IN THE SUPREME COURT OF THE STATE OF NEVADA

CORPORATION OF THE PRESIDING BISHOP OF THE CHURCH OF JESUS CHRIST OF LATTER-DAY SAINTS, ON BEHALF OF CLEVELAND RANCH,

Petitioner,

vs.

SEVENTH JUDICIAL DISTRICT COURT OF THE STATE OF NEVADA IN AND FOR THE COUNTY OF WHITE PINE and THE HONORABLE ROBERT E. ESTES, SENIOR DISTRICT COURT JUDGE,

Respondents,

and

JASON KING, P.E., in his official capacity as the Nevada State Engineer, and the NEVADA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES, DIVISION OF WATER RESOURCES, and SOUTHERN NEVADA WATER AUTHORITY,

Real Parties in Interest.

Case No. 65424

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APPENDIX TO PETITION FOR LIMITED WRIT REVIEW OF WHETHER NRS 533.3705 CAN BE APPLIED RETROACTIVELY TO PERMIT STAGED APPROVAL OF SOUTHERN NEVADA WATER AUTHORITY'S 1989 APPLICATIONS

VOLUME I

APPENDIX 1

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IN THE SEVENTH JUDICIAL DISTRICT COURT
OF THE STATE OF NEVADA IN AND FOR
~~LINCOLN~~, WHITE PINE ~~AND EUREKA~~ COUNTIES

* * * * *

CORPORATION OF THE PRESIDING BISHOP OF THE CHURCH OF JESUS CHRIST OF LATTER-DAY SAINTS, on Behalf of CLEVELAND RANCH, Petitioner, vs. JASON KING, P.E., in his official capacity as the NEVADA STATE ENGINEER; and the NEVADA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES, DIVISION OF WATER RESOURCES, Respondent.	Case No. CV 1204050 Dept. No. 2 **PETITION FOR JUDICIAL REVIEW**

Petitioner Corporation of the Presiding Bishop of the Church of Jesus Christ of Latter-day Saints ("CPB"), on behalf of Cleveland Ranch (the "Ranch"), petitions for judicial review of the Respondents Nevada State Engineer's and Nevada Department of Conservation and Natural Resources, Division of Water Resource's approval, subject to certain conditions, of eight of Southern Nevada Water Authority's ("SNWA's") Applications (##54009 - 54015, and 54020), as set forth in the Nevada State Engineer's March 22, 2012, Ruling #6164 (captioned, "In the Matter of Applications 54003 through 54021, Inclusive, Filed to Appropriate the Underground Waters of the Spring Valley Hydrographic Basin (184), Lincoln and White Pine Counties, Nevada"), as follows:

PROCEDURAL BACKGROUND

1. In 1989, the Las Vegas Valley Water District (the "LVVWD") filed 146 Applications with the State Engineer to appropriate approximately 800,000 acre-feet annually ("afa")[1] of public water from groundwater sources in 26 rural Nevada water basins to serve the greater Las Vegas area. The State Engineer acknowledged LVVWD's project as "the largest interbasin appropriation and transfer of water ever requested in the history of the state of Nevada." *Great Basin Water Network v. Taylor,* 126 Nev. Adv. Op. 20, 234 P.3d 912, 914 (2010).

2. In 1991, the Southern Nevada Water Authority ("SNWA") was created and acquired the rights to LVVWD's Applications.

3. Nineteen of SNWA's Applications (##54003-21) sought to appropriate groundwater from Spring Valley (the "Spring Valley Applications").

4. Spring Valley is located in eastern White Pine and northeastern Lincoln Counties and is about 120 miles long in a north-south direction and about 15 miles wide. Spring Valley has an area of approximately 1,700 square miles.

5. Many persons and entities, both private and governmental, protested the Spring Valley Applications during the original protest period, which ended in July 1990.

6. On January 5, 2006, the State Engineer held a pre-hearing conference at which some Protestants requested that the State Engineer re-open the period for protests. The State Engineer denied the requests and set the hearing on SNWA's Spring Valley Applications to

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1 An acre foot is 325,851 gallons.

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begin on September 11, 2006.

7. On or about July 6, 2006, some Protestants petitioned the State Engineer for a declaratory order requiring that SNWA's Applications be renoticed and that the protest period be reopened. On July 27, 2006, the State Engineer denied that petition.

8. The State Engineer held a hearing on the Spring Valley Applications from September 11-29, 2006.

9. On April 16, 2007, the State Engineer issued Ruling #5726, denying Spring Valley Applications ##54016, 54017, 54018, and 54021, and approving Spring Valley Applications ##54003, 54004, 54005, 54006, 54007, 54008, 54009, 54010, 54011, 54012, 54013, 54014, 54015, 54019, and 54020, subject to certain limitations and conditions.

10. On August 22, 2007, some Protestants filed in the Seventh Judicial District Court a Petition for Judicial Review of the State Engineer's denial of their requests to republish the Spring Valley Applications and reopen the protest periods. On May 30, 2007, the District Court denied that Petition and the Protestants then appealed that decision to the Nevada Supreme Court.

11. On June 17, 2010, in *Great Basin Water Network v. Taylor*, 126 Nev. Adv. Op. 2, 222 P.3d 665 (2010), *modified on petition for rehearing* 126 Nev. Adv. Op. 20, 234 P.3d 912 (2010), the Nevada Supreme Court reversed Ruling #5726 on the grounds the Spring Valley Applications had not been acted upon by the State Engineer within one year after the close of the protest period as required by statute. The Nevada Supreme Court concluded that "the proper and most equitable remedy is that the State Engineer must re-notice the applications and re-open the protest period." 234 P.2d at 919.

12. The State Engineer thereafter republished the Applications and scheduled hearings on the Applications between September 26 and November 18, 2011. The State

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Engineer also authorized the Applicant and Protestants to file opening and closing statements and proposed forms of the State Engineer's Ruling.

13. CPB protested 12 of SNWA's 19 Spring Valley Applications (##54009-54018, 54020, and 54021) on the following grounds, among others:

(A) Only SNWA's actual Applications were before the State Engineer and any consideration of SNWA's possible future applications, intentions, or changes would violate NRS 533.370 and fundamental due process;

(B) SNWA's analysis overestimated the amount of water available for appropriation in Spring Valley;

(C) SNWA's analysis underestimated existing and future uses in Spring Valley;

(D) SNWA's own data and model demonstrated that the protested wells would directly conflict with the Ranch's water rights and have a devastating impact, including the creation of a massive, ever-increasing aggregate cone of depression that would eventually consume the springs and wetlands located on and around the Ranch;

(E) Even with removal of the four wells denied by the State Engineer's Ruling #5726 in 2007 (Applications ##54016, 54017, 54018, and 54021), SNWA's model demonstrated dramatic drawdown and interference with the Ranch's existing water rights;

(F) Over time, the extensive drawdowns were likely to cause substantial subsidence and the permanent loss of aquifer storage capacity;

(G) SNWA's Applications and Groundwater Project ("GWP") did not call for the capture of much of the evapotranspiration ("ET") and would result in substantial and perpetual groundwater mining, contrary to the public interest and prohibited under Nevada law;[2]

(H) SNWA offered no realistic ability to monitor and/or mitigate the tremendous risks that its GWP posed to the Ranch, the public interest, and the environment;

(I) SNWA's reliance on a September 8, 2006, Stipulation between it and four bureaus of the U.S. Department of the Interior (National Park Service, Fish and Wildlife Service, Bureau of Land Management, and Bureau of Indian Affairs), and as to which neither the Ranch nor the State Engineer was a party, amounted to an

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[2] The water available for appropriation is the natural discharge (ET) that can be salvaged for beneficial use. SNWA's Applications were not designed to capture ET and its proposed wells in fact would capture only a fraction of ET, resulting in substantial and continual groundwater mining. SNWA's own model predicted that steady-state conditions would never be reached.

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abdication of the State Engineer's statutory obligations and offered no substantive protection to the Ranch or the public interest;

(J) Approval of SNWA's Applications would amount to an impermissible taking of the Ranch's property without just compensation; and

(K) Further study and analysis should have been conducted because of the difficulty of determining and anticipating the potentially devastating and irreversible effects of SNWA's Applications.

14. On March 22, 2012, the State Engineer issued Ruling #6164 on the Spring Valley Applications, again denying Spring Valley Applications ##54016, 54017, 54018, and 54021, and approving Applications ##54003, 54004, 54005, 54006, 54007, 54008, 54009, 54010, 54011, 54012, 54013, 54014, 54015, 54019, and 54020 subject to certain conditions, including certain monitoring and reporting requirements and a staged development, which authorized an initial development of 38,000 afa over 8 years, an additional 12,000 afa over the next 8 years, and the remainder, up to a total of 61,127 afa duty, available thereafter. According to Ruling #6164, "Any development beyond the initial stage will be dependent upon a favorable review of the data collection and analysis." State Engineer's 3/22/12 Letter accompanying Ruling #6164, Appendix Exhibit 10.

15. By Ruling #6164, the State Engineer also determined that there is 84,000 afa perennial yield in Spring Valley, as opposed to the 80,000 afa perennial yield determined by the State Engineer's 2007 Ruling #5726. In reaching this finding, the State Engineer determined that existing water rights in Spring Valley amount to 18,873 afa and that 4,000 afa suffices for future Spring Valley growth and development, leaving 61,127 afa unappropriated in Spring Valley.

16. CPB, on behalf of the Ranch, hereby petitions the Court for judicial review reversing the State Engineer's approval, based on certain conditions, of eight of SNWA's Spring Valley Applications, ##54009 - 54015, and 54020, copies of which are attached respectively as Appendix Exhibits 2-9.

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THE SNWA APPLICATIONS THAT ARE THE SUBJECT OF CPB'S PETITION FOR JUDICIAL REVIEW

17. Application #54009, Appendix Exhibit 2, was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined therein. The proposed point of diversion was described as being located within NW¼ NE¼ of Section 36, T.13N., R.66E., M.D.B.&M. Application #54009 continues, stating that the "water is to be diverted from a 20-inch diameter well, via deep well No. 184-7A, pump, pipelines, pumping stations, reservoirs, and distribution system," that is estimated to cost "$700,000 (well and equipment only)," and take "Minimum 20 years" to construct.

18. Application #54010, Appendix Exhibit 3, was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined therein. The proposed point of diversion was described as being located within SE¼ SE¼ of Section 25, T.14N., R.66E., M.D.B.&M. Application #54010 continued, stating that the "water is to be diverted from a 20-inch diameter well, via deep well No. 184-8A, pump, pipelines, pumping stations, reservoirs, and distribution system," that is estimated to cost "$700,000 (well and equipment only)," and take "Minimum 20 years" to construct.

19. Application #54011, Appendix Exhibit 4, was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined therein. The proposed point of diversion was described as being located within NE¼ SE ¼ of Section 14, T.14N., R.66E.,

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M.D.B.&M. Application #54011 continues, stating that the "water is to be diverted from a 20-inch diameter cased well, via deep well No. 184-9A, pump, pipelines, pumping stations, reservoirs, and distribution system," that is estimated to cost "$700,000 (well and equipment only)," and take "Minimum 20 years" to construct.

20. Application #54012, Appendix Exhibit 5, was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined therein. The proposed point of diversion was described as being located within SE¼ NE¼ of Section 16, T.14N., R.67E., M.D.B.&M. Application #54012 continues, stating that the "water is to be diverted from a 20-inch diameter cased well, via deep well No. 184-10A, pump, pipelines, pumping stations, reservoirs, and distribution system," that is estimated to cost "$700,000 (well and equipment only)," and take "Minimum 20 years" to construct.

21. Application #54013, Appendix Exhibit 6, was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined therein. The proposed point of diversion was described as being located within SW¼ SW¼ of Section 25, T.15N., R.66E., M.D.B.&M. Application #54013 continues, stating that the "water is to be diverted from a 20-inch diameter cased well, via deep well No. 184-11A, pump, pipelines, pumping stations, reservoirs, and distribution system," that is estimated to cost "$700,000 (well and equipment only)," and take "Minimum 20 years" to construct.

22. Application #54014, Appendix Exhibit 7, was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring

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Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined therein. The proposed point of diversion was described as being located within SW¼ SW¼ of Section 15, T.15N., R.67E., M.D.B.&M. Application #54014 continues, stating that the "water is to be diverted from a 20-inch diameter cased well, via deep well No. 184-12A, pump, pipelines, pumping stations, reservoirs, and distribution system," that is estimated to cost "$700,000 (well and equipment only)," and take "Minimum 20 years" to construct.

23. Application #54015, Appendix Exhibit 8, was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined therein. The proposed point of diversion was described as being located within SW¼ NW¼ of Section 14, T.15N., R.67E., M.D.B.&M. Application #54015 continues, stating that the "water is to be diverted from a 20-inch diameter cased well, via deep well No. 184-13A, pump, pipelines, pumping stations, reservoirs, and distribution system," that is estimated to cost "$700,000 (well and equipment only)," and take "Minimum 20 years" to construct.

24. Application #54020, Appendix Exhibit 9, was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 10 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined therein. The proposed point of diversion was described as being located within SE¼ SE¼ of Section 14, T.14N., R.67E., M.D.B.&M. Application #54020 continues, stating that the "water is to be diverted from a 20-inch diameter cased well, via deep well No. 184-2R, pump, pipelines, pumping stations, reservoirs, and distribution system," that is estimated to cost "$700,000 (well and equipment

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only)," and take "Minimum 20 years" to construct.

JURISDICTION AND VENUE

25. This Court has jurisdiction of this Petition pursuant to NRS 535.450.

26. Venue is properly in this Court pursuant to NRS 533.450(1) as the Seventh Judicial District Court in and for the State of Nevada includes White Pine and Lincoln Counties, both of which are "count[ies] in which the matters affected or a portion thereof are situated."

27. All requirements for judicial review have been satisfied.

THE PARTIES

28. SNWA, a political subdivision of the State of Nevada, was formed in 1991 by seven local Clark County water agencies, the Big Bend Water District, the City of Boulder City, the Clark County Water Reclamation District, the City of Henderson, the City of Las Vegas, the Las Vegas Valley Water District, and the City of North Las Vegas. SNWA now manages and operates the Southern Nevada Water System.

29. The Ranch, which is owned and operated by the CPB, is located in northern Spring Valley on 7,000 acres of fee land, with approximately 60,000 acres of grazing allotments. The Ranch is a major source of beef for the welfare program of The Church of Jesus Christ of Latter-day Saints, supplying approximately 35% of the Welfare Program's beef needs.

30. Cattle have been raised on the Ranch since at least the 1870s. The Ranch now runs about 1,750 head of cattle a year. To support this endeavor, the Ranch relies upon approximately 5,000 afa of certificated and decreed water rights; approximately 37,000 afa of vested surface water rights claims;[3] approximately 2,000 afa of permitted supplemental groundwater irrigation rights; and numerous stockwater rights and springs rights. The Ranch

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[3] These claims of vested rights are based on the use of surface water rights prior to Nevada's enactment of the water law in 1903.

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does not intend to diminish or cease its activities, but in fact to maintain and expand its water resources.

31. The springs located on the Ranch are the primary source of water for the cattle. The high water table in Spring Valley is what sustains the Ranch's springs and subirrigated lands as well as quality forage essential to cattle production. Lowering the water table would destroy those rights and have devastating effects on the Ranch.

32. Pursuant to NRS 532.020, the Nevada State Engineer is appointed by and responsible to the Director of the State Department of Conservation and Natural Resources. The State Engineer is statutorily authorized by NRS Chapter 533 to adjudicate applications to appropriate the public waters of the State of Nevada in the public interest and in conformity with various statutory criteria.

33. The Nevada Division of Water Resources ("NDWR") is headed by the Nevada State Engineer. According to the State Engineer, NDWR's mission is "to conserve, protect, manage and enhance the water resources of the state for Nevada's citizens through the appropriation and reallocation of pubic waters." Ruling #6164, Appendix Exhibit 1, at p. 27.

34. The State Engineer is responsible for reviewing all applications for the appropriation of water and, in accord with the water law and public policies of Nevada, approving or rejecting such applications. Ruling #6164, Appendix Exhibit 1, at p. 27.

BASIS FOR JUDICIAL REVIEW

35. The State Engineer's approval of SNWA's Spring Valley Applications ##54009 - 54015, and 54020 (1) directly conflicts with the Ranch's vested[4] water rights and will cause all of the Ranch's springs and subirrigated pastures to go dry; (2) will create a massive aggregate cone

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4 The Ranch uses the term "vested" to describe water rights which were fixed and established either by diversion and beneficial use prior to enactment of the statutory water law or by the statutory permit process. *See, e.g. Application of Filippini*, 66 Nev. 17, 22, 202 P.2d 535,

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of depression that will dominate Spring Valley in the vicinity of the Ranch with significant drawdowns; (3) will likely result in substantial subsidence and permanent loss of aquifer storage capacity; (4) will result in substantial and perpetual groundwater mining; and (5) will result in significant and irreversible impacts on unique animal and plant communities dependent on the current hydrological regime, destroying plant communities upon which the Ranch has relied for well over 100 years.

36. The State Engineer's approval of SNWA's Spring Valley applications ##54009 - 54015 and 54020 by Ruling #6164 (1) violates the Ranch's due process rights; (2) violates the Ranch's vested and other property rights; (3) exceeds the State Engineer's statutory authority; (4) constitutes a condemnation of private property without just compensation; (5) violates Nevada's public water policy as expressed by the Legislature, the Nevada Supreme Court, and other Rulings of the State Engineer; and (6) is not supported by substantial evidence, is arbitrary and capricious, and amounts to an abuse of discretion.

NEVADA LAW AND PUBLIC POLICIES

37. NRS 533.024 charges the Nevada State Engineer with responsibility for carrying out the public policy of the State with regard to water, stating in part that the State Engineer is "[t]o recognize the importance of domestic wells as appurtenances to private homes, to create a protectable interest in such wells and to protect their supply of water form unreasonable adverse effects which are caused by municipal, quasi-municipal or industrial uses and which cannot reasonably be mitigated[,]" and "to consider the best available science in rendering decisions concerning the available surface and underground sources of water in Nevada."

38. According to NRS 533.070(1), water may only be appropriated in Nevada if it is put to a beneficial use: "The quantity of water from either a surface or underground source which

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537 (1949).

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may hereafter be appropriated in this state shall be limited to such water as shall reasonably be required for the beneficial use to be served."

39. NRS 533.490(1) determines that the watering of livestock is a beneficial use.

40. According to NRS 533.085(1), nothing contained in NRS Chapter 533 is intended to be used to impair the vested right of any person to the use of water.

41. NRS 533.325 requires that anyone who wishes to appropriate any of Nevada's public waters, or to change the place of diversion, manner of use or place of use of water already appropriated, shall, before performing any work in connection with such application or change, apply to the State Engineer for a permit to do so. According to NRS 533.330, no application shall be for the water of more than one source to be used for more than one purpose.

42. SNWA's Spring Valley Applications are also governed by NRS 533.335, which requires that ***all*** applications ***shall*** contain each of the following items of specific information:

> 1. The name and post office address of the applicant and, if the applicant is a corporation, the date and place of incorporation.
> 2. The name of the source from which the appropriation is to be made.
> 3. The amount of water which it is desired to appropriate, expressed in terms of cubic feet per second, except in an application for a permit to store water, where the amount shall be expressed in acre-feet.
> 4. The purpose for which the application is to be made.
> 5. A substantially accurate description of the location of the place at which the water is to be diverted from its source and, if any of such water is to be returned to the source, a description of the location of the place of return.
> 6. A description of the proposed works.
> 7. The estimated cost of such works.
> 8. The estimated time required to construct the works, and the estimated time required to complete the application of the water to beneficial use.
> 9. The signature of the applicant or a properly authorized agent thereof.

43. If an application is for municipal supply or domestic use, as here, the application is also required by NRS 533.340(3) to state "the approximate number of persons to be served, and the approximate future requirement." If any water is to be stored, NRS 533.340(6) requires

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that the dimensions and locations of any proposed dam, its capacity, and a description of any land to be submerged by the impounded waters must also be stated.

44. NRS 533.368 authorizes the State Engineer to require, at the expense of the Applicant, hydrological, environmental, or other studies as necessary to make a final properly-informed determination on an application:

> 1. If the State Engineer determines that a hydrological study, an environmental study or any other study is necessary before the State Engineer makes a final determination on an application pursuant to NRS 533.370 and the applicant, a governmental agency or other person has not conducted such a study or the required study is not available, the State Engineer shall advise the applicant of the need for the study and the type of study required.
> 2. The required study must be conducted by the State Engineer or by a person designated by the State Engineer, the applicant or a consultant approved by the State Engineer, as determined by the State Engineer.
> 3. The applicant shall bear the cost of a study required pursuant to subsection 1. A study must not be conducted by the State Engineer or by a person designated by the State Engineer until the applicant has paid a cash deposit to the State Engineer which is sufficient to defray the cost of the study.
> 4. The State Engineer shall:
> (a) Consult with the applicant and the governing body of the county or counties in which the point of diversion and the place of use is located concerning the scope and progress of the study.
> (b) Send a copy of the completed study to all attorneys of record, to a public library, if any, or other public building located in the county of origin, to the county or counties in which the point of diversion and the place of use is located and to the governing bodies of the county of origin and of the county or counties in which the point of diversion and the place of use is located.
> 5. The State Engineer may adopt regulations to carry out the provisions of this section.

45. NRS 533.370(1) authorizes the State Engineer to approve an application submitted in proper form which contemplates the application of water to beneficial use if:

> (b) The proposed use or change, if within an irrigation district, does not adversely affect the cost of water for other holders of water rights in the district or lessen the efficiency of the district in its delivery or use of water; and
> (c) The applicant provides proof satisfactory to the State Engineer of the applicant's:
> (1) Intention in good faith to construct any work necessary to apply the water to the intended beneficial use with reasonable diligence; and
> (2) Financial ability and reasonable expectation actually to construct the work and apply the water to the intended beneficial use with reasonable diligence.

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46. The State Engineer has acknowledged that NRS 533.370(1)(c)'s requirements express the Nevada public policy against speculation in water rights and/or any practice authorizing applicants to tie up water for some future use. *See, e.g.,* State Engineer's 2011 Ruling #6122, at p. 42 (""NRS § 533.370(1)(c)(2) has as its goal the protection against speculation. Its intent is to avoid issuance of permits which can never, or unlikely to ever, satisfy the ultimate beneficial use requirement"); State Engineer's 2011 Ruling #6095, at p. 2 ("The State Engineer finds that the beneficial use requirement provides that the Applicant must demonstrate an actual beneficial use for the water applied for and does not allow for an applicant to tie up water for some project it might find in the future"); 2010 Ruling #6063, at p. 4 (to the same effect); *id.*, pp. 4-5 ("The State Engineer finds while it is useful to have new studies of water availability for Nevada's future growth, it threatens to prove detrimental to the public interest to allow an applicant to hold on to a water right application when it is unable to demonstrate an actual project for which the water will be used or to fail to provide information required by Nevada law"); 2009 Ruling #5997, pp. 5-6 (discussing the State's anti-speculation doctrine and an applicant's need to demonstrate actual need for water, its actual beneficial purpose, the quantity of water to be appropriated, and actions undertaken in furtherance of beneficial use of the water sought); 2007 Ruling #5782, p. 20 ("The Applicant also did not provide any evidence on the specifics of where water would be used and in what quantities; thus, there was no evidence of beneficial use"); 2006 Ruling #5612, p. 10 ("The State Engineer finds the Applicant did not provide anything specific as to what would be built and where. The State Engineer finds this is not the kind of specificity required under a water right application"). The Nevada Supreme Court has also declared the State's "anti-speculation doctrine." *See Bacher v. State Engineer*, 122 Nev. 1110, 1119-20, 146 P.3d 793, 799 (2007) (an "anti-speculation doctrine" precludes "speculative water rights acquisitions" to ensure "satisfaction of the

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beneficial use requirement that is so fundamental to our State's water law jurisprudence").

47. According to NRS 533.370(2), "where there is no unappropriated water in the proposed source of supply, or where its proposed use or change conflicts with existing rights or with protectable interests in existing domestic wells as set forth in NRS 533.024, or threatens to prove detrimental to the public interest, the State Engineer shall reject the application and refuse to issue the requested permit."

48. The Spring Valley Applications are interbasin transfers. Ruling #6164, Appendix Exhibit 1, at p. 28. NRS 533.370(3) imposes additional criteria on the State Engineer's approval or rejection of interbasin transfers, stating:

> 3. In addition to the criteria set forth in subsections 1 and 2, in determining whether an application for an interbasin transfer of groundwater must be rejected pursuant to this section, the State Engineer shall consider:
>
> (a) Whether the applicant has justified the need to import the water from another basin;
>
> (b) If the State Engineer determines that a plan for conservation of water is advisable for the basin into which the water is to be imported, whether the applicant has demonstrated that such a plan has been adopted and is being effectively carried out;
>
> (c) Whether the proposed action is environmentally sound as it relates to the basin from which the water is exported;
>
> (d) Whether the proposed action is an appropriate long-term use which will not unduly limit the future growth and development in the basin from which the water is exported; and
>
> (e) Any other factor the State Engineer determines to be relevant.

49. The State Engineer is required to act upon an application in writing in accord with NRS 533.370(8), which states:

> If a hearing is held regarding an application, the decision of the State Engineer must be in writing and include findings of fact, conclusions of law and a statement of the underlying facts supporting the findings of fact. The written decision may take the form of a transcription of an oral ruling. The rejection or approval of an application must be endorsed on a copy of the original application, and a record must be made of the endorsement in the records of the State Engineer. The copy of the application so endorsed must be returned to the applicant. Except as otherwise provided in subsection 11, if the application is approved, the applicant may, on receipt thereof, proceed with the construction of

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> the necessary works and take all steps required to apply the water to beneficial use and to perfect the proposed appropriation. If the application is rejected, the applicant may take no steps toward the prosecution of the proposed work or the diversion and use of the public water while the rejection continues in force.

50. NRS 533.380(1) addresses, among other things, the time for an applicant to complete work and apply water to beneficial use, and requires that in approving any application, the State Engineer shall: "(a) Set a time before which the construction of the work must be completed, which ***must be within 5 years after the date of approval*** " and "(b) [S]et a time before which the complete application of water to a beneficial use must be made, which ***must not exceed 10 years after the date of the approval.*** " [Emphasis added.] According to NRS 533.380(3), any extensions must be "[a]ccompanied by proof and evidence of the reasonable diligence with which the applicant is pursuing the perfection of the application." NRS 533.380(6) also provides that "the measure of reasonable diligence is the steady application of effort to perfect the application in a reasonably expedient and efficient manner under all the facts and circumstances."

51. The burden of meeting all of the statutory conditions for grant of an application to appropriate water is on the Applicant, here SNWA. *Bacher v. State Engineer*, 122 Nev. 1110, 1116, 146 P.3d 793, 797 (2007) ("NRS Chapter 533 prescribes the general requirements that every applicant must meet to appropriate water"). Thus, it was SNWA's burden to present evidence showing that its Applications should be granted. To the extent of any gaps in the Application or the evidence, SNWA did not meet its burden and its Applications should have been denied as a matter of law

52. According to the Nevada Supreme Court, Nevada's water laws are to be construed strictly. *Preferred Equities Corp. v. State Engineer*, 119 Nev. 384, 390, 75 P.3d 380, 383-84 (2003).

53. A vested water right "is regarded and protected as property." *Application of Filippini*, 66 Nev. 17, 22, 202 P.2d 535, 537 (1949). A water right "is regarded and protected as real property." *Town of Eureka v. State Engineer*, 108 Nev. 163, 167, 826 P.2d 948, 951 (1992), *citing Carson City v. Estate of Lompa*, 88 Nev. 541, 542, 501 P.2d 262, 264-65 (1979).

54. Vested water rights are entitled to the protections of due process. *Revert v. Ray*, 95 Nev. 782, 787, 603 P.2d 262, 264-265 (1979).

55. The "utilization of water by grazing livestock," for example, "constitutes sufficient appropriation to establish a vested water right" in a spring that is used for such a purpose. *Waters of Horse Spring v. State Engineer*, 99 Nev. 776, 778, 671 P.2d 1131, 1132 (1983) (cattle ranching operation had vested right to water of springs).

56. Permanent groundwater mining is unacceptable under Nevada law and public policy. *See, e.g.,* State Engineer's 2007 Ruling #5726, at p. 52, stating when considering the same Applications as are the subject of Ruling #6164: "Mining of ground water is not acceptable and appropriation of this magnitude will lower the water table and degrade the quality of water from existing wells, cause negative hydraulic gradients influences, and other negative impacts and adversely affect existing rights and the public interest." *See also,* 7/9/1964 Ruling #707, p. 1 (extraction of any additional water would have an adverse effect on existing water rights within the basin); 2/3/1969 Ruling #1327, p. 1 (existing groundwater rights exceeded estimates of recharge to the basin); 4/26/1972 Ruling #1842, p. 1 (existing groundwater rights exceeded estimated recharge); 4/13/1975 Ruling #2045, p. 1 (existing groundwater rights exceeded the perennial yield); 4/10/1979 Ruling #2453, pp. 4-5 (additional withdrawal of water would result in groundwater mining); 1/13/1988 Ruling #3486, p. 6 (additional withdrawal of water would result in groundwater mining and "conflict with existing rights and be detrimental to the public interest"); 12/28/1989 Ruling #3664, p. 9 (existing groundwater rights exceeded annual recharge

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within the basin and would "impair the value of existing rights and threaten to prove detrimental to the public interest and welfare"); 5/21/1990 Ruling #3708, pp. 3-4 (existing groundwater rights substantially exceeded the perennial yield); 1/23/1990 Ruling #3679, pp. 11-13 ("Withdrawals of ground water in excess of the perennial yield contribute to adverse conditions such as water quality degradation, storage depletion, diminishing yield of wells, increased economic pumping lifts, land subsidence and reversal of ground water gradients which could result in significant changes in the recharge/discharge relationship. These conditions have developed in several other ground water basins within the State of Nevada where storage depletion and declining water tables have been recorded and documented"); 04/16/2007 Ruling #5726, p. 52 ("Mining of groundwater is not acceptable"); 7/16/2007 Ruling #5750, pp. 21-22 (withdrawal of substantial amounts of groundwater in excess of perennial yield would :adversely affect existing rights and would threaten to prove detrimental to the public interest"); 8/3/11 Ruling #6134, at p. 4 (denying permits where basin was already over-appropriated and increased withdrawals would constitute groundwater mining with "significant impact" on both the quality of water and existing water rights); 10/14/2011 Ruling #6151, p. 4 (approval of application would result in withdrawal of groundwater in substantial excess of perennial yield and the resulting groundwater mining "would conflict with existing rights and would threaten to prove detrimental to the public interest").

57. To withstand the Court's reversal on judicial review, the State Engineer's determination of an application to appropriate water must be supported by "substantial evidence." *Bacher v. State Engineer*, 122 Nev. 1110, 1121, 146 P.3d 793, 800 (2007). Substantial evidence is that evidence "which 'a reasonable mind might accept as adequate to support a conclusion.'" *Id.*; and *id.* at 122 Nev. at 1123, n. 37, 146 P.3d at 801, n. 37 ("speculative evidence of development projects is not sufficient to survive a substantial evidence

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inquiry on review").

COUNT ONE
THE STATE ENGINEER'S RULING #6164 VIOLATES FUNDAMENTAL DUE PROCESS

58. Petitioner repeats and realleges the allegations in Paragraphs 1-57 as though set forth fully herein.

59. The due process requirements of the 14th Amendment to the U.S. Constitution and Article 1, Sec. 8(5) of the Nevada Constitution apply to administrative decisions and require that interested parties be apprised of the nature of the proceeding so that there is no unfair surprise. *Nevada State Apprenticeship v. Joint Apprenticeship*, 94 Nev. 753, 765, 587 P.2d 1315, 1317 (1978).

60. SNWA's 1989 Applications ##54009 - 54015, and 54020 for Spring Valley each state that the proposed diversion will require a drilled and cased well, motor and pump, pipelines and a distribution system. The proposed points of diversion are hundreds of miles from the proposed places of use. Despite the enormity of the work involved in effecting the work upon which the Applications were noticed, the Applications estimate the cost of necessary work at $750,000. That estimate is unrealistically low and cannot be achieved at that cost. In fact, at p. 48, Ruling #6164 states that SNWA's engineering department now estimates the cost of completion of the GWP, by 2020, to be approximately $6.45 billion, or 850 times greater than what was noticed to the public and Protestants by SNWA's Spring Valley 1989 Applications.

61. NRS 533.335's requirement that Applications state the source from which appropriation is to be made, the amount requested in cubic feet per second, the purpose for the water, the place of diversion, a description of the proposed work, the estimated cost of the works, and the time required to construct the work and apply the water to its proposed beneficial use is imperative and implies that a +/- 50-year process is not intended. The confusion in protesting an

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application for a project of unknown start-date, unknown cost, and unknown beneficial use is not intended by Nevada's statutory scheme and does not comport with fundamental due process. The State Engineer's consideration and approval of SNWA's challenged 1989 Applications violated the Ranch's fundamental due process rights.

62. SNWA's 23-year old Applications are sketchy, vague, outdated, and invalid. They do not give reasonable or fair notice of what SNWA was seeking and should not have been the subject of the State Engineer's action. SNWA's actual intent and the State Engineer's Ruling deviate so far from the content of the actual applications as to have rendered the 23-year old Applications of no use at all in giving notice to the Ranch or other interested parties and the public of SNWA's true intentions. The State Engineer's reliance on the outdated Spring Valley Applications violates the State Engineer's statutory authority and fundamental due process.

63. Ruling #6164, at p. 211, states that "The State Engineer finds for the purposes of the application form, the Applications adequately describe the proposed works, the cost of such works, estimated time required to construct the works and place the water to beneficial use and the approximate number of persons to be served" and dismisses protests based on the insufficiency of the 1989 Applications to apprise interested parties, including the Ranch, of SNWA's Application and intent.

64. Ruling #6164 leaves too much up to SNWA's good intentions. SNWA's own experts admitted that the viability of SNWA's GWP depends entirely on the success of the monitor-manage-mitigate plan. *See, i.e.,* 10/10/11 Transcript, pp. 2533-35 (Prieur and Marshall).

65. While SNWA's presentation to the State Engineer described its needs as "pressing," it also acknowledged that it could not begin putting the water to beneficial use until around 2028, 39 years after its Applications were made, and that it is unclear and uncertain whether the GWP is required for other than "drought purposes." *See* SNWA's 9/16/11 Opening

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Statement.

66. Ruling #6164 violates fundamental due process because it does not give reasonable notice of what rights have been granted to SNWA and it allows SNWA to move forward imposing it own manage, monitor, and mitigate decisions without adequate protection of the Ranch's vested and other water rights through notice and information and without adequate supervision of the State Engineer. For example, at pp. 103-104 of Ruling #6164, the State Engineer accords tremendous responsibility and authority to groups, panels, and committees created by the 2006 Stipulation between SNWA and four divisions of the U.S. Department of the Interior to which neither the State Engineer nor any of the Protestants, including CPB, are parties, stating:

> The State Engineer is not a party to the Stipulation with the Federal Agencies. While the Stipulation is binding on the Applicant and the Federal Agencies, it is not binding on the State Engineer. However, the Stipulation is important to the consideration of the Applications for a number of reasons. First, the Stipulation formed the process for the initial development of the Spring Valley Management Plan. Second, the Stipulation addresses how the Federal Agencies and the Applicant will resolve issues between themselves that are related to Federal claims to water rights and resources. Third, the Stipulation provides a forum through which critical information can be collected from hydrologic and biological experts that the State Engineer can utilize to assure development of the Applications will not conflict with existing water rights or with protectable interests in existing domestic wells.
>
> By its terms, the Stipulations, and its exhibits, set forth the guidelines for the elements of the monitoring plan. Exhibit A established the technical framework and structure for the hydrologic elements of the monitoring, management and mitigation program. Exhibit B provided the same technical structure and management elements for the biologic portion of the plan. The parties agreed upon mutual goals to guide the development of these monitoring plans. The common hydrologic goals of the parties are: (1) to manage the development of groundwater by SNWA in the Spring Valley hydrographic basin without causing injury to Federal water rights and/or any unreasonable adverse effects to Federal resources; (2) to adequately characterize the groundwater gradient from Spring Valley to Snake Valley via Hamlin Valley; and (3) to avoid effects on Federal resources located within the boundaries of Great Basin National Park.
>
> The Stipulation established a Technical Review Panel ('TRP') for the hydrologic plan, a Biological Work Group ('BWG') for the biological plan, and an Executive Committee to oversee implementation and execution of the agreement. The TRP and BWG are composed of subject matter experts who act as representatives from each of the parties to the Stipulation who review, analyze, interpret, and evaluate information collected under the plan. The technical panels will also evaluate model results and make recommendations to the Executive

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Committee.

The technical review teams for both the hydrologic component and the biologic component work together to accomplish the goals of the Stipulation. For example, Mr. Prieur[5] testified that during development of the monitoring plan, the teams conducted field trips to identify springs that were of biologic interest and should be included in the monitoring plan network. The Applicant's representatives regularly meet with the TRP and the BWG to discuss ways to best utilize each group's data and to discuss any additional hydrologic data that may be needed under the plan.

The Executive Committee reviews TRP recommendations pertaining to technical and mitigation actions. The Executive Committee also resolves disputes in the event the TRP cannot reach a consensus on monitoring requirements, research needs, technical aspects of study design, interpretation of results or appropriate actions to minimize or mitigate unreasonable adverse effects on Federal resources or injury to Federal water rights. If the Executive Committee cannot reach a consensus, a dispute resolution procedure directs such a matter to be forwarded for resolution to the State Engineer or another qualified third-party.

67. The State Engineer concedes that the 2006 Stipulation between SNWA and the Department of the Interior's four bureaus was not intended to protect CPB. "CPB is not a party to the Stipulation, and the Stipulation was not intended to address non-federal water rights," but argues that the Stipulation "in no way limits" his obligations or authority to protect CPB's existing water rights." Ruling #6164, p. 105.[6] But, the State Engineer is not a party to the Stipulation and the State Engineer does not control of what testing, information, and planning he or she will receive from the actual parties to the Stipulation. The State Engineer does not even control what information the Stipulation's teams and committees are obliged to release to him or her. The "monitoring" conducted by SNWA and/or the committees, groups, and teams created by the Stipulation are insufficient regarding identification of impacts specific to the Ranch's water rights. By relying to such a large extent on the Stipulation and the committees, groups,

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[5] James Prieur is a Senior Hydrologist for the Applicant.

[6] To illustrate CPB's position as an outsider to the members of the Stipulation's panels, committees, and groups responsible for analyzing how and when to mitigate or minimize potential harm to the CPB and others similarly situated, the Hearing Officer cut CPB short when questioning Mr. Zane Marshall, SNWA's Environmental Resources Director, about how the monitor-manage-mitigate provisions of the 2006 Stipulation would operate. Ruling #6164, at pp. 2498-2500 ("Hold on, Mr. Hejmanowski. [I]t's a stipulated settlement between particular parties. The Tribe didn't settle. The ranch didn't settle. So I don't really know your point. So I don't know how much farther I'm going to let you go.... Told you I wasn't going to let you go much further").

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and teams created by it, the State Engineer's Ruling #6164 does not protect existing water rights and violates fundamental due process owed to those to whom the State Engineer is responsible, including the CPB.

COUNT TWO
THE STATE ENGINEER'S RULING #6164 VIOLATES NRS 533.370(2) AND NEVADA LAW AND PUBLIC POLICY AGAINST GROUNDWATER MINING

68. Petitioner repeats and realleges Paragraphs 1-67 as though fully set forth herein.

69. SNWA represented in the hearing that:

> For basins with significant groundwater discharge to the surface in the form of ET, the perennial yield is limited to the total annual groundwater ET. For basins without significant groundwater ET, the definition of the perennial yield has been interpreted in different ways. The maximum perennial yield has, however, always been defined as no more than the total annual recharge volume to the basin.
>
> Spring Valley is a basin with considerable groundwater ET; therefore, the perennial yield is equal to groundwater ET in the basin, 94,800 afy.

SNWA 9/16/11 Opening Statement, at p. 6.

70. The State Engineer acknowledges that SNWA's application constitute the largest demand for interbasin transfers in Nevada's history and that Nevada is the driest state in the United States. Such facts have caused the State Engineer to condemn groundwater mining in general, as in Ruling #5726, p. 52, in consideration of precisely the same SNWA Applications as at issue in Ruling #6164, stating: "Mining of ground water is not acceptable and appropriation of this magnitude will lower the water table and degrade the quality of water from existing wells, cause negative hydraulic gradients influences, and other negative impacts and adversely affect existing rights and the public interest."

71. Ruling #6164 contains no similar condemnation of groundwater mining, because, in fact, it authorizes SNWA to engage in precisely the dangerous and detrimental, and heretofore unlawful practice which is against Nevada public interest and will interfere with and prove

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detrimental to, if not outright destroying, CPB's existing water rights.

72. The State Engineer's Ruling #6164 does not condemn groundwater mining, choosing instead only to define it:

> The perennial yield of a groundwater reservoir may be defined as the maximum amount of groundwater that can be salvaged each year over the long term without depleting the groundwater reservoir. Perennial yield is ultimately limited to the maximum amount of natural discharge that can be salvaged for beneficial use. The perennial yield cannot be more than the natural recharge to a groundwater basin and in some cases is less. If the perennial yield is exceeded, groundwater levels will decline and steady state conditions will not be achieved, a situation commonly referred to as groundwater mining.

Ruling #6164, Appendix Exhibit 1, at p. 56.

73. Ruling #6164 does not require that ET be captured by SNWA's project. *See, i.e.*, Ruling #6164 at p. 90 ("The State Engineer finds that there is no provision in Nevada water law that addresses time to capture, and no State Engineer has required that ET be captured within a specified period of time. It will often take a long time to reach near-equilibrium in large basins and flow systems...); and at p. 91 ("The State Engineer finds that the Applicant is not required to prove capture of ET as a prerequisite to approval of the Applications"). Those determinations result in authorizing SNWA to engage in unprecedented and impermissible permanent groundwater mining which poses devastating harm to the Ranch and is contrary to Nevada law and public policy.

74. When asked why SNWA's proposed project is not groundwater mining, Dr. James Watrus, SNWA's senior hydrologist and expert witness, testified that SNWA "will not in all likelihood be awarded" what it applied for, and in addition, reliance on SNWA's good intentions should suffice. 10/11/11 Transcript, at 2609.

75. Dr. Watrus also conceded that were SNWA to engage in groundwater mining, it "would result in devastating effects." 10/11/11 Transcript, at 2609.

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76. Were groundwater mining not of serious concern and a potential result of the approval of SNWA's Spring Valley Applications, there would have been no reason for the State Engineer to have (1) addressed the amount of perennial yield for 35 pages of Ruling #6164 (pp. 56-90); or (2) determined that the perennial yield of the Spring Valley Hydrographic Basin is 84,000 acre-feet (*id.*, at p. 90).

77. SNWA will not be able to capture ET and will engage in permanent groundwater mining to the injury of the Ranch and in violation of public policy. Ruling #6164 violates Nevada law and public policy by sanctioning groundwater mining.

COUNT THREE
RULING #6164 EXCEEDS THE STATE ENGINEER'S STATUTORY AUTHORIZATION

78. Petitioner repeats and realleges Paragraphs 1-77 as though fully set forth herein.

79. In reviewing applications to appropriate water, the State Engineer is charged by statute with responsibility for determining the amount of water available for appropriation. The State Engineer concluded by Ruling #6164 that for the Spring Valley Hydrographic Basin there is 84,000 afa perennial yield primarily based on groundwater ET. The State Engineer also determined existing water rights to be 18,873 afa. Reserving 4,000 afa for future growth and development, the State Engineer determined the total amount of unappropriated water in the Spring Valley Hydrographic Basin to be 61,127 afa.[7]

80. The State Engineer is also charged by statute with responsibility for determining whether applications to appropriate public water will conflict with existing water rights. The State Engineer approved 15 wells for SNWA (of which eight are the subject of this Petition for

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[7] Ruling #6164 is unclear whether the 4,000 afa left for future growth and development includes or excludes use by SNWA. It is the Ranch's position that if SNWA wants to use groundwater from Spring Valley for ranching and/or "mitigation" (*i.e.*, pumping water re replace spring flows, lost irrigation flows, or other losses), it should be required to do so from its 61,127 afa and leave the 4,000 afa to other users, such as the Ranch.

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Judicial Review) for 61,127 afa, with a staged development limited to 38,000 afa for the first eight years; 50,000 afa for the next eight years; and 61,127 afa perpetually thereafter. Ruling #6164 says the State Engineer will evaluate the impact of the pumping at each stage of development before SNWA is to be allowed to proceed to the next stage of development.

