure cycle and it's significant in southern Nevada.
1453	4-5	...has been directing barometric pressure data to a number of different margin points.	...has been directing collecting barometric pressure data to at a number of different margin monitoring points.	...has been collecting barometric pressure data at a number of different monitoring points.
1453	15	...storage coefficients more confined will respond greater to...	...storage coefficients, are more confined, and will respond greater to...	...storage coefficients, are more confined, and will respond greater to...
1454	3-4	But some have sufficient barometric efficiencies.	But some have suffieient significant barometric efficiencies.	But some have significant barometric efficiencies.
1454	13-14	...water level studies in Death Valley Regional Flow...	...water level studies in the Death Valley Regional Flow...	...water level studies in the Death Valley Regional Flow...
1454	20	...pressure changes and earth-type changes, you need...	...pressure changes and earth-type tide changes, you need...	...pressure changes and earth-tide changes, you need...
1455	2-3	...based off this absence of presence of a "pumping signal"...	...based off this absence of or presence of a "pumping signal"...	...based off this absence or presence of a "pumping signal"...
1455	8	Is there still a season of cycle or not.	Is there still a seasonal of cycle or not.	Is there still a seasonal cycle or not.
1455	23-24	...this may be result of starting to collaborate to pumping near the...	...this may be the result of starting to collaborate equilibrate to pumping near the...	...this may be the result of starting to equilibrate to pumping near the...

Page No.	Lines	Currently Reads	Suggested Changes ¹	Clean Copy
1456	4-5	...geographic areas but, you know, as the Death Valley Regional...	...geographic areas. But , you know, as the Death Valley Regional...	...geographic areas. But , you know, the Death Valley Regional...
1456	6-7	...geographic area down the White River Flow System far...	...geographic area. down The White River Flow System far...	...geographic area. The White River Flow System far...
1456	8-9	As we understand the flow system to the desert again is just a...	As And we understand the flow system to of the Tule Desert again is just a...	And we understand the flow system of the Tule Desert is just a...
1456	18-19	I think what SNWA's work in both in their prior analysis and...	I think what that from SNWA's work in both in their prior analysis and...	I think that from SNWA's work in both in their prior analysis and...
1456	20-21	...analysis being brought forward. It's pretty clearly demonstrated that...	...analysis being brought forward., It's pretty clearly demonstrated that...	...analysis being brought forward, it's pretty clearly demonstrated that...
1457	10	Those near a pumping center are going to have a more...	Those wells near a pumping center are going to have a more...	Those wells near a pumping center are going to have a more...
1457	19	I don't think we felt much, if any, effect to...	I don't think we've felt much, if any, effect to...	I don't think we've felt much, if any, effect to...
1458	2-3	...river it explains a lot of a capture that's been presented.	...river it explains a lot of a the capture that's been presented.	...river it explains a lot of the capture that's been presented.
1458	6	...duration, location magnitude all factors into capture...	...duration, location, magnitude all factors into capture...	...duration, location, magnitude all factors into capture...
1458	8-9	...you know, water rights going back to the 1940s.	...you know, water rights going back to the 1940s.	...you know, water rights go back to the 1940s.
1458	13	...emphasis from SNWA about capture river flows.	...emphasis from SNWA about capture of river flows.	...emphasis from SNWA about capture of river flows.
1458	14-15	...grappling with this issue up to the north in the Humboldt...	...grappling with this issue up to in the north in the Humboldt...	...grappling with this issue up in the north in the Humboldt...
1458	18-19	We have a screen flow capture issue here, but it's...	We have a screen stream flow capture issue here, but it's...	We have a stream flow capture issue here, but it's...
1459	4-5	...we do have to really quantify, have a mechanism to quantify...	...we do have to really the ability to quantify, have a mechanism to quantify...	...we do have the ability to quantify, have a mechanism to quantify...

Page No.	Lines	Currently Reads	Suggested Changes ¹	Clean Copy
1459	16-17	...along the Moapa and Gilbert's Park. And, you know, we've...	...along the Moapa and Gilbert's Park Overton Arm . And, you know, we've...	...along the Moapa and Overton Arm. And, you know, we've...
1460	1	...that's the driver for water granting decisions.	...that's the driver for water granting management decisions.	...that's the driver for water management decisions.
1460	9	But according to the City of Las Vegas, they have...	But according to the City of North Las Vegas, they have...	But according to the City of North Las Vegas, they have...
1460	10-11	You know, it's injunctive use bringing in multiple sources, it's...	You know, it's in conjunctive use bringing in multiple sources, it's...	You know, it's conjunctive use bringing in multiple sources, it's...
1460	17-18	...water rights on their municipal water supply lists.	...water rights on their municipal water supply lists wellswater rights on their municipal water supply wells.
1461	2-3	...down to those rights. Senior is important because the future...	...down to those rights wells . Seniority is important because the future...	...down to those wells. Seniority is important because the future...
1461	6	...not asking you how to answer that question today.	...not asking you how now to answer that question today.	not asking you now to answer that question today.
1461	7-8	But from a municipal water conveyor perspective that gives them...	But from a municipal water conveyor purveyor perspective that gives them...	But from a municipal water purveyor perspective that gives them...
1462	10-11	...entities could buy the leased water rights, whatever...	...entities could buy the or leased water rights, whatever...	entities could buy or lease water rights, whatever...
1462	11-12	...there's paths to look forward on that.	...there's paths to look work forward on that.	...there's paths to work forward on that.
1462	13-14	From a modern maverick perspective, again, I think you need to keep...	From a modern maverick groundwater management perspective, again, I think you need to keep...	From a groundwater management perspective, again, I think you need to keep...
1463	5-6	...from the alluvium carbonate should not be generically limited...	...from the alluvium to carbonate should not be generically limited...	...from the alluvium to carbonate should not be generically limited...

Page No.	Lines	Currently Reads	Suggested Changes ¹	Clean Copy
1464	4-5	...encourage the State to shift to a safety overload approach. In fact, maybe, you know, shift to a safety overload approach.	...encourage the State to shift to a safety overload from the perennial yield approach. In fact, maybe, you know, shift to a safety overload safe yield approach.	...encourage the State to shift from the perennial yield approach to a safe yield approach.
1465	2-3	...levels in Hidden Valley that SHV-1 down in the north I believe is...	...levels in Hidden Valley that other then , SHV-1 down in the north I believe is...	...levels in Hidden Valley other then, SHV-1 in the north I believe is...
1486	16-17	...that we're able to find to date, it appears that that flow is...	...that we're able to find define to date, it appears that that flow is...	...that we're able to define to date, it appears that that flow is...
1487	4-5	...out through to the waters of Dupont Springs, but possibly deeper.	...out through to the waters Rogers and of Dupont Springs Blue Point Springs , but possibly deeper.	...out through to the Rogers and Blue Point Springs, but possibly deeper.
1489	18-19	...can pump and harvest and not get be getting into trouble...	...can pump and harvest and not get be getting into trouble...	...can pump and harvest and not be getting into trouble...
1491	2	...and I believe mostly interpretation of this area are vented...	...and I believe mostly interpretation instrumentation of this area are vented...	...and I believe mostly instrumentation of this area are vented...
1491	9-10	This is a true observed when the barometric pressure rises...	This is a true observed ation when the barometric pressure rises...	This is a true observation when the barometric pressure rises...