81. At page 91 of Ruling #6164, the State Engineer "finds that there is no requirement that the Applicant must show that the proposed well placement will actually be able to fully capture discharge." That finding is contrary to law governing the State Engineer's responsibilities because in determining whether an applicant may appropriate water, the State Engineer is required to determine that there is unappropriated water available for use. If the discharge cannot or will not be captured, then it is not available for use.

82. As the Applicant, SNWA bears the burden of demonstrating that the water is available for use.

83. If SNWA did not demonstrate that it can or will capture the discharge, then SNWA has not met its statutory burden and the eight Applications challenged by this Petition should not have been approved by the State Engineer as a matter of law.

84. The State Engineer acted in excess of his authority in relieving SNWA of its statutory burden to demonstrate that its GWP will not constitute groundwater mining.

85. In determining that Applications ##54009-15, and 54021 do not conflict with CPB's existing rights, the State Engineer acted in excess of his statutory authority because he did not determine the amount of unappropriated water "in the proposed source of supply" as required by NRS 533.370(2), as opposed to the amount of unappropriated water available in the entire Spring Valley Hydrologic Basin.

86. The State Engineer was required to determine what portion of the 84,000 afa is in the area of the protested Applications, evaluate what existing water rights are in that area, and

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then determine the amount of the unappropriated water for that area. For the State Engineer not to have made such determinations violates NRS 533.370(2), which requires a determination of unappropriated water that is available "in the proposed source of supply."

87. The State Engineer's Ruling #6164 is based on so many unknowns that the approval of the challenged Applications constitutes action in excess of the State Engineer's statutory authority. *See, i.e.,* the following statements evidencing the lack of information, uncertainties, and assumptions upon which Ruling #6164, so important to the Ranch's survival, is based:

> "In the case of more severe and prolonged shortages, there is a significant degree of uncertainty regarding the amount of water that would be available to Southern Nevada. In order to address that uncertainty, the Applicant used a series of assumptions in its analysis." (p. 36);
>
> "The assumptions in the Applicant's analysis may over-estimate or under-estimate the reductions that would occur during shortage, but the assumptions are reasonable for water planning purposes in light of the many uncertainties that exist. While the exact amounts of these reductions are unknown, the evidence clearly supports a conclusion that the reductions would be significant." (p. 37);
>
> "In the short-term, there is a high degree of uncertainty regarding the population increases that will occur in Southern Nevada." (p. 41);
>
> "The information used by both parties to support their interbasin flow calculations is sparse, and estimates of flow using limited data will have significant uncertainty." (p. 83);
>
> "For large projects like the one at issue, the detailed hydraulic properties are simply not known well enough to precisely predict the dynamic response of pumping. In addition, the groundwater in a basin may be appropriated by many different individuals and entities. There is no practical way to require them to manage their groundwater operations collectively to reach full capture. Moreover, the location of the small amount of private land in Nevada limits where wells can be placed to capture ET." (p. 91);
>
> "The complexity and large size of the region modeled and the sparseness of available data result in uncertainties in the Applicant's model simulations. Furthermore, the lack of good historical data on anthropological uses of groundwater provides further uncertainty to the model simulations. Because of the model's regional scale, local-scale features are not accurately simulated. For instance, Dr. D'Agnese testified that it would not be appropriate to use the model to make drawdown predictions at Cleveland Ranch or spring-flow predictions for the Gandy Warm Springs and McGill Springs." (p. 125);

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"The State Engineer finds that the Applicant's model provides a reliable tool to examine potential effects on the groundwater system; however, the model contains many uncertainties that must be kept in mind as it is used to analyze the system." (p. 128);

"The uncertainty with longer prediction periods relates in part to the fact that no actual data exists for large-scale pumping, so predicting conditions many hundreds of years into the future only compounds the uncertainty caused by lack of data." (p. 129);

"Some adjustments had to be made to the model to represent full pumping of the Application points of diversion. Specifically, the model framework could not support pumping at Application 54021. The Applicant's model locates points of diversion in the center of the modeling cell, which in this case was an impermeable rock layer."[8] (p. 130);

"There are limitations in the model predictions that must be accounted for in the conflicts analysis." (p. 130);

"[T]he model is a regional model whose site specific predictions are highly uncertain. The model cannot currently represent the complex geologic stratification on the valley floor in Spring Valley." (p. 131);

"Other limitations include a lack of historical pumping drawdown data to determine how consumptive uses affect the aquifer over time and a lack of variation in recharge over time to assess how increased or decreased recharge will influence drawdown under different pumping regimes." (p. 131);

"The State Engineer finds that predictions of the models become increasingly uncertain over extended periods of time. The State Engineer further finds that model predictions of drawdowns of less than 50 feet and spring flow reductions of less than 15% are highly uncertain..... [B]ecause the model does not accurately represent local-scale geologic and hydrogeologic features that influence drawdown, numeric drawdown predictions are not precise." (p. 132);

"The State Engineer agrees the reliability of model predictions decreases the further out into the future they are made, especially when the period of future simulations exceeds the period of available pumping data." (p. 146); and

"The State Engineer finds that due to the uncertainties associated with many of the studies and evidence submitted during the hearing by all the parties, it is prudent to consider and weigh the science provided by all parties...." (p. 162).

88. Ruling #6164 acknowledges a lack of "critical information" and the need for additional data. Ruling #6164, at p. 104. The Applications should have been denied based on this lack of critical evidence. Instead, Ruling #6164 takes a wait-and-see approach by granting the Applications subject to what additional information shows. The following excerpts from Ruling # 6164 are examples:

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"Third, the Stipulation provides a forum through which critical information can be collected from hydrologic and biological experts that the State Engineer can utilize to assure development of the Applications will not conflict with existing water rights or with protectable interests in existing domestic wells." (p. 104.)

"[T]he monitoring efforts and data collection in Spring Valley will provide scientifically sound baseline information from which changes to the system and potential impacts can be diagnosed, assessed, and, if necessary, mitigated." (p. 111.)

"In order to ensure that existing rights are not impacted, additional information is necessary." (p. 151.)

"The State Engineer finds that staged development of the resource under the applications granted allows for further data collection to alleviate any uncertainty ...." (p. 151.)

"The Applicant's model will be improved in the future as more data is collected.... As the model continues to improve, it will be used as a management tool by the State Engineer to monitor and manage the Applicant's pumping in order to prevent impacts to existing rights and environmentally sensitive areas. The State Engineer finds that the Applicant will be required to improve and use its model as a management tool, which will be used to prevent impacts currently predicted by the models in this hearing." (p. 117.)

The State Engineer is charged with guarding the public interest. Given the unknowns and variables associated with the challenged Applications, it was impossible for the State Engineer to have approved the challenged Applications and still have guarded the public interest. *See, e.g.* 2011 State Engineer's Ruling #6136 (denying an application and stating that "without the additional data, sufficient information is not available to properly guard the public interest").

89. The State Engineer also acted in excess of his statutory authority by ignoring the plain language of NRS 533.370(3)(d) regarding future growth and development.

90. The State Engineer's Ruling #6164 wrongfully focuses on whether the Protestants presented evidence of future growth and development that would require a specific quantity of water.

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[8] Application #54021 is one of the Applications protested by CPB.

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91. In determining that Applications would not unreasonably limit future growth, the State Engineer wrongfully allocated the burden to the Protestants rather than to the Applicant.

92. When the provisions of NRS 533.370(3)(d) were added to NRS Chapter 533, the legislative history evidences the Legislature's concern for the originating basins' "potential losses of taxable income, social stability or the ability to economically develop in the future." Summ. of Legisl., 1999 Legl. 70th Sess. 11, 41 Nev. (1999) (remarks of Naomi Duerr). A broad view of future growth and development was to be applied. *See* Gregory J. Walch and Stacy D. Harrop, *The SNWA Groundwater Development Project: Creating New Water Law,* Clark County Bar *Communique*, September 2008. The State Engineer's Ruling #6164 ignores the Legislature's directive.

93. The State Engineer is not a party to SNWA's September 8, 2006, Stipulation with four federal bureaus through the Department of the Interior (the National Park Service, the Fish and Wildlife Service, the Bureau of Land Management, and the Bureau of Indian Affairs). Nonetheless, the State Engineer finds that the Stipulation "provides a forum through which critical information can be collected... and used to assure development of the Applications will not conflict with existing water rights or with protectable interests in existing domestic wells." Ruling #6164, at pp. 119-120. Part of the information to be collected by the parties to the Stipulation concerns the potential effect of SNWA's potential request to change points of diversion and rates of withdrawal of groundwater within the Spring Valley Hydrographic Basin Reliance. Such changes have a tremendous impact on the Ranch and the State Engineer's reliance on the studies and reports generated by groups, panels, or committee of which the State Engineer is not a part is a wrongful abdication of the State Engineer's duties and obligations to CPB and the public under NRS Chapter 533.

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94. The State Engineer's Ruling #6164 does not specify time limits in accord with NRS 533.380(1) for SNWA's completion of the construction of work, which must be within 5 years after the date of approval, or for SNWA's application of the water to a beneficial use, which must not exceed 10 years from the date of approval.

<u>COUNT FOUR</u>
RULING #6164 AMOUNTS TO A TAKING OF PRIVATE PROPERTY WITHOUT JUST COMPENSATION

95. Petitioner repeats and realleges Paragraphs 1-94 as though fully set forth herein.

96. The right to just compensation for private property taken for the public use is guaranteed by the Fifth Amendment to the United States Constitution, and Article I, section 8, of the Nevada Constitution.

97. A taking can occur when the government regulates or physically appropriates an individual's private property.

98. "Just compensation" requires that the market value of the property should be determined by reference to the highest and best use for which the land is available and for which it is plainly adaptable. Every factor which affects the value of the property and which would influence a prudent purchaser must be considered.

99. The State Engineer's approval of SNWA's Applications 54009 - 54015, and 54020 constitutes a taking by regulation of private property belonging to CPB on behalf of Cleveland Ranch and entitles CPB to just compensation.

<u>COUNT FIVE</u>
RULING #6164 IS ARBITRARY AND CAPRICIOUS, AN ABUSE OF DISCRETION, AND NOT SUPPORTED BY SUBSTANTIAL EVIDENCE

100. Petitioner repeats and realleges Paragraphs 1-99 as though fully set forth herein.

101. NRS 533.370(5) says the State Engineer "shall reject" an application "where its proposed use or change conflicts with existing rights or with protectable interest in existing

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domestic wells ...."

102. The State Engineer's Ruling #6164 acknowledges that the evidence presented to him predicted significant impact to existing rights, but granted the Applications based on the lack of information and evidence, subject to future evidence gathering. For example, Ruling #6164 states: "The Applicant's model will be improved in the future as more data is collected" and "the Applicant will be required to improve and use its model as a management tool, which will be used to prevent impacts currently predicted by the models in this hearing." Ruling #6164, at p. 117.

103. The State Engineer did not find that the protested Applications would not conflict with existing rights. Instead, the State Engineer acknowledged that the models predicted significant impact, but granted the Applications anyway without a clear understanding of what the impact to existing rights will be based on future changes to avoid those impacts. Not only is the information insufficient for determining current impacts, but there is no provision for collecting the right information to determine impacts as SNWA's GWP moves forward through a staged development. In effect, the State Engineer did not make the decision the law requires him to make but adopted an arbitrary wait-and-see approach with the promise to intervene when existing rights are impacted. The Ruling, in essence, hopes for the best while committing to undo itself if the worst occurs. This is arbitrary and capricious.

104. Ruling #6164 is arbitrary and capricious and an abuse of discretion in that it granted the Applications even while acknowledging significant uncertainty due to a lack of evidence.

105. The State Engineer's ruling is not supported by substantial evidence. Instead, the State Engineer specifically acknowledged the need for additional evidence: "In order to ensure that existing rights are not impacted, additional information is necessary." Ruling #6164, at p.

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151. This is an express acknowledgment that SNWA did not meet its burden. "Staged development, in conjunction with an updated and more comprehensive Management Plan is also necessary to assure the Applications will not conflict with existing rights or domestic wells, and to assure pumping is environmentally sound." *Id.* The State Engineer acknowledges the need for "further data collection …." *Id.*

106. The State Engineer arbitrarily refused to consider evidence of impacts after 75 years, even though the undisputed evidence showed that groundwater mining would continue perpetually and that the GWP would never reach steady-state conditions.

107. The State Engineer's ruling ignores the "best ***available*** science" and grants the Applications despite the fact that the ***available*** science predicted perpetual groundwater mining and significant impacts to existing rights.

108. Ruling #6164 is arbitrary and capricious in that it adopts no standards for monitoring or mitigation, or for determining when intervention is necessary to protect existing rights and the public interest.

109. Ruling #6164 is arbitrary and capricious and against the public interest in that it gambles billions of dollars in public money on the hope that the project will not interfere with existing rights and have to be significantly curtailed or shut down.

WHEREFORE, Petitioner respectfully requests that this Court declare the State Engineer's Ruling #6164 invalid and unenforceable as to SNWA Applications ##54009 - 54015, and 54020; and

Petitioner also respectfully requests that this Court grant such other and further relief as the Court deems just and proper, including, but not limited to, relief requiring that to the extent any portion of Ruling #6164 may remain operative, a more robust monitoring system be imposed to determine impacts to the Ranch's water rights, and that the Ruling be clarified that the 4,000

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afa reserved by the State Engineer for "future use" in the Spring Valley Hydrographic Basin be reserved for parties other than SNWA.

DATED this 19TH day of April, 2012.

LIONEL SAWYER & COLLINS

By [signature]
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Attorneys for Petitioner, Corporation of the Presiding Bishop of The Church of Jesus Christ of Latter-day Saints on behalf of Cleveland Ranch

CERTIFICATE OF SERVICE

I hereby certify that on this 20th day of April, 2012, a true and correct copy of the foregoing Petition for Judicial Review of the Corporation of the Presiding Bishop on Behalf of the Cleveland Ranch and accompanying Appendix to Petition for Judicial Review was served by certified or registered mail on the following:

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State of Nevada Department of
Conservation and Natural Resources
Division of Water Resources
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Carson City, Nevada 89701-5250

Southern Nevada Water Authority
Dana R. Walsh, Esq.
1001 South Valley View Blvd, MS #485
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[signature]

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Appendix Exhibits

1	State Engineer's Ruling #6164
2	SNWA Application No. 54009
3	SNWA Application No. 54010
4	SNWA Application No. 54011
5	SNWA Application No. 54012
6	SNWA Application No. 54013
7	SNWA Application No. 54014
8	SNWA Application No. 54015
9	SNWA Application No. 54020
10	State Engineer's 3/22/12 Letter accompanying Ruling #6164

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APPENDIX 2

IN THE OFFICE OF THE STATE ENGINEER
OF THE STATE OF NEVADA

IN THE MATTER OF APPLICATIONS 54003)
THROUGH 54021, INCLUSIVE, FILED TO)
APPROPRIATE THE UNDERGROUND)
WATERS OF THE SPRING VALLEY)
HYDROGRAPHIC BASIN (184), LINCOLN)
AND WHITE PINE COUNTIES, NEVADA.)

RULING

#6164

GENERAL

I. DESCRIPTION OF APPLICATIONS

Application 54003 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cubic feet per second ("cfs") of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark). The proposed point of diversion is described as being located within the NW1/4 NE1/4 of Section 20, T.8N., R.68E., M.D.B.&M, within Lincoln County.[1]

Application 54004 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined above. The proposed point of diversion is described as being located within the NE1/4 SE1/4 of Section 25, T.9N., R.67E., M.D.B.&M, within Lincoln County.[2]

Application 54005 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined above. The proposed point of diversion is described as being located within the NE1/4 NE1/4 of Section 14, T.9N., R.67E., M.D.B.&M, within Lincoln County.[3]

Application 54006 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined above. The proposed point of diversion is described as being located within the SE1/4 SE1/4 of Section 22, T.10N., R.67E., M.D.B.&M, within White Pine County.[4]

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[1] Exhibit No. SE_003.
[2] Exhibit No. SE_004.
[3] Exhibit No. SE_005.
[4] Exhibit No. SE_006.

Application 54007 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined above. The proposed point of diversion is described as being located within the SE1/4 NW1/4 of Section 34, T.11N., R.66E., M.D.B.&M, within White Pine County.[5]

Application 54008 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined above. The proposed point of diversion is described as being located within the SW1/4 SW1/4 of Section 1, T.11N., R.66E., M.D.B.&M, within White Pine County.[6]

Application 54009 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined above. The proposed point of diversion is described as being located within the NW1/4 NE1/4 of Section 36, T.13N., R.66E., M.D.B.&M, within White Pine County.[7]

Application 54010 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined above. The proposed point of diversion is described as being located within the SE1/4 SE1/4 of Section 25, T.14N., R.66E., M.D.B.&M, within White Pine County.[8]

Application 54011 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined above. The proposed point of diversion is described as

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[5] Exhibit No. SE_007.
[6] Exhibit No. SE_008.
[7] Exhibit No. SE_009.
[8] Exhibit No. SE_010.

being located within the NE1/4 SE1/4 of Section 14, T.14N., R.66E., M.D.B.&M, within White Pine County.[9]

Application 54012 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined above. The proposed point of diversion is described as being located within the SE1/4 NE1/4 of Section 16, T.14N., R.67E., M.D.B.&M, within White Pine County.[10]

Application 54013 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined above. The proposed point of diversion is described as being located within the SW1/4 SW1/4 of Section 25, T.15N., R.66E., M.D.B.&M, within White Pine County.[11]

Application 54014 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined above. The proposed point of diversion is described as being located within the SW1/4 SW1/4 of Section 15, T.15N., R.67E., M.D.B.&M, within White Pine County.[12]

Application 54015 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined above. The proposed point of diversion is described as being located within the SW1/4 NW1/4 of Section 14, T.15N., R.67E., M.D.B.&M, within White Pine County.[13]

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[9] Exhibit No. SE_011.
[10] Exhibit No. SE_012.
[11] Exhibit No. SE_013.
[12] Exhibit No. SE_014.
[13] Exhibit No. SE_015.

Application 54016 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined above. The proposed point of diversion is described as being located within the NE1/4 SW1/4 of Section 7, T.15N., R.67E., M.D.B.&M, within White Pine County.[14]

Application 54017 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined above. The proposed point of diversion is described as being located within the NW1/4 SE1/4 of Section 25, T.16N., R.66E., M.D.B.&M, within White Pine County.[15]

Application 54018 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined above. The proposed point of diversion is described as being located within the SE1/4 NE1/4 of Section 24, T.16N., R.66E., M.D.B.&M, within White Pine County.[16]

Application 54019 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 10 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined above. The proposed point of diversion is described as being located within the SW1/4 NE1/4 of Section 32, T.12N., R.68E., M.D.B.&M, within White Pine County.[17]

Application 54020 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 10 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined above. The proposed point of diversion is described as

[14] Exhibit No. SE_016.
[15] Exhibit No. SE_017.
[16] Exhibit No. SE_018.
[17] Exhibit No. SE_019.

being located within the SE1/4 SE1/4 of Section 14, T.14N., R.67E., M.D.B.&M, within White Pine County.[18]

Application 54021 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 10 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined above. The proposed point of diversion is described as being located within the SW1/4 NE1/4 of Section 33, T.16N., R.66E., M.D.B.&M, within White Pine County.[19]

Additionally in Item 12, the remarks section of the Applications, the Applicant indicates that the water sought under the Applications shall be placed to beneficial use within the Las Vegas Valley Water District ("LVVWD") service area as set forth in Chapter 752, Statutes of Nevada 1989, or as may be amended. The Applicant also indicates that the water may be served to and beneficially used by lawful users within Lincoln, Nye and White Pine Counties, and that water would be commingled with other water rights owned or served by the Applicant or its designee.

By letter dated March 22, 1990, the Applicant further indicated, in reference to Item 12, that the approximate number of persons to be served is 800,000 in addition to the then-current service population of approximately 618,000 persons, that the Applications seek all the unappropriated water within the particular groundwater basins in which the water rights are sought and that the projected population of the Clark County service area at the time of the 1990 letter was estimated to be 1,400,000 persons by the year 2020.[20]

The Applications were originally filed by the LVVWD and are now held by the Southern Nevada Water Authority ("SNWA" or "Applicant").[21]

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[18] Exhibit No. SE_020.
[19] Exhibit No. SE_021.
[20] File Nos. 54003 through 54021, official records in the Office of the State Engineer.
[21] File Nos. 54003 through 54021, official records in the Office of the State Engineer.

II. PROCEDURAL HISTORY

Many persons and entities protested the Applications during the original protest period, which ended in July, 1990. On January 5, 2006, the State Engineer held a pre-hearing conference to discuss issues related to hearings on the Applications. In the notice of the pre-hearing conference, the State Engineer asked Protestants to declare their intent to formally participate in the pre-hearing conference and future administrative hearings.[22]

At the pre-hearing conference, some of the Protestants requested that the State Engineer re-publish notice of the Applications and re-open the period for filing of protests. By order dated March 8, 2006, the State Engineer denied the request, noting that Nevada Revised Statutes did not authorize him to re-publish notice of the Applications and re-open the period for filing of protests. The State Engineer also found that protests do not run to any successor.[23] The State Engineer scheduled a hearing on the Spring Valley applications to begin on September 11, 2006.[24]

On or around July 6, 2006, several of the Protestants petitioned for a declaratory order to re-publish notice of the Applications and re-open the period for filing of protests.[25] On July 27, 2006, the State Engineer issued an intermediate order stating that he would not reconsider the request to re-publish notice of the Applications and re-open the period for filing of protests.[26]

On or around September 8, 2006, the Applicant and four bureaus of the U.S. Department of Interior (National Park Service, Fish and Wildlife Service, Bureau of Land Management, and Bureau of Indian Affairs) entered into a stipulation by which the bureaus agreed to withdraw their protests against the Spring Valley applications in exchange for, among other things, implementation of monitoring, management, and mitigation plans.[27]

The State Engineer held hearings on the Spring Valley applications from September 11, 2006 to September 29, 2006. On April 16, 2007, the State Engineer issued a ruling rejecting Applications 54016, 54017, 54018, and 54021 and approving Applications 54003, 54004, 54005,

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[22] *In re Applications 53987-53992 & 54003-54030*, State Engineer Intermediate Order & Hearing Notice, p. 1 (March 8, 2006).
[23] *Id.* at 7.
[24] *Id.* at 11.
[25] *In re Applications 53987-53992 & 54003-54030*, Protestants' Petition for Declaratory Order (July 6, 2006).
[26] *In re Applications 54003-54021*, State Engineer Intermediate Order No. 3, p. 2 (July 27, 2006).
[27] Exhibit No. SE_041.

54006, 54007, 54008, 54009, 54010, 54011, 54012, 54013, 54014, 54015, 54019, and 54020 subject to monitoring and mitigation requirements and staged pumping limitations.[28]

On August 22, 2006, some of the Protestants filed a petition for judicial review of the State Engineer's denial of their request to re-publish notice of the Applications and re-open the period for filing of protests in the Seventh Judicial District Court of the State of Nevada.[29] On May 30, 2007, the District Court held, inter alia, that the State Engineer had given all the notice and time to file protests that the statutes required and that the denial of the request to re-publish and re-open the protest period did not violate due process and denied the petition for judicial review.[30]

Those Protestants appealed the District Court's order to the Supreme Court of Nevada. The Supreme Court held that the State Engineer had violated his duty to act on the Applications within one year under Section 533.370 of the Nevada Revised Statutes and that a 2003 amendment that would provide an exception for the one-year deadline did not apply to the Applications.[31] The Supreme Court reversed the District Court's order and remanded to the District Court to develop a proper remedy with respect to whether the Applicant must file new applications or the State Engineer must re-notice the Applications and re-open the protest period.[32]

On June 17, 2010, the Supreme Court granted, in part, the Applicant's and State Engineer's request for re-hearing.[33] The Supreme Court withdrew its prior opinion and issued a new opinion in its place to clarify the scope of its opinion with respect to protested applications and the proper remedy.[34] The Supreme Court concluded that "the proper and most equitable remedy is that the State Engineer must re-notice the applications and re-open the protest period"

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[28] State Engineer Ruling No. 5726, p. 56, dated April 16, 2007, official records in the Office of the State Engineer.
[29] *Great Basin Water Network v. Taylor*, No. CV 0608119, Petition for Judicial Review (7th Judicial Dist. Ct. Nev. Aug. 22, 2006).
[30] *Great Basin Water Network v. Taylor*, No. CV 0608119, Order pp. 9-12 (7th Judicial Dist. Ct. Nev. May 30, 2007).
[31] *Great Basin Water Network v. Taylor*, 126 Nev. Adv. Op. 2, 222 P.3d 665, 670-72 (2010), *withdrawn and superseded by* 126 Nev. Adv. Op. 20, 234 P.3d 912 (2010).
[32] *Ibid.*
[33] *Great Basin Water Network v. Taylor*, 126 Nev. Adv. Op. 20, 234 P.3d 912, 913 (2010).
[34] *Id.* at 913-14.

and remanded the matter to District Court with instructions to remand it to the State Engineer for further proceedings.[35]

On remand, Applications 54003 - 54005 were sent for republication in the Lincoln County Record on January 26, 2011, and last published on February 24, 2011. On March 26, 2011, the protest period ended and Applications 54003 - 54005 became ready for action. Applications 54006 – 54021 were sent for republication in the Ely Times on January 26, 2011, and last published on February 25, 2011. On March 27, 2011, the protest period ended and Applications 54006 – 54021 became ready for action. On April 1, 2011, the State Engineer issued a notice setting a hearing to begin on September 26, 2011, and scheduling a pre-hearing conference for May 11, 2011.[36] The State Engineer ordered that successors in interest to water rights or domestic wells may pursue their predecessors' protests by filing a form with State Engineer by April 29, 2011.[37] The State Engineer further ordered that Protestants wishing to put on a case-in-chief notify the State Engineer by April 29, 2011.[38] The State Engineer ordered that an initial evidentiary exchange take place no later than July 1, 2011, and that a second, rebuttal evidentiary exchange take place no later than August 26, 2011.[39] The State Engineer scheduled oral public comment to take place on October 7, 2011, and ordered that written public comment must be submitted by December 2, 2011.[40]

After the pre-hearing conference, the State Engineer issued several procedural orders. The State Engineer ordered that parties must identify exhibits from the prior hearings that they wish to use in this hearing, but need not exchange copies of the prior exhibits, as they were all available on the State Engineer's public website.[41] The State Engineer further ordered that pre-hearing motions must be served by September 2, 2011, and responses must be served by September 14, 2011.[42] The State Engineer allowed the parties to file written opening statements by September 19, 2011.[43] The State Engineer allowed the parties to file written closing briefs by

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[35] *Id.* at 920.
[36] Exhibit No. SE_001, pp. 1, 3.
[37] Exhibit No. SE_001, p. 1.
[38] Exhibit No. SE_001, p. 3.
[39] Exhibit No. SE_001, p. 4.
[40] Exhibit No. SE_001, p. 5.
[41] Exhibit No. SE_100, p. 3.
[42] Exhibit No. SE_100, p. 5.
[43] Exhibit No. SE_100, p. 6.

December 23, 2011, and to file proposed rulings by January 27, 2012.[44] The State Engineer also set the hearing schedule and format for exhibits.

The State Engineer held a hearing on the Spring, Cave, Dry Lake, and Delamar Valley applications between September 26, 2011, until November 18, 2011.

III. LIST OF PROTESTANTS

Applications 54003-54021 were originally published in 1990 and many protests were filed. The Applications were published again in 2011 and a second round of protests and updated (amended) protests were filed. Many persons or entities protested Applications 54003-54021; however, not every person protested every application. The Applications were protested by the following persons as identified below:

In 1990, one or more of Applications 54003-54021 were protested by: Abigail C. Johnson; Alton C. Leavitt; Amelia Sonnenberg; Art Kinder; Barlow White; Barry C. Isom; Bath Lumber Co.; Beatrice D. Mathis; Beverly R. Gaffin; Bidart Brothers; Bob Nichols; Bonnie J. Higdon; Boundy & Forman, Inc.; Bruce Ashby; Bruce Pencek; Bunny R. Hill; Candi Tweedy; Carter L. Perkins; Charlene R. Holt; Christine Hermansen; Chuck Marques; Cindy Cracraft; Citizen Alert; Clarence S. Prestwich; Clive Sprouse; Connie K. Stasiak; Cory Carson; Daniel Maes; Daniel Weaver; Danny Cracraft; Danny E. Griffith; David Eldridge; Dean G. Neubauer; Debbie Rollinson; Delbert D. Eldridge; Dennis H. Eldridge; Dennis Mangum; Dewey E. Carson; Diana Barkley Crane; Diana Smith; Dolores A. Arnold; Don Cooper; Donald R. Carrick; Donald Terry Fackrell; Donna A. Nye; Donna Bath; Dr. Dan A. Love; Duane Reed; E. Unit; NV Cattlemens Assoc.; Edith Jean Hill; Edna Oxborrow; El Tejon Cattle Company; Elva J. Eldridge; Ely Shoshone Tribe; Evan R. Barton; Frances Murrajo; Fred Baca and John Theissen; Freddy Van Camp; Garland N. Hollingshead; George Eldridge & Sons, Inc.; Glen W. Harper; Gordon D. Eldridge; Harry James Hill; Helen Eldridge; Helen Hackett; Helen O'Connor; Irene Spaulding; Mildred Valencia successor to Irvin Baker Edwards; Jack Van Camp; James H. Bath; James I. Lee; James R. Fraser; Janell Ahlvers; Janet K. Neubauer; Jess Hiatt; Jim and Betty Nichols; Joan F. Hanson; John A. and Vivian A. Havens; John Barney; John G. Tryon; John M. Wadsworth; John Perondi; John R. McKay; Joseph I. Anderson; Joseph M. Boland; Juan M. Escobedo; Karen L. Prestwich; Karen Sprouse (now Karen Sprouse Bevis); Karma H.

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[44] Exhibit No. SE_100, p. 7.

Hollingshead; Katherine A. Rountree; Kay Carson; Keith M. Anderson; Kelly Wiedmeyer; Kirkeby Ranch; Kristine P. Kaiser (now Fillman); Lance Burns; Larry Shew; Las Vegas Fly Fishing Club; Laurel Ann Mills; Lee Jensen; Lenora McMurray; Linda H. Isom; Linda Palczewski; Lois Weaver; Lory M. Free; Lyle Norcross; Marcia Forman; Margaret H. Jones; Margaret Rowe; Marietta Carson; Mark Schroeder; Marsha Lynn Sanders; Mary Collins; Mary Ellen Anderson; Mary Goeringer; Mary Goeringer; Mary Mosley; Mary R. Eldridge; Max Hannig; Merle C. Hill; Mildred L. Stevens; Monte Hansen; Moriah Ranches, Inc.; Nancy J. Eldridge; Nancy Overson; Neva Bida; NV Farm Bureau Federation; Nye County, Nevada; Panaca Irrigation Co.; Patricia Williams; Paula Williams; Pioche Town Board; Randy A. Weaver; Randy J. Heinfer; Richard W. Forman; Richie Forman; Rick Havenstrite; Robert L. and Fern A. Harbecke; Robert N. Marcum; Roy Theiss; Rudolph E. Krause; Rutherford Day; Sally Gust; Sarah G. Bishop; Sarah Locke; Selena M. Forman; Selena Weaver; Sherlyn K. Fackrell; Sportsworld; Steve Collard; Tara Cutler; The City of Caliente; The Unincorp. Town Of Pahrump; Thomas R. Wiedmeyer; Tonya K. Tomlinson; Virginia B. Terry; Walter J. Benson; Wanda McKrosky; Wesley A. Holt; White Pine County & City of Ely; White Pine County Cowbelles; William R. Rountree; Jane Lindley; Lincoln County Board of Commissioners; Norman L. Lindley; Toiyabe Chapter Sierra Club; U. S. Fish & Wildlife Service; U.S. Bureau of Land Management; U.S. National Park Service;[45] and Moapa Band of Paiute Indians.[46]

In 2011, one or more of Applications 54003-54021 were protested by: 2nd Big Springs Irrigation Co.; Abigail Johnson (Amended Protest); Alyson Hammond; Baker GID; Baker Ranches Inc.; Border Inn LLC; Brandi Lewis; Cecelia D. Phillips; Christopher C. Wheeler; Citizen Education Project; Central Nevada Regional Water Authority; Col. James R Byrne; Confederated Tribes of the Goshute Reservation; Craig F. Baker; Darwin C. Wheeler; David H. Von Seggern; David Tilford; Dean Baker; Defenders of Wildlife; Douglas G. Smith; Duckwater Shoshone Tribe; Edith Tilford; Elko Band Council; Ely Shoshone Tribe; EskDale Center; Gary and Jo Ann Perea; Geo Eldridge & Son Inc.; Govert Bassett; Great Basin Business & Tourism Council; Great Basin Water Network; Henry C. Vogler IV; Holly M. Wilson; Jeffrey C. Carlton; Jo Anne Garrett; John Gianoli; Julie Gianoli; John Hadder; Juab County, Utah; Kathleen M. Cole; Kathy C. Hiatt; Kodee Hiatt O'Connor; Las Vegas Fly Fishing Club (Amended Protest);

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[45] Exhibit Nos. SE_022 through SE_040.
[46] File Nos. 54003 through 54021, official records in the Office of the State Engineer.

League of Women Voters, Utah; Leland Rex Leonard; Linda Johnson; Lorena A. Stever; Louis Cole; Lund Irrigation and Water Co.; Mark E Rogers; Mary J. Feldman; Max and Diane Chipman; Melissa Renfro; Millard County, Utah; Nevada Dept. of Wildlife; Orvan Maynard; Patrick Fillman; Pete T. Delmue; Peter Coroon; Preston Irrigation Co.; Richard A. Spilsbury; Richard and Lesley Sears; Richard Stever; Rob Mrowka; Robert and Sandra Benson; Roderick G. McKenzie; Rowena R. Leonard; Susan Rogers; Terrence Marasco; Terry and Debora Steadman; The Long Now Foundation; Thelma Matlin; Thomas D. Baker; Toiyabe Chapter of Sierra Club (Amended Protest); U.S. Department of Agriculture-Forest Service; Utah Audubon Council; Corporation of the Presiding Bishop of the Church of Jesus Christ of Latter-Day Saints, Utah; Walter Richard Benoit; White Pine County; and the City of Ely (Amended Protest).[47]

IV. WITHDRAWN PROTESTS

Of the above listed Protestants, several later withdrew their protests for various reasons. Pursuant to the Cooperative Agreement among Lincoln County, the Southern Nevada Water Authority and the Las Vegas Valley Water District, the protests by Lincoln County Board of County Commissioners were withdrawn on July 15, 2003.[48] The protests by Moapa Band of Paiute Indians were withdrawn on April 11, 2006.[49] Pursuant to the Stipulation for Withdrawal of Protests dated September 8, 2006, the protests by U.S. Fish and Wildlife Service, Bureau of Land Management, Bureau of Indian Affairs, and the National Park Service, were withdrawn.[50] In response to the hearing questionnaire form sent out by the Nevada Division of Water Resources, Jane Lindley indicated she would like to withdraw her protest.[51] Also, in response to the hearing questionnaire form sent out by the Nevada Division of Water Resources, Norman L. Lindley indicated he would like to withdraw his protest.[52] Pursuant to the Stipulation for Withdrawal of Protests dated September 15, 2011, the protests by the United States Department

[47] Exhibit Nos. SE_060 through SE_078.
[48] File Nos. 54003 through 54021, official records in the Office of the State Engineer. *See*, agreement dated April 17, 2003, and recorded June 19, 2003, under Document Number 1203 :5 in the Official Records of the Lincoln County Recorder, Nevada, and as filed at the Office of the Nevada State Engineer on July 15, 2003, in the Water Rights files for the Applications.
[49] File Nos. 54019 through 54021, official records in the Office of the State Engineer. *See*, Moapa Band of Paiutes' Withdrawal of Protests Regarding Spring and Snake Valleys, dated April 11, 2006.
[50] Exhibit No. SE_041.
[51] File No. 54007, official records in the Office of the State Engineer.
[52] File No. 54006, official records in the Office of the State Engineer.

of Agriculture – Forest Service, were withdrawn on Septe:nber 15, 2011.[53] The protests by Richard and Lesley Sears were also withdrawn.[54]

V. PARTICIPATING PROTI STANTS

The Protestants that indicated an intent to participate at the administrative hearing were: Confederated Tribes of the Goshute Reservation; Duckwat r Shoshone Tribe; Ely Shoshone Tribe; The Long Now Foundation; Nye County, Nevada; Coi poration of the Presiding Bishop of the Church of Jesus Christ of Latter-Day Saints, Utah; EskI ale Center; Millard County, Utah; Juab County, Utah; Henry Vogler, IV; Great Basin Water N etwork, et al. (GBWN); County of White Pine and City of Ely (with GBWN); Defenders o: Wildlife (with GBWN); Preston Irrigation (with GBWN); Toiyabe Chapter Sierra Club (wi h GBWN); Orvan Maynard (with GBWN); Great Basin Business and Tourism Council (wi h GBWN); Terrance and Debora Steadman (with GBWN); Utah Audubon Council (with GB\ 'N); Govert Basset (with GBWN); Pete Delmue (with GBWN); Lund Irrigation and Water Co. (with GBWN); Roderick McKenzie (with GBWN); Patrick Fillman (with GBWN); Linda John on (with GBWN); Max & Diane Chipman (with GBWN); 2nd Big Springs Irrigation Co. with GBWN); Dean Baker (with GBWN); Abigail Johnson (with GBWN); Baker GID (witl GBWN); Border Inn, LLC (with GBWN); Craig Baker (with GBWN); David Von Seggern (with GBWN); Amelia Sonnenberg (with GBWN); James & Donna Bath (with GBWN); Bath Lumber Company (with GBWN); JoAnne Garrett (with GBWN); Keith Anderson (with GBW); Kristine Fillman (with GBWN); League of Women Voters of Salt Lake City, Utah (with GI WN); White Pine County and the City of Ely (with GBWN); Mildred Valencia successor to I /in Baker Edwards (with GBWN); Gary and Jo Ann Perea (with GBWN); Nevada Farm Burea 1 (with GBWN); Panaca Irrigation Company (with GBWN); Kathy Hiatt (with GBWN); Tho nas Baker (with GBWN); Walter Benoit (with GBWN); Louis Cole (with GBWN); Citizen's Education Project (with GBWN); Lois Weaver (with GBWN); Sportsworld (with GBWN); an l William and Katherine Rountree (with GBWN).[55]

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[53] Exhibit No. SE_095.
[54] File Nos. 54019 through 54021, official records in the Office of the Stat Engineer.
[55] Exhibit Nos. SE_100, SE_022 through SE_040, and SE_060 through SI _078.

VI. SUMMARY OF PROTEST GROUNDS

The Protestants filed hundreds of protests with many protest grounds that are summarized below:

1. The Applicant does not have the ability to access the points of diversion and rights of way that are needed to construct the works of diversion and move the water to the intended place of use.

2. Eastern Nevada has had severe drought conditions for the past three years, which has created hardships on all cattlemen. If the drought created numerous hardships, the continual removal of the perennial yield by the Applicant will destroy all ranching operations as well as the whole environment of the basin.

3. If granted, the allocation of all unappropriated waters in this groundwater basin would adversely affect the basin of origin and surrounding area by reducing the quality and quantity of water. The proposed use may: a) adversely affect the economic welfare of all farms and ranches; b) destroy the environmental balance by eliminating the natural surface moistures and reducing the humidity levels, which creates the natural growing environment of the surrounding areas, thereby destroying the grazing lands, wetlands and farm lands; c) halt all potential agricultural growth; d) destroy each agricultural operation because the operators will be unable to continue to operate or expand; e) destroy environmental, ecological, scenic and recreational values that the State holds in trust for all its citizens; f) stunt growth in the impacted basins at their current levels, destroying the local economy and potential for growth; g) cause damage to or loss of wildlife areas that could cause a decline in tourist visits to the region; and h) adversely impact economic activity (current and future) of the water-losing area.

4. Granting the applications may interfere with interbasin flow from Spring Valley to Snake Valley and thereby unduly limit future growth and development.

5. Clark County should not be allowed to drain off water necessary for our counties' well being.

6. Diversion and export of such a quantity of water will deprive both Spring and Snake Valleys of the water needed for its environmental and economic well being, and will unnecessarily destroy environmental, scenic and recreational values that the State and the Nation hold in trust for all its citizens.

7. Leave the rural water alone as it ultimately 1 ›ws to the growth center anyway. The rural water is the source of springs and artesian wells t at surface here, and that first gave travelers and settlers their survival.

8. The Applicant has not implemented a sufficie : conservation plan in the proposed place of use to protect the affected basins and current cons rvation programs instituted by the Applicant are ineffective public-relations oriented efforts tha are unlikely to achieve substantial water savings. The Applications should be denied bec ıse the current per capita water consumption rate of the Las Vegas area is double that of othe southwestern municipalities.

9. Any temporary mining of water is unacceptal .e due to excessive waste of water that is currently exhibited and will continue without forese n change. Conservation, coupled with recycling of water, as has been implemented in other ıreas of the Southwest and West, could support a population four-times the present number. This could be accomplished with current water resources without the additional rural water. It will benefit the public best to conserve existing water demands starting at home.

10. The appropriation and export of water propos l in the Applications is detrimental to the public interest on environmental grounds in the ba n of origin and in hydrologically connected and/or downwind basins, due to: harm to wildlife nd wildlife habitat, degradation of air quality (dust storms), destruction of recreational and ae hetic values, degradation of water quality, degradation of cultural resources, harm to state wildli e management areas and parks and state and federal wildlife refuges and parks.

11. It is the public policy of the State of Nevada, er Governor Bob Miller's January 25, 1990, State of the State Address, to protect Nevada's e ıironment, even at the expense of growth.

12. The granting or approval of the Applications ; detrimental to the public interest in that it, individually and together with other application of the water importation project, would jeopardize and harm endangered and threatened specie , interfere with the conservation of those threatened or endangered species; and generally interl re with the purpose for which the federal lands are managed under federal statutes.

13. Granting the Applications will interfere with ıterbasin flow from Spring Valley to Snake Valley. The appropriation will lower the water ı ble to such an extent that it will substantially reduce groundwater dependent vegetation. his reduction in vegetation will

destabilize soils and contribute to blowing dust resulting i . reduced air quality in Juab and Millard County and northward into other Utah counties due) the alkali nature of the soils and potential radioactive fallout in the soils. Reduction in the w :er table will thereby diminish and otherwise damage the phreatophytic vegetative species that c pend on the water table as well as the wildlife and livestock that depend on those phreatophy ic species, causing environmental harm, including harm to endangered and threatened species.

14. Granting the Applications will interfere with iterbasin flow from Spring Valley to Snake Valley and thereby deplete the quantity and quality f water flow in various springs and seeps throughout the basin targeted by the Applications and ill thereby diminish and otherwise damage riparian areas and the riparian vegetation, riparian wi llife, migrating birds and livestock that depend upon those riparian areas.

15. Groundwater dependent vegetation will be aff :ted, changing the general ecology and providing opportunity for invasive or non-native spec :s to compete with both wildlife habitat and agricultural cropping, threatening the agricultural basis of the community and future economic development opportunities.

16. Regarding concern for the Great Basin Nation l Park: that streams and pools will disappear if the water tables are lowered, which would adve ely affect all animal and plant life and destroy a national heritage. The protest requests an Envi nmental Impact Statement.

17. Spring Valley Basin is home for the Swamp Cedar and Spring Valley Pupfish [sic] and both species are extremely rare and uniquely indig ious. Survival of both depends on the water quality and levels that currently exist. These spe .es cannot tolerate less water than currently exists.

18. The applications should be denied because th y will exceed the safe yield of the Spring Valley Basin and the Great Basin National Park, there y adversely affecting their riparian zones and phreatophytes.

19. The subject application should be denied beca se Spring Valley lies down-stream from the Great Basin National Park, and diversion of water h re could result in drawdown of the water table in the Great Basin National Park, thus having a negative effect on migratory birds and the plant and animal species inhabiting and dependent n water resources in the National Park and the Spring Valley Basin, including some sensitive pecies and some species protected under the federal Endangered Species Act and related state : atutes. On information and belief

this would include, but not be limited to, the Spring Vall y Pupfish [sic], Pennell's Draba, Nevada Greasebush and Swamp Cedar.

20. The requested water is already being used an further pumping in large amounts would deplete the underground water, and dry up springs.

21. To grant an application for withdrawal from n alluvial-fan aquifer up-gradient from Davis Spring would not be in the public interest due) the probability of impacting the spring, which serves wildlife, livestock, and irrigation uses.

22. Air pollution in Las Vegas Valley is so bad t at the valley has been classified a non-attainment area for national and state ambient air-qualit standards. The Applications and the other applications associated with the water importation | 'oject should be denied since more water means more growth and, therefore, more air pollution.

23. The appropriation of this water when dded to the already approved appropriations and existing uses and water rights in the host vater basin will exceed the annual recharge and safe yield of the basin.

24. There is no groundwater left in the hydrograpl c area targeted by the Applications that can be safely appropriated above and beyond that wh h is already appropriated without disrupting the interbasin flow from Spring Valley to Snake V ley.

25. Appropriation in Spring Valley, when dded to the already approved appropriations and dedicated users in Basin 209 (Pahrana; it Valley) will exceed the annual recharge and safe yield of the basin.

26. The granting or approval of the Applications v)uld conflict with or tend to impair existing rights in the Snake Valley because, if granted, it ' ould exceed the safe yield of the subject valley and unreasonably lower the static water level.

27. The granting or approval of the Applications v)uld sanction water mining.

28. There is not sufficient unappropriated water a ailable in the Spring Valley Basin to provide the water being sought. Due to cyclical drought, ınd long term climatic change, the water resource in this basin and all connecting basins is dimi shing.

29. Appropriation, even if limited to annual recl ırge, inevitably will damage plant and animal life on the surface. Wild and cultivated areas will)e destroyed and wildlife would be disturbed or killed off, thus impacting the lives of human re .dents and visitors. In this regard, the water is not available.

30. The Applications seek to appropriate more groundwater than the perennial yield of the basin as currently recognized by the State Engineer.

31. The appropriation and use of the requested water will lower the water table and degrade the quality of water from existing wells, cause negative hydraulic gradient influences; threaten springs, seeps and phreatophytes, which provide water and habitat critical to the survival of wildlife, grazing livestock, and other surface area existing uses, and further cause other negative impacts and adversely affect existing rights, sources and uses, in the basins of origin and surrounding valleys including areas in Utah.

32. The appropriation and proposed use would violate the reserved water rights of the Confederated Tribes of the Goshute Reservation, the Ely Shoshone Tribe and the Duckwater Shoshone Tribe ("Tribes").

33. The Applications are like the dewatering processes of the mining industry; however, unlike mining, the subject applieations are not temporary in nature, and return flows will not occur in the valleys; all water pumped will permanently leave the basin effectively providing all of the adverse affects of mine dewatering with none of the mitigation capability of mine dewatering.

34. While the Applications are in Spring Valley, many Protestants states that the appropriation and export of groundwater from Cave, Dry Lake, and Delamar Valleys could harm hydrologically connected areas including but not limited to: Pahranagat and Moapa National Wildlife Refuges, Pahranagat and White River Valleys and Lake Mead National Recreation Area, and Overton and Key Pittman and Wayne E. Kirsch Wildlife Management Areas, Railroad Valley wetlands areas, and Ash Meadows National Wildlife Refuge.

35. The appropriation and export of groundwater from Spring Valley will harm existing permitted uses in the hydrologically connected areas including, but not limited to, Snake Valley and Great Basin National Park.

36. The applications should be denied because of potential impacts to the Indian Springs Valley Basin, which is already over allocated. Such impacts may harm rights owned by the U.S. Air Force in the Indian Springs Valley Basin.

37. Panaca Big Spring comes from deep aquifers and this appropriation would very likely be detrimental to the spring.

38. The appropriation and diversion proposed may reduce the volume and velocity of groundwater flowing through the regional aquifer system, which could begin the process of closing connected fractures and solution cavities, impairing the capacity of the aquifer to transmit water.

39. The approval of this application would jeopardize the community water supply that is now being developed in Snake Valley for the town of Baker by means of the Baker General Improvement District.

40. Millard and Juab Counties, Utah assert that based on the interconnectivity of the hydrogeologic structures in the Great Basin as identified by the USGS BARCASS report and other such investigations and reports, granting the applications will interfere with interbasin flow from Spring Valley to Snake Valley and thereby cause long-term detrimental effects on other groundwater resources and flows in other parts of Juab and Millard County and other Utah counties, negatively impacting the agricultural industry of Juab and Millard County and other Utah Counties. Such appropriation of water will cause depletion of the county tax base in the area and potential damage to the ability of agricultural interests to develop and expand in the area of the proposed underground pumping.

41. The lack of water will restrict further growth in the Pioche area.

42. Granting the Applications would threaten to prove detrimental to the public interest and the interests and rights of The Long Now Foundation because among other things, it would: a) result in degraded air quality and adverse impacts to visual resources in the region; b) result in adverse economic impacts due to degraded air quality and visual resources; c) result in adverse impacts to hydrological, biological, cultural, and environmental resources; d) result in adverse impacts to the riparian vegetation and natural habitat that support sensitive plant and animal species in the region; e) result in adverse impacts to the water resources in adjacent basins; f) result in interference with artesian water sources, springs, and seeps in the region; and, g) otherwise adversely affect the interests of The Long Now Foundation.

43. Protestant Marasco owns a business (motel and restaurant), which will be affected. He states that the business is based on tourism and a desiccated Spring and Snake Valleys will depreciate tourism. Impacts to the Great Basin National Park will in turn depreciate the value and income from his business.

44. EskDale Center states that the withdrawal of large quantities of groundwater from Spring Valley threatens the existing groundwater levels in Snake Valley. Being a nearby community with an agricultural support base, EskDale Center asserts that it will be severely affected economically in the event of lowering of current groundwater levels due to the following: a) current wells have produced consistently for over 50 years, b) the cost of drilling deeper wells has increased many fold over that 50-year period, c) the state-regulated community potable water supply quality would be jeopardized and domestic wells will be threatened, d) it would place unnecessary hardship on, and thereby threaten the economic survival of the protesting community if the Applications are approved, e) it would threaten the groundwater supply in other areas of Snake Valley where the community has interests in water rights and economic and social relationships with other communities and individuals.

45. The Corporation of the Presiding Bishop of the Church of Latter-Day Saints ("CPB") owns and operates Cleveland and Rogers Ranches and associated grazing permits as part of a large livestock operation in north Spring Valley. The CPB's holdings include vested rights, surface water rights and groundwater rights. Since several applications are in proximity to their holdings they may have a detrimental effect on water availability for the Cleveland and Rogers Ranches and within the water basin.

46. While the water taken from a basin may be within the perennial yield of that basin, areas as far away as 200 miles may experience drawdown, and the negative impacts associated with this phenomenon.

47. Some of the points of diversion are a few miles up-gradient from Deep Spring (a.k.a. Davis Spring). Large-volume pumping from the valley-fill aquifers will adversely impact the flow and water rights from Davis Spring.

48. Pumping will withdraw water from the alluvial fan from which numerous springs rise and flow to serve George Eldridge and Sons, Inc. water rights and to serve the pre-existing rights of others. Large-volume pumping from the alluvial-fan aquifers will adversely impact the flow from those springs. To grant applications for withdrawal from alluvial-fan aquifer up-gradient from underground and spring sources previously appropriated would be detrimental to the public interest from the probability of impacting pre-existing rights.

49. Great Basin National Park is Nevada's only National Park. To divert and export water from it without a water resource plan will be sinful.

50. The Applicant has said that the Applications are to be temporary in nature, but the Applications request permanent water rights, making the nature of the request unclear. The Applications should be denied because the public has been denied relevant information and due process because of the stated confusion.

51. The Applications fail to adequately include the statutorily required information, to wit: a) description of proposed works; b) the estimated cost of such works; c) the estimated time required to construct the works and the estimated time required to complete the application of water to beneficial use; d) the approximate number of persons to be served and the future requirement; e) the dimensions and location of proposed water-storage reservoirs, the capacity of the proposed reservoirs, and a description of the lands to be submerged by impounded waters; and f) description of the place of use. Because of this alleged exclusion, it is asserted that the Applications should be denied. The lack of information denies the Protestants the meaningful opportunity to submit protests to the Applications and other applications associated with the water importation project.

52. If the Applications are not denied outright, then any permitted use under these Applications should be conditioned upon and preceded by sufficient comprehensive studies of groundwater resources in the area and interbasin flow. The potential impacts on those resources can be limited by implementing incremental groundwater pumping and withdrawal to intermittent levels. No additional pumping should be allowed until it is proven through the studies that resources would not be damaged.

53. A water extraction and transbasin conveyance project of this magnitude has never been considered by the State Engineer, it is therefore impossible to anticipate all potential adverse affects without further information and study.

54. According to USGS studies cited in Water Related Scientific Activities of the USGS in Nevada, 1985-89, pp. 47, 48, 57, and 58, it is impossible to predict the consequences of exporting water in such quantities. Comprehensive studies of this aquifer system have not been made and little appropriate data are available.

55. Potential impacts cannot be anticipated as no environmental impact study has been published.

56. The Applications cannot be granted because the Applicant has failed to provide information to enable the State Engineer to safeguard the public interest properly. The adverse

effect of the Applications and related applications associated with the proposed water appropriation and transportation project (the largest appropriation of groundwater in the history of the State of Nevada) cannot properly be evaluated without an independent, formal and publicly-reviewable assessment of: a) cumulative impacts of the proposed extraction; b) mitigation measures that will reduce the impacts of the proposed extraction; and c) alternatives to the proposed extraction including, but not limited to, the alternatives of no extraction and aggressive implementation of all proven and cost-effective water demand management strategies.

57. The State Engineer previously has found that there is too much uncertainty, too little sound data and too great a risk of unsustainable over-appropriation in the interbasin flow system, of which this basin is a part, for further appropriations to be permitted until substantial additional data were gathered and evaluated. Sufficient data gathering and evaluation have not been completed concerning interbasin flow from Spring Valley to Snake Valley, and until that happens, it would be premature to permit any additional appropriation from hydrologically interconnected basins within the interbasin flow system and associated carbonate-rock province.

58. The subject application proposed has obviously been formed without prior consideration of long-term impacts to surrounding counties. Nevada, known for its many miles of desert land, cannot put a price on water. This fact alone makes it impossible to project adverse affects on the static water tables, land owners, wildlife and natural habitat. Inasmuch as Las Vegas has willfully wasted valuable water and, therefore, created a shortage for Clark County, some feel it is their right if not their duty to protest any extraction of water from the county.

59. The Applicant's answer to "Question 12" does not provide sufficient details for the proposed project or proposed water usage, to allow the public, interested parties, protestants, and the State Engineer to make a proper evaluation of the potential impacts of approving the Applications.

60. Based on the scope and magnitude of the water exportation scheme proposed by the Applications, the Applicant should be required to conduct the Hydrologic and Environmental Studies specified by NRS 533.368 before the State Engineer makes a final determination on the Applications.

61. The Applicant has duplicative applications filed in 2010 in this basin, that a duplicative hearing for the same groundwater may be required in the future.

62. The Applicant has not demonstrated the good faith intent or financial ability and reasonable expectation to actually construct the work and apply the water to the intended beneficial use with reasonable diligence. With the economic downturn and resulting economic difficulties funding of the project is unlikely.

63. The Applicant has not shown a need for the water or the feasibility (technical and financial) of the water-importation project. Further, that the simplistic water demand forecasts upon which the proposed transfers are based substantially overstate future water demand needs and are unrealistic and ignore numerous constraints to growth.

64. The Applications should be denied because the costs of the project will result in water rate increases of such magnitude that demand will be substantially reduced thereby rendering the water transfer unnecessary.

65. Because the Applicant announced in the U.S. Bureau of Land Management ("BLM") Environmental Impact Statement that it intends to use the requested water as a backup if other resources fail, the Applications should be denied absent clear proof satisfactory to the State Engineer that the Applicant intends in good faith to the carry out the development of the project.

66. Given the present economic downturn and halt in economic growth, the Applicant cannot justify the need to import water from another basin.

67. The State Engineer must consider all of the future environmental and socioeconomic ramifications of the trans-basin transfer in order to protect the State of Nevada by not allowing these transfers.

68. Clark County must grow only within the limits of its natural resources or the environmental and socioeconomic balance of the State of Nevada will be destroyed.

69. The State of Nevada should consider public-policy issues concerning dispersal of population, which are part of the debate on appropriation of the region's water.

70. The water-importation project should not be approved if said approval is influenced by the State Engineer's desire or need to ensure that there is sufficient water for those lots and condominium units created in Las Vegas Valley by subdivision maps. These maps were approved by the State Engineer, and he certified that there is sufficient water for the lots and

units created by the maps. If there is not sufficient water for these lots and units, then Clark County water resources (e.g., water created by conservation, water saved by reuse, etc.) should be developed and assigned to the water-short lots and units.

71. The proposed action is not an appropriate long-term use of Nevada's water.

72. The State Engineer has a responsibility to all of the people of Nevada and must consider all adverse affects, which the granting of these Applications will have on all areas in the State of Nevada.

73. California's experiences suggest that large-scale water projects injure the state's reputation, promote factious politics and allegations of corruption, waste tremendous quantities of water through leakage and evaporation, and foster the dangerous illusions that water supplies are limitless and are either free for the wasting or are allocated solely for the advantage of the rich and powerful.

74. Las Vegas Valley population is big enough. Further growth is not in the best interest of the Las Vegas community; neither will it benefit Nevada and the Nation. Rather than give Las Vegas Valley more water, the State should encourage growth control, water economy, a sustainable lifestyle, and the building up of other communities.

75. It is time for Clark County to solve their problems there and not steal the good things rural Nevada offers.

76. The full extent of the water exportation project is unknown at this time and it is uncertain how many additional groundwater and/or surface water appropriations or change applications will be filed in the future to supplement or change the current applications. Before acting on the current Applications, the Applicant should further be required to detail the total duty of water sought for exportation for the entire project.

77. The water will not be put to good use.

78. The appropriation and export of water proposed in the Applications will jeopardize public health and be detrimental to the public interest

79. The Applications should be outright denied because the State Engineer has previously denied other applications for water from the basin.

80. Granting or approval of the Applications would allow the Applicant to lock-up vital water resources for possible use sometime in the distant future beyond current planning horizons, which is not in the public interest.

81. The appropriation and proposed use would have unduly negative impacts on cultural, historic, and religious resources of the Confederated Tribes of the Goshute Reservation, the Ely Shoshone Tribe, and the Duckwater Shoshone Tribe, which would harm the public interest.

82. The Tribes assert that the appropriation and proposed use would unduly injure the Tribes' capacity for self-governance and would unduly injure the Tribes' sovereignty and ability to regulate their territory.

83. The Tribes allege that the appropriation and proposed use would violate federal and state laws that protect cultural, religious, and historic resources as well as violate the federal government's trust responsibility to the Tribes.

84. The Applications should be denied because they lie within the boundaries of land covered by the Treaty of Ruby Valley of 1863. It is alleged that approving the Applications would conflict with the reserved water rights of the Western Shoshone Tribes, which are subject to the Treaty of Ruby Valley and federal statutes.

85. Spring Valley has been the traditional home of the Native Newe (Western Shoshone) people since prehistoric times. There are many prehistoric sites in the area, including ancient petroglyphs and graves. The Shoshone Cedars Sacred Historic Site will be completely devastated by pipeline construction and water withdrawal. It is asserted that the State Engineer's office ignores Native American water rights as a matter of political expediency. Tribal ancestors have lived in the basin sustainably for 10,000 years and morally have existing water rights. Nevada water laws give away Native American and wildlife's water to the first capable of wasting it, for free. When the water is gone, people will look back at the Project as a mistake.

VII. PRE-HEARING ORDERS

On September 1, 2011, the Applicant filed several motions in limine. The Applicant filed a motion in limine to exclude an expert report by Dr. Lanner identified as Spring Valley Exhibit 3040. The Applicant filed a motion in limine to exclude expert reports by Dr. Charlet identified as Delamar, Dry Lake, and Cave Valley ("DDC") Exhibits 1150 and 1230 and Spring Valley Exhibit 3030, and a report by Ms. Hutchins-Cabibi identified as Spring Valley Exhibit 3064. The Applicant filed a motion in limine to exclude an expert report by Dr. Mayer identified as DDC Exhibit 501, expert reports by Dr. Krueger, identified as DDC Exhibits 539 and 559, and an expert report by Dr. Scoppettone identified as DDC Exhibit 609. Finally, the Applicant filed an objection to expert witnesses Dr. Heilweil, Dr. Hurlow, Dr. Jones, Dr. Mayo, and Dr. Roundy and the expert reports by Dr. Heilweil (MILL Exhibit 10), Dr. Hurlow (MILL Exhibit 11), Dr. Myers (CTGR Exhibit 14), and Drs. Jones and Mayo (CPB Exhibit 11).

The CPB, the Confederated Tribes of the Goshute Reservation, and Millard and Juab Counties filed responses to the Applicant's objection. Great Basin Water Network filed a response to the Applicant's motions in limine.

The State Engineer granted the Applicant's motion in limine to exclude DDC Exhibits 501 (Mayer report), 539 (Kreuger report), 559 (Kreuger report), and 609 (Scoppettone report).[56] The State Engineer granted the Applicant's motion in limine to exclude DDC Exhibits 1150 (Charlet report) and 1230 (Charlet report) and Spring Valley Exhibits 3030 (Charlet report) and 3064 (Hutchins-Cabibi report) in part and denied it in part. The State Engineer ruled that DDC Exhibit 1230 (Charlet report) and Spring Valley Exhibit 3030 (Charlet report) would not be excluded, but that the transcript of the cross-examination of the authoring expert from the prior hearing would be admitted along with these exhibits. With respect to DDC Exhibit 1150 (Charlet report), the State Engineer denied the Applicant's motion to exclude. The State Engineer granted the Applicant's motion to exclude as to Spring Valley Exhibit 3064 (Hutchins-Cabibi report).[57] The State Engineer denied the Applicant's motion to exclude Spring Valley Exhibit 3040 (Lanner report), but also noted that only the first page of the exhibit is admissible.[58] Finally, the State Engineer overruled the Applicant's objections to expert witnesses Dr. Heilweil, Dr. Hurlow, Dr. Jones, Dr. Mayo, and Dr. Roundy and MILL Exhibit 10 (Heilweil report), MILL Exhibit 11 (Hurlow report), CTGR Exhibit 14 (Myers report), and CPB Exhibit 11 (Jones and Mayo report).[59]

VIII. STATUTORY STANDARD TO GRANT

Nevada Revised Statute 533.370(1)(c) provides that the State Engineer shall approve an application submitted in proper form which contemplates the application of water to beneficial use if the applicant provides proof satisfactory of the applicant's intentions in good faith to construct any work necessary to apply the water to the intended beneficial use with reasonable

[56] Exhibit No. SE_090, p. 7.
[57] Exhibit No. SE_090, p. 10.
[58] Exhibit No. SE_090, p. 12.
[59] Exhibit No. SE_090, p. 13.

diligence, and his financial ability and reasonable expectation actually to construct the work and apply the water to the intended beneficial use with reasonable diligence.

IX. STATUTORY STANDARD TO DENY

Nevada Revised Statute 533.370(2) provides that the State Engineer shall reject an application and refuse to issue the permit where there is no unappropriated water in the proposed source of supply, or where the proposed use or change conflicts with existing rights or with protectable interests in existing domestic wells as set forth in NRS 533.024, or where the proposed use threatens to prove detrimental to the public interest.

X. STATUTORY STANDARD FOR INTERBASIN TRANSFERS

Nevada Revised Statute 533.370(3) provides that in determining whether an application for an interbasin transfer of groundwater must be rejected, the State Engineer shall consider: (1) whether the applicant has justified the need to import the water from another basin; (2) if the State Engineer determines a plan for conservation of water is advisable for the basin into which the water is imported, whether the applicant has demonstrated that such a plan has been adopted and is being effectively carried out; (3) whether the proposed action is environmentally sound as it relates to the basin from which the water is exported; (4) whether the proposed action is an appropriate long-term use which will not unduly limit the future growth and development in the basin from which the water is exported; and (5) any other factor the State Engineer determines to be relevant.

XI. GUIDING PRINCIPLES IN THE APPLICATION OF THE WATER LAW TO THIS DECISION

The Nevada Division of Water Resources (NDWR) is headed by the State Engineer who supervises the appropriation of water in Nevada. The mission of the NDWR is to conserve, protect, manage and enhance the water resources of the state for Nevada's citizens through the appropriation and reallocation of the public waters. The State Engineer is responsible for reviewing all applications to appropriate water and, in conjunction with the water law and policies of Nevada, approving or rejecting such applications. The Nevada Legislature has expressed many guiding principles in the development of water resources in Nevada and has developed the statutory criteria the State Engineer must apply when approving or denying applications for a project involving the beneficial use of water. The following summarizes many of the guiding principles and statutory criteria that the State Engineer will follow in making the decision on the subject applications.

Nevada water law is first and foremost founded on the doctrine of prior appropriation. The most significant principles of the prior appropriation doctrine are as follows: (1) "first in time, first in right," in other words, priority controls the use of water in times of shortage; (2) beneficial use is the basis, the measure, and the limit of the right to the use of water; and (3) the "use it or lose it" principle, i.e., water not placed to beneficial use may be lost through cancellation, forfeiture or abandonment. In Nevada, the waters of all sources of water supply within the boundaries of the state belong to the public. NRS 533.025. Subject to existing rights, and other statutory criteria, all water may be appropriated for beneficial use. NRS 533.030. Nevada Revised Statutes 533.370(3), 533.007 specifically provide for the interbasin transfer of water, which is defined as the transfer of groundwater for which the proposed point of diversion is in a different basin than the proposed place of beneficial use. In this matter, the Applicant has lawfully filed for an interbasin transfer of groundwater for a beneficial public use of water.

Nevada Revised Statute 540.011 establishes a basic legislative policy, which recognizes the relationship between the critical nature of the state's limited water resources and the increasing demands placed on these resources as the population of the state continues to grow. The legislature further recognizes the important role of water resource planning and that such planning must be based upon identifying current and future needs for water. The State Engineer believes that the legislative declarations of policy establish the importance of protecting existing water rights, supporting water conservation, and acknowledging the role of water planning. The State Engineer will determine whether unappropriated water within the subject basins is available for the Applicant's future water supply plans to protect against shortages on the Colorado River, meet projected demands, and replace temporary water supplies, and whether this can be done in a responsible manner utilizing all the tools at his disposal, including monitoring, adaptive management and, if necessary, mitigation to ensure that there is no conflict with existing water rights or other provisions of Nevada water law.

The legislature declared that it is the policy of this state to encourage the State Engineer to consider the best available science in rendering decisions concerning the available surface and underground sources of water in Nevada. NRS 533.024(1)(c). Understanding the hydrology of this region is critical in evaluating the potential hydrological impacts of groundwater development. Both the Applicant and Protestants submitted thousands of pages of scientific information, evidence and testimony for consideration during a record long six weeks of administrative hearing. This area has been under study for decades and voluminous published scientific reports were made available as evidence for review. The State Engineer will weigh the evidence presented at the administrative hearing and utilize the best available science that has been correctly applied and evaluated for accuracy in rendering his decision on this matter in accordance with stated legislative policies.

Nevada is the driest state in the nation and has been one of the fastest growing. Due to its relative scarcity, water is Nevada's most precious resource and must be managed wisely and to its fullest extent to maximize efficient use of its water. It is imperative that the State Engineer maximize the beneficial use of all waters within the state, otherwise, it could unnecessarily stymie economic growth, eliminate recreational opportunities, hinder the use of water for environmental concerns, and be generally detrimental to the state as a whole. However, maximizing the beneficial use of Nevada's water resources shall not be done to the detriment of the other criteria found in Nevada's water law.

Over 70% of the State's economy is generated in Clark County[60] and the export of water as proposed will directly benefit 7 of 10 Nevadans. The Las Vegas area currently relies on the Colorado River for 90% of its water supply. The right to divert water from the Colorado River is limited, with Nevada's share allocated at 300,000 acre-feet annually ("afa") of the 7,500,000 afa allocated to the lower basin states of Arizona, Nevada and California. Steps have been taken to augment this allocation, but the supply of water within the Colorado River itself is ultimately limited by up-stream use and precipitation patterns. Historical flow records indicate that the Colorado River is over-appropriated and recent drought conditions on the Colorado River have caused that over-appropriation to be exacerbated. Conditions will worsen as the Colorado Basin states begin to use more of their previously unused allocations. It is clear from the evidence and testimony, and as discussed in greater detail in this ruling, that Southern Nevada needs an alternative water source. The all-encompassing question that first must be answered is whether unused in-state water resources can be appropriated to provide that additional source of water for Southern Nevada. In reading and listening to the public comment submitted as part of the

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[60] Exhibit No. SNWA_459, Slide 10 (Aguero).

administrative hearing, it was suggested by many people that the SNWA should look to California and Mexico for desalinization or other water strategies, should look to other users on the Colorado River for additional supply, and should look at other options outside of Nevada. However, the evidence and testimony provided indicates that other strategies for developing alternative water sources have been explored and vetted by the SNWA, but not one alternative has been found to be more viable than in-state water resources at this time. In addition, the SNWA is continuing to explore other water supply strategies, including many of the options suggested by the public, as planning for future water supply is a continuous process. The State Engineer considers the use of in-state resources to augment and diversify the water portfolio of Southern Nevada to be of vital interest to Nevada and the use of water in the project is consistent with various legislative declarations and proclamations, as discussed above. However, the State Engineer will balance the needs of Southern Nevada with the protections necessary, and provided for by statute, and by utilizing his authority under NRS 533.3705.

FINDINGS OF FACT

I. BENEFICIAL USE AND NEED FOR WATER

The Applicant must demonstrate a need to put the water from the Applications to beneficial use in Southern Nevada.[61] Beneficial use is the basis, the measure and the limit of the right to the use of water in the State of Nevada.[62]

The Applicant presented the following witnesses who testified regarding Southern Nevada's need for this water: (1) Patricia Mulroy, the Applicant's General Manager; (2) Richard Holmes, the Applicant's Deputy General Manager for Engineering and Operations, an expert in water development and necessity of the Project;[63] (3) John Entsminger, the Applicant's Senior Deputy General Manager, an expert in Colorado River water resources;[64] and (4) Kay Brothers, the Applicant's former Deputy General Manager of Engineering and Operations and now a consultant to the Applicant, an expert in water planning purposes on the Colorado River.[65] These witnesses have all been responsible for managing Southern Nevada's water-resource

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[61] *See,* NRS 533.030(1); NRS 533.035; NRS 533.045; NRS 533.060(1); NRS 533.070(1); NRS 533.370(3)(a).
[62] NRS 533.035.
[63] Transcript, Vol.1 p. 174:7-8 (State Engineer).
[64] Transcript, Vol.1 p. 191:1-3 (State Engineer).
[65] Transcript, Vol.1 p. 186:22-24 (State Engineer).

portfolio and each expressed an opinion that the Applicant would not be able to meet Southern Nevada's water needs without the water from the Applications.[66]

The Protestants presented Dr. Peter Gleick, President of the Pacific Institute, an expert in water conservation and efficiency, who testified regarding Southern Nevada's need for this water. Dr. Gleick consults with governmental and non-governmental entities regarding water conservation and efficiency and he expressed an opinion that a substantial amount of projected new supply needs could be eliminated through conservation and efficiency improvements in Southern Nevada.[67]

The Applicant is a political subdivision of the State of Nevada and a joint powers agency, which is governed by a seven member board of directors who represent the Applicant's seven member agencies.[68] The Applicant is responsible for ensuring that adequate water supplies are available to meet Southern Nevada's water needs. All of the Applicant's member agencies have determined that Southern Nevada needs this water and have adopted resolutions supporting the Applications.[69] Public advisory committees in Southern Nevada have determined that Southern Nevada needs this water and have recommended that the Applicant develop the project associated with the Applications.[70] The Applicant's board of directors has determined that the Applicant needs this water and has directed staff to pursue permitting of the Applications.[71]

The Applicant presented evidence to demonstrate that the water from the Applications is a critical component of the water-resource portfolio for Southern Nevada and that the water is needed to protect against shortages on the Colorado River, meet projected demands, and replace temporary supplies.

A. <u>Shortages on Colorado River</u>

In order to understand why Southern Nevada needs the water from the Applications, it is first necessary to understand the situation on the Colorado River. Southern Nevada is almost entirely dependent on the Colorado River to meet its water needs. The Colorado River is a highly regulated and complex water source that is shared by seven states and the country of

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[66] Transcript, Vol.2 p. 328:1-4 (Holmes); p. 345:14-18 (Brothers); p. 347:3-20 (Entsminger).
[67] Transcript, Vol.23 pp. 5127:22-5128:25 (Gleick).
[68] Exhibit No. SNWA_189, p. 2-1.
[69] Exhibit Nos. SNWA_223 through SNWA_229.
[70] Exhibit No. SNWA_209, Appendix 2; Exhibit No. SNWA_201; Transcript, Vol.1 pp. 225:11-228:6 (Brothers).
[71] Exhibit No. SNWA_211; Transcript, Vol.1 pp. 235:25-236:4 (Brothers).

Mexico. The Colorado River is divided into an upper basin and a lower basin, each of which is allocated 7.5 million afa from the river. The upper basin consists of Colorado, Utah, Wyoming and New Mexico. The lower basin consists of California, Arizona and Nevada. Nevada is entitled to just 300,000 afa of the 7.5 million afa allocated to the lower basin. Mexico is allocated 1.5 million afa. An estimated 1.5 million afa is lost to evaporation.[72] Taking into account the allocations to the upper and lower basins, the allocation to Mexico, and evaporation losses, there are 18 million acre-feet accounted for annually on the Colorado River.[73]

However, the Colorado River is over-appropriated. Historical records dating from 1905 to 2010 indicate that the average annual flow of the Colorado River is 15 million acre-feet.[74] Based on those historical records, the Colorado River is over-appropriated by roughly 3 million afa, i.e., 18 million acre-feet accounted for with only 15 million acre-feet available.[75]

Southern Nevada is almost entirely dependent on the Colorado River as it supplies 90% of Southern Nevada's water.[76] Pursuant to contract with the Bureau of Reclamation, the Applicant and its members receive 272,000 afa of Nevada's 300,000 acre-feet allocation, plus any surplus that becomes available to Nevada.[77] The Applicant receives additional Colorado River water through intentionally created surplus ("ICS") projects, whereby lower basin states can convey water resources to the Colorado River for credits, which can then be used to withdraw Colorado River water.[78] In addition, the Applicant pays the Arizona Water Banking Authority to bank a portion of Arizona's Colorado River water in an underground aquifer for future use in Southern Nevada.[79] The Applicant has agreements with the Metropolitan Water District of Southern California and the Bureau of Reclamation, which allow the Applicant to bank a portion of Nevada's unused Colorado River water in a reservoir for future use in Southern Nevada.[80] The Applicant also relies heavily on the use of return-flow credits on the Colorado River, whereby the Applicant returns treated wastewater to Lake Mead in exchange for the right to divert a corresponding amount of Colorado River water. The use of return-flow credits allows

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[72] Transcript, Vol.2 p. 262:24-25 (Entsminger).
[73] Transcript, Vol.2 p. 264:6-8 (Entsminger).
[74] Exhibit No. SNWA_189, p. 8-2, Figure 8-1; Transcript, Vol.2 p. 264:11-13 (Entsminger).
[75] Exhibit No. SNWA_189, p. 8-2, Figure 8-1; Transcript, Vol.2 p. 264:14-16 (Entsminger).
[76] Exhibit No. SNWA_189, p. 7-1; Transcript, Vol.2 p. 260:20-22 (Entsminger).
[77] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 261:13-16 (Entsminger).
[78] Exhibit No. SNWA_189, pp. 3-1, 3-4.
[79] Exhibit No. SNWA_189, p. 3-4.
[80] Exhibit No. SNWA_189, p. 3-5.

the Applicant to extend its available water supplies by approximately 70%, which represents a significant portion of Southern Nevada's water resources.[81]

The Applicant diverts all of its Colorado River water from Lake Mead through a system of intake and conveyance facilities and delivers the water to its members for use in their respective service areas. Between 2000 and 2010, Lake Mead saw a drastic decline in water-level elevation due largely to drought conditions. During this period, the average flow in the Colorado River was 69% of the normal average flow and in one year, 2002, the flow in the Colorado River was only 25% of the average flow.[82] The water-level elevation in Lake Mead dropped by roughly 130-140 feet.[83] That decline is equal to a reduction in the capacity of Lake Mead by roughly 55-60%, which is a loss of nearly 15 million acre-feet of water.[84] As a point of reference, that reduction is equal to Nevada's Colorado River allocation for a period of 50 years.[85] Even though the unofficial 2011 flow in the Colorado River was 140% of the normal average flow, the average flow for the last 12 years was only 75% of the normal average flow.[86]

In response to the drastic declines in Lake Mead water elevation, the lower basin states entered into negotiations and reached an agreement regarding the amounts of water that would be available to each state from the Colorado River during shortage conditions.[87] The water-level elevation of Lake Mead now ultimately determines the amount of water that Nevada and the other lower basin states can divert from the Colorado River. When Lake Mead drops below 1,075 feet, 1,050 feet, and 1,025 feet, the Applicant's Colorado River allocation will be reduced by 13,000 acre-feet, 17,000 acre-feet, and 20,000 acre-feet, respectively. When Lake Mead drops below 1,025 feet, the Applicant's Colorado River allocation will be further reduced after consultation with the other lower basin states and the Secretary of the Interior.[88] The amounts of those reductions are uncertain, but are anticipated to be significantly larger than those quantified in existing agreements.[89]

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[81] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 282:2-16 (Entsminger).
[82] Exhibit No. SNWA_232; Transcript, Vol.2 p. 266:20-23 (Entsminger).
[83] Exhibit No. SNWA_189, p. 7-1; Exhibit No. SNWA_232; Transcript, Vol.1 p. 194:25 (Holmes).
[84] Exhibit No. SNWA_189, p. 7-1; Exhibit No. SNWA_403; Transcript, Vol.1 p. 195:2-6 (Holmes).
[85] Transcript, Vol.1 p. 195:6-9 (Holmes).
[86] Transcript, Vol.2 pp. 266:23-267:5 (Entsminger).
[87] Exhibit Nos. SNWA_189, p. 2-2; SNWA_203; SNWA_204; Transcript, Vol.2 pp. 269:9-272:11 (Entsminger).
[88] Exhibit No. SNWA_189, p. 6-3; Transcript, Vol.2 p. 269:21-23, p. 277:8-21 (Entsminger).
[89] Exhibit No. SNWA_189, p. 1-2; Transcript, Vol.2 p. 277:11-17 (Entsminger).

Shortage conditions would cause other reductions to the amount of water available to Southern Nevada. During shortage, the Applicant would lose water from System Efficiency ICS projects and any Extraordinary Conservation ICS projects.[90] If shortage conditions cause Arizona municipalities to receive less water, the Applicant would lose water from the Arizona water bank on a pro-rata basis.[91] Furthermore, if Lake Mead elevation levels drop below 1,000 feet, which is the operational limit of the Applicant's current pumping intake facilities, the Applicant might not be able to withdraw any of its Colorado River water from Lake Mead.[92] That would also preclude the use of return-flow credits, which would reduce the remaining water available to Southern Nevada by an additional factor of 70%. If the Applicant were to lose its ability to withdraw water from Lake Mead, the water from the Applications would not be sufficient to meet Southern Nevada's water needs, but it would provide essential water for health and human safety during such a period.[93]

Drought conditions are likely to continue and intensify, which would increase the frequency, severity, and duration of shortage conditions. Multi-decadal droughts can, and have, occurred on the Colorado River system.[94] Although 2011 was a wet year, it does not mean that the Colorado River system is no longer experiencing drought because it had just one wet year.[95] As severe as the current 11-year drought has been, there is evidence that droughts of greater severity than any in the last 100 years have previously occurred and that droughts have lasted as long as 50 years.[96] The Applicant has estimated, using a Bureau of Reclamation model, that based on past flow records, there is a 40% probability by 2020 and a 50% probability by 2025 that in any given year the lower basin will be in shortage,[97] which means the amount of Colorado River water available to the Applicant will be reduced. Climate change could further reduce the amount of Colorado River runoff due to precipitation changes and dust deposits. The Bureau of Reclamation published reports that state that the Colorado River basin is expected to warm between five to six degrees Fahrenheit during the 21st century, which could have significant

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[90] Exhibit No. SNWA_189, p. 2-3; Transcript, Vol.2 p. 414:4-9 (Entsminger).
[91] Transcript, Vol.2 p. 303:10-12, p. 414:4-10 (Entsminger).
[92] Exhibit No. SNWA_189, p. 7-2.
[93] Exhibit No. SNWA_189, p. 8-4; Transcript, Vol.2 p. 269:6-9 (Entsminger).
[94] Transcript, Vol.2 p. 268:10-12 (Entsminger).
[95] Transcript, Vol.2 p. 268:1-8 (Entsminger), p. 333:12-19 (Brothers).
[96] Exhibit No. SNWA_189, pp. 7-2 to 7-3, Figure 7-1; Transcript, Vol.2 p. 334:4-9 (Brothers).
[97] Exhibit No. SNWA_189, p. 7-2, p. A-5, p. A-6, Figure A-2.

effects on the availability of water supplies.[98] Although it is impossible to predict what will happen from year to year, there is a strong probability that over the long-term, drought will reduce the amount of water that will be available to meet Southern Nevada's water needs.

Development and increased water use in the upper basin states is also expected to contribute to shortage conditions. Upper basin states have yet to develop their full 7.5 million acre-feet Colorado River allocation.[99] The amount that is currently not used by the upper basin states eventually flows down to Lake Mead for use by the lower basin states.[100] When the upper basin states begin using that water, it will no longer flow to Lake Mead. There is a strong probability that over the long-term development and increased water use in the upper basin states will reduce the amount of water that will be available to meet Southern Nevada's water needs.

The Applicant needs the water from the Applications to protect against shortages on the Colorado River. The Applicant used the Bureau of Reclamation's Colorado River Simulation System ("CRSS") model to analyze the probability, frequency and duration of future shortages.[101] The Bureau of Reclamation uses the CRSS model to evaluate long-term policy and address long-term planning for the Colorado River system.[102] The CRSS model uses the Indexed Sequential Method to sample historical natural flow data from 1906 through 2007 in order to create a set of 102 separate simulations referred to as "traces" or "hydrological sequences."[103] CRSS allows the Bureau of Reclamation to evaluate proposed operating policies over a broad range of possible future hydrologic conditions.[104] CRSS allowed the Applicant to simulate future conditions on the Colorado River system during its 50-year planning period.

The CRSS model results demonstrate that the probability, frequency and duration of shortages are significant. The CRSS model results show a 40% probability by 2020 and a 50% probability by 2025 that in any given year the Lake Mead water elevation level will be at or below 1,075 feet and the lower basin will be in shortage.[105] The CRSS model results show a 50% probability of shortage by 2035 with the probability of shortage reaching upwards of 60%

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[98] Exhibit No. SNWA_237, p. 25.
[99] Exhibit No. SNWA_189, p. 7-2; Transcript, Vol. 2 p. 336:16-20 (Brothers).
[100] Transcript, Vol.2 p. 336:16-20 (Brothers).
[101] Exhibit No. SNWA_189, p. A-1; Transcript, Vol.2 p. 337:2-10 (Brothers).
[102] Exhibit No. SNWA_189, p. A-1.
[103] Exhibit No. SNWA_189, pp. A-1 to A-2.
[104] Exhibit No. SNWA_189, p. A-2.
[105] Exhibit No. SNWA_189, p. A-5, p. A-6, Figure A-2.

by 2060.[106] Every "trace" or "hydrological sequence" created by the CRSS model shows at least one shortage sequence for the lower basin during the Applicant's 50-year planning period. On average, the CRSS model results predict roughly two shortage sequences during the Applicant's planning period, and that these shortage sequences would last, on average, over 15 consecutive years.[107] That means that the CRSS model predicts on average that 30 years of shortage will occur during the Applicant's 50-year planning period.[108]

These shortage scenarios would result in significant reductions in the amount of water available to Southern Nevada. The Applicant analyzed the potential effects that shortage conditions would have on available water supplies.[109] As discussed above, the Applicant's Colorado River allocation will be reduced by 13,000 acre-feet, 17,000 acre-feet, and 20,000 acre-feet when Lake Mead drops to 1,075 feet, 1,050 feet, and 1,025 feet, respectively. In the case of more severe and prolonged shortages, there is a significant degree of uncertainty regarding the amount of water that would be available to Southern Nevada. In order to address that uncertainty, the Applicant used a series of assumptions in its analysis.[110] When Lake Mead remains at or below 1,025 feet for over two years, the Applicant's analysis assumes that its Colorado River allocation would be reduced by 40,000 acre-feet (twice as much as the 20,000 acre-feet reduction at 1,025 feet).[111] In the third year that Lake Mead remains at or below 1,025 feet, the Applicant's analysis assumes that water from the Arizona water bank would no longer be available because Arizona municipalities would likely be sharing in shortages, but the pro-rata amount of the reductions is unknown.[112] When Lake Mead is below 1,000 feet, the Applicant's analysis assumes that no water would be available from Lake Mead because the Applicant would be taking emergency measures to deliver water from Lake Mead and the viability of those emergency measures is unknown.[113]

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[106] Exhibit No. SNWA_189, p. A-6, Figure A-2; Transcript, Vol.2 p. 339:10-13 (Brothers).
[107] Exhibit No. SNWA_189, pp. A-5 to A-6.
[108] Exhibit No. SNWA_189, p. A-6, Table A-1; Transcript, Vol.2 p. 340:16-21 (Brothers).
[109] Exhibit No. SNWA_189, Appendix A.
[110] Exhibit No. SNWA_189, Appendix A, pp. A-3 to A-5.
[111] Exhibit No. SNWA_189, p. 8-4; Transcript, Vol.2 p. 343:14-20 (Brothers).
[112] Exhibit No. SNWA_189, p. 8-4.
[113] Exhibit No. SNWA_189, p. 8-4.

The Applicant's analysis graphically demonstrates the amount of water that the Applicant estimates could be available under shortage conditions on the Colorado River.[114] The Applicant's analysis includes spreadsheets showing the amount of water that could be available depending on the frequency, severity and duration of shortages as predicted by the CRSS model results.[115] The assumptions in the Applicant's analysis may over-estimate or under-estimate the reductions that would occur during shortage, but the assumptions are reasonable for water planning purposes in light of the many uncertainties that exist. While the exact amounts of these reductions are unknown, the evidence clearly supports a conclusion that the reductions would be significant.

Colorado River issues are necessarily involved in almost every water-management decision made by the Applicant. The severity of the current drought has taught the basin states and Southern Nevada that the Colorado River is a highly dynamic system with the potential for enormous fluctuations in the amount of water available.[116] In light of that fact, Southern Nevada's almost total reliance on the Colorado River has injected a high degree of uncertainty into Southern Nevada's water-resource portfolio.

The State Engineer finds Southern Nevada needs a water resource that is independent of the Colorado River and that it would not be advisable for the Applicant to continue to rely upon the Colorado River for 90% of Southern Nevada's water when that source is over-appropriated, highly susceptible to drought and shortage, and almost certain to provide significantly less water to Southern Nevada in the future.

B. Meeting Projected Demand

Even under normal (non-shortage) conditions on the Colorado River, the Applicant presented evidence to support a finding that available water supplies would be insufficient to meet projected future water demands without the water requested in these Applications.

The Applicant adopts a Water Resource Plan annually, which forecasts water supply and demand over a 50-year planning period under both normal and shortage conditions on the Colorado River.[117] A 50-year planning period is considered to be reasonable and is used elsewhere in Nevada. Mr. Holmes testified that the Applicant uses a 50-year water planning

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[114] Exhibit No. SNWA_189, p. 8-5, Figure 8-5.
[115] Exhibit No. SNWA_189, pp. A-10 to A-12.
[116] Transcript, Vol.2 p. 267:18-23 (Entsminger).
[117] Exhibit No. SNWA_209.

horizon because it provides a long enough look into the future to assess potential water demand and to provide enough lead time to meet that demand.[118] Mr. Holmes further testified that other entities such as the City of Phoenix and White Pine County, as well as Federal agencies, such as the Army Corps of Engineers, use a 50-year planning horizon.[119] Although the Water Resource Plan is reviewed annually, the previous year's plan may be adopted without revision if it remains effective for water planning purposes.[120] The current Water Resource Plan was revised in 2009 and that version was adopted without revision in 2010 and 2011.[121] To forecast available supply, the Water Resource Plan identifies all water supplies expected to be available during the planning period, including water supplies that are expected to be developed in the future. To forecast demand for the Water Resource Plan, projected population is multiplied by projected individual (per capita) use to create a demand-line. The Water Resource Plan presents this information in a chart which shows the available sources of supply in colored blocks under the projected demand-line.[122] The Applicant uses the Water Resource Plan to assure its members that it will be able to meet their water needs during the planning period.

The Applicant also presented an expert report that incorporates the projections in the Water Resource Plan and further analyzes the Applicant's projected sources of supply and projected water demands.[123] The State Engineer finds that the evidence demonstrates that the Applicant's current available supplies would be insufficient to meet projected future water demands under normal conditions on the Colorado River and that shortfalls would be even greater under shortage conditions.

1. Projected Supply

The water-resource portfolio for Southern Nevada includes all available sources of supply, including permanent and temporary supplies. Permanent supplies are resources that are replenished and available annually.[124] Permanent supplies available to the Applicant include Nevada's allocation of Colorado River water, return-flow credits, conservation savings, Virgin/Muddy River Tributary Conservation ICS water, Coyote Spring Valley Imported ICS

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[118] Transcript, Vol.2 pp. 307:19-308:5 (Holmes).
[119] Transcript, Vol.2 p. 308:6-15 (Holmes).
[120] Transcript, Vol.2 p. 249:13-18 (Entsminger).
[121] Transcript, Vol.2 p. 250:1-16 (Entsminger).
[122] Exhibit No. SNWA_209, p. 43, Figure 28.
[123] Exhibit No. SNWA_189.
[124] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 251:16-18 (Entsminger).

water, Las Vegas Valley groundwater, and other in-state groundwater.[125] Temporary supplies are one-time use resources that are not replenished and are used as a bridge until permanent supplies can be developed.[126] Temporary supplies available to the Applicant include Brock Reservoir System Efficiency ICS water, Arizona banked water, California banked water, and Southern Nevada banked water.[127] Because temporary supplies are one-time use resources, the Applicant must ensure that it has developed permanent supplies to satisfy demand after temporary supplies are exhausted. Additionally, because some temporary supplies are not available for use during declared shortages on the Colorado River, permanent supplies with no shortage-use restrictions are necessary to replace these restricted temporary supplies.

The Water Resource Plan addresses both normal and shortage conditions on the Colorado River and assumes that the amount of water available from these permanent and temporary sources of supply will be constant. As shown in its Water Resource Plan, the Applicant expects to receive 272,000 afa from the Colorado River,[128] as well as a total of 50,000 afa of Virgin/Muddy River Tributary Conservation ICS water.[129] The Applicant expects to develop some 9,000 afa of Coyote Spring Valley groundwater Imported ICS.[130] There are 46,340 afa available from Las Vegas Valley groundwater rights held by the City of North Las Vegas and LVVWD.[131] The Applicant expects to receive 40,000 afa from the Arizona water bank during the planning period.[132] Conservation savings are also considered a permanent water supply and conservation is built into the demand-line as further discussed below.[133] The Applicant expects to achieve conservation savings of more than 276,000 afa by 2035.[134] Finally, the Applicant expects to develop in-state groundwater, which includes 2,200 afa from Garnet and Hidden Valleys, 10,600 afa from the Three Lakes and Tikaboo Valleys, and the water requested in these

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[125] Exhibit No. SNWA_189, pp. 3-1 to 3-3; Exhibit No. SNWA_209; Transcript, Vol.2 pp. 248-306 (Entsminger).
[126] Exhibit No. SNWA_189, p. 3-3; Transcript, Vol.2 p. 251:19-22 (Entsminger).
[127] Exhibit No. SNWA_189, pp. 3-3 to 3-5; Exhibit No. SNWA_209; Transcript, Vol.2 pp. 248-306 (Entsminger).
[128] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 261:13-16 (Entsminger).
[129] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 293:6-23 (Entsminger).
[130] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 294:14-17 (Entsminger).
[131] Exhibit No. SNWA_189, p. 3-2; Transcript, Vol.2 p. 255:5-17 (Entsminger).
[132] Exhibit No. SNWA_189, p. 3-4; Exhibit No. SNWA_209, p. 26.
[133] Exhibit No. SNWA_189, p. 3-3; Transcript, Vol.2 pp. 254:22-255:4 (Entsminger).
[134] Exhibit No. SNWA_189, p. 6-1, Figure 6-1; Exhibit No. SNWA_209, p. 39, Figure 24.

Applications.[135] The Applicant expects that it will continue to use return-flow credits to extend available water supplies by roughly 70%.[136]

The Water Resource Plan graphically demonstrates the amount of water that the Applicant expects will be available under normal and shortage conditions on the Colorado River.[137] These resources are represented by colored blocks and the diversion amounts of each resource are adjusted to reflect the 70% increase resulting from the Applicant's use of return-flow credits. As discussed above, shortage conditions would result in significant reductions in the amount of water available to Southern Nevada from these supplies. The State Engineer finds that the Applicant's plans and projections regarding available water supplies are reasonable for water planning purposes.

2. Projected Demand

Forecasting water demands for a large metropolitan area comprised of nearly 2,000,000 people is not an exact science. There are numerous factors that may lead to under-forecasting or over-forecasting actual demand. The risk of under-forecasting demand is that the municipal water provider may not have developed sufficient supplies to meet actual demand, which could result in catastrophic consequences for the community.[138] In the event that a municipal water provider under-forecasts demand, it may be difficult to correct that failure due to the long lead time involved in capital construction projects.[139] That is especially true for a project like the one at issue here, where the permitting and licensing efforts and projected construction timelines are estimated to take decades. The Applicant estimates future water demand based on two primary factors, population projections and average water use per customer. As described below, the State Engineer finds that the Applicant made reasonable assumptions to estimate projected water demand during its planning period.

a. Projected Population

The Applicant uses population forecasts prepared by the Center for Business and Economic Research ("CBER") at the University of Nevada, Las Vegas ("UNLV"). CBER forecasts are based on a regional economic model that is widely accepted throughout the United

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[135] Exhibit No. SNWA_189, p. 3-2.
[136] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 pp. 289:3-290:5 (Entsminger).
[137] Exhibit No. SNWA_189, p. 4-9, Figure 4-9; Exhibit No. SNWA_209, p. 43, Figure 28.
[138] Transcript, Vol.2 p. 312:8-23 (Holmes).
[139] Transcript, Vol.2 p. 312:8-11 (Holmes).

States.[140] CBER has monitored the Clark County economy for more than 25 years and has prepared population forecasts annually since the 1990s.[141] The Applicant has used CBER forecasts for every Water Resource Plan that it has adopted since 1996.[142] CBER forecasts are only prepared for Clark County, and are therefore more specialized than other forecasts, such as those from the Nevada State Demographer.

Testimony and evidence indicates that CBER population forecasts have proven to be reliable and useful for water planning purposes, although CBER forecasts have historically under-forecasted actual population.[143] To protect against under-forecasting population, the Applicant conducts a continuous independent review of the CBER forecast and staff demographers make adjustments for water planning purposes.[144] In its current Water Resource Plan, prepared in 2009 and reviewed and adopted subsequently, the Applicant used the 2008 CBER forecast and then made adjustments to reflect the economic downturn and the lack of expected population increase in the short term. The Applicant then adopted the annual population increases from the 2008 CBER forecast for the long-term without adjustment.[145]

In the short-term, there is a high degree of uncertainty regarding the population increases that will occur in Southern Nevada. Southern Nevada was one of the fastest growing regions in the country leading up to the current economic downturn.[146] Southwestern states are expected to continue to experience some of the fastest population growth in the country over the next 30 to 40 years.[147] Water managers focus on long-term population forecasts for water planning purposes.[148] In the long-term, substantial population increases are likely to occur in Southern Nevada and that those population increases are reasonably reflected in the Applicant's population forecasts.

The Protestants claim that the Applicant is over-estimating population increases in light of recent economic and demographic trends.[149] One report states "future demand projections

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[140] Exhibit No. SNWA_189, p. 5-1; Transcript, Vol.2 p. 311:12-13 (Holmes).
[141] Exhibit No. SNWA_189, p. 5-1; Transcript, Vol.2 pp. 310:24-311:22 (Holmes).
[142] Exhibit No. SNWA_189, p. 5-1.
[143] Exhibit No. SNWA_189, p. 5-2.
[144] Exhibit No. SNWA_189, p. 5-2; Transcript, Vol.2 p. 312:14-23 (Holmes).
[145] Exhibit No. SNWA_189, p. 5-2; Transcript, Vol.2 p. 313:1-13 (Holmes).
[146] Exhibit No. SNWA_189, pp. 5-4 to 5-5.
[147] Exhibit No. SNWA_189, p. 5-5; Transcript, Vol.2 p. 318:11-18 (Holmes).
[148] Transcript, Vol.2 p. 317:3-8 (Holmes).
[149] Transcript, Vol.23 p. 5098:17-20 (Gleick).

have typically been based on assumptions of future population and housing expansions that may not materialize and are well above rates for the past few years."[150] The State Engineer recognizes that actual population increases may diverge from the population forecasts provided by the Applicant. From the perspective of a water manager, the risk of under-estimating population increases is that the municipal water provider may not have developed sufficient water supplies to meet actual demand. The State Engineer finds that the population forecasts in the Water Resource Plan are appropriate for water planning purposes.

b. <u>Individual Water Use Estimates</u>

The Applicant calculates individual water use in terms of gallons per person per day or gallons per capita per day ("GPCD"). The Applicant calculates GPCD as total community water use, divided by the permanent community population, divided by 365 days per year.[151]

The Applicant uses GPCD to measure and compare its water use over time.[152] There is currently no standard measuring system for comparing water use between communities.[153] GPCD cannot be used to compare water use in different communities because of inconsistent water use accounting practices, varying climate conditions, demographics and other factors.[154] While no formal evaluation has been conducted, there was testimony that Southern Nevada's annual influx of an estimated 37 million tourists also inflates GPCD in Southern Nevada compared to per capita use in other communities.[155] Despite those limitations, GPCD is an effective tool for an individual community to use as a yardstick against its own water use.[156]

Conservation achievements affect the GPCD calculation, and in turn, the water-demand projections for Southern Nevada. The Applicant's GPCD projections reflect past conservation achievements and future conservation goals. The Applicant's water conservation efforts have been highly successful and nationally recognized as discussed in detail in "Interbasin Transfer Criteria – Conservation" below. Between 1991 and 2009, the GPCD in Southern Nevada

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[150] Exhibit No. GBWN_069, p. 5.
[151] Exhibit No. SNWA_189, p. 5-1; Transcript, Vol.2 p. 309:10-15 (Holmes).
[152] Exhibit No. SNWA_189, p. 5-1.
[153] Transcript, Vol.1 pp. 107:16-109:16 (Mulroy); Transcript, Vol.2 p. 321:8-21 (Holmes).
[154] Exhibit Nos. SNWA_189, p. 5-1; SNWA_15, p. 66; SNWA_397, p. 8; Transcript, Vol.2 pp. 321:24-323:6 (Holmes).
[155] Transcript, Vol.2 p. 322:10-13 (Holmes); Transcript, Vol.23, pp. 5204:15-5205:9 (Gleick).
[156] Exhibit No. SNWA_189, p. 5-1.

decreased from 344 to 240 due largely to intensive conservation efforts.[157] In 2009, the Applicant set a conservation goal of 199 GPCD by 2035.[158] The Applicant believes that conservation goal is challenging but also realistic.[159] The demand forecast in the Applicant's Water Resource Plan incorporates the conservation goal established in 2009 to achieve 199 GPCD by 2035.[160]

The Protestants allege that additional conservation efforts would allow the Applicant to further reduce its GPCD projections. The Protestants claim that the Applicant could achieve 166 GPCD by 2035. The Protestants point to the fact that 166 GPCD is "well in line with current practice in most western arid climate cities" and that 166 GPCD is higher than Los Angeles's current delivery rate and comparable to the current delivery rate in Albuquerque and Phoenix.[161] However, as explained above, GPCD cannot be used to accurately compare per capita water use in different communities, so these comparisons do not support a conclusion that the Applicant could actually achieve 166 GPCD. The Protestants also identify a variety of conservation efforts that they believe would allow the Applicant to further reduce its GPCD projections. The Applicant has already achieved significant reductions in water use through its conservation efforts, as discussed below in the "Interbasin Transfer Criteria – Conservation" section.[162] Additional conservation savings will be necessary to achieve the goal of 199 GPCD by 2035.[163] Although the Applicant expects increased conservation in the future, the Applicant expects diminishing returns from its conservation efforts in light of the significant reductions it has already achieved.[164] Despite evidence from the Protestants, the State Engineer finds that the Applicant's per-capita water use forecasts are sound and are a proper basis for projecting future supply needs.

3. <u>Projected Shortfall</u>

Based on the evidence presented, available water supplies will not be sufficient to meet projected water demands in Southern Nevada during the Applicant's 50-year planning period.

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157 Exhibit No. SNWA_189, p. 5-2.
158 Exhibit No. SNWA_189, 5-2; Exhibit No. SNWA_004, p. 8-1; Transcript, Vol.2 p. 320:12-21 (Holmes).
159 Transcript, Vol.2 p. 320:12-21 (Holmes).
160 Exhibit No. SNWA_209, p. 39.
161 Transcript, Vol.23 p. 5100:16-20, p. 5124:22-25 (Gleick).
162 Exhibit No. SNWA_189, p. 5-2.
163 Exhibit No. SNWA_189, p. 5-2.
164 Transcript, Vol.4 p. 896:4-7 (Bennett).

There will be shortfalls between water supply and demand in the water-resource portfolio for Southern Nevada.[165] Shortfalls would be potentially catastrophic as the Applicant would not be able to supply water to meet the needs in Southern Nevada.

Under normal Colorado River conditions, the Applicant anticipates that as early as 2020, additional water will be necessary to meet customer demand.[166] The Applicant anticipates that it could manage its use of temporary supplies in order to avoid shortfalls until 2028.[167] However, as explained above, temporary supplies are one-time use resources that are not replenished. Therefore, without additional water, shortfalls would increasingly become greater over the planning period as there would be no permanent supplies available to replace temporary supplies after they are exhausted.[168]

By the end of the 50-year planning period, customer demand is projected to require the diversion of 897,087 afa.[169] Without any additional water resources, projected demand would exceed available supplies by approximately 275,000 afa.[170] Under shortage conditions, shortfalls are projected to be greater and to occur sooner.[171] The Applicant's analysis of the CRSS model results and potential water-resource management under the various scenarios demonstrates that projected customer demand will require additional water resources. Under a dry scenario on the Colorado River, customer demand exceeds available supply by 184,655 afa as early as the year 2021.[172] Under an average Colorado River scenario, customer demand exceeds available supply by more than 100,000 afa by the year 2041 and steadily increases to 313,914 afa by the year 2060.[173] Even under a wet scenario on the Colorado River, customer demand exceeds available supply by a range of 100,000 afa to 170,000 afa during 14 of the years in the 50-year planning period.[174] Water from the Applications could be used to fill these supply gaps.

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165 Exhibit No. SNWA_189, p. 6-2, Figure 6-2; Exhibit No. SNWA_209, p. 43; Transcript, Vol.2 pp. 345:22-347:20 (Holmes, Brothers, Entsminger).
166 Exhibit No. SNWA_189, p. 6-2, Figure 6-2; Exhibit No. SNWA_209, p. 43; Transcript, Vol.2 p. 326:13-18 (Holmes).
167 Exhibit No. SNWA_189, p. 6-4, Figure 6-3; Transcript, Vol.2 p. 327:14-18 (Holmes).
168 Transcript, Vol.2 p. 327:8-13 (Holmes).
169 Exhibit No. SNWA_189, p. 6-4, Table 6-1.
170 Exhibit No. SNWA_189, p. 6-4, Figure 6-3 and Table 6-1.
171 Exhibit No. SNWA_189, p. 8-5, Figure 8-5, p. 6-5 and pp. A-10 to A-12.
172 Exhibit No. SNWA_189, Appendix A, Table A-2.
173 Exhibit No. SNWA_189, Appendix A, Table A-3.
174 Exhibit No. SNWA_189, Appendix A, Table A-4.

The Applicant has identified all available water supplies and has presented reasonable water-demand projections to demonstrate that it will not be able to meet Southern Nevada's water needs. A witness for the Protestants expressed opinions that combining reductions in both projected population and per capita demand may completely eliminate Southern Nevada's need for new water supplies.[175] The State Engineer finds the Applicant's evidence shows that by the year 2028, under normal Colorado River conditions, without water from the Applications or other augmentation supplies, demands for water in Southern Nevada would not be met.

II. GOOD FAITH INTENTION AND FINANCIAL ABILITY

The Applicant must provide proof satisfactory to the State Engineer of the Applicant's intention in good faith to construct any work necessary to apply the water to the intended beneficial use with reasonable diligence, and financial ability and reasonable expectation actually to construct the work and apply the water to the intended beneficial use with reasonable diligence.[176] The purpose of these requirements is to protect against water speculation.

A. Good Faith Intention to Place the Water to Beneficial Use

The Applicant is a government agency responsible for ensuring that adequate water supplies are available to meet Southern Nevada's water needs. As discussed above, the Applicant will have insufficient water available to meet Southern Nevada's water needs unless it puts the water from the Applications to beneficial use. Therefore, it is reasonable to conclude that the Applicant intends to construct the works necessary to put this water to beneficial use.

The support in Southern Nevada for the development of the Applications is also evidence of the Applicant's intention. In 2004, an Integrated Advisory Committee comprised of 29 stakeholder representatives recommended that the Applicant pursue development of the Applications.[177] The Big Bend Water District, the City of Boulder City, the City of Henderson, the City of Las Vegas, the City of North Las Vegas, the Clark County Water Reclamation District, and the LVVWD have all passed resolutions supporting development of the Applications.[178] These entities represent the interests of nearly 2 million people in Southern Nevada. The Applicant's board of directors has directed staff to pursue these Applications.[179]

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[175] Transcript, Vol.23 p. 5124:18-21 (Gleick).
[176] NRS 533.370(1)(c).
[177] Exhibit No. SNWA_209, Appendix 2; Exhibit No. SNWA_201; Transcript, Vol.1 pp. 225:11-228:5 (Brothers).
[178] Exhibit Nos. SNWA_223 through SNWA_229.
[179] Exhibit No. SNWA_211; Transcript, Vol.1 pp. 235:24-236:4 (Brothers).

These recommendations, approvals and directions are evidence that the Applicant intends to construct the works necessary and put water from the Applications to beneficial use.

The fact that the Applicant has expended considerable resources pursuing the Applications is also evidence of its intentions. This is the second time that the Applicant has come to a hearing before the State Engineer on these Applications. The Applicant has generated hundreds of studies, analyses and expert reports for these hearings and in connection with the Applications generally. The Applicant has directed its staff to prepare multiple versions of development plans for the Applications as the legal and scientific landscape has evolved.[180] The Applicant has developed monitoring, management and mitigation plans for eventual pumping as described below. The Applicant has spent tens of millions of dollars purchasing land, surface and groundwater rights, and grazing permits for use in monitoring, management and mitigation efforts.[181] The Applicant has gone through extensive federal permitting and procedural requirements as described below. Ms. Brothers testified regarding the long history of efforts by the Applicant in pursuing the Applications and expressed an opinion that the Applicant has a good faith intention to construct the infrastructure necessary to use water from the Applications.[182] This expenditure of considerable time, money and resources is evidence that the Applicant intends to construct the works necessary and put water from the Applications to beneficial use.

The Applicant's timeline for construction demonstrates reasonable diligence given the unique nature and scope of the diversion and delivery infrastructure. Construction is expected to take place in phases over an estimated ten-year period. The Applicant expects that, if necessary, it could begin putting the water to beneficial use by 2020 depending on the existence of shortage conditions on the Colorado River.[183] The State Engineer finds that the Applicant has provided proof satisfactory of its intention in good faith to construct the works necessary and apply the water to beneficial use with reasonable diligence.

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[180] Exhibit No. SNWA_190; Exhibit No. SNWA_190; SNWA_191; Transcript, Vol.1 pp. 204:16-205:13 (Holmes).
[181] Transcript, Vol.1 p. 100:19-20 (Mulroy).
[182] Transcript, Vol.1 p. 238:14-18 (Brothers).
[183] Exhibit No. SNWA_195; Transcript, Vol.1 pp. 216:10-217:13 (Holmes).

B. Financial Ability and Reasonable Expectation

1. Plan of Development

The Applicant's engineering department has developed a conceptual plan of development for the Clark, Lincoln, and White Pine Counties Groundwater Development Project (the "Project"), which will provide the infrastructure needed to put water from the Applications to beneficial use.[184] The Applicant presented evidence that the conceptual plan of development for the Project is feasible. Although the Project is large in scale, its basic components are similar to other projects that the Applicant has successfully constructed.[185] There is no evidence that the Project will require technologies or construction methods that are unattainable and the Protestants did not present any evidence that the Project would not be technically feasible. The conceptual plan would allow the Applicant to divert and convey all of the water requested in these Applications.[186] The State Engineer finds that construction of the Project has a feasible conceptual plan of development.

a. Estimated Construction Costs

The Applicant's engineering department has developed a cost estimate based on the conceptual plan of development for the Project.[187] The engineering department prepared this cost estimate using the same methods it has used to develop cost estimates for other capital construction projects.[188] The engineering department uses a cost estimating guide that contains cost curves, or reasonable cost estimates, for various project components.[189] The guide is based on construction costs for various projects constructed in the southwestern United States from 1995 to 2003, including projects constructed by the Applicant during that time.[190] The guide was prepared in accordance with industry standards, including those set by the Association for Advancement of Cost Engineering ("AACE").[191] The engineering department has used this guide to generate cost estimates for projects since 2006, including projects in its 2011 Major

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[184] Exhibit No. SNWA_190; Transcript, Vol.1 pp. 201:16-204:15 (Holmes).
[185] Transcript, Vol.1 p. 201:6-14 (Holmes).
[186] Transcript, Vol.1 p. 204:5-12 (Holmes).
[187] Exhibit No. SNWA_195; Transcript, Vol.1 p. 211:18-25 (Holmes).
[188] Exhibit No. SNWA_195; Transcript, Vol.1 p. 214:18-22 (Holmes).
[189] Exhibit No. SNWA_194; Exhibit No. SNWA_195; Transcript, Vol.1 pp. 208:9-209:15 (Holmes).
[190] Exhibit No. SNWA_195, pp. 2-3; Transcript, Vol.1 p. 209:8-15 (Holmes).
[191] Exhibit Nos. SNWA_195, p. 2; SNWA_233; SNWA_234; Transcript, Vol.1 p. 210:3-15 (Holmes).

Construction and Capital Plan.[192] The engineering department used this same cost estimating guide to develop the cost estimate for the Project.[193]

The Applicant's engineering department estimates that the capital costs for the Project will be approximately $3.224 billion.[194] Including contingency (15%) and inflation (4%), the engineering department estimates that the cost to construct the Project would be approximately $6.45 billion.[195] The engineering department has developed schedules for phased construction of the Project based on the earliest timing that construction would likely occur and has prepared cost breakdowns for each phase.[196] The engineering department also developed cash-flow projections to allow financial experts to evaluate potential funding requirements for the Project.[197]

The current Project cost estimate is a Class 4 estimate under the AACE guidelines, which means that it is in the concept or feasibility study estimate category.[198] Under AACE guidelines regarding a Class 4 estimate, a reasonable expectation is that the actual cost of the Project could range from 50% above to 30% below the Class 4 cost estimate.[199] However, the Applicant's current cost estimate is the best available evidence regarding the cost of the Project. At this stage of development, it is not realistic to expect a concrete number and there is no evidence that the Applicant's current cost estimate is unreasonable. The Protestants did not present any evidence to support an alternative cost estimate. The Applicant's Deputy General Manager who oversees the Applicant's engineering department testified that the current estimates are very reasonable and that he is very confident in the number that they have prepared.[200]

The State Engineer finds that the Applicant's cost estimate is reasonable.

b. <u>Ability to Finance Estimated Construction Costs</u>

The Applicant provided the cost estimate, construction schedule and cash-flow projections to John Bonow and Guy Hobbs.[201] Mr. Bonow and Mr. Hobbs prepared an expert

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[192] Exhibit No. SNWA_195, p. 2; Transcript, Vol.1 pp. 207:25-208:19 (Holmes).
[193] Transcript, Vol.1 pp. 215:25-216:6 (Holmes).
[194] Exhibit No. SNWA_195, p. 4, Table 1; Transcript, Vol.1 p. 213:13-21 (Holmes).
[195] Exhibit No. SNWA_195, p. 5, p. 7; Transcript, Vol.1 p. 214:4-6 (Holmes).
[196] Exhibit No. SNWA_195, pp. 3-5.
[197] Exhibit No. SNWA_195, p. 5, p. 7, Table 2.
[198] Exhibit No. SNWA_195, p. 2.
[199] Exhibit No. SNWA_189, p. 2.
[200] Transcript, Vol.1 pp. 215:25-216:6 (Holmes).
[201] Exhibit No. SNWA_383; Transcript, Vol.13 p. 214:11-17 (Holmes).

report that analyzed the Applicant's ability to issue bonds to finance the estimated cost of the Project.[202] Mr. Bonow and Mr. Hobbs are financial advisors to various Nevada municipalities, including the Applicant, and are recognized experts in the field of public finance. Together, they have been involved in hundreds of publicly financed projects, which have required the issuance of tens of billions of dollars in municipal debt obligations.[203] Mr. Bonow and Mr. Hobbs have served as financial advisors to the Applicant for over a decade and have a specialized knowledge of the Applicant's financial condition and available revenue sources.[204]

In their report, Mr. Bonow and Mr. Hobbs analyzed the Applicant's past financing history and its current credit status, and prepared a funding plan, which demonstrates that the Project would be able to be financed via issuance of bonds. This is the same analysis that is undertaken by the Applicant each time it needs to access the capital markets.[205] This is the same methodology used by other financial advisors when determining whether any municipality has the financial ability to construct a large capital project.[206]

With regard to the Applicant's past financing history, the report analyzes the Applicant's ability to access the capital markets, the performance of bonds supported by the Applicant's revenues, and the past credit ratings of entities that have issued bonds on behalf of the Applicant.[207] That analysis describes the sources of revenue that are available to the Applicant, including various rates and charges to customers, and presents a summary of the revenues received over the past five years that were available to pay debt service on outstanding debt. Based on this review, Mr. Bonow and Mr. Hobbs concluded that the Applicant has never had a barrier to accessing the capital markets and that it has done so on agreeable terms, meaning a cost of capital (i.e., the interest rate on the bonds) that is low compared to the marketplace.[208]

With regard to the Applicant's current credit status, the report analyzes factors such as the Applicant's current plan of finance for capital projects and the most recent credit ratings of entities that have issued bonds on behalf of the Applicant.[209] The Applicant's current plan of

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[202] Exhibit No. SNWA_383.
[203] Transcript, Vol.13 p. 2836:1-25 (Bonow); p. 2840:11-23 (Hobbs).
[204] Transcript, Vol.13 pp. 2837:5-2838:3 (Bonow); pp. 2841:17-2842:11 (Hobbs).
[205] Transcript, Vol.13 pp. 2842:22-2843:19 (Hobbs).
[206] Transcript, Vol.13 p. 2846:1-5 (Hobbs).
[207] Exhibit No. SNWA_383, Section I.
[208] Transcript, Vol.13 p. 2844:11-15 (Bonow), p. 2854:18-20 (Hobbs).
[209] Exhibit No. SNWA_383, Section II.

finance is to fund 10% of initial construction costs through its commercial paper program and to then issue tax-exempt bonds every two years through the LVVWD with level debt service over 30 years.[210] The Applicant uses that plan of finance and issues debt predominantly through LVVWD because doing so results in the lowest cost of capital at this time.[211] As of September 2011, the LVVWD enjoyed a credit rating of AA+ and Aa2 from S&P and Moody's, respectively, which are among the highest ratings available from those agencies.[212] The Applicant has never failed to make full and timely payment on its debt obligations.[213] Based on this review, Mr. Bonow and Mr. Hobbs concluded that the Applicant currently accesses the capital markets on agreeable terms.[214]

Mr. Bonow and Mr. Hobbs expressed an opinion that debt supported by the Applicant's revenues is attractive to the capital markets because of five main factors: (1) the Applicant is an essential service provider, which means that its revenues are reliable because customers place a high priority on receiving, and paying for, water service; (2) the Applicant has independent rate setting authority which means it does not have to go through multiple levels of state or federal approval to adjust its rates as necessary; (3) the Applicant has ample headroom to increase rates because current rate levels are modest, which gives investors comfort that the Applicant can raise rates as necessary; 4) the Applicant has a high quality credit rating due to its past financing history and current status as a credit risk; and (5) the Applicant is contractually obligated to raise rates in certain circumstances, which gives investors comfort that they will receive full and timely payment.[215] Mr. Bonow and Mr. Hobbs expect that these factors will allow the Applicant to remain attractive to the capital markets in the future and to finance the Project on agreeable terms.[216]

Mr. Bonow and Mr. Hobbs created a funding plan to analyze the Applicant's ability to finance its funding needs for all ongoing and planned projects, including the Project. The funding plan assumes that the Applicant would access the capital markets under the Applicant's

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[210] Exhibit No. SNWA_383, p. 22.
[211] Transcript, Vol.13 pp. 2847:23-2848:17 (Bonow).
[212] Exhibit No. SNWA_383, p. 22; Transcript, Vol.13 p. 2853:11-19, p. 2860:10-15 (Hobbs).
[213] Transcript, Vol.13 p 2858:3-6 (Hobbs).
[214] Transcript, Vol.13 p. 2860:12-15 (Hobbs).
[215] Transcript, Vol.13 pp. 2856:7-2858:2 (Hobbs).
[216] Transcript, Vol.13 p. 2845:3-6 (Bonow).

typical plan of finance because that is the most cost-effective approach at this time.[217] The funding plan assumes that current market conditions, with the exception of an assumption about higher interest rates (as noted below), would be in place because predicting future market conditions would be a highly speculative exercise.[218]

The funding plan uses a series of assumptions regarding interest rates, projected growth and development that would affect growth-related fees and the size of the customer base, available revenues, future refinancing and costs of issuance of the bonds. These assumptions demonstrate that the Applicant would have the financial ability to construct the Project even during challenging market conditions and periods of almost non-existent population growth.[219]

With regard to interest rates, the funding plan assumes a blended interest rate of roughly 6.25% for the bonds, which is significantly higher than interest rates in the current marketplace.[220] When the Applicant last accessed the capital markets in 2011, it achieved an interest rate of 4.06%.[221] If that interest rate had been used in the funding plan, the resulting interest costs would have been about two-thirds of the costs identified in the funding plan.[222]

With regard to projected growth and development, the funding plan assumes almost non-existent population increases.[223] This assumption affects the amount of commodity charge revenues and connection charge revenues that are projected to be available under the funding plan.[224] Commodity charge revenues would be constrained because essentially only existing customers would be paying these charges. Connection charge revenues would be almost non-existent because they are dependent on new customers connecting to the water system.[225] This assumption allowed the financial experts to analyze the Applicant's ability to finance the Project even if no growth occurs and the Project is built solely for drought-protection purposes.[226] If

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[217] Transcript, Vol.13 pp. 2865:7-2866:11 (Hobbs).
[218] Transcript, Vol.13 p. 2846:21-24, pp. 2889:21-2891:16, pp. 2906:22-2907:9, p. 2910:18, p. 2921:13-15 (Bonow).
[219] Transcript, Vol.13 p. 2846:12-24 (Bonow, Hobbs).
[220] Exhibit No. SNWA_383, Appendix F; Transcript, Vol.13 p. 2868:14-16 (Hobbs).
[221] Transcript, Vol.13 p. 2869:10-11 (Hobbs).
[222] Transcript, Vol.13 p. 2869:16-19 (Hobbs).
[223] Exhibit No. SNWA_383, Appendix C.
[224] A "commodity charge" is a charge for each 1,000 gallons of potable water, from any source whatever, delivered by Henderson, North Las Vegas and LVVWD to their customers. A "connection charge" is a charge for each new connection within the service areas of Henderson, North Las Vegas and LVVWD to their customers. *See,* Exhibit No. SNWA_383, p. 16.
[225] Transcript, Vol.13 p. 2879:10-19 (Bonow).
[226] Transcript, Vol.13 p. 2872:15-24 (Hobbs).

moderate growth were to occur, it would increase the amount of revenues available to pay debt service on the bonds from sources other than the commodity charge.

In addition, with regard to available revenues, the funding plan also assumes that only revenues from its commodity charge and reliability charge[227] would be used to pay debt service even though revenues from other charges could be available.[228] At the same time, only the commodity charge rate was adjusted to generate additional revenues meaning there was no increase to other rates that could be adjusted to generate revenues.[229] The funding plan assumes that neither accumulated reserves nor current reserves would be used to pay debt service even though those sources could be available to pay debt service.[230] The funding plan also assumed that revenues from the Applicant's 0.25% sales tax would not be available after the current tax sunsets in 2025 even though the Clark County board of commissioners is now authorized to extend the sales tax beyond 2025.[231] These assumptions depress the funding plans' projections regarding the amount of revenues available to pay debt service on the bonds. The result is that the commodity-charge rate bears the full brunt of the cost of financing the Project under the funding plan.[232]

With regard to refinancing, the funding plan assumes that there would be no refinancing of the bonds prior to their final maturities when they are paid off.[233] The vast majority of bonds in the marketplace, approximately 95% of the bonds with a call option or prepayment feature, are refinanced at least once prior to maturity, which allows the issuer to achieve interest cost savings.[234] If the Applicant were to refinance the bonds prior to maturity at a lower interest rate, it would likely result in lower financing costs for the Project, and lower monthly bills for southern Nevadans than were calculated in the financing report by Mr. Bonow and Mr. Hobbs.[235]

With regard to the projected debt coverage ratio, the funding plan does not reflect the fact that the commodity charge rate could decrease as bonds are retired and debt service levels

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[227] A "reliability charge" is an excise tax on all residential customers at 0.25% of the total water bill and at 2.5% for all other customer classes within Henderson, North Las Vegas and LVVWD. *See*, Exhibit No. SNWA_383, p. 16.
[228] Exhibit No. SNWA_383, p. 29.
[229] Exhibit No. SNWA_383, p. 33; Transcript, Vol.13 p. 2851:14-21, pp. 2871:23-2872:14 (Hobbs).
[230] Transcript, Vol.13 p. 2861:10-13 (Hobbs).
[231] Transcript, Vol.13 pp. 2880:18-2882:7 (Hobbs).
[232] Transcript, Vol.13 p. 2896:21-23 (Hobbs).
[233] Transcript, Vol.13 pp. 2869:25-2870:10 (Hobbs).
[234] Transcript, Vol.13 p. 2870:2-4 (Hobbs).
[235] Transcript, Vol.13 p. 2870:4-10 (Hobbs).

decline. The Applicant is required to maintain a minimum debt coverage ratio of 1.00x, meaning pledged revenues must at least be equal to debt service requirements on outstanding bonds.[236] However, the funding plan reflects coverage ratios that exceed that requirement.[237] That means that over time, the commodity charge rate levels could decrease since those inflated debt coverage ratios would not be required.[238]

With regard to the cost of issuance of the bonds, the funding plan assumes roughly $800 million in additional bonds would be needed to finance costs of issuance, including costs of capitalized interest and original issue discount.[239] If the Applicant's cash-flow requirements do not require the use of capitalized interest or if investors prefer a bond pricing structure other than original issue discount bonds, other financing structures could be used that would significantly reduce those financing costs.[240]

Even though many of these assumptions depress revenue projections, the funding plan still demonstrates that the Applicant would be able to finance the Project. The funding plan includes tables showing the financing requirements for: (1) existing debt; (2) existing debt and planned capital projects other than the Project; and (3) existing debt and planned capital projects including the Project.[241] These tables demonstrate the annual principal and interest payments for the bonds, the amount of revenues that would be required for those payments, and the commodity charge rate increases that would be necessary to generate those revenues and maintain the required minimum 1.00x debt coverage ratio.[242] Under the assumptions discussed above: (1) the principal amount of the bonds issued for the Project would be estimated at approximately $7.283 billion; (2) the interest costs of the Project would be estimated at approximately $8.18 billion; and (3) the total cost of the Project would be estimated at approximately $15.463 billion.[243] The maximum commodity-charge rate that would be required to pay debt service on existing debt and planned projects including the Project would be $4.67 per thousand gallons of water. If the commodity-charge rate were increased to $4.67 per

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[236] Exhibit No. SNWA_383, p. 15.
[237] Exhibit No. SNWA_383, p. 35.
[238] Transcript, Vol.13 pp. 2877:15-2878:2 (Hobbs).
[239] Exhibit No. SNWA_383, p. 34; Transcript, Vol.13 p. 2870:16-23 (Hobbs).
[240] Transcript, Vol.13 pp. 2870:19-2871:4 (Hobbs).
[241] Exhibit No. SNWA_383, pp. 30, 33, 34-35.
[242] Transcript, Vol.13 pp. 2863:13-2865:4 (Hobbs).
[243] Exhibit No. SNWA_383, p. 35.

thousand gallons of water, the resulting average monthly residential water bill in Southern Nevada would be $90.62 by the year 2026.[244]

Mr. Bonow and Mr. Hobbs analyzed the ability of customers to pay increases in the commodity-charge rate by comparing the current and projected average water bill in Southern Nevada to the current and projected average water bills in 50 of the largest U.S. metropolitan areas. The comparison used a survey prepared by Black and Veatch to identify average water bills for those areas in 2010 and then made adjustments to reflect rate increases that would, by assumption, occur in those areas in the future.[245] The comparison shows that as the commodity-charge rate increases under the funding plan, the resulting average water bill in Southern Nevada would continue to compare favorably to the average water bills in other metropolitan areas.[246] Therefore, even with the assumptions in the funding plan, there is evidence that the resulting average water bill would continue to be affordable for customers in Southern Nevada.

To contest the analysis prepared by Mr. Hobbs and Mr. Bonow, the Protestants presented Sharlene Leurig, an expert in the assessment of risk factors affecting municipal bond financing for water projects or water infrastructure.[247] Ms. Leurig is the Senior Manager, Insurance Program at CERES, which is a non-profit research and advocacy group. [248,249] She is the author of a report titled *The Ripple Effect: Water Risk in the Municipal Bond Market.*[250] Ms. Leurig has experience in engaging with insurers on investment and asset management opportunities related to climate change, including energy-efficiency financing, renewable energy, investments and adaptation investments, including water infrastructure.[251] She has experience with issues relating to municipal bonds, but has never advised a municipality on how to access the capital markets.[252] She is not an expert regarding the Applicant's financial condition or the process the Applicant uses to finance its capital construction projects,[253] and did not prepare an independent analysis regarding the Applicant's past financing history, its current status as a credit risk, or its ability to

244 Exhibit No. SNWA_383, p. 36.
245 Exhibit No. SNWA_383, p. 38; Exhibit No. SNWA_384; Transcript, Vol.13 pp. 2882:22-2885:18 (Bonow).
246 Transcript, Vol.13 p. 2887:11-15 (Bonow).
247 Transcript, Vol.22 p. 4831:1-3 (State Engineer).
248 Exhibit No. GBWN_125.
249 Transcript, Vol.22 p. 4868:19-21 (Leurig).
250 Exhibit No. GBWN_116.
251 Exhibit No. GBWN_125.
252 Transcript, Vol.22 p. 4864:9-20 (Leurig).
253 Transcript, Vol.22 p. 4865:10-21 (Leurig).

finance the Project.[254] Lastly, she did not analyze the Applicant's rate levels, ability to raise rates, or how those rates compare to other municipalities.[255]

Ms. Leurig testified that the credit-rating agencies and investors are not currently accounting for "water risks" relating to municipal utilities. However, the Applicant provided evidence that the credit-rating agencies and investors have asked the Applicant about Southern Nevada's water supply issues, which indicates an awareness of water risks.[256]

Ms. Leurig pointed to a number of water-related risk factors that she believes were not adequately addressed in the Applicant's funding model. Mr. Hobbs testified that those are not the types of considerations or assessments of risk that the credit markets do take into account.[257] The Applicant's funding model is based on current market conditions. It would not be reasonable to base a funding model on hypothetical future market conditions, because predicting future market conditions would be a highly speculative exercise. Ms. Leurig testified that financing the Project may be more expensive than predicted in the funding plan because of factors she believes will be taken into account by investors in the future. However, Ms. Leurig did not express an opinion, either in her testimony or reports, that the Applicant would not have the financial ability to construct this Project and put the water to beneficial use. When asked by the State Engineer whether she believed the Applicant has the financial ability and reasonable expectation to construct the work, Ms. Leurig replied that the Applicant's ability to actually finance the Project is somewhat tenuous.[258]

Ms. Leurig's testimony and reports do not support a determination that the Applicant lacks the requisite financial ability to finance the Project. Based on the funding model and analysis, it was the opinion of the Applicant's financial experts that the Applicant would have the financial ability to construct the Project.[259] The State Engineer finds that this evidence outweighs the testimony and evidence presented by Ms. Leurig.

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[254] Transcript, Vol.22 p. 4866:9-23 (Leurig).
[255] Transcript, Vol.22 p. 4867:2-14 (Leurig).
[256] Transcript, Vol.1 pp. 93:17-95:7 (Mulroy).
[257] Transcript, Vol.13 p. 2889:6-13 (Hobbs).
[258] Transcript, Vol.22 p. 4891:1-13 (Leurig).
[259] Transcript, Vol.13 p. 2846:12-17, p. 2896:13-16 (Bonow).

The State Engineer finds that the Applicant has provided proof satisfactory of its financial ability and reasonable expectation actually to construct the Project and put this water to beneficial use with reasonable diligence.

III. PERENNIAL YIELD

Nevada Revised Statute 533.370(2) provides that the State Engineer must reject an application where there is no unappropriated water in the proposed source of supply. In determining the amount of groundwater available for appropriation in a given hydrographic basin ("basin"), the State Engineer relies on available hydrologic studies to provide relevant data to determine the perennial yield of a basin. The perennial yield of a groundwater reservoir may be defined as the maximum amount of groundwater that can be salvaged each year over the long term without depleting the groundwater reservoir. Perennial yield is ultimately limited to the maximum amount of natural discharge that can be salvaged for beneficial use. The perennial yield cannot be more than the natural recharge to a groundwater basin and in some cases is less. If the perennial yield is exceeded, groundwater levels will decline and steady state conditions will not be achieved, a situation commonly referred to as groundwater mining. Additionally, withdrawals of groundwater in excess of the perennial yield may contribute to adverse conditions such as water quality degradation, storage depletion, diminishing yield of wells, increased pumping costs, and land subsidence.

Under natural pre-development conditions, the groundwater system has recharge, which is water being added to the system over time from precipitation and groundwater flow into the basin. The inflows to the system also are balanced by groundwater discharge by which groundwater is withdrawn and consumed by plants or by groundwater that flows out of the basin to an adjacent down-gradient basin. Components that add or remove water from the system are referred to as fluxes. Even though many of the basins within Nevada are bounded by mountain ranges, groundwater can flow between them. Such groundwater flow cannot be observed directly, but experts determine its occurrence based on geologic, hydrologic, and geochemical evidence. Where this occurs, the groundwater flow is typically referred to as a boundary flux, or interbasin flow.

Perennial yield is a guideline that is used in Nevada to manage groundwater development. Since perennial yield is determined by the natural hydrologic conditions, limiting groundwater development to a basin's perennial yield ensures sustainable development of the groundwater resource.

Perennial yield is estimated by developing a groundwater budget for a hydrographic basin. Generally, groundwater systems are thought to be in steady state prior to human development of the resource. Steady state means that recharge to the groundwater system equals discharge; thereby resulting in a balanced groundwater budget. Accordingly, the groundwater budget and the perennial yield are typically first computed under these pre-development conditions. The State Engineer will use the groundwater budget method (also sometimes called the groundwater balance method) to make this determination.

Spring Valley is a basin with a large amount of groundwater discharge to the ground surface and a relatively small volume of subsurface outflow.[260] Groundwater discharges to the ground surface via evaporation from the soil or via transpiration through plants that draw groundwater through their roots. Evaporation and transpiration are often considered together and referred to as evapotranspiration ("ET"). Groundwater is recharged by precipitation that percolates through soil and into the aquifer. For basins like Spring Valley where most groundwater discharge is via ET, perennial yield is at least equal to the estimated annual groundwater ET, but is in no case larger than the estimated volume of annual groundwater recharge.[261]

To provide background and context for the determination of perennial yield in Spring Valley, the Applicant initially conducted a comprehensive literature review of prior investigations by the U.S. Geological Survey ("USGS").[262] The Applicant's witness, Mr. Andrew Burns,[263] testified that he reviewed the following USGS reports: the Reconnaissance Series Reports, the Basin and Range Carbonate Aquifer System Study ("BARCASS") that was mandated by Congress, the Great Basin Regional Aquifer System Analysis ("RASA"), and sections of the Great Basin Carbonate and Alluvial Aquifer System study ("GBCAAS"), which is a recently published update to RASA.[264]

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[260] Exhibit No. SNWA_258, p. 10-1.
[261] *See*, State Engineer's Ruling 5986, pp. 4-5, dated April 29, 2009, official records in the Office of the State Engineer.
[262] Transcript, Vol.3 p. 588:14-22 (Burns).
[263] Mr. Burns is a hydrologist for Southern Nevada Water Authority. Exhibit No. SNWA_256. He was qualified as an expert in surface water and groundwater hydrology. Transcript, Vol.3 p. 576:11-14.
[264] Transcript, Vol.3 pp. 588:14-592:22 (Burns).

A. Groundwater ET

Groundwater ET is important because it can be more accurately measured than groundwater recharge or subsurface flow.[265] In hydrologically closed basins, groundwater ET is equal to recharge. In 1965, Rush and Kazmi completed the first hydrologic study of the Spring Valley Hydrographic Basin as part of the Reconnaissance Report Series for the USGS. They estimated groundwater ET by mapping phreatophyte communities and applying a probable average rate of groundwater use to derive the total groundwater discharge via ET. Since 1965, there have been many advances in science and technology that allow for more accurate estimates of basin-wide groundwater ET.

To estimate groundwater ET in Spring Valley, the Applicant relied on direct ET measurements using state-of-the-art Eddy Covariance Towers in Spring Valley, Snake Valley and White River Valley, and five years of satellite data to characterize vegetation health and density. Eddy Covariance Towers are towers equipped with calibrated sensors that measure energy-budget and meteorological parameters. Data collected from these towers are used to calculate ET rates of the vegetation and bare soil that occur in the area surrounding the tower. In essence, these towers measure the annual total ET rate for the vegetation and bare soil located at the tower location. The Applicant also presented an estimate of the spatial distribution of precipitation in Spring Valley based on the best tool available to estimate precipitation in the groundwater ET areas.

The Applicant initially delineated the extent of the potential groundwater-ET area of Spring Valley using mapping by previous investigators (Rush and Kazmi (1965) and Nichols (2000)). The Applicant then used satellite imagery and field investigations to refine and verify the groundwater-ET extent boundaries based on the presence of phreatophytic vegetation and consideration of the depth to groundwater. The Applicant delineated two areas of significant groundwater discharge, which the Applicant referred to as the "Main" groundwater discharge area and the "Northern" groundwater discharge area.[266] The Main groundwater discharge area is located along the longitudinal axis of the valley, including the majority of the valley bottom. The much smaller Northern groundwater discharge area is also located along the longitudinal

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[265] Exhibit No. GBWN_103, p. 17; Transcript, Vol.17 p. 3794:6-11 (Myers); Transcript, Vol.24 p. 5413:19 (Bredehoeft).
[266] Exhibit No. SNWA_258, p. 5-3.

axis of the valley, but in the very northern part of the basin and is disconnected from the Main groundwater discharge area.[267] The Applicant determined that the total groundwater-ET extent boundary in Spring Valley is 172,605 acres, which is very similar to the area determined by prior investigations.[268]

The Applicant divided the groundwater-ET area into six land-cover classes: (1) open water; (2) bare soil/low density vegetation; (3) phreatophytic/medium density vegetation; (4) wetland/meadow; (5) agriculture; and (6) playa.[269] The Applicant conducted field checks to ensure that land-cover classifications based on satellites and prior mapping were accurate. The overall accuracy of the Applicant's land-cover delineations was 88%. The accuracies by class ranged from 78% for bare soil/low vegetation to 92% for open water. The accuracy was 88% for agriculture, 89% for phreatophyte/medium vegetation, and 90% for wetland/meadow. The Applicant argues values above 85% are considered sufficiently accurate.[270] Most groundwater ET occurs in the phreatophyte/medium vegetation and wetland/meadow land-cover classes for which the Applicant reports high accuracy.

The Applicant applied the same general approach used in previous investigations to estimate groundwater ET within the groundwater discharge areas by subtracting precipitation from annual total ET, but applied slightly different data processing steps for each groundwater discharge area.

For the Main groundwater discharge area of Spring Valley, the Applicant completed the following steps to estimate groundwater ET: (1) collect and process site-specific ET-rate data from ET measurement sites located within the primary groundwater discharge areas of Spring, Snake, and White River Valleys to derive annual total ET rates; (2) acquire and process satellite imagery to derive distributions of normalized difference vegetation indices ("NDVI"); (3) develop an empirical relationship between annual total ET measurements and NDVI values for the corresponding ET measurement sites; (4) apply the empirical relationship to NDVI distributions to estimate the distribution of annual total ET rates within the groundwater discharge area; (5) subtract the distributions of annual precipitation rates from the annual total

[267] Exhibit No. SNWA_258, p. 5-4, Figure 5-1.
[268] Exhibit No. SNWA_258, p. 5-5.
[269] Exhibit No. SNWA_258, p. 5-3.
[270] Exhibit No. SNWA_258, p. D-5.

ET rates to arrive at distributions of annual groundwater ET rates for each year; and (6) calculate the annual average groundwater ET for the five-year period of ET data collection.

The Applicant estimated ET for wetland/meadow, phreatophytic/medium vegetation, and bare soil/low vegetation land-cover classes in the Main groundwater discharge area in Spring Valley using an empirical relationship developed in cooperation with the Desert Research Institute. The empirical relationship is expressed by a regression equation that represents the best fit relationship between footprint-weighted growing season average NDVI values and annual total ET measurements. NDVI is a vegetation index in which a number is assigned to a pixel in a satellite image that is intended to represent the physical character of the vegetation in the pixel (i.e., greenness, vegetation density). There are several vegetation indices that are used to represent vegetation cover based on satellite data. The regression equation is developed by comparing actual measurements of ET at a measurement site with the vegetation index values at those specific sites. The regression relationship is then used to estimate ET rates for other pixels in the ET areas based on the vegetation index value computed for each of those pixels.

Dr. Lynn Fenstermaker conducted the exercise of acquiring and processing the satellite imagery and performed a linear regression analysis to develop the empirical relationship. She was qualified by the State Engineer as an expert in ET estimates using remote sensing.[271]

In order to determine the best method for estimating total ET using remote sensing, Dr. Fenstermaker carefully evaluated the techniques that had been used in prior studies. After conducting a statistical evaluation of the accuracy of the prior studies, she determined the best approach is one that compares a growing-season average NDVI value for each ET tower footprint with the annual ET value measured at that ET tower.[272] NDVI is the most commonly used vegetation index.[273] Dr. Fenstermaker determined that NDVI provides better estimates of ET than the Enhanced Vegetation Index ("EVI") by performing an independent accuracy assessment on prior studies that had used either NDVI or EVI.[274] By relating a growing-season average NDVI value with an annual ET value, Dr. Fenstermaker accounts for all the variation in ET that occurs during the year. By using a footprint average rather than the single-pixel average where the tower is located, Dr. Fenstermaker accounts for the fact that the ET measurements

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[271] Transcript, Vol.3 p. 657:7-9.
[272] Exhibit No. SNWA_312, pp. 2-1 to 2-7; Transcript, Vol.4 pp. 807:1–808:5 (Fenstermaker).
[273] Transcript, Vol.3 p. 685:7-10 (Fenstermaker).
[274] Transcript, Vol.3 p. 696: 18-23 (Fenstermaker).

include contributions of ET from areas beyond the measurement site. By using a weighted average, Dr. Fenstermaker accounts for the fact that certain areas within the footprint contribute more to the ET measurement than others. The State Engineer finds this approach to be scientifically sound.

Dr. Fenstermaker used Eddy Covariance tower measurements of ET. The Eddy Covariance method is the most direct and defensible way to measure fluxes of heat, water vapor and gas concentrations and momentum between the atmosphere and biosphere.[275] Mr. Burns described the Eddy Covariance method as state of the art.[276] The Eddy Covariance towers use sophisticated sensors to measure the components of ET.[277] The sensors were installed and calibrated according to manufacturer recommendations.[278] The ET measurements were taken from the UNLV, Desert Research Institute, and Southern Nevada Water Authority ET-measurement sites in Spring, White River, and Snake Valleys.[279] Seven of the towers were located in Spring Valley.[280] Dr. Fenstermaker testified that she was unaware of any other published study that used this many Eddy Covariance Towers.[281] The ET tower locations were chosen to represent a range of uniform-composition phreatophytic vegetation for defined land-cover classifications and are located within a sufficiently large area of each class.[282] The site selection was independently evaluated and approved by Dr. Travis Huxman of the University of Arizona.[283] Dr. Huxman has extensive experience in locating ET measurement sites in complex ecosystems.[284]

The ET measurement sites did not include agriculture, open water, or playa.[285] The State Engineer finds this is reasonable because these areas are small in comparison to the entire groundwater discharge area and represent a very small component of the groundwater discharge for the basin. ET estimates based on vegetation indices will not necessarily be reliable for areas of minimal or no vegetation, such as playa and open water. In addition, the goal of the approach

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[275] Exhibit No. SNWA_312, p. 3-1.
[276] Transcript, Vol.3 p. 670:11-13 (Burns).
[277] Exhibit No. SNWA_312, p. 3-2.
[278] Exhibit No. SNWA_312, p. 3-3; Transcript, Vol.4 pp. 796: 15–797:4 (Fenstermaker).
[279] Exhibit No. SNWA_312, pp. 3-1, 3-3.
[280] Exhibit No. SNWA_312, p. 1-2.
[281] Transcript, Vol.4 p. 759:8-10 (Fenstermaker).
[282] Exhibit No. SNWA_312, p. 3-3.
[283] Transcript, Vol.3 p. 675:3-16 (Fenstermaker).
[284] Transcript, Vol.3 pp. 674:25-675:12 (Fenstermaker).
[285] Exhibit No. SNWA_312, pp. 3-4 to 3-5.

was to estimate pre-development ET. Therefore, it is reasonable to exclude measurements at agriculture sites. The period of measurements at the sites was from 2006 to 2010, though not all sites have measurements for all years.[286] One tower in Spring Valley had measurements for all five years, two had measurements for four years, and four had measurements for three years.[287] Mr. Burns testified that the ET data collected was excellent.[288] Dr. Myers did not question the Applicant's measurement of ET rates.[289]

Dr. Fenstermaker acquired satellite imagery from Landsat Thematic Mapper 5 scenes that are generated by the USGS Earth Resources Observation and Science Data Center. The presence of clouds and cloud shadows in the satellite images limits the utility of those images. The vegetation index value should be based on the radiation from the ground surface based on sunlight reflecting off of vegetation and soil. Such reflectance cannot be sensed in a satellite image if it is blocked by clouds. Though techniques can account for clouds and shadows, a large amount of cloud cover renders certain satellite images less reliable. Therefore, Dr. Fenstermaker excluded from her data set satellite images with 30% or more cloud cover. After excluding scenes with 30% or more cloud cover, 31 scenes remained for the growing season in Spring and Snake Valleys and 29 scenes remained for the growing season in White River Valley. Dr. Fenstermaker calibrated, corrected, and normalized the scenes using standard techniques and then calculated NDVI grids for each image. She then replaced clouds and cloud shadows that remained in the images with the average NDVI values from cloud free dates.[290] The replacement pixels were based on the exact same location and were selected from images representing the same growing season. No adjacent pixel values were used to replace cloud-covered or cloud-shadow covered pixels.[291] Finally, Dr. Fenstermaker averaged the scenes for each year to obtain average growing-season NDVI images.[292]

Dr. Fenstermaker and her colleagues then calculated the footprint-weighted growing season average NDVI values for each Eddy Covariance Tower. This approach was selected to account for the fact that the towers measure ET from an area surrounding the tower that is larger

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[286] Exhibit No. SNWA_312, pp. 3-3, 3-10.
[287] Exhibit No. SNWA_312, p. 3-10.
[288] Transcript, Vol.3 p. 683:8-11 (Burns).
[289] Transcript, Vol.17 p. 3794:18-19 (Myers).
[290] Exhibit No. SNWA_312, p. 4-13.
[291] Transcript, Vol.4 p. 770:1-5 (Fenstermaker)
[292] Exhibit No. SNWA_312, pp. 4-4 to 4-5.

than the area directly below the towers. Using an equation of Hsieh, et al. (2000), footprints were delineated based on wind speed and direction. The number of times each pixel contributed to a measurement was then used to compute a weighted-average NDVI value for each tower.[293] Dr. Fenstermaker concluded that this weighted approach is an improvement on all prior studies regarding calculation of the NDVI value for each ET tower. The State Engineer finds that the use of footprint-weighted NDVI values is appropriate.

Dr. Fenstermaker ended up with 38 data points of annual ET and growing-season average footprint-weighted NDVI values.[294] She reserved seven of the data points for independent accuracy assessment and performed a linear regression on the remaining 31 points. She concluded the resulting regression equation is an excellent fit to the data with an r-squared value of 0.953.[295] She testified that the r-squared was an excellent fit and higher than the values she typically sees in studies regressing ground-based data with remotely-sensed data.[296] When evaluated against the seven reserved points, the analysis revealed no clear bias to over-estimate or under-estimate.[297] Dr. Fenstermaker testified that this accuracy assessment step was not completed in many prior studies, and that it is critical to determining the accuracy of the linear relationship that is derived from the data. Based on this expert opinion and the evidence submitted, the State Engineer finds that the accuracy assessment is scientifically sound and represents an improvement over past studies, and validates the accuracy of the Applicant's ET estimates.

The Applicant applied the regression equation to growing-season average NDVI grids after the removal of areas of agriculture, open water, and playa to obtain a total annual ET distribution for the remaining land-cover classes in the Main groundwater discharge area for each year in the period of record.[298] The Applicant queried the initial ET distribution grid to identify grid-cell values exceeding the average annual reference ET in Spring Valley of 4.2 feet as measured by the Eddy Covariance stations. For these grid-cells, the Applicant used the average annual reference ET.[299]

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[293] Exhibit No. SNWA_312, pp. 4-5 to 4-7.
[294] Exhibit No. SNWA_312, p. 5-1.
[295] Exhibit No. SNWA_312, p. 5-4.
[296] Transcript, Vol.4 p. 726:2–5 (Fenstermaker).
[297] Exhibit No. SNWA_312, p. 5-7; Transcript, Vol.4 p. 730:8–19 (Burns).
[298] Exhibit No. SNWA_258, p. D-16.
[299] Exhibit No. SNWA_258, pp. D-16 to D-17.

As noted, the Applicant's goal was to develop an estimate of groundwater ET for Spring Valley prior to human development. Therefore, estimates of ET for present-day agriculture had to be replaced with estimates of the ET that would occur within these areas prior to development. The Applicant estimated pre-development ET rates for the agriculture land-cover class in Spring Valley by assigning the ET rates derived from the empirical relationship for the natural vegetation surrounding the agricultural areas.[300] For areas of open water, the Applicant assigned a consumptive-use rate of 4.70 feet per year based on Huntington and Allen (2010, Appendix 14, p. 246).[301] For playa areas, the Applicant assigned null values for ET rates. The Applicant later assigned groundwater-ET rates for playa areas during the derivation of the groundwater-ET distribution.[302]

The Applicant estimated an average total ET of 174,500 afa in the Main groundwater discharge area in Spring Valley for the period of record 2006 to 2010. The yearly total ET estimates, in acre-feet, were: 184,900 in 2006; 162,900 in 2007; 153,500 in 2008; 186,600 in 2009; and 184,700 in 2010.[303] Dr. Fenstermaker testified that these were very good estimates and that the regression equation will provide a more accurate estimate of annual ET in the region than those developed in prior studies.[304] Protestants' witness Dr. Myers testified that the Applicant's total-ET estimates are probably as accurate as they can be.[305] The State Engineer finds that the Applicant provided a scientifically sound estimate of total ET in Spring Valley.

To estimate groundwater ET, precipitation has to be subtracted from the total ET estimates. The Applicant used the Parameter-elevation Regressions on Independent Slopes Model ("PRISM") 4-km precipitation grids to estimate the amount of precipitation over the groundwater-ET area for the period of record from 2006 to 2010.[306] PRISM is a model that estimates how much precipitation falls on specific areas throughout the United States.[307] PRISM distributions are available in 4-km and 800-m grids. The 800-m PRISM grid is available for a thirty-year normal period from 1971 to 2001. The 4-km grid is available on an annual basis,

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[300] Exhibit No. SNWA_258, pp. 5-6 to 5-7.
[301] Exhibit No. SNWA_258, p. 5-7.
[302] Exhibit No. SNWA_258, p. 5-7.
[303] Exhibit No. SNWA_258, p. 5-7.
[304] Transcript, Vol.4 p. 731:8-17; pp. 731:25-732:8-11 (Fenstermaker).
[305] Transcript, Vol.20 p. 4442:6-7 (Myers).
[306] Exhibit No. SNWA_258, p. 5-5, pp. D-6 to D-15.
[307] Exhibit No. SNWA_258, p. B-2.

including for the period of record of the Applicant's ET measurements.[308] Ms. Drici testified that PRISM provided the best available method to estimate the precipitation distribution over the areas of interest.[309] The Applicant provided evidence comparing PRISM modeled precipitation to actual measurement sites, and demonstrated that there is very little difference. The PRISM measurement sites all use bulk storage precipitation gages. Dr. Myers testified that PRISM is generally a good tool and probably the best tool available to distribute precipitation, though he asserts that it under-estimates or over-estimates in certain areas.[310]

To assess the accuracy of the PRISM 4-km estimates in the groundwater-ET discharge areas within the basins of interest, the Applicant compared the PRISM estimates to actual valley-floor measurements of precipitation at several UNLV, Desert Research Institute, SNWA and USGS precipitation measurement stations located in Spring Valley and White River Valley. After comparing the PRISM values to measured values using gages in Spring Valley, the Applicant found that PRISM over-estimated precipitation on the valley floor in Spring Valley.[311] To account for this, the Applicant reduced the PRISM precipitation estimate by the average amount of over-estimation for each year.[312] The Applicant's witness testified that this step removed the over-estimation bias.[313] However, the precipitation gages in use on the valley floors in those basins were not all of the bulk-storage type; several were of the tipping-bucket type. The Applicant measured precipitation at several locations where both bulk collection and tipping bucket precipitation gages were utilized simultaneously.[314] Measured differences between tipping buckets and bulk storage precipitation gages are shown in Table 1.

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[308] Transcript, Vol.3 p. 608:4-13 (Drici).
[309] Transcript, Vol.3 p. 606:9-21 (Drici).
[310] Transcript, Vol.21 pp. 4649: 25–4650:15 (Myers).
[311] Exhibit No. SNWA_258, pp. 5-5, D-6 to D-15.
[312] Exhibit No. SNWA_258, pp. 5-5, D-6 to D-15.
[313] Transcript, Vol.3 p. 667:5-11 (Burns).
[314] Exhibit No. SNWA_313, Appendices B and C.

Table 1. Precipitation data from co-located tipping bucket and standard bulk-storage gages

Site	Year	Measured precipitation at tipping bucket gage (inches) [a]	Measured precipitation at standard bulk storage gage (inches) [b]	Percent difference
WRV2	2008	4.54	6.44	42%
	2009	7.13	9.02	27%
	2010	13.91	14.13	2%
SV1	2008	4.74	6	27%
	2009	5.84	8.17	40%
	2010	11.25	12.6	12%
	2010	7.37	8.42	14%
SV3	2008	2.72	3.17	17%
	2009	6.56	7.78	19%
	2010	7.96	10.17	28%
SV2b	2008 [c]	7.33	2.79	
	2009 [c]	3.11	7.51	
SNV1	2008	4.21	5.13	22%
	2009	4.92	6.3	28%
	2010	7.68	11	43%
SNV2	2008	3.01	4.08	36%
	2009	4.7	5.74	22%
	2010	7.39	7.35	-1%
			Average	23%

[a] Exhibit SNWA 313, Table B-2
[b] Exhibit SNWA 313, Table C1-C3
[c] Site SV2b had several months of missing data and is excluded from this comparison.

For simultaneous measurements in Spring, Snake and White River Valleys, the data show that bulk gages collect 23% more precipitation than tipping buckets.[315] When the Applicant adjusted PRISM to match measured data in Spring Valley, they did not account for their own measurements of undercatch by tipping buckets. Table 2 replicates the Applicant's Table D-4 in Exhibit No. SNWA_258 with tipping bucket data adjusted by a factor of 1.23. Highlighted cells are the adjusted tipping bucket measured precipitation depths.

[315] Exhibit No. SNWA_313, Appendices B and C.

Table 2. Comparison of 4-km annual PRISM precipitation to station data with tipping buckets adjusted by 1.23

Station Name	2006			2007			2008			2009			2010		
	Station	PRISM	Difference	Station	PRISM	Difference	Station	PRISM	Difference	Station	PRISM	Difference	Station	PRISM	Difference
SV1	7.52	8.35	-0.83	6.15	7.25	-1.10	6.00	5.90	0.10	8.17	10.68	-2.51	12.60	11.60	1.00
SV2b	--	--	--	6.48	6.04	0.44	2.79	4.62	-1.83	7.51	10.98	-3.47	8.42	11.60	-3.18
SV3	--	--	--	5.18	5.54	-0.36	3.17	4.55	-1.38	7.78	9.60	-1.82	10.17	10.84	-0.67
SV4	--	--	--	7.12	6.67	0.45	6.30	5.55	0.75	8.56	10.29	-1.73	--	--	--
SV5	--	--	--	6.69	6.70	-0.01	4.31	5.91	-1.61	10.70	10.63	0.07	--	--	--
SV6	--	--	--	6.45	6.33	0.12	4.15	5.54	-1.39	10.06	10.31	-0.25	--	--	--
SV7	--	--	--	4.86	5.72	-0.86	3.19	4.65	-1.46	7.61	10.38	-2.77	--	--	--
SPV-1	7.07	8.35	-1.28	--	--	--	--	--	--	--	--	--	--	--	--
SPV-2	7.89	8.09	-0.20	--	--	--	--	--	--	--	--	--	--	--	--
SPV-3	6.60	8.30	-1.70	--	--	--	--	--	--	--	--	--	--	--	--
Average	--	--	-1.00	--	--	-0.19	--	--	-0.98	--	--	-1.78	--	--	-0.95

Unmodified PRISM precipitation for the groundwater discharge area for the period 2006 to 2010 averages 107,660 acre-feet.[316] After adjusting PRISM to site precipitation measurements, but ignoring documented undercatch by tipping buckets, precipitation for 2006 to 2010 in the same area averaged 87,260 acre-feet.[317] Had the Applicant multiplied those station-years where only tipping bucket data are available by the correction factor of 1.23, then adjusting PRISM to match station averages, they would have calculated an additional 7,700 acre-feet of precipitation annually, as shown in Table 3.

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[316] Exhibit No. SNWA_258, p. D-14.
[317] Exhibit No. SNWA_258, p. D-14.

Table 3. Difference in precipitation, after adjustment to tipping bucket measured data

	2006	2007	2008	2009	2010	**Average (rounded)**
Average PRISM overestimation at gage locations, as reported by applicant(inches) [a]	1.36	1.34	1.45	2.77	0.95	
Average PRISM overestimation at gage locations with tipping bucket adjustment factor of 1.23 (inches) [b]	1.00	0.19	0.98	1.78	0.95	
Difference	0.36	1.15	0.47	0.99	0.00	
Main groundwater discharge area, excluding playa (acres) [c]	156,092	156,092	156,092	156,092	156,092	
Volume of precipitation resulting from tipping bucket adjustment (AF)	4,635	14,972	6,176	12,853	0	7,700

[a] Exhibit SNWA 258, Table D-4

[b] Table 2

[c] Main discharge area is reported as 169,425 acres. The estimated playa area is 13,000 acres, based on Applicant's findings of 1200 AF and 0.09 feet of groundwater ET.

Because groundwater ET is calculated as the difference of total ET and precipitation, any error in precipitation estimates will result in an equal but opposite error in groundwater ET estimation. Dr. Myers appears to agree that PRISM over-estimates precipitation in Spring Valley and does not suggest that the Applicant was wrong to adjust the PRISM results to remove the over-estimation bias, but did not comment on the issue of tipping bucket undercatch.[318] Given the evidence submitted regarding the accuracy assessment of PRISM and the adjustments applied by the Applicant based on determined over-estimates in the Main groundwater discharge area of Spring Valley, the State Engineer finds that the Applicant's method of developing estimates of precipitation distribution for Spring Valley erred by not considering their own documented undercatch by tipping buckets. The State Engineer finds that the method employed to adjust the PRISM-modeled precipitation to actual measurements is generally sound, but by ignoring undercatch by tipping buckets, under-estimated average annual precipitation, and consequently over-estimated average annual groundwater ET for the five-year period by approximately 7,700 acre-feet.

[318] Exhibit No. GBWN_103, pp. 15–18.

After subtracting the precipitation distribution from the total ET distribution in the Main groundwater discharge area in Spring Valley, the Applicant assigned an annual groundwater-ET rate of 0.09 feet to the playa areas based on Deverel, et al. (2005, p. 14).[319]

The Applicant's final estimate of average annual groundwater ET in the Main groundwater discharge area of Spring Valley is 91,500 acre-feet for the period of record from 2006 to 2010. The yearly groundwater-ET estimates, in acre-feet, were: 104,400 in 2006; 99,700 in 2007; 104,700 in 2008; 92,000 in 2009; and 56,700 in 2010.[320]

The Applicant's yearly estimates of groundwater ET do not equal the difference between their total ET and precipitation estimates due to their handling of locations where precipitation exceeded groundwater ET. In cases where the local precipitation exceeded the local ET, a value of zero was assigned rather than assigning negative groundwater ET.[321] Mr. Burns believes that the average annual groundwater ET estimate may be skewed lower by the low estimate for 2010 derived for the Main groundwater discharge area because extraordinary precipitation occurred in the basin during 2010. The method of determining annual groundwater ET by subtracting precipitation from total ET assumes that 100% of the precipitation is effectively discharged by ET and that none of it is retained as soil moisture or percolates to the groundwater table to be consumed in subsequent years. The assumption that 100% of precipitation is effectively consumed by ET during the same year may not be valid in years of high precipitation. Instead, some precipitation may remain as soil moisture or reach the groundwater table where it remains until consumed in subsequent years. There may be a maximum amount of precipitation that the vegetation can consume.[322] He argues that more groundwater ET would actually occur than the amount determined by subtracting all precipitation from total ET. In this case, this would mean that more groundwater ET occurred than estimated for 2010.[323] The State Engineer does not agree with Mr. Burns' conclusion in this case, because in their calculations, the Applicant assigned a value of zero to their groundwater-ET calculation where precipitation exceed total ET, thus they already discounted the excess precipitation. Had they not discounted excess precipitation, Mr. Burns would have been correct. As computed by the Applicant, their

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[319] Exhibit No. SNWA_258, pp. 5-8.
[320] Exhibit No. SNWA_258, pp. 5-8.
[321] Transcript, Vol.6 p. 1331:6-8 (Burns).
[322] Transcript, Vol.4 p. 740:6–17, p. 811:3–12 (Burns).
[323] Exhibit No. SNWA_258, pp. 5-9 to 5-10.

groundwater ET estimate for 2010 would be accurate, but 10,000 acre-feet of excess precipitation is available for phreatophyte use in the following year(s). Because the study ended in 2010, there is no accounting for this water. Another issue of possible concern is that 2010 was an exceptionally wet year. The five-year period was just below the long-term average; if 2010 had average precipitation, it would have been a dry period. Failing to account for the excess precipitation in the wettest year is problematic, and supports the Protestants' claim that a five-year period is not representative of long-term average conditions.

Dr. Myers disagrees with Mr. Burns' conclusion, and argues that precipitation in excess of ET would be stored in the ground and consumed by ET the following year. Thus, though groundwater ET may be under-estimated for wet years, it would be similarly over-estimated the year following the wet period as precipitation reaching the groundwater system during the prior year would be discharged through ET.[324] Dr. Myers may be correct. Over the long run, the groundwater ET would be under-estimated in wet years and over-estimated for the following years due to holdover moisture. In the long term, these over-estimates and under-estimates would effectively cancel each other out. However, the Applicant's method does not allow for carryover precipitation.[325] The excess precipitation is removed from the mass balance equation, and subsequent years' groundwater ET is based solely on total ET and precipitation for the given year.

Dr. Myers suggests that this holdover effect occurs from 2005, a wet year, to 2006 and from 2010 to 2011.[326] It may also occur from 2009 to 2010. Mr. Burns argues the holdover from 2010 may be irrelevant in this case, because 2010 was the final year in the Applicant's period of record, so whatever over-estimation of groundwater ET that might result in 2011 is not included in the Applicant's average.[327] Dr. Myers did not quantify the effect of this possible holdover. The State Engineer agrees with Dr. Myers that precipitation that exceeds ET would infiltrate, be stored in either the unsaturated soils or in the aquifer, and be used by the plants in following years. Mr. Burns was asked by State Engineer staff why his groundwater ET estimate from Table 5.3 did not equal the difference between his total ET from Table 5.2 and his

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[324] Exhibit No. GBWN_103, p. 18.
[325] Transcript, Vol. 4 pp. 812-814 (Burns).
[326] Transcript, Vol.20 pp. 4438:16–4439:10 (Myers).
[327] Transcript, Vol.4 p. 741:10-25 (Burns).

precipitation in Table D-5.[328] His response was that differences were due to their discounting of excess precipitation.[329] The provided data indicates that 1,200 acre-feet of the difference is accounted for in the playa groundwater ET estimate. Therefore, excess precipitation was 1,200 acre-feet in 2006, 100 acre-feet in 2007, 3,900 acre-feet in 2009, and 10,000 acre-feet in 2010, as shown in Table 4.[330]

Table 4. Excess precipitation

	2006	2007	2008	2009	2010	Average
ET volume for main groundwater discharge area [a]	184,900	162,900	153,500	186,600	184,700	174,500
Adjusted-PRISM Precip Volume for main groundwater discharge area [b]	82,900	64,500	50,000	99,700	139,200	87,260
Difference between Total ET and Precipitation, plus 1,200 AF for playa ET	103,200	99,600	104,700	88,100	46,700	88,460
Applicant's groundwater ET estimate [c]	104,400	99,700	104,700	92,000	56,700	91,500
Excess Precipitation	1,200	100	0	3,900	10,000	3,040

a. Exhibit No. SNWA_258, Table 5-2

b. Exhibit No. SNWA_258, Table D-5

c. Exhibit SNWA 258, Table 5-3

The State Engineer finds that the Applicant's groundwater-ET estimation method does not under-estimate groundwater ET in wet years because they discount precipitation in excess of ET; however, their method does over-estimate groundwater ET in dry years when carry-over soil moisture from prior-year precipitation is available. The State Engineer finds the Applicant's method is a mass balance approach to determine groundwater ET, and by ignoring a portion of the water budget their groundwater ET estimation method is flawed. The State Engineer also finds that the annual average groundwater-ET over-estimation error attributable to this cause is approximately 3,000 acre-feet.

[328] Exhibit No. SNWA_258.
[329] Transcript, Vol. 4 pp. 812-814.
[330] Exhibit No. SNWA_258, p. 5-7, p. D-14.

Dr. Myers also notes that the Applicant's calculation of average annual groundwater ET depends on several factors that may vary. He notes that phreatophytic areas change in areal extent and plant density and that ET, precipitation, and runoff vary with climate.[331] Dr. Myers points out that the Applicant's ET estimate varies from 153,500 to 186,600 afa, over the five-year period, for a range that equaled 19% of the mean 174,500 afa. Dr. Myers argues that this range is too high to consider any year representative.[332] Dr. Myers, however, does not provide a recommendation on how to adjust the Applicant's groundwater-ET estimate to account for the representative average issue, nor does he provide analysis or a value that he believes is representative of long-term mean conditions.[333] He admits, however, that it may be appropriate to adjust the precipitation component of the groundwater-ET estimate based on variance from the long-term average.[334]

Landsat imagery was not acquired for the small groundwater discharge area in Northern Spring Valley; therefore, separate analyses were applied to estimate groundwater ET for this area, which are as follows:[335] (1) compute annual groundwater-ET rates for land-cover classes comprising the Northern groundwater discharge area by subtracting the annual precipitation from total ET that was measured at ET-measurement sites located in Spring Valley; (2) compute the average annual groundwater-ET rate for each land-cover class; (3) estimate the average annual groundwater-ET volume by multiplying the average annual groundwater-ET rate by the corresponding acreage of each land-cover class.

The Applicant derived average annual groundwater-ET rates for the land-cover classes comprising the Northern groundwater discharge area by subtracting precipitation measured at ET-measurement sites in Spring Valley from the measured ET-rates at those sites.[336] The Applicant calculated the average groundwater-ET rate for each land-cover class and multiplied it by the corresponding area to calculate the average annual groundwater-ET volumes.[337] The Applicant's final estimate of average annual groundwater-ET in the Northern groundwater

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[331] Exhibit No. GBWN_103, pp. 17–18.
[332] Exhibit No. GBWN_103, p. 18.
[333] Transcript, Vol.20 p. 4438:4-12, p. 4443:9-13 (Myers).
[334] Transcript, Vol.20 pp. 4442: 24–4443: 13 (Myers).
[335] Transcript, Vol. 4, p. 745:20–23 (Burns).
[336] Exhibit No. SNWA_258, p. D-17.
[337] Exhibit No. SNWA_258, p. D-17.

discharge area of Spring Valley is 3,300 acre-feet.[338] Adding this estimate to the Applicant's estimate of 91,500 acre-feet of average annual groundwater ET in the Main groundwater discharge area of Spring Valley, yields the Applicant's average annual groundwater-ET estimate for Spring Valley of 94,800 acre-feet.

Rush and Kazmi provided a reconnaissance-level estimate of average annual groundwater ET of 70,000 acre-feet.[339] Nichols (2000) reported groundwater ET estimates of 101,770 acre-feet and 77,460 acre-feet for 1985 and 1989, respectively.[340] Nichols' average is about 90,000 afa. Welch, et al. (2007) estimated the average annual groundwater ET for Spring Valley to be approximately 75,600 acre-feet.[341] The State Engineer finds the Applicant over-estimated groundwater ET for the five-year period 2006 to 2010 by approximately 7,700 afa due to tipping bucket undercatch and 3,000 afa due to unaccounted excess precipitation. Therefore, the State Engineer subtracts 10,700 afa from the Applicant's estimated 94,800 afa of groundwater ET. The State Engineer finds that, after adjustments as described above, the Applicant's data supports an annual groundwater-ET estimate in Spring Valley of 84,100 acre-feet.

The Applicant states that its estimate of groundwater ET is likely representative of the long-term average and that the five-year period represents a range of hydrologic conditions indicative of long-term mean hydrologic conditions.[342] One way to determine whether the Applicant's estimate of groundwater ET is truly representative of a long-term average is to compare the Applicant's data with climate indices from the U.S. Climate Diagnostics Center/National Oceanic and Atmospheric Administration ("NOAA"). The Climate Diagnostics Center/NOAA maintains a database of climate data. Historical mean annual precipitation values are based on measurements made within each climate division and are available for all U.S. climate divisions.[343] Climate divisions intersecting the Project basins and the area of interest include Nevada Divisions 2, 3, and 4. The ET area in Spring Valley falls mostly within Division 2.[344]

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[338] Exhibit No. SNWA_258, p. 5-9.
[339] Exhibit No. SNWA_298, pp. 22–23.
[340] Exhibit No. SNWA_292, p. C44.
[341] Exhibit No. GBWN_001, p. 21; Exhibit No. SNWA_068, p. 45.
[342] Transcript, Vol.4 p. 739:2–9, p. 810:19–24 (Burns).
[343] Exhibit No. SNWA_258, p. B-18
[344] Exhibit No. SNWA_258, p. B-19.

Based on the undisputable nature of the NOAA climate division data, the State Engineer takes administrative notice of the Climate Diagnostics Center/NOAA data for the climate divisions that overlap the Project basins. Based on NOAA climate indices, the State Engineer finds that the period of record mean precipitation for Nevada Division 2 is 10.86 inches per year for the period 1895 through 2010. Nevada Division 2 includes the extent of the groundwater-ET areas within Spring Valley. By comparing the annual precipitation data with the long-term period of record mean precipitation for the Nevada Division 2 climate index, the State Engineer finds that precipitation was: 102% of the mean value for 2006; 77% of the mean value for 2007; 71% of the mean value for 2008; 110% of the mean value for 2009; and 120% of the mean value for 2010. For the Applicant's period of record, 2006-2010, the average precipitation was 10.43 inches per year or 96% of the long-term period of record mean value. Therefore, the 2006 to 2010 period is 4% dryer than the long-term period of record. Since the period used for the Applicant's estimate of groundwater ET had precipitation rates that are very close to the NOAA long-term average, it should be representative of the current long-term average.

Because plants generally use easily available water from precipitation first and groundwater second, they use more groundwater when there is less precipitation. This is apparent on a year-by-year basis as demonstrated by the Applicant's data, where the year with the highest precipitation (2010) had the lowest groundwater ET, and the year with the lowest precipitation (2008) had the highest groundwater ET.[345] Nevertheless, over an extended period of time, it is expected that lower precipitation would ultimately result in lesser recharge, and consequently, lesser groundwater ET. It is unclear whether groundwater ET over a five-year period, when precipitation was minimally less than the long-term average, would differ measurably from the long-term average. Therefore, the State Engineer finds no additional adjustments to the estimate of groundwater ET are warranted.

Dr. Myers asserts that the Applicant fails to account for runoff in wet years. He suggests that during wet years, runoff could cause effective precipitation to exceed 100% because rainfall would find specific areas of the soil surface more receptive to seepage and become more effective (consumed by phreatophytes).[346] Dr. Myers also states that the Applicant fails to

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[345] Exhibit No. SNWA_258, pp. 5-8, D-14.
[346] Exhibit No. GBWN_103, p. 18.

account for spring discharge in its estimate of groundwater ET. He suggests that spring run-on may enter wetlands and riparian areas in the groundwater-ET discharge area.[347]

In general, Dr. Myers agrees that spring discharge within the groundwater discharge area will be accounted for as part of the ET estimate.[348] Often the best measurement of total spring discharge is an estimate of ET.[349] Mr. Burns testified that surface water in the groundwater discharge area is accounted for in the ET measurements and that, based on his and his staff's observations over the course of many years, there is no overland sheet flow into the groundwater-discharge area and such flow is unlikely.[350] Though the effects of runoff and spring run-on may create some uncertainty, Dr. Myers has not proposed a method of accounting for these factors or suggested that another estimate of ET better accounts for them. Therefore, the State Engineer finds that the Applicant's estimate is not invalidated by potential runoff and spring run-on.

Another potential estimate of groundwater ET in Spring Valley was produced in BARCASS. BARCASS provides an estimate of approximately 75,600 afa reported by Welch, et al. (2007).[351] Welch, et al. (2007) classified land cover into ET units based on vegetation and soil-moisture conditions.[352] The accuracy of the land classification in Nevada ranged from 18% to 100%. The overall accuracy of ET-unit delineation was 72%.[353] This is substantially less accurate than the Applicant's land classification accuracy of 88%.

BARCASS derived a range of ET rates for each ET unit from literature and data from six Eddy Covariance towers in White River, Spring, and Snake Valleys from September 1, 2005 to August 31, 2006.[354] Three of the towers were in Spring Valley.[355] The Applicant's estimate was based on a longer period of record and more ET-measurement sites, including more measurement sites in Spring Valley.

In BARCASS, the ET rate within each ET unit was derived by linearly scaling the ET rate range computed for the unit using an average Modified Soil Adjusted Vegetation Index

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[347] Exhibit No. GBWN_103, pp. 18–19; Transcript, Vol.17 p. 3793:6-18 (Myers).
[348] Transcript, Vol.20 p. 4443:18-22 (Myers).
[349] Exhibit No. GBWN_009, p. 5; Transcript, Vol.24 p. 5413:17–20 (Bredehoeft).
[350] Transcript, Vol.4 p. 743: 9–744:22; p, 783:13–784:21 (Burns)..
[351] Exhibit No. GBWN_001, p. 21; Exhibit No. SNWA_68, p. 45.
[352] Exhibit No. SNWA_068, p. 51, p. 56.
[353] Exhibit No. SNWA_320, pp. 17–18.
[354] Exhibit No. SNWA_068, p. 51, p. 56.
[355] Exhibit No. SNWA_321, p. 20.

based on satellite-imagery data.[356] To derive groundwater ET, Welch, et al. (2007) calculated the difference between annual ET and local precipitation, which is the same general approach used by the Applicant.[357] A Desert Research Institute study found the coefficient of variation of total groundwater discharge to be 0.241, meaning BARCASS had a 24% error rate.[358] This 24% error was determined using the data BARCASS used to develop the ET estimate, not independent data.[359] The Applicant's predictive error of total ET in Spring Valley was stated to be 15%. Furthermore, the Applicant's error was based on an assessment using independent data while BARCASS did not use independent data.

The State Engineer finds that the Applicant's estimate of groundwater ET, adjusted to account for carryover precipitation and for tipping bucket undercatch, is the best estimate currently available. Though measurements were not used from all ten Eddy Covariance Towers for all five years, the Applicant has still provided the most comprehensive data set available to the State Engineer. The methods of measuring phreatophyte discharge have greatly improved in the past 50 years.[360] The Applicant has used state of the art Eddy Covariance Towers and satellite imagery in developing their estimate of groundwater ET in Spring Valley. The Applicant's estimate of precipitation was found to have error, but after adjusting for that error, it represents a scientifically sound estimate of precipitation in Spring Valley. Therefore, the State Engineer will use the adjusted estimate of 84,100 afa of groundwater ET for the purpose of determining perennial yield.

B. Interbasin Flow

Interbasin flow is another component of a groundwater budget analysis. Interbasin flow into and out of a groundwater basin, along with groundwater ET, are applied to the groundwater balance equation to derive an estimate of total recharge for the basin. The Applicant evaluated interbasin flow into and out of Spring Valley using available geologic, hydrologic, and geochemical evidence.

SNWA presented two witnesses, Dr. Peter Rowley and Mr. Burns, to support its conclusions about Spring Valley interbasin flow. Dr. Rowley, who the State Engineer qualified

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[356] Exhibit No. SNWA_068, p. 59.
[357] Exhibit No. SNWA_068, p. 61.
[358] Exhibit No. SNWA_322, p. 13.
[359] Transcript, Vol.4 pp. 768: 15–769:3 (Fenstermaker).
[360] Exhibit No. GBWN_009, p. 5.

as an expert in geology and hydrogeology (Dr. Rowley was qualified in hydrogeology only for the purpose of preparing maps and discussing geologic framework for hydrologists to make decisions),[361] provided expert testimony on the geologic and hydrogeologic framework of Spring Valley and the surrounding area. Mr. Burns combined the geologic information supplied by Dr. Rowley with data and information regarding groundwater elevations, aquifer properties, and hydrologic features of the groundwater system to estimate amounts of interbasin flow as part of the Applicant's groundwater budget analysis for the basin.

The Protestants presented two witnesses, Dr. Myers and Dr. Hurlow, to support their conclusions about the region's geologic framework for their interbasin flow analysis. Dr. Myers primarily relied upon BARCASS for geologic information and interbasin flow calculations.[362] Dr. Hurlow is a senior scientist at the Utah Geological Survey ("UGS") and was qualified as an expert in hydrogeology.[363] Dr. Hurlow is in charge of research projects on hydrogeologic studies of groundwater basins, involving summarizing the geology and hydrogeology and subsurface structure of various groundwater basins and evaluating issues of groundwater flow and occurrence.[364] Dr. Hurlow has worked in the Snake Valley area since 2004, and based his opinions about interbasin flow in this area on his knowledge of the general geologic framework of the area, groundwater flow characteristics of geologic units, the role of faults, as well as interpretations of geophysical work, such as gravity surveys and AMT data.[365] His opinion was that subsurface groundwater flow occurs from southern Spring Valley eastward into northern Hamlin Valley and southern Snake Valley,[366] but that only 10 to 25% of the groundwater resources present in southern Snake Valley comes from interbasin flow from southern Spring Valley.[367] He concluded that the most likely volume of interbasin flow in this area was in a range between 4,000 and 12,000 acre-feet. He also was aware of the BARCASS estimate that interbasin flow was 33,000 acre-feet, but he did not adopt that BARCASS interbasin flow estimate.[368]

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[361] Transcript, Vol.5 p. 974:11-12, p. 976:23-25 (Rowley).
[362] Transcript, Vol.20 p. 4479:7-10 (Myers).
[363] Transcript, Vol.16 p. 3593:1-6 (Hurlow).
[364] Transcript, Vol.16 p. 3583: 18-23 (Hurlow).
[365] Transcript, Vol.16 p. 3582: 3-13 (Hurlow).
[366] Transcript, Vol.16 p. 3596: 3-5 (Hurlow).
[367] Transcript, Vol.16 pp. 3599-3600: 25-4 (Hurlow).
[368] Transcript, Vol.16 p. 3632: 9-11 (Hurlow).

1. **Mapping**

The Applicant based its geologic interpretations on 1:250,000 scale mapping.[369] The Applicant's geologic maps incorporate all previous geologic mapping of the area and are the most comprehensive maps of the geology and hydrogeology of the region that are available.[370] Previous geologic mapping included many other 1:250,000 and 1:100,000 scale maps that cover only portions of the Project basins.[371] The Applicant's 1:250,000 scale mapping includes previous work, provides greater detail, and shows the location of more faults than 1:500,000 scale mapping.[372] The Applicant's 1:250,000 scale geologic maps also show the location of confining units and aquifers and are more valuable than larger-scale maps in identifying features impacting interbasin flow.[373]

2. **Geophysical Data**

In addition to using more detailed mapping, the Applicant worked closely with the USGS to collect and analyze gravity and AMT data to help identify and interpret the region's subsurface geology.[374] AMT is a geophysical technique that uses the earth's natural electromagnetic fields as an energy source to determine the electrical resistivity of the subsurface.[375] AMT studies can indicate buried faults by mapping differences in resistivity of the buried rock formations.[376] Gravity studies are an additional geophysical approach that uses gravity readings across a broad area to measure the density of the mass of the underlying rock.[377] Gravity maps characterize buried faults by indicating areas where there are changes in density.[378] The Applicant also used this technology to calculate the depth to basement rock in the Project basins.[379] Knowing the depth to basement rock allows the Applicant to determine the thickness of the basin-fill aquifers.

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[369] Transcript, Vol.5 p. 1099:1-3 (Rowley).
[370] Exhibit No. SNWA_058, p. 3-4; Transcript, Vol.5 p. 983:5-9 (Rowley); Transcript, Vol.6 p. 1255:6-18 (Rowley); Transcript, Vol.16 pp. 3644:23-3645:10 (Hurlow).
[371] Transcript, Vol.5 p. 982:15-22 (Rowley).
[372] Transcript, Vol.5, p. 985:4-12 (Rowley) (referencing Exhibit No. SNWA_061).
[373] Transcript, Vol.5, pp. 986:23-987:25; p. 987:1-4 (Rowley).
[374] Transcript, Vol.5, p. 989:1-15, p. 990:10-23 (Rowley).
[375] Transcript, Vol.5 pp.1093:23-1094:1 (Rowley).
[376] Transcript, Vol.5 p. 1095:15-16 (Rowley).
[377] Transcript, Vol.5 pp. 995:24-996:4; Transcript, Vol.5 p. 990:6-9 (Rowley).
[378] Transcript, Vol.5 p. 998:10-13 (Rowley).
[379] Transcript, Vol.5 pp. 997:13-998:9 (Rowley).

3. **Fault and Fracture Flow**

The Applicant applied the principles of fracture flow as part of its interbasin flow analysis. Hydrogeologists use both fracture-flow and porous-media flow concepts to explain groundwater flow in basin-range topography.[380] Regional flow through mountain ranges occurs via fracture flow. The Project basins are characterized by basin-range topography and contain primarily north-south trending normal faults aligned with the basins and ranges.[381]

The Applicant's fracture-flow analysis assumes as a general rule that most groundwater flow in a basin-range region is affected by faults, orientation of the geologic structures, hydraulic gradients, and hydraulic properties of the rocks.[382] Both faults and the fractures generated by movement along the faults transmit groundwater. "Orientation of the geologic structures" refers to whether the hydraulic gradient is parallel or perpendicular to the fault-fracture zone. The general rule is that if the hydraulic gradient is parallel to the fault-fracture zone, the fault-fracture zone operates as a conduit to flow. If the hydraulic gradient is perpendicular to the fault-fracture zone, the fault-fracture zone can operate as a barrier to flow.[383] Despite this general rule, the experts in this case recognized there are no absolutes in nature.[384] There is extensive peer-reviewed scientific literature that explains the fracture-flow approach and the role of faults as barriers and/or conduits,[385] and both Protestant experts recognized the validity of the analytical method.[386]

The Applicant applied the general principle that if the hydraulic gradient is parallel to a fault-fracture zone, the fault-fracture zone operates as a conduit to flow. In instances where the hydraulic gradient is perpendicular, the fault-fracture zone can, but may not completely operate as a barrier to flow.

4. **Geologic Likelihood of Interbasin Flow**

The Applicant summarized its conclusions concerning the geologic likelihood of interbasin flow across certain boundaries as likely, unlikely or permissible.[387] The Applicant

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[380] Transcript, Vol.5, p. 1112: 3-6 (Rowley); Exhibit No. SNWA_058, pp. 2-4 to 2-5.
[381] Transcript, Vol.5 p. 1107: 12-13, p. 1112:7-10 (Rowley).
[382] Transcript, Vol.5 pp. 1111:22-1113:18 (Rowley).
[383] Transcript, Vol.5 p. 1112: 13-25 (Rowley).
[384] Transcript, Vol.5 p. 1132:22-24 (Rowley).
[385] Exhibit No. SNWA_058, p. 2-9; Exhibit No. SNWA_063, pp. 1025-1028.
[386] Transcript, Vol.16 p. 3643:8-20 (Hurlow); Transcript, Vol.20 pp. 4448:22-4449:7 (Myers).
[387] Exhibit No. SNWA_058, p. 4-34, Figure 4-9.

started its analysis with Dr. Rowley's development of a geologic framework and conceptual model based on fracture flow.[388] Mr. Burns then applied hydrologic information, including groundwater-elevations data, hydraulic gradients, and aquifer properties to Dr. Rowley's framework.[389] The Applicant argues that where interbasin flow is classified as geologically likely, the basin boundary is generally topographically low; the bedrock at and beneath the surface of the boundary is an aquifer or otherwise permeable because of fracturing; and there is a hydrologic gradient parallel to the typical north-south trend of faults or east-west faults that allow groundwater to pass through the basin boundary.[390] Conversely, they assert that interbasin flow is unlikely where the basin boundary is topographically high, the bedrock making up the subsurface of the boundary is a confining unit, and the orientation of faults is perpendicular to the hydraulic gradient.[391] Areas of permissible flow occur in situations where topographic and geologic data indicates that a boundary possesses a significant likelihood for flow, but evidence of actual groundwater flow is not as definitive as in the areas of likely flow.[392]

BARCASS also produced a map depicting boundaries where interbasin groundwater flow may exist and referred to each potential flow area as "not permitted, permitted, and possible by subsurface geology."[393]

In considering the Applicant's expert testimony and exhibits, the State Engineer generally agrees with their analyses. However, there is a component of interbasin flow that they appear to have ignored. Their analyses do not address interbasin flow that would occur as a result of a water table divide occurring somewhere other than directly below a hydrographic basin boundary. Basin boundaries usually occur at topographic divides, and any place where the water table divide was not below the topographic divide would be a location of interbasin flow. It is generally assumed that such occurrences are minor and would offset each other, so that this type of interbasin flow at a basin scale is negligible. However, as can be seen on the Applicant's groundwater contour map, significant exceptions are possible.[394] The Applicant's witnesses correctly point out that flow is subject to local controls, such as the location, orientation and

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[388] Transcript, Vol.5 p. 1134:7-23 (Rowley).
[389] Transcript, Vol.5 p. 1136:7-17 (Rowley).
[390] Transcript, Vol.5 p. 1134:7-23 (Rowley).
[391] Exhibit No. SNWA_058, p. 2-10, Figure 2.5.; Transcript, Vol.5 p. 1115: 20-24 (Rowley).
[392] Transcript, Vol.5 p. 1136:1-6 (Rowley).
[393] Exhibit No. SNWA_068, p. 34.
[394] Exhibit No. SNWA_089, Plate 3.

hydraulic properties of faults, and the hydraulic properties of the rocks, which would include anisotropy. Anisotropic regions of a mountain block, where bedding dips primarily in one direction, therefore, would be likely locations for such interbasin flow.

a. Spring Valley to Hamlin Valley

A potential area for interbasin flow is located on the border of southeastern Spring Valley and Hamlin Valley in an area commonly referred to as the Limestone Hills. None of the parties dispute that interbasin outflow occurs in this area; the only dispute involves the amount of such outflow. Previous investigations reported interbasin outflow estimates of 4,000 acre-feet (Rush and Kazmi, 1965); 8,000 to 12,000 acre-feet (Nichols, 2000); and 33,000 acre-feet (Welch, et al., 2007).[395]

The Applicant submitted geologic and hydrologic evidence supporting its interbasin flow estimate. The Applicant's geologic analysis concluded that the Limestone Hills is a horst of east-dipping Devonian carbonate rock defined on either side by two north-trending basin-range range-front and subsidiary faults.[396] The Applicant mapped fault structures to the north and south ends of the Limestone Hills that likely support interbasin outflow to northern Hamlin Valley.[397] In between these areas, they believe interbasin flow is permissible, but due to the orientation of the fault structures and the hydraulic gradient, the Applicant considered flow to be minor.

With available hydrologic data, the Applicant applied Darcy's Law to calculate interbasin flow.[398] Darcy's Law is expressed as $Q = (K \times b) \times I \times W$. Q is the quantity of groundwater flow, usually expressed in terms of afa. K is the hydraulic conductivity of the aquifer, expressed in terms of feet per day, and is the rate at which water is capable of moving through the aquifer. The saturated thickness of the aquifer through which flow occurs is expressed as "b" in feet. The estimated saturated thickness is primarily dependent on the geologic formations in the flow section area. For compressible soil, like basin-fill material, they argue groundwater flow is restricted to the upper 2,000 feet of saturated aquifer because the weight of the soil causes it to compress at depth and close the porous spaces in the aquifer below 2,000 feet. "I" is the horizontal hydraulic gradient, expressed in feet per feet, which is the slope of the water table.

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[395] Exhibit No. SNWA_258, p. 7-8
[396] Exhibit No. SNWA_258, p. 7-5, § 7.1.3.; Transcript, Vol.5 p. 1157:14-21 (Rowley).
[397] Exhibit No. SNWA_258, p. 7-5, § 7.1.3.
[398] Exhibit No. SNWA_258, pp. E-1 to E-2.

"W" is the width of the flow section also expressed in feet.[399] None of the parties disputed that Darcy's Law is an appropriate method for calculating groundwater flow. Rather, the Protestants disputed the values used by the Applicant in the Darcy analysis.

For this interbasin flow boundary, the hydraulic conductivity was determined from an aquifer test on a test well located in the northern part of the Limestone Hills that penetrated fractured carbonate rocks and a fault structure. The conductivity values derived from the aquifer test were considered representative of the fractured carbonate rocks comprising the sections of the Limestone Hills through which interbasin flow is likely.[400] Analysis of the aquifer-test data yielded estimates of hydraulic conductivity ranging from 7.6 to 8.0 feet per day.[401] The Applicant calculated a hydraulic gradient of 0.0008866 foot per foot using two carbonate wells located near the northern flow boundary, one located in Spring Valley and the other located in Hamlin Valley.[402] Darcy's Law calculations were completed for both the north and south flow sections using an estimated flow section width of 30,000 feet and 6,500 feet, respectively, and an estimated saturated aquifer thickness of 2,000 feet.[403] Applying these values to the Darcy equation, the Applicant calculated 3,600 acre-feet of outflow for the northern flow section and 800 acre-feet of outflow for the southern flow section.[404] The Applicant's total outflow estimate was 4,400 acre-feet, which is within the range of previously reported estimates. In reviewing this analysis, the State Engineer disagrees with the Applicant limiting the depth of the flow section to 2,000 feet. They argue that 2,000 feet is the probable limit for flow through saturated alluvium, but their measured section is in fractured carbonate rock. The evidence presented indicates that flow through carbonate rock is not limited by that depth, so their use of a 2,000-foot thickness for flow through the Limestone Hills is probably too low.[405] Had the Applicant used a thicker section, their calculated flow would be proportionately greater.

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[399] Exhibit No. SNWA_258, p. E-1. The term (365/43560) is a unit conversion from ft^3 per day to acre-feet per year.
[400] Exhibit No. SNWA_258, p. 7-7, § 7.1.3.
[401] Exhibit No. SNWA_258, p. 7-7, § 7.1.3.
[402] Exhibit No. SNWA_258, p. 7-7, § 7.1.3.
[403] Exhibit No. SNWA_258, p. 7-7, § 7.1.3.
[404] Exhibit No. SNWA_258, p. 7-7, § 7.1.3.
[405] Exhibit No. SNWA_087, p. C-28.

Protestant Millard County's witness, Dr. Hugh Hurlow,[406] stated in his expert report that his preferred range of interbasin flow through the Limestone Hills area was 4,000 to 12,000 acre-feet.[407] Dr. Hurlow re-calculated the interbasin flow using Darcy's Law, but used an average of hydraulic gradients derived from USGS wells located in the vicinity of the Limestone Hills.[408] Dr. Hurlow's assumed gradients were approximately three times greater for the fault sections, and the wells that were used to make this calculation were, except for one, completed in the basin fill.[409]

Both Dr. Hurlow and the Applicant use a Darcy flux calculation to estimate flow through the Limestone Hills, which would move groundwater from Spring Valley into Hamlin Valley and then to Snake Valley. The section shown by the Applicant where flow is likely or permissible is approximately 15 miles in length.[410] The information used hy both parties to support their interbasin flow calculations is sparse, and estimates of flow using limited data will have significant uncertainty.

Dr. Myers, on the other hand, appears[411] to adopt BARCASS's estimate of 33,000 acre-feet of outflow, which is the equivalent of his estimated inflow from Steptoe and Lake Valleys to Spring Valley. The BARCASS estimate for interbasin flow was based on an imbalance in the groundwater budget for Steptoe Valley. The BARCASS groundwater budget estimated Steptoe Valley received 154,000 acre-feet of recharge annually, and only discharged 101,000 acre-feet through ET, leaving 53,000 acre-feet to discharge from the basin as subsurface interbasin flow.[412] According to BARCASS, "[g]roundwater outflow from central Steptoe Valley is to Jakes and northern White River Valleys; and outflow from southern Steptoe Valley is to Lake Valley and southern Spring Valley. The latter two flow paths from central and southern Steptoe

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[406] Dr. Hurlow is a senior scientist at the Utah Geologic Survey. Dr. Hurlow was qualified as an expert in hydrogeology. Transcript, Vol.16 p. 3593:5-6.
[407] Exhibit No. MILL_011, pp. 4 and 5.
[408] Exhibit No. MILL_011, p. 15.
[409] Exhibit No. MILL_011, pp. 14 and 17.
[410] Exhibit No. SNWA_058, p. 4-73.
[411] The State Engineer notes that Dr. Myers' reports and testimony do not explicitly state his groundwater budget components for Spring Valley. Though Dr. Myers presented interbasin flow estimates from BARCASS, he testified that these were not necessarily his opinions as to what the interbasin flow actually is. Transcript, Vol.20 pp. 4399:1–4401:15 (Myers). To develop his groundwater model parameters, Dr. Myers relied on BARCASS, Reconnaissance Reports, Kirk and Campana, and his own estimates for different basins. Transcript, Vol.21 pp. 4600:19–4610:3 (Myers).
[412] Exhibit No. SNWA_068, p. 44, Table 5; p. 45, Table 6.

Valley have not been identified in previous investigations."[413] These postulated flow paths are probably dependent on the accuracy of the postulated imbalance in the BARCASS groundwater budget for Steptoe Valley and the presence of carbonate rocks at the boundaries; however, no additional data was ever collected or analyzed to corroborate the flow paths. The analysis that resulted in this suggested flow path was subsequently updated by the USGS in GBCAAS.[414] The purpose of GBCAAS is to update "the previous RASA conceptual model integrating new findings from several recent basin-scale studies, the Death Valley Regional Flow System study, and BARCASS."[415] Using this information, GBCAAS recalculated the groundwater-budget components for Steptoe Valley.[416] The new groundwater budget significantly reduced the estimated recharge in Steptoe Valley from 154,000 afa to 86,000 afa and slightly increased the estimated discharge from 101,000 afa to 110,000 afa.[417] The new groundwater budget for Steptoe Valley leaves a recharge deficit of 24,000 afa.

Outflow to Hamlin Valley is generated by precipitation recharge in the southern sub-basin of Spring Valley and inflow from Lake and Steptoe Valleys. The Applicant argues there is no inflow from those valleys due to the hydrogeologic conditions, including faults and high mountain peaks. However, their model incorporated those hydrogeologic properties and, in their modeling results, show that the groundwater divide between Spring and Steptoe Valleys is shifted westward, so that it is no longer located directly beneath the topographic basin boundary, and 4,400 afa is simulated to flow from Steptoe to Spring Valley.[418] Thus groundwater recharge in the southeastern part of Steptoe Valley is modeled to flow to Spring and/or Lake Valleys; this is by definition interbasin flow. The Applicant's model also estimates 7,600 afa of interbasin flow from Spring to Hamlin Valley.[419] The Applicant's expert witnesses argue that the groundwater-flow model should not be used to determine interbasin flow, but the State Engineer finds that such estimates are at least as reliable as Darcy flux calculations in this area given the paucity of available head and hydraulic property data. The State Engineer finds the Applicant's

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[413] Exhibit No. SNWA_068, p. 5.
[414] Exhibit No. SNWA_065; Exhibit No. MILL_038.
[415] Exhibit No. MILL_038, p. 1.
[416] Exhibit No. MILL_033, p. 4; Exhibit No. MILL_034, p. 4.
[417] Exhibit Nos. MILL_033, p. 4; MILL_034, p. 4; SNWA_058, p. 44, Table 5; p. 45, Table 6.
[418] Exhibit No. SNWA_089, Plate 3.
[419] Exhibit No. SNWA_089, Plate 3.

and Dr. Hurlow's estimate of interbasin flow are similar, and accepts the range of interbasin flow through the Limestone Hills is between 4,000 and 12,000 afa.

b. Steptoe and Lake Valleys to Spring Valley

Dr. Myers estimated that up to 33,000 acre-feet of groundwater flows into southern Spring Valley from Steptoe and Lake Valleys (29,000 acre-feet inflow from Lake Valley and 4,000 acre-feet directly from Steptoe Valley).[420] Dr. Myers adopted this estimate from BARCASS and suggested that this interbasin flow estimate is now accepted.[421] Dr. Myers did not identify any other studies prior to or after BARCASS that have accepted this interbasin flow estimate, and as discussed above, the USGS updated and modified the BARCASS understanding of flow in this area in the GBCAAS report.

As Dr. Myers acknowledged in his expert report, there are barriers to interbasin flow between southern Spring Valley and Lake and Steptoe Valleys. The first barrier is the Indian Peak Caldera Complex that comprises the southern half of the Fortification Range at the southwest boundary of Spring and Lake Valleys.[422] According to Dr. Myers, the "[v]olcanic portions of the Fortification Range bound southwest Spring Valley and may impede flow between Spring and parts of Lake Valley."[423] The Applicant's witness, Dr. Rowley found that this caldera complex is likely a barrier to flow.[424]

Flow is also unlikely to the northwest of the Indian Peak Caldera Complex through the northern half of the Fortification Range at the southwest boundary of Spring and Lake Valleys. Dr. Myers conceded that "[n]orthwest of the Fortification Range along Lake Valley summit, there is carbonate rock (UCU), through which the postulated interbasin flow would occur, but with a 'thin Chainman Shale' layer which may slow or prevent flow through that region."[425] The Applicant's witness Dr. Rowley found that the northern Fortification Range is complexly faulted and has repeated sections of the Chainman Shale beneath the surface, likely preventing groundwater flow through the northern half of the range.[426] The State Engineer finds that the groundwater flow is likely minimal or negligible across the Fortification Range due to the

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[420] Transcript, Vol.19 pp. 4297: 24-4298:78 (Myers).
[421] Transcript, Vol.19 p. 4297:720-23 (Myers); Exhibit No. GBWN_001, p. 12.
[422] Exhibit No. SNWA_258, Plate 1.
[423] Exhibit No. GBWN_001, p. 23.
[424] Transcript, Vol.5 p. 1156:10-14 (Rowley); SNWA_058, p. 4-63.
[425] Exhibit No. GBWN_001, p. 23.
[426] Exhibit No. SNWA_058, p. 4-60.

caldera complex in the southern part and the Chainman Shale confining unit in the northern part of the range.

There are other barriers to flow between Spring Valley and Lake and Steptoe Valleys that Dr. Myers did not acknowledge. First, there are north-south striking normal faults on the western and eastern sides of the Fortification Range.[427] The hydraulic conductivities in these faults are usually higher along the fault rather than across the fault.[428] Therefore, the preferential flow path for the water would be along these faults rather than across the faults, and would probably prevent any significant amount of interbasin flow.

Dr. Myers' groundwater model itself supports the idea that 33,000 acre-feet of interbasin flow from Steptoe and Lake Valleys to Spring Valley is unrealistic. His groundwater model does not simulate this magnitude of interbasin flow from Steptoe Valley to Spring Valley, but rather simulates a flow of about 2,300 acre-feet from Steptoe Valley to Spring Valley and about 13,000 acre-feet from Lake Valley to Spring Valley.[429]

Also, the Applicant presented evidence of a groundwater divide that lies just north of the Chainman Shale in the northwestern part of the Fortification Range and crosses the entire width of Spring Valley.[430] The Applicant used gravity data to map the depth to basement rock in this area. The depth to basement rock decreases from approximately 7,500 feet (1.4 miles) to approximately 500 feet or (.1 miles) below ground surface.[431] The groundwater divide is marked by a groundwater elevation high of approximately 5,800 feet above mean sea level ("amsl") and defined by groundwater elevations in wells located to the north and south of 5,763 feet and 5,707 feet amsl, respectively.[432] This feature would further limit the ability of interbasin flow to move south through Spring Valley.

The State Engineer finds that the low-permeability rocks associated with the Indian Peak Caldera Complex and the Chainman Shale comprising the Fortification Range, in combination with hydrogeologic features between Steptoe and Lake Valleys and southern Spring Valley, likely prevent significant inflow from Lake Valley through the Fortification Range into southern

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[427] Exhibit No. SNWA_426, p. 8.
[428] Exhibit No. SNWA_058, p. 2-7, p. 2-8; Exhibit No. SNWA_063; Transcript, Vol.5 p. 1112:20-25 (Rowley). *See also,* Section III, B. (3) above for discussion of fracture flow.
[429] Exhibit No. GBWN_002, p. 38.
[430] Exhibit No. SNWA_258, p. 8-3.
[431] Exhibit No. SNWA_258, p. 8-3.
[432] Exhibit No. SNWA_258, p. 8-2.

Spring Valley. As discussed in the previous section, the Applicant's groundwater flow model simulates 4,400 afa of flow from Steptoe to Spring Valley.[433] The State Engineer finds that the best evidence indicates that inflow from Steptoe and Lake Valleys to southern Spring Valley is not significant, and that the flow model estimate of 4,400 afa is probably at the upper limit of likely flow.

c. **Northern Spring Valley to Northern Snake Valley**

The Applicant evaluated the potential for outflow from northern Spring Valley to northern Snake Valley. Prior investigations reported interbasin outflow estimates of 4,000 acre-feet (Nichols, 2000), 6,000 acre-feet (Katzer and Donovan, 2003), and 16,000 acre-feet (Welch, et al. 2007).[434] The Applicant's geologic data indicated that flow from northeastern Spring Valley to northern Snake Valley is permissible with the depth and extent of the flow section limited due to the geologic framework. Granitic rocks of the Kern Mountains form the northern extent of the profile and Precambrian-Cambrian siliclastic rocks of the lower Snake Range form the southern extent.[435] In the middle, carbonate rocks are separated by Chainman Shale confining units.[436] Overlying these rocks are Tertiary volcanic rocks and younger sediments. The valley between the Kern Mountains and the Snake Range is a shallow basin with a shallow depth to basement rock.[437] These geologic features have low permeability. The State Engineer finds that the presence of these low-permeability geologic formations limits interbasin flow in this area.

While groundwater flow through the younger sediments along an inferred northwest-southeast trending fault is permissible, available water-level data does not support the likelihood of such flow. The basin-fill wells in this area of Spring Valley (Map ID's184-197, 184-200, 184-195, and 184-186) show a prevailing gradient to the south toward the Main groundwater-discharge area.[438] Any outflow through this flow section likely originates in Tippett Valley where water levels in wells completed in the basin fill (Map ID's 185-2, 185-4, 185-3, and 185-1) indicate a hydraulic gradient to the south and east. Along this hydraulic gradient, groundwater

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433 Exhibit No. SNWA_089, Plate 3.
434 Exhibit No. SNWA_258, p. 7-5, § 7.1.2.
435 Exhibit No. SNWA_258, p 7-3, § 7.1.2.
436 Exhibit No. SNWA_258, p. 7-3, § 7.1.2.
437 Transcript, Vol.5 p. 1150:6-25 (Rowley); SNWA_058, p. 5-9; Fig. 5-6.
438 Exhibit No. SNWA_258, Plate 1.

from Tippett Valley would flow on the east side of the Red Hills into northeastern Spring Valley between the Kern Mountains and the northern Snake Range and into western Snake Valley.

Dr. Myers' groundwater model simulated zero interbasin flow through this boundary, and he conceded that interbasin flow is closer to zero at this location.[439] Therefore, the State Engineer finds that the hydrologic and geologic data all support the conclusion that there is not substantial outflow from northern Spring Valley to northern Snake Valley.

d. Spring Valley to Tippett Valley

The Applicant has identified two permissible flow boundaries between Spring Valley and Tippett Valley on the west and east side of the Red Hills.[440] As stated above, the Applicant agrees that flow across the eastern boundary is permissible and may result in a minor amount of outflow to Snake Valley. For the western boundary, the Applicant's geologic analysis concluded the geologic framework in Tippett Valley is basin fill that may be, in part, underlain by caldera complexes,[441] that would limit or prevent outflow.[442] The potential for flow is not supported by the Applicant's hydrologic evidence either. The basin-fill wells (Map ID's 184-197, 184-200, and 184-195) located to the south of the flow section in Spring Valley show a prevailing hydraulic gradient to the south in the direction of the groundwater-discharge area in Spring Valley.[443]

Dr. Myers appears to adopt the BARCASS interbasin-outflow estimate of 2,000 acre-feet from Spring Valley to Tippett Valley. As stated above, Dr. Myers' groundwater budget for Spring Valley cannot support this outflow estimate. In addition, Dr. Myers' groundwater contour maps do not support this conclusion. Dr. Myers' intermediate-well contour map shows a hydraulic gradient from Spring Valley to Tippett Valley.[444] The Applicant's rebuttal report found that the northern most well on this contour map was geographically misplaced and that the actual location of the well was approximately four miles to the south of the plotted location.[445] Dr. Myers also conceded that the southern well was misplotted.[446] Dr. Myers further conceded

[439] Transcript, Vol.20 p. 4423:18-22; p., 4424:19-25 (Myers).
[440] Exhibit No. SNWA_258, p. 7-1.
[441] Exhibit No. SNWA_058, p. 4-67.
[442] Exhibit No. SNWA_258, p. E-3.
[443] Exhibit No. SNWA_258, Plate 1.
[444] Exhibit No. GBWN_001, p. 7.
[445] Exhibit No. SNWA_426, p. 3.
[446] Transcript, Vol.20 p. 4409:12-17 (Myers).

that there were additional wells in this area that were not included in his analysis.[447] Based on this evidence, Dr. Myers admitted that the gradient does not exist and that the intermediate well contour map cannot be relied upon to indicate a gradient toward Tippett Valley.[448] Given this admission, the State Engineer finds the Applicant's hydrologic and geologic evidence persuasive and further finds that insufficient evidence exists to support a finding that outflow exists from Spring Valley to Tippett Valley.

C. **Recharge**

The Applicant directly calculated recharge for Spring Valley by applying the estimate of average annual groundwater ET and interbasin flow to the groundwater balance equation.[449] Using this approach, the Applicant estimated 99,200 acre-feet of recharge for Spring Valley.[450] Using the same groundwater balance approach as the Applicant, but correcting for the adjusted groundwater ET by the State Engineer, would result in an estimated annual recharge of 88,500 acre-feet. The Applicant reported the following recharge estimates from prior investigations: 81,339 acre-feet (SNWA, 2009a); 75,000 acre-feet (Reconnaissance Series Reports and Scott, et al., 1971); 61,636 acre-feet (Dettinger, 1989); 104,000 acre-feet (Nichols, 2000); 66,402 acre-feet, 93,840 acre-feet, 92,965 acre-feet, 53,335 acre-feet, and 139,194 acre-feet (Epstein, 2004); 66,987 acre-feet and 56,179 acre-feet (Flint, et al., 2004); 72,000 acre-feet (Brothers, et al., 1994); 93,000 acre-feet (Welch, et al., 2007); and 62,000 acre-feet (Mizel, et al., 2007).[451] In addition, GBCAAS estimated that Spring Valley receives 110,000 acre-feet of recharge.[452] The Applicant's estimated recharge is within the range of prior estimates and less than the current USGS estimate.

Dr. Myers' groundwater budget for Spring Valley is based on the average of recharge estimates from prior studies.[453] This approach is inconsistent with his recharge analysis for other basins during the hearing. For Cave, Dry Lake, and Delamar Valleys, Dr. Myers testified that the Reconnaissance Report Series recharge estimates were the best estimates for these basins, but

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[447] Transcript, Vol.20 p. 4411:18-24 (Myers).
[448] Transcript, Vol.20 pp. 4409:25–4410:2; pp. 4411:25–4412:6 (Myers).
[449] Exhibit No. SNWA_258, p. 6-10.
[450] Exhibit No. SNWA_258, p. 6-10.
[451] Exhibit No. SNWA_258, p. 6-12, Table 6-2.
[452] Exhibit No. MILL_033, p. 5.
[453] Transcript, Vol.20 p. 4432:8-9 (Myers).

that the BARCASS estimates in other basins were appropriate.[454] If Dr. Myers had applied the same reasoning in Spring Valley and selected the BARCASS estimate of recharge instead of averaging, his recharge value for Spring Valley would have been 93,000 acre-feet.[455]

Groundwater recharge in Spring Valley is not directly measured. It can be estimated by the groundwater balance of the basin. As discussed above in the groundwater ET section, groundwater ET is estimated to be 84,100 afa. Inflow from Steptoe Valley is highly uncertain, and probably is between zero and 4,400 afa. Outflow to Hamlin Valley is believed to be 4,000 to 12,000 afa. Therefore, groundwater recharge in the basin reasonably ranges from 84,000 to 96,000 afa.

D. Perennial Yield

In hydrographic basins that have relatively little subsurface interbasin flow, such as Spring Valley, the State Engineer has consistently determined the perennial yield to be equal to the basin's groundwater ET, rather than estimates of recharge or interbasin flow. Because groundwater ET is a measured value with relatively high confidence, the State Engineer finds that the perennial yield in Spring Valley will be based on the groundwater-ET estimate, rounded to the nearest thousand. Basin boundary flows are not a component of the perennial yield of Spring Valley. Any outflow to Snake Valley and/or Hamlin Valley is reserved for those basins. **The State Engineer finds the perennial yield of the Spring Valley Hydrographic Basin is 84,000 acre-feet.**

E. Time to Reach Equilibrium

The Protestants suggest that the perennial yield of a basin is further limited to the amount of groundwater discharge that the proposed pumping will actually capture in a reasonable amount of time.[456] The State Engineer finds that there is no provision in Nevada water law that addresses time to capture, and no State Engineer has required that ET be captured within a specified period of time. It will often take a long time to reach near-equilibrium in large basins and flow systems, and this is no reason to deny water right applications. The estimated time a pumping project takes to reach a new equilibrium does not affect the perennial yield of a basin.

[454] Exhibit No. GBWN_004, p. 35, Table 6; Transcript, Vol.20 pp. 4576:23–4577:45 (Myers).
[455] Exhibit No. SNWA_068, p. 44.
[456] Exhibit No. GBWN_003, p. 3; Transcript, Vol.24 pp. 5369:16–5370:8 (Bredehoeft).

F. ET Capture

The State Engineer finds that there is no requirement that the Applicant must show that the proposed well placement will actually be able to fully capture discharge. Such a requirement is impractical both from a hydrodynamics/aquifer properties perspective and a land ownership perspective. The exact pumping response depends on the hydrologic conditions affecting the groundwater system and the hydraulic properties of the aquifer, as well as management decisions made during the life of the pumping project.[457] For large projects like the one at issue, the detailed hydraulic properties are simply not known well enough to precisely predict the dynamic response of pumping. In addition, the groundwater in a basin may be appropriated by many different individuals and entities. There is no practical way to require them to manage their groundwater operations collectively to reach full capture. Moreover, the location of the small amount of private land in Nevada limits where wells can be placed to capture ET. The State Engineer finds that the Applicant is not required to prove capture of ET as a prerequisite to approval of the Applications.

IV. EXISTING RIGHTS

To determine the amount of water available for appropriation in a groundwater basin, the State Engineer must determine the amount of committed groundwater rights in the basin.[458] The State Engineer prepared an inventory of all water rights in Spring Valley pursuant to NRS 533.364 ("Spring Valley Inventory").[459] The Applicant also undertook an evaluation of committed groundwater rights in Spring Valley ("Stanka Report").[460] The results presented in the Stanka Report are similar to the results presented in the Spring Valley Inventory, and the differences will be discussed in the appropriate subsection below.

Both the Spring Valley Inventory and the Stanka Report identified every groundwater right in Spring Valley and then made adjustments for the total combined duty, the supplemental nature and the consumptive use of the water rights. This is added to the amount of groundwater

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[457] *See*, Exhibit No. GBWN_009, p. 3; Exhibit No. GBWN_013, p. 342; Transcript, Vol.24 p. 5371:3-5 (Bredehoeft).
[458] NRS 533.370(2); NRS 534.110(3).
[459] Exhibit No. SNWA_460.
[460] Exhibit No. SNWA_097.

that is estimated to be consumed for domestic uses and the amount of valley-floor spring discharge estimated to be consumptively used.[461]

Both the Spring Valley Inventory and the Stanka Report follow a similar analysis. A review of the records of the Office of the State Engineer was conducted to identify every active water right in the basin, those being permits, certificates, decreed rights, claims of vested rights and claims of implied federal water rights identified as public water reserves.[462] Pending applications are not included, because unless or until they are permitted, they are not a commitment on the basin.[463] In the case of the Spring Valley Inventory, claims of vested right not accepted due to deficiencies requiring correction by the claimant are not included as a commitment on the basin (see subsection F below).[464]

When groundwater from a specific well, or point of diversion, is used as the sole source of water for a specific place of use, it is commonly referred to as a "stand-alone" right. When a water right is used in combination with surface water or with groundwater from another water right, the right is considered "supplemental," meaning the groundwater right supplements, or is supplemented by, water from another source used on the same place of use.[465]

A. <u>Non-Irrigation Groundwater Rights</u>

For groundwater rights with a manner of use other than irrigation ("non-irrigation groundwater rights"), the permit or certificate may identify a total combined duty associated with that permit or certificate the purpose of which is to indicate water rights that are supplemental to another water right(s). The total combined duty may limit the total duty of a group of supplemental water rights. The Stanka Report identified a total combined duty of 1,901.25 afa of non-irrigation groundwater rights in Spring Valley.[466] This value agrees within 1 afa of the Spring Valley Inventory, which gave a value of 1,901 afa.[467] The State Engineer finds that 1,901 afa of non-irrigation groundwater rights are consumptively used and are not available for appropriation.

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[461] Exhibit No. SNWA_097, p. 1-7; Exhibit No. 460 SNWA_460 (Spring Valley Inventory).
[462] Exhibit No. SNWA_097, Section 5.2, pp. 5-4 to 5-10; Transcript, Vol.2 p. 425:21-23 (Stanka); Exhibit No. SNWA_460 (Spring Valley Inventory), pp. 1-2.
[463] Exhibit No. SNWA_097, p. 5-4; Transcript, Vol.2 p. 430:5-18 (Stanka); Exhibit No. 460 SNWA_460 (Spring Valley Inventory), pp. 1-2.
[464] Exhibit No. SNWA_460 (Spring Valley Inventory), p. 1.
[465] *Id.* at 3.
[466] Exhibit No. SNWA_097, Section 5.2, pp. 5-4 to 5-10; p. 5-6, Table 5-3; p. 5-19, Table 5-10.
[467] Exhibit No. SNWA_460 (Spring Valley Inventory), p. A-3.

B. Groundwater Irrigation Rights

For groundwater rights with a manner of use of irrigation ("groundwater irrigation rights"), the permit or certificate may identify a total combined duty term associated with that permit or certificate the purpose of which is to indicate water rights that are supplemental to another water right(s). The total combined duty may limit the total duty of a group of supplemental water rights; however, in some cases the water right is not explicit and an analysis of the place of use must be performed to identify supplemental water rights.

Both the Stanka Report and the Spring Valley Inventory considered the supplemental nature of groundwater irrigation rights. The Stanka Report identified a total combined duty of 19,772.473 afa of groundwater irrigation rights.[468] This value agrees within 10 afa of the Spring Valley Inventory, which gives a value of 19,780 afa.[469]

Within these groundwater irrigation rights, some are supplemental to surface water rights and some are not ("stand-alone"). Both the Stanka Report and the Spring Valley Inventory identify those water rights that are at least partially supplemental to surface water rights, but they are not entirely in agreement.

The Stanka Report presented that a total of 9,950.45 afa of groundwater irrigation rights are supplemental to surface water irrigation rights, and thus, a total of 9,822.023 afa of groundwater irrigation rights are not supplemental to surface water irrigation rights.[470]

While the general method utilized by Mr. Stanka is sound, there are discrepancies between his report and the Spring Valley Inventory that must be addressed. The Spring Valley Inventory reported that 8,823 afa of groundwater irrigation rights are supplemental to surface water irrigation rights.[471]

In reviewing both the Stanka Report and the Spring Valley Inventory, the State Engineer agrees with Mr. Stanka's determination regarding the supplemental group of groundwater rights comprised of Permits 20817, 26228, 26229, 26546, 26952, 26953, 34727 and 78107. Additionally, the State Engineer agrees with Mr. Stanka's determination regarding the supplemental group of groundwater rights comprised of Permits 18525, 25679, 25680 and 30319.

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[468] Exhibit No. SNWA_097, p. 5-6, Table 5-3; p. 5-19, Table 5-9; Transcript, Vol.2 p. 450:7-12 (Stanka).
[469] Exhibit No. SNWA_460 (Spring Valley Inventory), p. A-3.
[470] Exhibit No. SNWA_097, p. 5-24, Table 5-12; Transcript, Vol.2 p. 471:1-4 (Stanka).
[471] Exhibit No. SNWA_460 (Spring Valley Inventory), p. A-3.

However, the State Engineer disagrees with Mr. Stanka's determination of some of the supplemental groundwater values. First, in the case of Permit 71840, the duty and acreage that is supplemental cannot exceed the total value of the permit. Mr. Stanka also treated the entire amount of Permit 39817 as non-supplemental to Claim of Vested Right V01213, but from the description of claim it is possible for 40 acres to be supplemental; this is the best estimate until Claim of Vested Right V01213 is adjudicated and Permit 39817 is certificated.

Based on the place of use descriptions and place of use maps, the most acreage that could overlap between Permit 39818 and Claim of Vested Right V01214 is 440 acres, so the 540 acres from the Stanka Report is too high; this is the best estimate until Claim of Vested Right V01214 is adjudicated and Permit 39818 is certificated. As for Permit 27378, Certificate 8357, it is clear from examining the certificate and proof of beneficial use map that there is only 2.20 acres stand-alone. It cannot be determined from the scale of the map in the Stanka Report where the additional 0.75 acres of stand-alone portion was thought to exist. For the supplemental groundwater group of water rights comprised of Permits 63532, 63533, 71525, 71526, 71603 and 74274, the original base right for Permits 71525, 71526, 71603 and 74274 is Permit 18827. Looking at the supplemental nature of this base right, 416.69 acres were determined to be supplemental to surface water. These water rights are limited to a duty rate of 2.43 afa per acre due to the total combined duty term. The results of the Stanka Report assumed 4 afa per acre. Otherwise, Stanka Report and the Spring Valley Inventory are in agreement.

Resolving these discrepancies, the State Engineer finds that the best value for the groundwater-irrigation rights that are supplemental to surface water irrigation rights is 9,186 afa and, thus, the State Engineer finds that the value for the groundwater irrigation rights that are not supplemental to surface water irrigation rights is 10,595 afa.

C. Consumptive Use of Groundwater Irrigation Rights

The portion of a water right that is not consumptively used is not a committed groundwater right because it returns to the basin and is available for appropriation by another user.[472] Both the Stanka Report and the Spring Valley Inventory reduced the amount of water committed in the basin to the consumptive use portion.

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[472] Transcript, Vol.3 pp. 508:22-509:9 (Stanka).

The State Engineer has established a list of net irrigation water requirements for crops in Spring Valley. The net irrigation water requirements are equal to the consumptive use requirements of the crop minus the amount of those water requirements that are supplied by precipitation.[473] It is estimated that in Spring Valley the net irrigation water requirement (NIWR) for alfalfa and highly managed pasture grass crops is 3 afa per acre.[474] The Stanka Report divided the net irrigation water requirements by the total duty of the water rights in order to establish a consumptive use ratio for all groundwater irrigation rights in Spring Valley.[475] For the Spring Valley Inventory, the NIWR was multiplied by the number of acres of groundwater irrigation water rights to determine the consumptive use portion of the groundwater irrigation water rights if the duty rate of the water right exceeded 3 afa per acre. If the duty rate was less than 3 afa per acre, then the permitted or certificated duty rate was used (e.g., Permits 71525, 71526, 71603 and 74274 have an effective duty rate of 2.43 afa per acre).[476]

When accounting for the discrepancies between the Stanka Report and Spring Valley Inventory as discussed in subsection B above, the State Engineer finds that 8,304 afa of stand-alone groundwater irrigation rights are consumptively used and are not available for appropriation.

D. Groundwater Irrigation Rights Supplemental to Surface Water Rights

The State Engineer also finds that the consumptive use amount of groundwater irrigation rights that are supplemental to surface water rights is 7,710 afa. However, when a groundwater right is issued as supplemental to a surface water source, it is expected that the groundwater permit will not be utilized until the surface water becomes unavailable, and then only to make up the difference between the surface water available and the right allowed. Thus, it is expected that a supplemental groundwater right will not be used to its full allocation.[477]

The best way to determine the amount of groundwater that would be used to supplement surface water in an average irrigation season would be to look at records of the actual amounts of

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[473] Exhibit No. SNWA_097, p. 5-31; Transcript, Vol.3 pp. 509:14-510:20 (Stanka).
[474] Exhibit No. SNWA_460 (Spring Valley Inventory), p. 2; Huntington, J. L., Allen, R. G., 2010, *Evapotranspiration and Net Irrigation Water Requirements for Nevada.* State of Nevada, Department of Conservation and Natural Resources, Division of Water Resources.
[475] Exhibit No. SNWA_097, p. 5-31, Table 5-16; Transcript, Vol.3 pp. 510:21-511:12 (Stanka).
[476] Exhibit No. SNWA_460 (Spring Valley Inventory), p. B-7; File No. 74274, official records in the Office of the State Engineer.
[477] Exhibit No. SNWA_460 (Spring Valley Inventory), p. 3.

groundwater that have been pumped to supplement actual surface water flows in the basin over an extended period of time. However, there are no such pumping records available for Spring Valley.[478] Therefore, it becomes necessary to estimate this value. The Stanka Report describes two types of analyses, one of which is similar to the analysis that formed the basis of the Spring Valley Inventory estimate.

The first approach presented in the Stanka Report analyzed the amount of groundwater that would be needed to supplement flows on Cleve Creek, which is a surface water source in Spring Valley for which there are more than 40 years of stream gage information available.[479] The Stanka Report takes the position that Cleve Creek hydrograph is similar to other hydrographs in Spring Valley because Cleve Creek is located near the valley floor and runoff is attributable to snowpack.[480] The Stanka Report identified the maximum monthly amount of water that would be needed during a given month of the irrigation season, and then calculated the portion of that amount that would need to be supplied by groundwater after the peak flow of Cleve Creek had occurred.[481] This approach resulted in an estimate that 39.1% of all supplemental groundwater irrigation rights would be used to supplement surface water irrigation rights in Spring Valley during an average irrigation season.[482]

The second approach presented in the Stanka Report was an analysis of data regarding supplemental groundwater usage for a surrogate surface water source that is not located in Spring Valley, but does have some associated supplemental groundwater-use data. That data is then normalized for application to surface water sources in Spring Valley.[483] Daggett Creek, which is located in Carson Valley on the west side of the state, was selected because: (1) Daggett Creek surface use has 40 years of stream gage data and supplemental groundwater use has ten years of data; (2) surface water is directly related to snow pack runoff; and (3) groundwater rights are fully supplemental to surface water.[484] The Nevada Division of Water Resources has previously determined that the percentage of the total duty of supplemental groundwater used on Daggett

[478] Transcript, Vol.3 p. 483 (Stanka).
[479] Exhibit No. SNWA_097, Section 5.6.1, pp. 5-26 to 5-27; Transcript, Vol.3 pp. 484-495 (Stanka); Exhibit No. SNWA_097, p. 5-26; Transcript, Vol.3 p. 485:6-8 (Stanka).
[480] Transcript, Vol.3 p. 489:11-21 (Stanka).
[481] Exhibit No. SNWA_097, p. 5-27, Figure 5-8 and Table 5-14.
[482] Exhibit No. SNWA_097, p. 5-27, Table 5-14; Transcript, Vol.3 p. 494:17-21 (Stanka).
[483] Exhibit No. SNWA_097, Section 5.6.2, pp. 5-28 to 5-30; Transcript, Vol.3 pp. 495-504 (Stanka).
[484] Exhibit No. SNWA_097, pp. 5-28 to 5-29; Transcript, Vol.3 pp. 496:23-497:1; p. 499:8-10 (Stanka).

Creek ranges from 9.3% to 26.7% annually with an average of 18.0% annually.[485] After determining the percentage of supplemental groundwater used on Daggett Creek during an average irrigation season, Mr. Stanka applied a formula to account for the differences in post-peak flow between Daggett Creek and Cleve Creek in order to estimate the amount of groundwater that would be used to supplement flows in Spring Valley during the average irrigation season.[486] This approach resulted in an estimate that 27.4% of all supplemental groundwater irrigation rights in Spring Valley would be used to supplement surface water irrigation rights during an average irrigation season.[487] This is similar to the approach used by the State Engineer for the Spring Valley Inventory; however, instead of using the average value of 18.1%, the State Engineer used the more conservative upper value of 26.7%. This approach was described in State Engineer's Ruling 5726. This resulted in an estimated use of about 50%.

Mr. Stanka chose the 39.1% result from the Cleve Creek approach for his analysis because it was the more conservative value.[488] However, many streams in Spring Valley have insufficient data to develop a profile for comparison with Cleve Creek or Daggett Creek. For those streams where there is at least some seasonal or annual data,[489] the same analysis described above can be performed comparing Daggett Creek supplemental use to these creeks as a check for reasonableness. For those creeks on the western side of the valley, like Cleve Creek, that also have underground supplemental rights, a range of values from 13% to 68%, with an average 48.4%, is calculated.[490] For those creeks on the eastern side of the valley that also have underground supplemental rights, a range of values from 25% to 68%, with an average 49.9%, is calculated. For those creeks that do not have underground supplemental rights, a range of values from 34% to 66%, with an average 51.9%, is calculated. An average of all creeks for which such data is available, not including Cleve Creek, is 50.2%. An average of all creeks for which such data is available, including Cleve Creek, is 50.0%. Thus, the analysis of other creeks in the basin justifies the use of 50% of estimated underground supplemental water use, as this value appears to be more indicative of the entire basin.

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[485] Exhibit No. SNWA_097, p. 5-28; Transcript, Vol.3 pp.497:19-498:6 (Stanka).
[486] Exhibit No. SNWA_097, p. 5-30, Eq. 5-1; Transcript, Vol.3 pp. 499:24-500:19 (Stanka).
[487] Exhibit No. SNWA_097, p. 5-30; Transcript, Vol.3 p. 504:7-11 (Stanka).
[488] Exhibit No. SNWA_097, p. 5-30; Transcript, Vol.3 pp. 504:12-505:15 (Stanka).
[489] Exhibit No. SNWA_460 (Spring Valley Inventory), Appendix C.
[490] Exhibit No. SNWA_460 (Spring Valley Inventory), Appendix C;

Multiplying 7,710 afa by 50% results in a value of 3,855 afa. The State Engineer finds that, after adjustment for estimated annual use, 3,855 afa of groundwater irrigation rights that are supplemental to surface water rights are consumptively used and are not available for appropriation.

E. Consumptive Use from Domestic Wells

In Nevada, the owner of a domestic well has a statutory right to pump up to 2 afa from the domestic well without having to apply for a water right permit from the State Engineer.[491] When the State Engineer is examining the amount of unappropriated water available in a groundwater basin, only the amount of groundwater consumed by domestic wells is treated as a committed groundwater right.

The Stanka Report presented an estimate of the amount of water that is consumptively used by domestic wells in Spring Valley by estimating the acre-foot amount of water consumptively used per well and multiplying that value by the estimated number of wells in Spring Valley. The estimate of the acre-foot amount of water consumptively used per well was estimated by multiplying the estimated number of people per well by the estimated per capita water use and then from that product subtracting the estimated amount of water returned to the groundwater system through secondary recharge via septic systems.[492]

The Stanka Report estimated that the number of wells in Spring Valley was equal to the number of wells identified in the Nevada Division of Water Resources Well-Driller Log Database with a well casing diameter of 5 to 9 inches, which is within the diameter range for a domestic well casing.[493] The Stanka Report identified 50 well logs meeting this criterion, but perusing the well logs revealed that many of these were drilled specifically for other uses, which include commercial, industrial, mining, monitoring, stock-watering and testing purposes. Based on a review of the Well-Driller Log Database for new and replacement wells and also accounting for plugged wells, 20 domestic wells were identified within the Spring Valley Hydrographic Basin.[494] This is the value used in the Spring Valley Inventory.[495]

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[491] NRS 534.180.
[492] Exhibit No. SNWA_097, Section 5.8, pp. 5-34 to 5-35.
[493] Exhibit No. SNWA_097, p. 5-34; Transcript, Vol.3 p. 517:6-16 (Stanka).
[494] Well-Driller Log Database accessed February 1, 2012, official records in the Office of the State Engineer.
[495] Exhibit No. SNWA_460 (Spring Valley Inventory).

Mr. Stanka reviewed the mean number of people per household in six Nevada counties as identified by the State Demographer and assumed that the estimated number of people per well in Spring Valley was equal to the highest mean number identified.[496] As a result of this analysis, Mr. Stanka estimated that 28.5 afa is being pumped from domestic wells in Spring Valley.[497] Mr. Stanka estimated that 40% of groundwater pumped from domestic wells in Spring Valley is returned to the groundwater system through secondary recharge, and that 60%, or 17.1 afa, is consumptively used.[498]

The data and analysis in the Stanka Report is for primarily suburban locations, while Spring Valley is primarily rural in nature. The more appropriate value for estimating water use from domestic wells is 1 afa per well. Multiplying 20 domestic wells by 1 afa per well results in an estimate of 20 afa, which is the value used in the Spring Valley Inventory.[499]

The State Engineer finds that 20 afa is committed in the basin for domestic wells.

F. Spring Rights in Discharge Area

Mr. Stanka also prepared an analysis to quantify the total amount of committed spring water rights in the discharge area of Spring Valley.[500] Additionally, the State Engineer has undertaken an independent evaluation of spring water rights as part of his inventory of all water rights in Spring Valley pursuant to NRS 533.364.[501] Mr. Stanka identified all spring water rights in the discharge area of Spring Valley and then made adjustments for supplemental and consumptive use using generally the same methodology and approach that was used to identify committed groundwater rights.[502] Based upon that analysis, Mr. Stanka estimated that there are a total of 6,069.78 afa of committed spring water rights in the discharge area of Spring Valley.[503]

However, Claims of Vested Rights V09665 - V09672 have not been properly filed in the Office of the State Engineer, and are not entitled to protection from impairment as specified in NRS 533.085. The estimated consumptive use of these claims of 1,276.6 afa[504] shall be

[496] Exhibit No. SNWA_097, p. 5-34; Exhibit No. SNWA_098; Transcript, Vol.3 pp. 517:17-23-518:4 (Stanka).
[497] Exhibit No. SNWA_097, p. 5-34.
[498] Exhibit No. SNWA_097, p. 5-34; p. 5-35, Eq. 5-2; Transcript, Vol.3 pp. 521:3-523:6 (Stanka).
[499] Exhibit No. SNWA_460 (Spring Valley Inventory).
[500] Exhibit No. SNWA_423; Transcript, Vol.3 pp. 532-540 (Stanka).
[501] Exhibit No. SNWA_460.
[502] Transcript, Vol.3 p. 534:2-8, pp. 534:25-535:10 (Stanka).
[503] Exhibit No. SNWA_423, p. 13, Table 8; Transcript, Vol.3 p. 534:19-24 (Stanka).
[504] Exhibit No. SNWA_423, p. 13, Table 7.

deducted from the above amount of 6,069.78. The State Engineer finds that there are 4,793 afa of consumptively used committed spring rights in the discharge area of Spring Valley.

Dr. Myers estimated there are a total of 122,695 afa of certificated, permitted, reserved and vested water rights associated with springs in Spring Valley.[505] However, Dr. Myers did not conduct any analysis of the individual water rights and did not make any adjustments for supplemental or consumptive use. Dr. Myers clarified during his testimony that he did not intend to claim that the quantity of existing spring rights was that high and that the large number was primarily the result of counting the rights related to the spring complex held by CPB multiple times.[506] Therefore, the State Engineer finds that Dr Myers' estimates cannot be relied upon to determine the amount of committed spring water rights in Spring Valley.

G. <u>Results</u>

The Protestants did not present any evidence quantifying the committed groundwater rights in Spring Valley. Dr. Myers commented on existing rights, but conceded his numbers are not accurate and he did not adjust those amounts for supplemental and consumptive uses. He did not estimate the amount of groundwater used from domestic wells.[507] Therefore, the State Engineer finds that Dr. Myers' estimates cannot be relied upon to determine the amount of committed groundwater rights in Spring Valley.

The CPB presented a report prepared by Resource Concepts, Inc. ("RCI") and related testimony from Bruce Scott, P.E., an expert in water rights research and quantification, and his employee Jeremy Drew.[508] The RCI report and testimony urged the State Engineer to use the results of the State Engineer's basin inventory as the committed groundwater rights in Spring Valley.[509]

The State Engineer finds the Spring Valley Inventory, as adjusted by the above findings, is the most reasonable estimate of the groundwater rights in Spring Valley.

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505 Exhibit No. GBWN_001, p. 41; Transcript, Vol.3 p. 533:16-17 (Stanka).
506 Exhibit No. GBWN_001, p. 41; Transcript, Vol.17 pp. 3877:18-3878:15 (Myers); Transcript, Vol.3 pp. 535:17-536:6 (Stanka).
507 Transcript, Vol.19 pp.4285:17-4286:8 (Myers); Transcript, Vol. 17 pp. 3858:25-3859:3 (Myers); Transcript, Vol.17, pp. 3877:18-3878:18 (Myers); Transcript, Vol.3 pp. 535:17-536:6 (Stanka).
508 Transcript, Vol.23 p. 6149:11-18.
509 Exhibit No. CPB_011, p. 9; Transcript, Vol.27 p. 6207:9-22, p. 6208:5-20, p. 6210:19-21 (Scott).

The findings of this section are summarized in the table below:

Table 5. Summary of committed water rights that will be deducted from the perennial yield of Spring Valley.

Commitment Values to the Nearest 1 afa			
Type of Commitment	**Spring Valley Inventory**	**Stanka Report**	**Finding**
Non-Irrigation	1,901	1,901	1,901
Stand-alone Irrigation	8,551	7,711	8,304
Supplemental Irrigation	3,731	3,140	3,855
Domestic Well	20	17	20
Commitment Subtotal	**14,203**	**12,769**	**14,080**
Spring Discharge	NA	6,090	4,793
Total Commitment	**14,203**	**18,858**	**18,873**

H. Applicability to Junior Rights

The Nevada water rights appropriation system is based on the principle of first in time, first in right. Applications to appropriate water are given priority based on the date they are filed with the State Engineer.[510] When an application is approved and a permit issued, the priority date of the permit is the date the application was filed. If water is beneficially used pursuant to the permit terms, the State Engineer will issue a certificate with the same priority date as the underlying permit and application.[511] Relative to each other, a water right with a priority date earlier in time to another water right is senior to the junior right.

Under normal circumstances, the State Engineer would act on new appropriations for water in order of their date of filing so that senior applications would be acted on first. In that context, only senior water rights would be considered to be committed groundwater rights. For that purpose, Mr. Stanka's analysis distinguished between water rights with a priority date before and after October 17, 1989 (the priority date of the Applications).[512] However, these are special circumstances, because junior groundwater irrigation rights were approved in Spring Valley after Ruling 5726 was issued. These junior groundwater irrigation rights were issued subject to existing rights, which would include the Applications, if permitted. Although Ruling 5726 was

[510] NRS 534.080(3) ("[T]he date of priority of all appropriations of water from an underground source . . . is the date when application is made in proper form and filed in the Office of the State Engineer").
[511] NRS 533.425; NRS 533.430.
[512] Transcript, Vol.2 pp. 426:12-427:2 (Stanka).

vacated, these junior rights remain in existence. The State Engineer will treat these junior groundwater irrigation rights as committed groundwater rights since they were approved as part of the 8,000 afa reserve allowed to the basin for future development under Ruling 5726.

Based on the evidence in the record, and on the State Engineer's water right files, the State Engineer finds that 14,080 afa of groundwater rights are committed and consumptively used in Spring Valley and 4,793 afa of spring water rights are committed and consumptively used from valley floor springs, which also utilize groundwater. Therefore, the State Engineer finds that 18,873 afa of the 84,000 acre-foot perennial yield of the basin is already allocated.

V. IMPACTS TO EXISTING RIGHTS

When considering new applications to appropriate water, the Nevada State Engineer must deny the applications if development of the new applications will conflict with existing water rights or with protectable interests in existing domestic wells.[513] To address this requirement, the Applicant prepared an expert report describing a three part analysis. [514] First, a qualitative analysis was performed, which assessed potential conflicts based on water right ownership, geographical location, and priority date.[515] Second, a quantitative analysis was performed with the Applicant's groundwater model, using the model to identify potential conflicts with existing water rights and sensitive environmental areas.[516] Third, a qualitative site-specific analysis of each of the areas of concern identified in the model was performed to assess the potential for conflicts.[517] Additionally, the Applicant prepared a management plan for Spring Valley that included hydrologic monitoring components, management tools, and mitigation options. The Applicant requested that the State Engineer make the Hydrologic Monitoring and Mitigation Plan for Spring Valley part of the permit terms for the Applications.[518]

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[513] NRS 533.370(2).
[514] Exhibit No. SNWA_337, pp. 1-1, 3.
[515] Transcript, Vol. 11, pp. 2540:21-2541:8 (Watrus).
[516] Transcript, Vol. 11, pp. 2540:21-2541:8 (Watrus).
[517] Transcript, Vol. 11, pp. 2540:21-2541:8 (Watrus).
[518] Exhibit No. SNWA_149, p.1; Transcript, Vol.8 p. 1795:18-21 (Prieur).

A. Spring Valley Monitoring, Management and Mitigation Plan

The Project proposed by the Applicant is of a size and scope that requires a comprehensive monitoring, management and mitigation plan that will control development of the Applications long after the Applications are permitted. The State Engineer has required such plans to effectively manage other large-scale water development projects in Nevada, particularly for the mining industry. A Hydrologic Monitoring and Mitigation Plan was previously approved by the State Engineer in 2009, and a 2011 revision of that plan has been submitted into evidence.[519] The revised Monitoring and Mitigation Plan ("Management Plan") presented in this case is designed to promote sustainable development of the resource while protecting existing rights. The data collected from the plan will allow the State Engineer to make real-time assessments of the spread of drawdown within the basin as well as make predictions, using data collected under the monitoring plan, as to the location and magnitude of drawdown in the future under different pumping regimes. The State Engineer finds an effective management program that includes monitoring activities, management tools and mitigation options is critical to the determination that the Applications will not conflict with existing water rights or with protectable interests in existing domestic wells.

The record reflects that the Applicant has been collecting data related to groundwater hydrology in Spring Valley since it filed the Applications.[520] Mr. Prieur testified that systematic data collection started in 2007 with project development and the implementation of a monitoring plan for Spring Valley.[521] The monitoring plan was initially completed as a component of the Stipulation between the Applicant and the U.S. Bureau of Indian Affairs, U.S. National Park Service, U.S. Bureau of Land Management, and U.S. Fish and Wildlife Service ("Federal Agencies") that resulted in the withdrawal of the Federal Agencies' protests against the Applications.[522] The monitoring plan was finalized to comply with permit terms for the Applications after the Applications were approved in Ruling 5726.

The State Engineer is not a party to the Stipulation with the Federal Agencies. While the Stipulation is binding on the Applicant and the Federal Agencies, it is not binding on the State Engineer. However, the Stipulation is important to the consideration of the Applications for a

[519] Exhibit No. SNWA_149.
[520] Transcript, Vol.8 p. 1797:20-21 (Prieur).
[521] Exhibit No. SNWA_151; Transcript, Vol.8 p. 1797:20-24 (Prieur).
[522] Exhibit No. SE_041; Transcript, Vol.8 p. 1798:5-11 (Prieur).

number of reasons. First, the Stipulation formed the process for the initial development of the Spring Valley Management Plan. Second, the Stipulation addresses how the Federal Agencies and the Applicant will resolve issues between themselves that are related to Federal claims to water rights and resources. Third, the Stipulation provides a forum through which critical information can be collected from hydrologic and biological experts that the State Engineer can utilize to assure development of the Applications will not conflict with existing water rights or with protectable interests in existing domestic wells.

By its terms, the Stipulation, and its exhibits, set forth the guidelines for the elements of the monitoring plan. Exhibit A established the technical framework and structure for the hydrologic elements of the monitoring, management and mitigation program.[523] Exhibit B provided the same technical structure and management elements for the biologic portion of the plan.[524] The parties agreed upon mutual goals to guide the development of these monitoring plans. The common hydrologic goals of the parties are: (1) to manage the development of groundwater by SNWA in the Spring Valley hydrographic basin without causing injury to Federal water rights and/or any unreasonable adverse effects to Federal resources; (2) to adequately characterize the groundwater gradient from Spring Valley to Snake Valley via Hamlin Valley; and (3) to avoid effects on Federal resources located within the boundaries of Great Basin National Park.[525]

The Stipulation established a Technical Review Panel ("TRP") for the hydrologic plan, a Biological Work Group ("BWG") for the biological plan, and an Executive Committee to oversee implementation and execution of the agreement.[526] The TRP and BWG are composed of subject matter experts who act as representatives from each of the parties to the Stipulation who review, analyze, interpret, and evaluate information collected under the plan. The technical panels will also evaluate model results and make recommendations to the Executive Committee.[527]

The technical review teams for both the hydrologic component and the biologic component work together to accomplish the goals of the Stipulation. For example, Mr. Prieur

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[523] Transcript, Vol.8 p. 1799:14-22 (Prieur).
[524] Exhibit No. SE_041.
[525] Transcript, Vol.8 pp. 1803:19-1804:6 (Prieur).
[526] Transcript, Vol.8 p. 1800:8-12 (Prieur).
[527] Transcript, Vol.8 p. 1802:8-12 (Prieur).

testified that during development of the monitoring plan, the teams conducted joint field trips to identify springs that were of biologic interest and should be included in the hydrologic monitoring plan network.[528] The Applicant's representatives regularly meet with the TRP and the BWG to discuss ways to best utilize each group's data and to discuss any additional hydrologic data that may be needed under the plan.[529]

The Executive Committee reviews TRP recommendations pertaining to technical and mitigation actions. The Executive Committee also resolves disputes in the event the TRP cannot reach a consensus on monitoring requirements, research needs, technical aspects of study design, interpretation of results or appropriate actions to minimize or mitigate unreasonable adverse effects on Federal resources or injury to Federal water rights.[530] If the Executive Committee cannot reach a consensus, a dispute resolution procedure directs such a matter to be forwarded for resolution to the State Engineer or another qualified third party.[531]

This process was questioned by the CPB as not requiring any type of resolution and not protecting existing rights.[532] First, CPB is not a party to the Stipulation, and the Stipulation was not intended to address non-federal water rights. The Stipulation was executed to protect Federal resources, not CPB water rights.[533] Second, the State Engineer will oversee groundwater development in Spring Valley and is required by law to take action if groundwater withdrawal conflicts with CPB's existing rights.[534] The Stipulation in no way limits the State Engineer's obligations or authority to protect CPB water rights. For instance, in addition to making the Management Plan part of the permit terms for these Applications, the State Engineer can require additional monitoring as needed to protect CPB water rights.

The Tribes argue that the Stipulation was executed by the Federal Agencies without proper consultation with the Tribes. The Tribes also argue that the Stipulations should not have been admitted into evidence based on the Tribes' interpretation of language in the Stipulation. The State Engineer finds that the Stipulation is relevant to the consideration of the Applications for the reasons stated above. Whether proper consultation occurred with the Tribes before the

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[528] Transcript, Vol.8 p. 1837:13-19 (Prieur).
[529] Transcript, Vol.8 p. 1837:20-25 (Prieur).
[530] Transcript, Vol.8 pp. 1802:19-1803:10 (Prieur).
[531] Exhibit No. SE_041, Exhibit A, p. 14, II(2).
[532] Transcript, Vol.29 pp. 6438:11-6439:14 (Hejmanowski).
[533] Exhibit No. SE_041; Transcript, Vol.11 p. 2500:3-9 (State Engineer).
[534] Transcript, Vol.11 pp. 2498:22-2499:15 (State Engineer).

Stipulation was executed is a matter between the Tribes and the Federal Agencies and does not require resolution in order to consider the Applications. Whether admission of the Stipulation at these hearings was contrary to terms of the Stipulation is an issue between the parties to that agreement, not the State Engineer, and does not require resolution in order to consider the Applications.

1. Monitoring Requirements

As indicated previously, a monitoring plan for the Applications was finalized to comply with permit terms for the Applications after the Applications were approved in Ruling 5726. That plan was approved by the State Engineer on February 9, 2009.[535] The Applicant submitted an updated Management Plan for this hearing and requested that the State Engineer include compliance with the Management Plan as part of the permit terms.[536] The proposed Management Plan includes all of the elements from the previous plan, includes management strategies and objectives, and was updated to include survey information and construction information obtained since the plan was approved. Additionally, the Management Plan addresses non-federal water rights.[537]

Data collection is a key component of the Management Plan. Mr. Prieur testified that the purpose of data collection at this time is to provide a baseline characterization of the hydrologic system, including seasonal as well as climatological events, which will be used as background information to assess changes to the system once groundwater production commences.[538] The Applicant is collecting different types of data, which include water-level measurements in wells completed in the basin fill and carbonate aquifers, surface water discharge measurements from springs and streams, regional precipitation measurements, and water chemistry samples.[539] The Management Plan also includes a gain loss study in the area around Big Springs Creek, Lake Creek, and Pruess Lake in Snake Valley. The gain loss study will evaluate how groundwater contributes to this surface water system in order to judge, over time, whether changes occur to the interaction between groundwater and surface water in this area after groundwater production commences in Spring Valley.

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[535] Exhibit No. SNWA_153; Transcript, Vol.8 p. 1839:8-22 (Prieur).
[536] Exhibit No. SNWA_149.
[537] Transcript, Vol.8 p. 1839:8-22 (Prieur).
[538] Transcript, Vol.8 pp. 1840:25-1841:6 (Prieur).
[539] Transcript, Vol.8 p. 1841:9-14 (Prieur).

The Management Plan includes a well monitoring network to characterize and monitor groundwater conditions. Mr. Prieur testified that the well network is designed to provide spatial distribution of monitoring across the valley in different hydrologic and geologic settings.[540] Importantly, the majority of the wells are clustered in the area of the proposed points of diversion.[541] Fourteen of these wells are equipped for continuous monitoring, which allows the Applicant to assess hourly water-level variations in these wells.[542] In addition, once production starts, water elevations in the proposed production wells will be continuously monitored.[543]

Information on water-level variation assists in assessing the horizontal and vertical hydraulic gradients (i.e., direction of groundwater flow) in the basin.[544] The information may also assist in evaluating confining units in the aquifer, which will have an influence on the propagation of effects from water withdrawals.[545] The goal of the monitoring network is to provide a three-dimensional understanding of the groundwater flow in the basin.[546] Mr. Prieur testified that the Applicant spent well over $10,000,000 to develop the monitoring and test well network and to characterize the area hydrogeology.[547]

In addition to the monitoring-well network, the Management Plan also calls for a test-well network. Test wells will provide geologic data and hydrologic aquifer property data.[548] Similar to the monitoring wells, these wells collect water-level elevation information that is plotted on a hydrograph.[549] Mr. Prieur testified that historical hydrographs can show seasonal recharge impulses at the well site, which can be used to develop different pumping regimes to meet peak water demand.[550] This information can also be used to help manage groundwater production, such as how much water is pumped, when it is pumped, and where it is pumped.[551]

The monitoring network also includes surface water monitoring sites. These monitoring efforts covers sites throughout the valley, but are mainly concentrated around the Applicant's

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540 Transcript, Vol.8 p. 1843:17-19 (Prieur).
541 Exhibit No. SNWA_147, p. 2-5.
542 Exhibit No. SNWA_147, pp. 2-5 and 2-6; Transcript, Vol.8 p. 1846:17-19 (Prieur).
543 Exhibit No. SNWA_147, p. 2-7.
544 Transcript, Vol.9 pp. 2029:23-2030:5 (Prieur).
545 Transcript, Vol.9 p. 2030:2-6 (Prieur).
546 Transcript, Vol.9 p. 2029:19-22 (Prieur).
547 Transcript, Vol.8 pp. 1845:24-1846:5 (Prieur).
548 Transcript, Vol.9 p. 2072:3-7 (Prieur).
549 Transcript, Vol.9 p. 2073:13-17 (Prieur).
550 Transcript, Vol.9 pp. 2073:15-2074:9 (Prieur).
551 Transcript, Vol.9 p. 2075:16-(20 (Prieur).

proposed points of diversion.[552] The spring-monitoring sites were selected in consensus with the TRP, BWG, and the State Engineer's office.[553] The criteria used to select the springs included the spatial distribution, the biologic importance, the hydrogeologic setting, and the areas of concern.[554]

Thirteen of the sites, including one site on Cleveland Ranch, have piezometers, or small wells, installed near the spring for the purpose of comparing water-level measurements with spring discharge and evaluating the spring response under varying climatic conditions.[555] This information will be compared against other spring monitoring sites and data near pumping areas to determine if they are hydrologically connected and to what degree they are connected.[556] Ultimately, impacts to springs on the range front or valley floor are dependent on three criteria: (1) whether there is a saturated material in the aquifer between the area that is being pumped and the spring; (2) whether there is a high enough hydraulic conductivity to propagate effects through the geologic material; and (3) whether the spring is within the area of influence of pumping.[557] As required by the State Engineer, the Management Plan already includes additional monitoring to protect existing non-federal water rights.[558] As part of the development of the approved monitoring plan, the State Engineer required the Applicant to monitor in the area of Cleveland Ranch. The State Engineer required two monitoring wells, one shallow and one deep, at two different sites. The State Engineer also required two flumes to measure spring discharge and a shallow piezometer.[559] The State Engineer also required regular spring discharge monitoring at Turnley Springs, which is a privately owned water source.[560] In addition, once the final pumping configuration is determined for the Applications, the State Engineer required installation of one additional monitoring well on the east side of the valley one mile north of the northernmost production well.[561] Also, throughout the development of the water rights, the State Engineer has the option and authority to add additional monitoring.

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[552] Exhibit No. SNWA_147, p. 2-8.
[553] Transcript, Vol.8 p. 1864:13-15 (Prieur).
[554] Transcript, Vol.9 p. 2059:13-17 (Prieur).
[555] Transcript, Vol.8 pp. 1866:23-1867:6 (Prieur).
[556] Transcript, Vol.8 pp. 1866:24-1868:22 (Prieur).
[557] Transcript, Vol.9 p. 2060:1-16 (Prieur).
[558] Transcript, Vol.8 pp. 1838:6-1839:7 (Prieur).
[559] Transcript, Vol.8 p. 1838:14-24 (Prieur).
[560] Transcript, Vol.8 pp. 1838:21-1839:1 (Prieur).
[561] Transcript, Vol.8 pp. 1838:25-1839:3 (Prieur).

The Management Plan includes other hydrologic elements that provide a comprehensive view of the hydrologic system. For example, there is a requirement to establish a precipitation measurement network. There is also a requirement to collect three rounds of water chemistry data from 40 sites at six-month intervals prior to groundwater production and every five years thereafter.[562] These additional data collection efforts will provide a well-rounded view of the hydrologic system.

The data collection process is subject to quality-assessment and quality-control procedures. The Applicant implemented a quality-control process for collection of field data. The Applicant has standard procedures for: site monitoring; instrumentation preparation, calibration and maintenance; and data collection and recording.[563] The Applicant also has standard procedures for database entry and management. The collected data is brought to the office and entered into the database.[564] Once it is entered into the database, it is checked at two levels by other professionals and reviewed to make sure the quality processes were completed properly.[565] The hourly continuous data is processed using Aquarius software and then it is placed into the database.[566] Any erroneous data must go through an audit process in order for it to be removed from the database.[567]

A report is submitted to the State Engineer on a yearly basis that updates the status of each element of the monitoring program and documents daily averages of continuous water-level readings, current and historical hydrographs, spring- and stream-discharge records, any water-chemistry analysis, and a summary of precipitation data provided by other agencies.[568] These reports have been submitted to the State Engineer for 2008, 2009, 2010, and 2011 and are available to the public.[569] Electronic data are also provided to the State Engineer on a quarterly basis.

Dr. Bredehoeft, a witness for GBWN, provided general opinions that monitoring will not be effective. He implied in his written report that monitoring may not effectively detect pumping

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[562] Transcript, Vol.9 p. 2062:7-23 (Prieur).
[563] Transcript, Vol.9 pp. 2066:6-2067:11 (Prieur).
[564] Transcript, Vol.9 p. 2067:11-15 (Prieur).
[565] Transcript, Vol.9 pp. 2067:19-2068:2 (Prieur).
[566] Transcript, Vol.9 p. 2068:8-11 (Prieur).
[567] Transcript, Vol.9 pp. 2068:25-2069:2 (Prieur).
[568] Transcript, Vol.9 pp. 2068:25-2069:17 (Prieur).
[569] Exhibit Nos. SNWA_154 through SNWA_157; Transcript, Vol.9 pp. 2068:25-2069:2 (Prieur).

signals at long distances or, if detected, it may be too late to effectively react to it.[570] He provided a simple model of a groundwater system to support his conclusions[571] and testified that, based on his hypothetical example, impacts due to pumping may not be detected for up to 75 years.[572] Though this hypothetical model illustrates some general principles, it carries little weight when considering the specific effects of the proposed pumping. Dr. Bredehoeft testified that his model differs from the conditions found in Spring Valley and that these differences would affect the results in some instances.[573] Mr. Prieur testified that Dr. Bredehoeft's example does not accurately reflect conditions in Spring Valley because Spring Valley has more dispersed recharge, more dispersed springs, more dispersed wells, and an extensive network of monitoring wells.[574]

In addition, Dr. Bredehoeft's example only uses either monitoring at the spring itself or one monitoring point two miles from the spring and 48 miles from the pump site.[575] With a network of monitoring wells, deviations among different wells at different locations can be compared to determine the likely source of the effect.[576] Even with Dr. Bredehoeft's example of a single monitoring point nearly 50 miles from the pumping source and very close to the spring of interest, the Applicant's witness testified early detection of drawdown at the monitoring well allows the water manager to halt pumping and prevent significant impacts to the spring.[577] Dr. Bredehoeft testified that if one placed a monitoring well between the pumping site and the area of interest, one could see the propagation of the drawdown cone prior to it reaching the area of interest.[578] In rebuttal to Dr. Bredehoeft's example, Mr. Prieur testified that more monitoring wells closer to the pumping would allow for even earlier detection.[579]

Dr. Bredehoeft highlights some difficulties in monitoring, but these difficulties can be overcome. The State Engineer finds that the Applicant's monitor well network is scientifically sound because of the spatial distribution across Spring Valley, the dense distribution of

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[570] Transcript, Vol.24 pp. 5400:17-5401:7, pp. 5409:8–5409:12, p. 5455:20-24, pp. 5495:16-5496:6 (Bredehoeft).
[571] Exhibit No. GBWN_109, p. 9; *see, e.g.*, GBWN_011.
[572] Transcript, Vol.24 pp. 5400:17–5401:7 (Bredehoeft).
[573] Transcript, Vol.24 pp. 5450:1–5455:5 (Bredehoeft).
[574] Transcript, Vol.11 pp. 2367:15–2368:24 (Prieur).
[575] Exhibit No. GBWN_011.
[576] Exhibit No. SNWA_428, pp. 17–18.
[577] Exhibit No. SNWA_428, p. 19; Transcript, Vol.11 pp. 2372:6–2375:20 (Prieur).
[578] Transcript, Vol.24 p. 5458:2–8 (Bredehoeft).
[579] Transcript, Vol.11 pp. 2375:21–2376:9 (Prieur).

monitoring wells near the points of diversion, and because the plan is flexible, allowing for changes as needed. Information from these wells will provide the State Engineer with knowledge of the characteristics of groundwater flow in this area for the purpose of diagnosing and addressing potential impacts to existing rights. The State Engineer finds that the Applicant's spring and stream monitoring sites are well distributed throughout Spring Valley, but additional monitoring sites will be required as necessary during Project development. In addition, the Applicant has provided significant hydrologic data regarding Spring Valley for four years. Finally, the State Engineer finds that the Applicant has provided persuasive scientific evidence that the monitoring efforts and data collection in Spring Valley will provide scientifically sound baseline information from which changes to the system and potential impacts can be diagnosed, assessed, and, if necessary, mitigated. In summary, the State Engineer finds that the Applicant's Management Plan will be effective.

a. <u>Cleveland Ranch Monitoring Activities</u>

After consultation with CPB and the State Engineer, the Applicant installed monitoring equipment, which is designed to protect CPB's existing water rights in the vicinity of Cleveland Ranch. The Applicant located the monitoring points with assistance from the State Engineer and CPB representatives.[580] As mentioned above, the State Engineer required two monitoring well site locations. Wells SPR7030M and M2 were located at the toe of the Cleve Creek alluvial fan approximately 100 feet from the nearest spring.[581] These wells were completed as one deep well and one shallow well for the purpose of evaluating the vertical hydraulic gradient at this location.[582] The water elevations in these wells will be compared with spring discharge records to define the relationship between water elevation variability and spring discharge variability for springs at the toe of the Cleve Creek alluvial fan.[583]

The second set of wells, SPR7029M and M2, are located approximately a mile and half to two miles to the west of SPR7030M and M2.[584] The location of these monitoring wells is coincident with the point of diversion for Application 54017.[585]

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[580] Transcript, Vol.8 pp. 1848:17-1849:4 (Prieur).
[581] Exhibit No. SNWA_149, p. 32; Transcript, Vol.8 pp. 1850:23-1851:4 (Prieur).
[582] Transcript, Vol.8 p. 1851:15-22 (Prieur).
[583] Transcript, Vol.8 pp. 1851:23-1852:3 (Prieur).
[584] Exhibit No. SNWA_149, p. 32; Transcript, Vol.8 p. 1857:17-19 (Prieur).
[585] Transcript, Vol.8 pp. 1857:25-1858:2 (Prieur).

The monitoring plan also includes spring and stream monitoring in and around Cleveland Ranch. Mr. Prieur testified that spring monitoring efforts in the vicinity of Cleveland Ranch include the west Spring Valley complex, South Millick Spring, Unnamed Spring, Unnamed # Five Spring, and Four-Wheel Drive Spring, which are part of the spring monitoring network described above.[586] In addition, the plan required maintenance of a continuous gaging station at Cleve Creek.[587] The purpose of continuous monitoring at Cleve Creek is to establish variations in stream discharge over time with varying precipitation.[588]

The spring and stream monitoring efforts associated with Cleveland Ranch cost the Applicant approximately $200,000. Mr. Prieur opined that the monitoring around Cleveland Ranch will allow for a determination as to how development of the Applications near Cleveland Ranch will impact that area.[589] The State Engineer finds that the current monitoring program is adequate in the Cleveland Ranch area to assess impacts from water development under the Applications that are being granted in this ruling.

b. <u>Turnley Spring</u>

In addition to the Cleveland Ranch area, the State Engineer previously required additional monitoring in the Turnley Spring area, which is the primary source of water for property owned by Katherine and William Rountree.[590] Turnley Spring is located in the mountain block on Sacramento Pass.[591] The purpose of monitoring at this location is to protect the Rountree's domestic water right and to provide another spring discharge monitoring point in the mountain block to assess baseline conditions and long-term variations in discharge.[592] The Applicant has collected spring discharge data at Turnley Spring since 2008.[593] The State Engineer finds that the Applicant is in compliance with this monitoring requirement and that continued monitoring will allow that State Engineer to continue to assure that development of the Applications will not conflict with these existing rights.

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586 Transcript, Vol.8 p. 1867:20-24 (Prieur).
587 Transcript, Vol.8 p. 1868:2-5 (Prieur).
588 Transcript, Vol.8 p. 1868:15-25 (Prieur).
589 Transcript, Vol.8 pp.1869:21-1870:1 (Prieur).
590 Transcript, Vol.9 p. 2032:5-17 (Prieur).
591 Exhibit No. SNWA_149, p. 31; Transcript, Vol.9 p. 2032:9-10 (2011Prieur).
592 Transcript, Vol.9 pp. 2032:18-2033:2 (Prieur).
593 Exhibit No. SNWA_147, p. 2-7.

c. **Shoshone Ponds**

The Management Plan requires monitoring wells in the area of Shoshone Ponds, which is an area of critical environmental concern.[594] Shoshone Ponds exists due to free-flowing artesian wells that were drilled between 1935 and 1971. These wells are the sole source of water for the Ponds.[595] A monitoring location in the Ponds area was selected in consensus with the TRP and the State Engineer's office.[596] It is located approximately one mile to the southeast of the Shoshone Ponds area.[597] The area near Shoshone Ponds is also a BLM Area of Critical Environmental Concern, which prevented the Applicant from selecting a site closer to the Ponds.[598] The monitoring point is positioned between Shoshone Ponds and the point of diversion for Application 54019. The monitoring location was selected to provide early warning of drawdown at the Ponds from pumping at Application 54019.[599]

Mr. Prieur testified that this monitoring location provides effective monitoring for Shoshone Ponds because the alluvial environment in the area indicates a more direct flow path between the point of diversion and Shoshone Ponds.[600] Dr. Myers, however, suggested that there may be an alternative flow path along the mountain front.[601] In response to this concern, Mr. Pricur testified that the monitoring wells were placed to the east of Shoshone Ponds to monitor any alternative flow along the mountain front and then to the west.[602] Two wells were completed at this site, a shallow well, SPR7024M, and a deep well, SPR7042M2, for the purpose of assessing the vertical hydraulic gradient.[603] Baseline conditions for Shoshone Ponds have not been obtained due to the unregulated flow of the artesian wells and the lack of quality data, among other reasons.[604] Mr. Prieur testified that the geologic conditions in this area are similar to Cleveland Ranch, where there are interbedded sands and clays near Shoshone Ponds and coarser sand and gravel material up the alluvial fan to the east where the monitoring wells are

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[594] Exhibit No. SNWA_147, pp. 2-4, 2-5; Transcript, Vol.9 p. 2037:2-4 (Prieur).
[595] Transcript, Vol.9 p. 2035:1-4 (Prieur).
[596] Transcript, Vol.9 p. 2040:18-20 (Prieur).
[597] Transcript, Vol.9 p. 2035:2-3 (Prieur).
[598] Transcript, Vol.9 pp. 2036:23-2037:3 (Prieur).
[599] Transcript, Vol.9 p. 2035:13-19 (Prieur).
[600] Transcript, Vol.9 p. 2037:5-7 (Prieur).
[601] Transcript, Vol.9 p. 2040:7-9 (Prieur).
[602] Transcript, Vol.9 p. 2037:7-10 (Prieur).
[603] Transcript, Vol.9 pp. 2035:6-2036:18 (Prieur).
[604] Transcript, Vol.9pp. 2039:3-2040:4 (Pricur).

located.[605] Ultimately, Mr. Prieur concluded that the location of the monitoring wells will provide for effective monitoring of any spread of drawdown toward Shoshone Ponds.[606] The State Engineer agrees and finds that the positioning of the monitoring wells in proximity to Shoshone Ponds and the point of diversion for Application 54019 is appropriate and will provide the data necessary to assure development of the Applications will not conflict with existing water rights at Shoshone Ponds.

d. <u>Interbasin Monitoring Zone</u>

The Management Plan includes monitoring of the hydraulic gradient from Spring Valley to Hamlin and Snake Valleys in an area referred to as the Interbasin Monitoring Zone ("Zone").[607] This area is important to understanding how impacts from development of the Applications may propagate out of Spring Valley and into Hamlin and Snake Valleys. The Management Plan includes six monitoring wells in the Zone. One well has already been completed in the carbonate aquifer. Three additional wells will be completed in carbonate rock and two will be completed in basin-fill material.[608] In addition, four additional basin-fill wells in the Zone were selected as part of the monitoring well network.[609]

Part of the hydraulic gradient analysis requires a geologic investigation. The Applicant has already drilled one monitor and one test well in the Zone, and has collected geologic data as part of those test well projects. The hydrologic report for test well 184W101 provides a summary of the geologic data collected during the well drilling process for test wells in the Zone.[610]

The Applicant also performed a surface geophysical profile as part of the geologic analysis to determine the resistivity of the rock around the well for the purpose of assessing the geology of the area.[611] By combining this information with hydraulic testing, Mr. Prieur testified that the Applicant was able to gain a deep understanding of the hydrogeologic conditions at the

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[605] Transcript, Vol.9 p. 2036:2-12 (Prieur).
[606] Transcript, Vol.9 p. 2041:7-12 (Prieur).
[607] Exhibit No. SNWA_149, p. 15; Transcript, Vol.9 pp. 2041:24-2042:8 (Prieur).
[608] Transcript, Vol.9 p. 2042:21-23 (Prieur).
[609] Transcript, Vol.9 p. 2042:23-25 (Prieur).
[610] Transcript, Vol.9 p. 2044:8-10 (Prieur).
[611] Transcript, Vol.9 p. 2050:6-2051:1 (Prieur).

site. The cost to develop the new Zone monitor wells will be approximately $1.3 to $1.4 million.[612]

There are two "near zone monitoring wells" included in the Plan.[613] These wells will be sited between the nearest carbonate-production well and the nearest basin-fill production well to the Zone. The wells will provide two more monitoring points in addition to the 14 other monitoring points located in the area where the Applicant identified the preferential flow paths between Spring, Hamlin, and Snake Valleys.[614]

In addition to the Applicant's wells, the USGS drilled two additional wells in the vicinity of Big Springs as part of a new Southern Nevada Public Lands Management Act study. The study's purpose is to assess various aspects of the hydrology in the area of the Great Basin National Park and Snake Valley.[615] These wells have provided new information about the potential interbasin flow in this area.

Millard County witness Dr. Hurlow recommended additional monitoring to account for potential impacts to the groundwater and surface water system in the Utah portion of Snake Valley.[616] In addition to the Zone monitoring that is included in the Management Plan, Dr. Hurlow recommended that the State Engineer add UGS monitoring sites 15, 23, 2, and 28 to it.[617] Dr. Hurlow testified that information from these wells is currently collected by UGS and he recommended the data reports that are submitted by the Applicant annually pursuant to the Management Plan include that information. The State Engineer finds that if UGS provides the data to the Applicant, the Applicant shall include the UGS data in the Applicant's annual data reports required under the Management Plan.

The State Engineer finds that the Management Plan is comprehensive and will protect Federal and non-federal existing water rights in Snake Valley, because it includes approximately 16 monitoring sites and a test well solely dedicated to monitoring changes to the hydraulic gradient and interbasin flow from Spring to Snake Valley. Any impacts to existing rights in

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[612] Transcript, Vol.9 p. 2051:4-6 (Prieur).
[613] Exhibit No. SNWA_149, p. 17; Transcript, Vol.9 p. 2052:6-8 (Prieur).
[614] Transcript, Vol.9 pp. 2052:25-2053:9 (Prieur).
[615] Transcript, Vol.9 p. 2053: 12-20 (Prieur).
[616] Exhibit No. MILL_011, pp. 8-9.
[617] Exhibit No. MILL_011, pp. 9, 13.

Snake Valley would necessarily be detected by the monitoring sites that are located in the flow path between the valleys.

e. **Big Springs**

The Management Plan requires a synoptic discharge study, or a gain loss study, for the Big Springs System in Snake Valley every five years during the irrigation and non-irrigation season to assess impacts to Big Springs from development of the Applications in Spring Valley.[618] However, Mr. Prieur testified that recent information collected by the Applicant and Dr. Prudic, with the USGS, suggested that the primary source for Big Springs is local recharge in southern Snake Valley.[619] When Mr. Prieur referred to southern Snake Valley, it is accepted that he was actually referring to northern Hamlin Valley, a Nevada Hydrographic Area that is located within the larger Snake Valley, Nevada and Utah. Given the monitoring that is occurring in the Zone and around Big Springs, the State Engineer finds that the Management Plan and USGS study will further define the primary and secondary sources of water to Big Springs and the potential for impacts from pumping of the Applications in southern Spring Valley.

f. **Tribal Resources**

The Management Plan also includes monitoring designed to protect the water resources of the Confederated Tribes of the Goshute Reservation ("CTGR"), whose reservation is located in basins north of Spring Valley. There is a significant distance between the Applications' points of diversion in Spring Valley and the CTGR resources located in Deep Creek Valley. There are also monitoring points in northern Spring Valley that were specifically requested by the U.S. Bureau of Indian Affairs between the Application points of diversion in that portion of Spring Valley and the CTGR's reservation in Deep Creek Valley.[620] The State Engineer finds that the monitoring points in northern Spring Valley will detect any spread of drawdown in the direction of the CTGR reservation. The State Engineer further finds that the significant distance between the Application points of diversion and the CTGR reservation will provide adequate lead time to prevent any potential conflicts with CTGR water rights on the reservation.

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[618] Exhibit No. SNWA_147.
[619] Transcript, Vol.9 p. 2058:12-19 (Prieur).
[620] Transcript, Vol.11 p. 2479:11-14 (Prieur).

2. Management Tools

The Management Plan requires the data collection efforts be coordinated with the development and refinement of a groundwater model for the purpose of managing the water resource in Spring Valley.[621] The State Engineer will use the groundwater model to assess where additional data is needed, to identify potential areas of impact, to review the appropriate location of new wells, and to optimize pumping at current well sites to prevent impacts.[622] Mr. Prieur testified that stressing the aquifer with large scale pumping will increase the model's predictive capability, because longer term pumping stresses provide aquifer response parameter data. With this information, the groundwater model will be used as a management tool.

The Applicant's model will be improved in the future as more data is collected.[623] Once the Applicant begins to pump, the model can be calibrated with a stress of the appropriate magnitude to develop a much more certain representation of hydrogeologic parameters.[624] Dr. Myers testified that once data from large-scale stresses are available, models can be calibrated to allow experts to make local-scale predictions on impacts from pumping.[625] As the model continues to improve, it will be used as a management tool by the State Engineer to monitor and manage the Applicant's pumping in order to prevent impacts to existing rights and environmentally sensitive areas.

The State Engineer finds that the Applicant will be required to improve and use its model as a management tool, which will be used to prevent impacts currently predicted by the models in this hearing. The State Engineer will use the Applicant's model for monitoring and management purposes in the development of the Applications. The State Engineer requires that the model be included in the Management Plan and updated for the purpose of assessing any emerging potential conflicts with existing rights.

Protestants GBWN and CPB assert that the absence of quantitative standards or triggers in the Applicant's Plan will limit its effectiveness. In order to set quantitative standards, well locations and other variables, such as pumping timing and duration, must be known. Stress placed on the system through pumping also helps determine these standards because it shows

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[621] Transcript, Vol.9 p. 2064:2-8 (Prieur).
[622] Transcript, Vol.9 p. 2064:1-9 (Prieur).
[623] Exhibit No. SNWA_087, p. 1, p. 20.
[624] Exhibit No. SNWA_428, p. 10; Transcript, Vol.20 pp. 4473:22–4474:15 (Myers).
[625] Transcript, Vol.21 pp. 4598:13–4599:10 (Myers).

how the aquifer responds to pumping. Additionally, the natural variability in the system must be documented to ensure that any observed changes are due to pumping, rather than natural fluctuations due to seasonal recharge or other factors. The high volume of pumping activity prior to adoption of the monitoring and management plan allowed quantitative standards to be set in monitoring plans for the Owens Valley project.[626] The same situation is not present in Spring Valley. Further, because the Applicant's proposed pumping will not begin for many years, there is ample time for studies to be conducted to determine a baseline as well as quantitative thresholds.[627] Dr. Harrington agreed that the collection of baseline data prior to groundwater withdrawal makes the Project far better positioned than the Owens Valley project to ensure water development occurs in a sustainable manner.[628] The proper place to address pumping management concerns is in an operation plan for pumping management.[629]

The State Engineer finds that it is premature to attempt to set quantitative standards or triggers for mitigation actions in the Management Plan at this time.

3. Mitigation Requirements

In the event mitigation is needed, Mr. Prieur testified that there is clear language in the Management Plan that outlines the mitigation process.[630] The State Engineer has authority under Nevada law to order mitigation measures for the Project independent of whether or not a description of mitigation measures is included in the Applicant's Management Plan. Mr. Prieur and Dr. Harrington both agreed that the need for mitigation actions should be assessed on a case-by-case, or a site-by-site basis.[631] Mr. Prieur testified that there is a wide range of mitigation alternatives.[632] Possible mitigation alternatives could include cessation of pumping, modifying the pumping regime, changing the location of pumping, drilling new wells, lowering a pump, or providing alternative sources of water.[633] A wide range of environmental mitigation alternatives also are available, and are discussed in the "Environmental Soundness" section below.

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[626] Transcript, Vol.23 p. 5294:15-21 (Harrington).
[627] Transcript, Vol.23 p. 5292:10-15 (Harington).
[628] Transcript, Vol.23 pp. 5286:18 - 5287:7 (Harrington).
[629] Transcript, Vol.23 p. 5308:11-17 (Harrington).
[630] Transcript, Vol.9 p. 2078:8-14 (Prieur).
[631] Transcript, Vol. 9 p. 2078:19-23 (Prieur); Transcript, Vol. 23 pp. 5301:3-5302:15 (Harrington).
[632] Transcript, Vol.9 p. 2078:19-23 (Prieur).
[633] Transcript, Vol.9 p. 2079:2-11 (Prieur).

The Applicant has demonstrated a financial commitment to monitoring, management and mitigation if necessary. To summarize, the Applicant spent over $10,000,000 for the monitoring, exploratory and test well network, and $200,000 for the monitoring points around Cleveland Ranch. The Applicant spent approximately $78,000,000 to acquire ranches in Spring Valley with surface water and groundwater rights, as well as grazing allotments that can be used as part of the mitigation process.[634] In addition, the Applicant has demonstrated that it has substantial experience with monitoring, management and mitigation, and is aware of the potential costs associated with these projects.[635]

Dr. Bredehoeft testified for GBWN and said that mitigation measures will be ineffective. Dr. Bredehoeft asserted that recovery may take a long time at locations a great distance from pumping wells. He testified that reducing or ceasing pumping is a technically feasible way to mitigate impacts of pumping,[636] and that stopping pumping would allow the basin to recover, but notes, however, that it may not achieve full recovery and that recovery may take a long time.[637] Dr. Bredehoeft also testified that the Endangered Species Act may effectively force the reduction or cessation of pumping.[638] In addition, the federal stipulations may require the Applicant to reduce pumping.[639] Also, it may be in the Applicant's own interests to reduce or cease pumping in order to prevent extreme drawdown and the associated increased costs of pumping. Mr. Prieur testified that there have been examples where ceasing pumping has been an effective mitigation measure.[640]

The State Engineer finds that the Applicant has presented a comprehensive monitoring, management and mitigation plan. The State Engineer finds that the monitoring network is scientifically sound and designed in such a manner to provide monitoring coverage, from a basin-wide scale to a site-specific scale, from groundwater to surface water, and from the valley floor to the mountain block. The State Engineer further finds that the data collection efforts of the Applicant demonstrate a commitment to sustainable development of the resource. The State Engineer finds that mitigation options, together with the required Management Plan and staged

[634] Transcript, Vol.11 p. 2397:2-8 (Entsminger).
[635] Transcript, Vol.11 pp. 2397:18-2398:9 (Entsminger).
[636] Transcript, Vol.24 pp. 5464:22–5465:4 (Bredehoeft).
[637] Transcript, Vol.24 p. 5378:1–17, p. 5402:9–13 (Bredehoeft).
[638] Transcript, Vol.24 p. 5465:13–23 (Bredehoeft).
[639] Transcript, Vol.11 p. 2384:8–25 (Prieur).
[640] Transcript, Vol.11 pp. 2385:1-2389:12 (Prieur).

development, will ensure the development of the Applications in a sustainable manner that will avoid conflicts with existing rights. While the State Engineer is not a party to the Applicant's Stipulation with the Federal Agencies, the State Engineer finds that it provides a forum through which critical information can be collected from hydrologic experts, and used to assure development of the Applications will not conflict with existing water rights or with protectable interests in existing domestic wells. The State Engineer finds that mitigation measures listed in the Management Plan will be effective, and that the Applicant is required to perform any mitigation activities that may be necessary to avoid conflicts with existing rights.[641] The State Engineer finds that Nevada Revised Statutes grant him authority to amend the Management Plan as necessary. Accordingly, the State Engineer will make the Spring Valley Management Plan a requirement of the permit terms for the Applications.

B. Analysis for Conflicts with Existing Rights

In addition to developing a management plan to assure the development of the Applications will not conflict with existing rights, the Applicant completed a specific analysis of every existing groundwater right and environmental area of interest located in Spring Valley. The Applicant's expert, Mr. James Watrus,[642] conducted a conflicts analysis by first identifying the Application points of diversion, existing rights and environmental areas of interest within Spring Valley.[643] The existing rights were queried from the Nevada Division of Water Resources database in September 2010 and updated in April 2011.[644] Federal claims of water rights and resources were included in this analysis.[645] The location of the environmental areas of interest were provided by Mr. Marshall and Ms. Luptowitz and further explained in the "Environmental Soundness" section of this ruling.[646] Mr. Watrus testified that he analyzed all of the identified water rights and environmental areas of interest in his conflicts analysis.[647] With this information, Mr. Watrus followed three steps in his analysis. First, he conducted a

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641 *See,* NRS 534.120(1) (State Engineer's authority to designate a basin for special administration); NRS 534.120(1) (State Engineer may regulate a basin where groundwater is being depleted); NRS 534.110(6) (where pumping exceeds recharge, State Engineer may restrict pumping based on priority rights); and NRS 534.110(5) (unreasonable adverse effects to domestic wells may be mitigated or pumping limited).

642 Mr. Watrus is a senior hydrologist with the Southern Nevada Water Authority and was qualified as an expert in groundwater hydrology. Transcript, Vol.11 pp. 2537: 3-2538:6.

643 Transcript, Vol.11 pp. 2540:24-2541:2 (Watrus).

644 Exhibit No. SNWA_337, Appendix A; Transcript, Vol.11 p. 2551:7-9 (Watrus).

645 Transcript, Vol.11 p. 2551:1-4 (Watrus).

646 Exhibit No. SNWA_337, pp. 3-6, 3-7; Transcript, Vol.11 p. 2551:1-7 (Watrus).

647 Transcript, Vol.11 pp. 2552:11-2555:3 (Watrus).

qualitative analysis, which assessed potential conflicts based on water right ownership, geographical location, and priority date.[648] Second, he conducted a quantitative analysis with the Applicant's groundwater model using the model to identify potential conflicts with existing water rights and sensitive environmental areas.[649] Third, he completed a qualitative site-specific analysis of each of the areas of concern identified in the model to assess the potential for conflicts.[650]

1. Initial Qualitative Analysis

The first step in the conflicts analysis was to identify the existing water rights that would not be in hydrologic or legal conflict with the Application points of diversion. Water rights that are junior in priority to the Applications and those that are owned by the Applicant were excluded from further analysis.[651] For hydrologic reasons, Mr. Watrus concluded that water rights located in the mountain block would not be impacted by development of the Applications because mountain block springs are likely perched and not in connection with the regional groundwater aquifer.[652] Since mountain block springs are likely perched and fed from a different water source than that sought under the Applications, there can be no impact on these springs. None of the Protestants disputed this step of the analysis, and Dr. Mayo admitted that the CPB water rights located in the mountain block would indeed not be impacted by the Applications.[653] After the first qualitative analysis was complete, there were 114 water rights in Spring Valley that were subject to further conflicts analysis.

2. Quantitative Analysis with Groundwater Model

The Applicant next used the Applicant's groundwater model to evaluate the development of the Applications. Numerical groundwater models are computer models that are used to approximately simulate groundwater systems. They can be used to test concepts about groundwater flow or to make predictions regarding the effects of future stresses on the groundwater system. Two numerical groundwater models were submitted for this hearing to simulate pumping in Spring Valley: the Applicant's model, originally designed for the BLM's

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648 Transcript, Vol.11 pp. 2540:23-2541:3 (Watrus).
649 Transcript, Vol.11 p. 2541:2-5 (Watrus).
650 Transcript, Vol.11 p. 2541:5-8 (Watrus).
651 Transcript, Vol.11 p. 2574:2-8 (Watrus).
652 Transcript, Vol.11 p. 2572:5-7 (Watrus).
653 Transcript, Vol.27 p. 6068:8-14 (Mayo).

Draft Environmental Impact Statement ("DEIS") and Dr. Myers' Spring and Snake Valleys model. Both of the models contain significant uncertainties when used to predict the effects of the proposed pumping; however, the fact that the two models, different as they are, provide similar results gives the State Engineer confidence in the overall models' results.

a. BLM DEIS Model

The Applicant's numerical model was originally developed for the BLM in order to comply with the National Environmental Policy Act ("NEPA") and the Endangered Species Act ("ESA"). The Applicant submitted a right-of-way request to the BLM for the construction of the proposed Project.[654] The Applicant provides assistance as needed to BLM as the BLM complies with the NEPA by preparing a DEIS that considers the environmental consequences of the BLM's decision and provides an opportunity for public involvement.[655] As part of the DEIS process, the BLM determined that a groundwater model was needed.[656]

Ms. Luptowitz is the Environmental Resources Division Manager for the Applicant.[657] Ms. Luptowitz testified that the purpose of the groundwater model for the DEIS is to provide a broad-scale, programmatic analysis of the indirect effects of issuing the right-of-way for the proposed pipeline Project.[658] The site-specific locations of the wells are not yet known for DEIS purposes so the BLM uses the model to identify regional patterns and compare alternatives.[659] The BLM will conduct more specific analysis when site-specific right-of-way applications are made for wells.[660] Under the NEPA, the BLM can grant the right-of-way even if the model simulates impacts to existing rights and environmental resources.[661] For the purposes of the current DEIS, the model does not need to predict absolute or specific values at specific locations.[662]

The DEIS model was developed through a collaborative process involving many experts and significant effort. The DEIS model was developed by Earth Knowledge, Inc., the Applicant, and the BLM's Hydrology Technical Group. The Hydrology Technical Group consisted of

654 Exhibit No. SNWA_089, p. 1-1.
655 Transcript, Vol.9 pp. 1881:4–1882:1 (Luptowitz).
656 Transcript, Vol.9 p. 1882:7–9 (Luptowitz).
657 Exhibit No. SNWA_362.
658 Transcript, Vol.9 pp. 1882:24–1883:11 (Luptowitz).
659 Transcript, Vol.9 p. 1883:12–18 (Luptowitz).
660 Transcript, Vol.9 pp. 1883:19–1885: 3 (Luptowitz).
661 Transcript, Vol.9 pp. 1887:16–1888:2 (Luptowitz).
662 Transcript, Vol.9 p. 1887:10–13 (Luptowitz).

representatives from the BLM and consulting experts.[663] A representative from the State Engineer's office also attended technical meetings on model development.[664] The model was reviewed by the cooperating agencies for the NEPA process.[665] The Applicant prepared the groundwater model under the direction of the BLM Hydrology Technical Group. The BLM is ultimately responsible for the groundwater model.[666]

The Hydrology Technical Group collaborated on the model development from November 2006 to November of 2009, including an 18-month period of intense collaboration.[667] The Hydrology Technical Group consisted of local, regional, and national representatives from the BLM as well as Dr. Eileen Poeter from the Colorado School of Mines and Dr. Keith Halford from the USGS.[668] Dr. Poeter has been involved in hydrogeologic and groundwater research for 30 years and is considered an international authority in groundwater modeling.[669] Dr. Halford is an experienced groundwater modeler who has developed and published numerous models in many parts of the country.[670] In addition, representatives from the State Engineer's office participated as observers.[671] Earth Knowledge, Inc., itself spent approximately 15,000 person-hours on the project.[672] Dr. D'Agnese, President of Earth Knowledge and an expert in groundwater modeling, [673] testified that development of this model probably involved more time and discussion than any other model he had worked on in his 20 years of experience.[674] He opined that the level of time and collaboration significantly benefited the model.[675]

The model was developed using the MODFLOW-2000 modeling code with some customizations.[676] The development of the model was completed according to Hill and

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663 Exhibit No. SNWA_087, p. 5; Transcript, Vol.9 pp. 1895:18–1896:18 (D'Agnese).
664 Exhibit No. SNWA_087, p. 6.
665 Exhibit No. SNWA_087, p. 2.
666 Transcript, Vol.9 pp. 1882:10–20 (Luptowitz), 1899:9–11 (D'Agnese).
667 Exhibit No. SNWA_087, p. 5; Transcript, Vol.9 pp. 1898:2–1899:4 (D'Agnese).
668 Transcript, Vol.9 p. 1896:10-18 (D'Agnese).
669 Transcript, Vol.9 p. 1897:9-14 (D'Agnese).
670 Transcript, Vol.9 pp. 1897:21–1898:1 (D'Agnese).
671 Transcript, Vol.9 p. 1896:15-18 (D'Agnese).
672 Transcript, Vol.9 p. 1900:5–8 (D'Agnese).
673 Exhibit No. SNWA_86; Transcript, Vol.9 p. 1895:11–12 (State Engineer). Dr. D'Agnese was the lead technical coordinator in the development of the Applicant's groundwater model. Transcript, Vol.9 pp. 1895:18–1896:2 (D'Agnese).
674 Transcript, Vol.9 p. 1899:12–19 (D'Agnese).
675 Transcript, Vol.9 pp. 1899:24–1900:2 (D'Agnese).
676 Exhibit No. SNWA_087, pp. 4–5.

Tiedeman's 14 Guidelines for effective model calibration.[677] Dr. D'Agnese testified that Hill and Tiedeman's 14 Guidelines are accepted as authoritative in the field of groundwater modeling.[678] The State Engineer finds that following Hill and Tiedeman's 14 Guidelines enhances the reliability of a groundwater model.

For purposes of the hearing on the Applications, the Applicant used a model that differed slightly from the model used by the BLM for the DEIS. During the NEPA process, the BLM requested that the Applicant modify the representation of Big Springs, which it did for the DEIS.[679] For reasons discussed in more detail below, the Applicant selected the original un-modified version of the DEIS model for the analysis the Applicant presented to the State Engineer (hereinafter referred to as the "Applicant's model"). Dr. Myers criticizes the Applicant's model for not completely implementing the Applicant's conceptual flow model and suggests that the Applicant altered the conceptual model to increase recharge in the targeted basin.[680] Dr. Myers notes that the per-basin recharge in the Applicant's numerical model is different than that in the Applicant's conceptual model.[681] The Applicant argues the model is designed to closely match observations in the system and to have parameters that are in the acceptable range of the conceptual model. Therefore, the mere fact that a numerical model may differ from a conceptual model does not mean that the numerical model is inadequate.

(1) <u>Scope of BLM DEIS Model</u>

In light of the model's purpose - to support analysis under the NEPA at a broad programmatic level - the Applicant's model is a regional model. It does, however, incorporate intermediate features that are connected to regional features. It does not include perched and local features that are not connected to the regional features.[682] Due to its regional nature, the Applicant's numerical model is not designed to simulate perched systems, predict drawdown at specific pumping wells or springs, derive steady state budgets, or derive new basin or flow system boundaries. Dr. D'Agnese testified that predictions in cells where wells are located should not be relied on.[683]

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677 Exhibit No. SNWA_087, p. 4, p. 15.
678 Transcript, Vol.9 p. 1913:13-21 (D'Agnese).
679 Exhibit No. SNWA_090, pp. 3-1 to 3-3.
680 Exhibit No. GBWN_103, p. 27; Exhibit No. GBWN_104, p. 15.
681 Exhibit No. GBWN_104, p. 10.
682 Exhibit No. SNWA_087, p. 1; Transcript, Vol.9 p. 1909:18-25 (D'Agnese).
683 Exhibit No. SNWA_087, p. 2; Transcript, Vol.9 p. 1908:12-1909:17 (D'Agnese).

The model covers 20,688 square miles, including Spring, Cave, Dry Lake, and Delamar Valleys.[684] Though there are other regional models of similar size in the United States, they typically have much more available data.[685] The model grid-cells are each one kilometer by one kilometer.[686] The Applicant's model has 474 rows, 202 columns, and 11 layers with a total of 589,391 active cells.[687] Dr. D'Agnese testified that the data resolution for the area did not justify using smaller grid-cell sizes.[688] He testified that given the size and amount of available data, the model should only be used to evaluate regional patterns and trends in drawdowns and changes in water budgets due to natural or human stresses.[689]

The complexity and large size of the region modeled and the sparseness of available data result in uncertainties in the Applicant's model simulations.[690] Furthermore, the lack of good historical data on anthropological uses of groundwater provides further uncertainty to the model simulations.[691] Because of the model's regional scale, local-scale features are not accurately simulated. For instance, Dr. D'Agnese testified that it would not be appropriate to use the model to make drawdown predictions at Cleveland Ranch or spring-flow predictions for the Gandy Warm Springs and McGill Springs.[692]

All layers in the Applicant's model are simulated as confined.[693] Dr. Myers states that the use of a confined top layer biases the Applicant's model to under-predict drawdowns.[694] Dr. D'Agnese stated that the Applicant's model had convergence issues when the top layer was simulated as unconfined. The Applicant addressed this by changing the layer to confined and then took measures to minimize any errors this could cause.[695] The use of a confining layer was directed and approved by the many groundwater modeling experts on the BLM's Hydrology Technical Group. Dr. D'Agnese testified that it is a common practice among modelers to simulate the top layer as confined due to model convergence issues. He did not believe the use

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[684] Exhibit No. SNWA_089, pp. 1-2, p. 4-2; Transcript, Vol.9 p. 1902:20–21 (D'Agnese).
[685] *See* Transcript, Vol.9 p. 1903:1–1906:6 (D'Agnese).
[686] Exhibit No. SNWA_087, p. 11; Exhibit No. 089, p. 4-1; Transcript, Vol.9 p. 1907:2–4 (D'Agnese).
[687] Exhibit No. SNWA_089, pp. 3-4, 4-2.
[688] Exhibit No. SNWA_087, p. 11; Transcript, Vol.9 pp. 1907:5–1908:11 (D'Agnese).
[689] Transcript, Vol.9 pp. 1906:20–1907:1, pp. 2026:9–2027:15 (D'Agnese).
[690] Exhibit No. SNWA_087, p. 9.
[691] Exhibit No. SNWA_087, p. 12.
[692] Transcript, Vol.9 p. 1911:2–15, p. 1915:7–9 (D'Agnese).
[693] Exhibit No. SNWA_089, p. 4-2.
[694] Transcript, Vol.18 pp. 4090:25–4091:3, p. 4094:2–10 (Myers).
[695] Exhibit No. SNWA_089, p. 4-2, p. 4-4.

of a confined layer for the top layer made the model inappropriate to use for this hearing.[696] Dr. Myers also noted that his model had convergence issues due to the use of an unconfined layer for Layer 1. However, Dr. Myers determined that this would have no affect on model results.[697]

The Applicant's model uses average conductances from the top of a cell to the bottom of a cell. Dr. Myers asserts that in thick cells the top and bottom may be grossly different and the average is essentially meaningless.[698] Dr. Myers also states that the Applicant's model structure is far too complex for the quantity and quality of hydrologic data used to calibrate it.[699]

(2) <u>Model Construction</u>

The Applicant used Horizontal Flow Barriers ("HFB") to represent geologic faults when they were considered to be barriers to groundwater flow.[700] Dr. Myers criticizes the Applicant's use of HFBs to represent faults in several ways. Dr. Myers asserts that the Applicant's model contains several faults that are supported by very little data or that simplify complex geologic features.[701] For instance, Dr. Myers criticizes the Applicant's model for not following the geology of Rowley, et al. (2011) by including an HFB between Steptoe and Spring Valleys that does not result in a mounding of contours.[702] Dr. D'Agnese, when questioned about this issue, explained that the model was completed prior to the completion of Rowley, et al. (2011) and so could not have relied on it. Dr. D'Agnese's response to this question is perplexing; if he did not rely on Rowley, et al. (2011),[703] then what is the purpose of Rowley's work? Dr. D'Agnese did rely on previous work of Rowley, including his contributions to the conceptual model, where those structures between Steptoe and Spring Valleys are clearly documented.[704] His response to this question seems disingenuous. He later stated that the HFB is not meant to be a complete barrier to groundwater flow; it is only meant to impede flow.[705]

Dr. Myers also argues that the Applicant's use of a specific storage value of 0.015 for lower layers indicates a bias in the model. Dr. Myers states that this value is more typical of

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[696] Transcript, Vol.9 pp. 1918:17–1919:16 (D'Agnese).
[697] Transcript, Vol.18 pp. 4107:25–4109:16 (Myers).
[698] Exhibit No. GBWN_104, pp. 14–15.
[699] Exhibit No. GBWN_104, p. 15.
[700] Exhibit No. SNWA_089, p. 4-16.
[701] Exhibit No. GBWN_104, pp. 4–8, p. 15; Transcript, Vol.18 p. 4092:15–22 (Myers).
[702] Exhibit No. GBWN_104, p. 9; Transcript, Vol.18 pp. 4085:17–4086:19 (Myers).
[703] Transcript, Vol.9 pp. 1922:9–1923:12 (D'Agnese); Exhibit No. SNWA_058.
[704] Exhibit No. SNWA_087, Plate 2.
[705] Transcript, Vol.9 pp. 1922:9–1923:12 (D'Agnese).

plastic clay and that the fill should typically have a lower specific storage value. This results in the model releasing more water from storage per foot of drawdown.[706] Dr. D'Agnese testified that the storage parameters were selected based on analysis of literature and aquifer test results with the concurrence of the Hydrology Technical Group.[707]

Dr. D'Agnese testified that if a model is to be used for predictions, it typically should be calibrated both to steady state conditions and to transient conditions.[708] Calibration refers to the process of trying to match simulated values in the model to actual observed field values. For example, if a spring was flowing at the rate of two cubic feet per second, an ideally calibrated model would simulate flow at that spring as two cubic feet per second, not one or three cubic feet per second. The Applicant's model was calibrated to steady state and transient development conditions.[709] The Applicant used both manual trial-and-error and automated-regression methods to calibrate the model.[710] The Applicant used 2,707 hydraulic head observations, 4,301 hydraulic drawdown observations, 126 groundwater ET discharge observations, 44 steady state spring flow observations, 27 transient spring flow change observations, 16 model flow boundary observations, and 144 spring or stream flow observations to constrain the model calibration.[711] The Applicant weighted observations so that more reliable measurements were given more weight during calibration.[712] Only a subset of the regional and intermediate springs in the model was used for calibration targets.[713] The Applicant argues if springs are not included as steady state calibration targets, then the existing spring flow is not necessarily accurately represented as a starting point in the model, and that one can have little confidence in the precision of spring flow predictions for such springs that were not included in the calibration process.[714]

Dr. D'Agnese testified that the model simulates the regional intermediate spring flows that were used as calibration targets quite well over time.[715] He also states that, though the

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[706] Exhibit No. GBWN_104, p. 9; Transcript, Vol.18 pp. 4084:21–4085:9 (Myers).
[707] Transcript, Vol.9 pp. 1923:22–1924:14 (D'Agnese).
[708] Transcript, Vol.9 pp. 1914:17–1915:2 (D'Agnese).
[709] Exhibit No. SNWA_087, p. 3.
[710] Exhibit No. SNWA_087, p. 6.
[711] Exhibit No. SNWA_087, p. 17.
[712] Exhibit No. SNWA_087, p. 7.
[713] Transcript, Vol.9 pp. 1910:1–1911:1 (D'Agnese).
[714] Exhibit No. 407, p. 5.
[715] Transcript, Vol.9 p. 1915:16–24 (D'Agnese).

model does not accurately simulate individual ET locations, it simulates aggregate ET well.[716] Dr. Myers asserts that the Applicant's model has a bias toward positive un-weighted residuals in the north of Spring Valley and the mountain front of Snake Valley. However, he notes that these areas would not be affected much by the proposed pumping.[717] The State Engineer finds that the Applicant's model provides a reliable tool to examine potential effects on the groundwater system; however, the model contains many uncertainties that must be kept in mind as it is used to analyze the system.

b. <u>Application of Model to Consider Impacts from Project</u>

Two model simulations were submitted by the Applicant, one using a baseline scenario and one that simulated pumping the full volume of the Applications.[718] Drawdown maps were prepared based on the difference in model results between the two scenarios.[719] In addition, changes in spring flow volumes were analyzed.[720] Mr. Watrus used the baseline pumping scenario to set the initial conditions of the water table.[721] He then used the full volume scenario to simulate the water elevations under pumping stresses.[722] The full volume pumping scenario simulated staged development of the resource based on the projected water demand in the Applicant's 2009 Water Resource Plan.[723] The baseline water-level elevations and spring flows were subtracted from the pumping elevations and spring flows to determine drawdown of the aquifer and changes in spring flow resulting from simulated pumping of the Applications.[724]

The Applicant selected the original version of the DEIS model for the analysis. During the NEPA process, the BLM requested that the Applicant modify the representation of Big Springs (in Snake Valley), which it did for the DEIS.[725] The original version, unlike the modified version of the model, simulated full discharge at Big Springs, which was an area of concern in the model analysis.[726] Dr. Myers testified that the original version used by the

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[716] Exhibit No. SNWA_087, p. 14.
[717] Exhibit No. GBWN_104, p. 3; Transcript, Vol.18 p. 4082:14-23 (Myers).
[718] Transcript, Vol.11 p. 2574:13-15 (Watrus).
[719] Transcript, Vol.11 pp. 2574:23-2575:4 (Watrus).
[720] Transcript, Vol.11 p. 2575:3-4 (Watrus).
[721] Transcript, Vol.11 p. 2555:5-10 (Watrus).
[722] Transcript, Vol.11 pp. 2555:17-2556:15 (Watrus); Exhibit No. SNWA_337, p. 4-3 and p. 4-4.
[723] Transcript, Vol.11 p. 2557:1-9 (Watrus).
[724] Transcript, Vol.11 p. 2555:11-15 (Watrus).
[725] Exhibit No. SNWA_090, pp. 3-1 to 3-3.
[726] Transcript, Vol.11 p. 2550:12-13 (Watrus).

Applicant during this hearing is likely a more accurate representation of the hydrogeology of Big Springs.[727]

Dr. Myers suggested that the conflicts analysis should have used the pumping scenarios identified in the DEIS.[728] The DEIS alternative pumping scenarios mainly simulate distributed pumping throughout Spring Valley.[729] The only pumping scenario that simulated pumping at the Application points of diversion also included pumping in Snake Valley. The Snake Valley Applications are not before the State Engineer for consideration at this time, and simulated pumping at those points of diversion may influence drawdown simulations from the Spring Valley Applications.[730] The State Engineer finds that this decision only involves the Application points of diversion in Spring Valley. None of the DEIS pumping scenarios analyze just pumping at the Spring Valley Application points of diversion. Accordingly, the State Engineer finds that the Applicant properly constructed a new model run in order to analyze the specific decision that is before the State Engineer at this time.

The Applicant selected a 75-year simulation period beyond full build-out of the project, which occurs in the year 2042. This simulation period was selected based upon the expected lifespan of the project and the reduced certainty in model results for longer simulation periods.[731] Mr. Holmes testified that the Applicant uses a 50-year water planning horizon because it provides a long enough look into the future to assess potential water demand and to provide enough lead time to meet that demand.[732] Mr. Holmes further testified that other entities such as the City of Phoenix and White Pine County, as well as Federal agencies, such as the Army Corps of Engineers, use a 50-year planning horizon.[733] On the other hand, Dr. Myers and Dr. Jones ran model simulations to 200 years beyond full build-out.[734] The uncertainty with longer prediction periods relates in part to the fact that no actual data exists for large-scale pumping, so predicting conditions many hundreds of years into the future only compounds the uncertainty caused by lack of data. The State Engineer finds that the 75-year simulation period is adequate for this

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[727] Transcript, Vol.18 p. 4087:8–12 (Myers).
[728] Transcript, Vol.19 pp. 4219:15-4222"10 (Myers).
[729] Transcript, Vol.11 pp. 2562:19-2563:2 (Watrus).
[730] Transcript, Vol.11 pp. 2562:19-2563:2 (Watrus).
[731] Transcript, Vol.11 p. 2559:3-9 (Watrus).
[732] Transcript, Vol.2 pp. 307:24-308:7 (Holmes).
[733] Transcript, Vol.2 p. 308:10-15 (Holmes).
[734] Exhibit No. GBWN_003, p.5; Transcript, Vol.27 p. 6009:13-18 (Jones).

conflicts analysis given the practical considerations provided by the Applicant and the substantial amount of uncertainty for longer prediction periods.

Some adjustments had to be made to the model to represent full pumping of the Application points of diversion. Specifically, the model framework could not support pumping at Application 54021. The Applicant's model locates points of diversion in the center of the modeling cell, which in this case was an impermeable rock layer.[735] For the simulation, the Applicant moved the Application point of diversion into alluvial material.[736] The geology in the actual location of the point of diversion is alluvial material, which, according to Mr. Watrus, is suitable for production.[737] Dr. Myers confronted a similar problem at more than one point of diversion in his simulations and used a similar technique to resolve the problem.[738] The State Engineer finds that for simulation purposes, it was appropriate for the Applicant to move the point of diversion for Application 54021 as described above.

There are limitations in the model predictions that must be accounted for in the conflicts analysis. First, at full build-out, the model simulated continuous pumping at maximum volume throughout the simulation period. As explained by Mr. Watrus, the model cannot account for human-driven management decisions to reduce, relocate, or stop pumping to prevent impacts to existing water rights or environmental areas of interest. He argues that the Project would be developed in a manner that responded to impacts before the drawdowns that are predicted in the model would occur.[739]

Second, Mr. Watrus testified that the volume of precipitation recharge that is simulated in the model is 82,600 afa as opposed to their estimate of 99,200 afa.[740] In essence, this imbalance between recharge to the aquifer and pumping from the aquifer magnifies simulated impacts. If the model simulated the current estimate of recharge, the drawdown predictions would be less. Further, the full application volume pumping scenario simulated 91,224 acre-feet of pumping in Spring Valley.[741] Mr. Watrus testified that the imbalance between recharge (82,600 acre-feet) and pumping volume (91,224 acre-feet) would cause the model to over-simulate impacts as a

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735 Exhibit No. SNWA_337, p. 4-5; Transcript, Vol.11 p. 2560:18-2561:16 (Watrus).
736 Exhibit No. SNWA_337, p. 4-5; Transcript, Vol.11 p. 2561:7-23 (Watrus).
737 Exhibit No. SNWA_337, p. 4-5; Transcript, Vol.11 p. 2561:17-2562:8 (Watrus).
738 Exhibit No. GBWN_003, p. 6.
739 Transcript, Vol.11 pp. 2558:6-2559:6; p. 2558:13-16 (Watrus).
740 Transcript, Vol.11 p. 2566:4-7 (Watrus).
741 Transcript, Vol.11 p. 2566:10-12 (Watrus).

whole simply because the simulation includes pumping greater than perennial yield.[742] A simulation that includes more recharge, and pumping at the rate than is ultimately approved by the State Engineer for these Applications, would predict less drawdowns and decreases in spring flows.

Third, as stated above, the model is a regional model whose site-specific predictions are highly uncertain. The model cannot currently represent the complex geologic stratification on the valley floor in Spring Valley.[743] The model represents uniform drawdown in an area that has potentially numerous confined units, which would influence drawdown.[744] Other limitations include a lack of historical pumping drawdown data to determine how consumptive uses affect the aquifer over time and a lack of variation in recharge over time to assess how increased or decreased recharge will influence drawdown under different pumping regimes.[745]

Given the limitations associated with the model, Mr. Watrus testified that the model should be used to identify areas of concern that require more detailed qualitative analysis and consideration of whether adequate monitoring exists to protect such areas of concern.[746] Mr. Watrus did not consider the model results sufficiently accurate to predict specific drawdowns and specific spring discharges.[747] This opinion is consistent with that of the model's author, Dr. D'Agnese, who testified that analyzing drawdown at specific sites was not an appropriate use of the model. Given all of these limitations of the model, and the model's predictive accuracy, Mr. Watrus determined that the proper use of the model was to determine which existing right points of diversion or environmental areas of interest have a simulated drawdown of more than 50 feet or a simulated reduction in spring discharge of greater than 15%.

For the DEIS analysis, different threshold values were used. In particular, the DEIS used a drawdown threshold of 10 feet and a 5% change in spring discharge for the purpose of comparing the potential impacts from the different pumping scenarios.[748] Ms. Luptowitz testified that the difference in threshold values depends on the purpose of the model simulation results. She testified that the DEIS thresholds were selected to compare the potential range of

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[742] Transcript, Vol.11 p. 2566:10-24 (Watrus).
[743] Transcript, Vol.11 p. 2585:2-12 (Watrus).
[744] Transcript, Vol.11 p. 2585:2-19 (Watrus).
[745] Transcript, Vol.11 pp. 2565:17- 2566:9;2567:25-2569-7 (Watrus).
[746] Transcript, Vol.11 p. 2575:3-7 (Watrus).
[747] Transcript, Vol.11 pp. 2574:23-2575:2 (Watrus).
[748] Transcript, Vol.9 p. 1890:4-7 (Luptowitz).

effects between the different alternatives.[749] Ms. Luptowitz testified that the conflicts analysis for this hearing analyzed specific points of diversion and required greater certainty in model results, which the threshold values used for this hearing provided.[750] The DEIS is meant to disclose a regional comparison of alternatives without having site-specific pumping locations.[751] The BLM may grant the right-of-way even if some impacts are shown. The DEIS was not intended to determine if there would be unreasonable effects to existing rights under the Nevada water law.[752]

Dr. Jones testified that screening criteria are appropriate for analyzing the results of the model, but also testified that he thought the Applicant's criteria were arbitrary.[753] Dr. Jones further testified that the screening criteria should be used in conjunction with the actual drawdown numbers.[754]

The State Engineer finds that predictions of the models become increasingly uncertain over extended periods of time. The State Engineer further finds that model predictions of drawdowns of less than 50 feet and spring flow reductions of less than 15% are highly uncertain. Furthermore, a drawdown of less than 50 feet over a 75-year period is generally a reasonable lowering of the static water table, but this determination must be made on a case-by-case basis. Therefore, the State Engineer will not reject the Applications based on model predictions of drawdowns of less than 50 feet or spring reductions of less than 15%. The State Engineer acknowledges that Protestants provided detailed model predictions that predicted an exact numeric amount of drawdown at points of diversion for their water rights and environmental areas of interest.[755] However, because the model does not accurately represent local-scale geologic and hydrogeologic features that influence drawdown, numeric drawdown predictions are not precise.

The State Engineer finds that the Applicant's approach to the conflicts analysis is acceptable given the limitations in the model and the purpose of this analysis.

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749 Transcript, Vol.9 p. 1890:4-7 (Luptowitz).
750 Transcript, Vol.9 p. 1890:20-23 (Luptowitz).
751 Exhibit No. SNWA_337, p. 6-2; Transcript, Vol.9 pp. 1889:7-1890:7 (Luptowitz).
752 Exhibit No. SNWA_408, p. 3.3-93.
753 Transcript, Vol.27 p. 6001:22-24 (Jones).
754 Transcript, Vol.27 p. 6001:24-25 (Jones).
755 Transcript, Vol.27 p. 6002:7-11 (Jones).

3. Site-Specific Qualitative Analysis of Impacts to Existing Rights and Environmental Areas of Interest

As a result of the quantitative analysis, 31 out of 114 water rights were located in an area where the model simulated greater than 50 feet of drawdown and three were located where the model simulated a reduction in spring discharge in excess of 15%.[756] These 31 water rights and three spring locations were further examined on a qualitative basis to determine whether pumping under the Applications conflicted with existing rights. One of the purposes of this further qualitative analysis was to determine if there were features or conditions that are not represented in the model that could affect the level of impact from pumping under the Applications. Another purpose was to determine whether sufficient monitoring exists at these locations to protect against impacts.

a. Groundwater Rights

The Applicant first qualitatively analyzed the underground water rights in areas with greater than 50 feet of simulated drawdown. The analysis of the CPB underground water rights in these areas will be discussed in the "Cleveland Ranch" section below. Nevada Revised Statute 534.110 states that groundwater rights "must allow for a reasonable lowering of the static water level" and the section "does not prevent the granting of permits to applicants later in time on the ground that the diversions under the proposed later appropriations may cause the water level to be lowered at the point of diversion of a prior appropriator, so long as any protectable interests in existing domestic wells . . . and the rights of holders of existing appropriations can be satisfied under such express conditions." This statute indicates even if a new application for groundwater will cause a drawdown at an existing water right, such a drawdown will not prevent the State Engineer from granting a permit for the new appropriation provided that drawdown is not unreasonable.

Permits 29371 (Certificate 10328) and 29567 (Certificate 10329) share a well, which corresponds to Well Driller's Log 10816 that is available in the State Engineer's records.[757] The driller's log indicates that the well is completed to a depth of 238 feet and has a static water level of 64 feet.[758] The saturated depth of this well is 174 feet. The State Engineer finds that this well

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[756] Exhibit No. SNWA_337, p. 6-4.
[757] Exhibit No. SNWA_337, p. 6-6.
[758] Exhibit No. SNWA_341; Transcript, Vol.11 pp. 2581:17-2582:6 (Watrus).

can accommodate a reasonable lowering of the water table at this location without causing a conflict to these existing rights. Permit 31239 (Certificate 10334) corresponds with Well Driller's Log 17124.[759] For this well, the completion depth is 535 feet and the static water level is 231 feet.[760] Again, the State Engineer finds that the saturated depth of this well, 304 feet, can accommodate a reasonable lowering of the water table. The State Engineer also finds that any effects to these water rights will be monitored and addressed pursuant to the required Management Plan.

The next group of water rights, Permits 7446 (Certificate 1515), 8075 (Certificate 1366), and 8077 (Certificate 1368), are located on the valley floor.[761] The water rights are small volume stock-water rights.[762] There is no well driller's log for these wells, and the Applicant determined that the wells were completed at shallow depths.[763] The State Engineer finds that if unreasonable impacts occur at this location, the small volume of water allocated to these water rights may be mitigated in any number of ways including deepening the current wells, drilling substitute wells, or simply replacing the water with water provided by the Applicant.[764]

Other than CPB rights, which are discussed below, the final underground right, Permit 45496 (Certificate 11965), is located at the interface of the valley floor and the alluvial fan.[765] The water right is a stock-water right with an annual duty of 86.24 acre-feet.[766] The well for this water right is completed to a depth of 495 feet and has a static water level of 407 feet below ground surface.[767] The saturated depth of the well, 88 feet, could accommodate some lowering of the water table. The first simulation period in which the right is impacted is in the year 2082.[768] Based on this evidence, the State Engineer finds that there is lead time in the model simulation to determine whether this right will be impacted. The State Engineer further finds that the Applicant's monitoring pursuant to the Management Plan will identify any potential

[759] Exhibit No. SNWA_341; Transcript, Vol.11 p. 2583:3-4 (Watrus).
[760] Exhibit No. SNWA_341; Transcript, Vol.11 pp. 2583:18-2584:1 (Watrus).
[761] Transcript, Vol.11 pp. 2583:25-2584:2 (Watrus).
[762] Transcript, Vol.11 p. 2586:1-6 (Watrus).
[763] Transcript, Vol.11 p. 2584:7-11 (Watrus).
[764] Transcript, Vol.11 p. 2586:1-6 (Watrus).
[765] Exhibit No. SNWA_337, p. 6-6; Transcript, Vol.11 p. 2586:3-6 (Watrus).
[766] Exhibit No. SNWA_337, p. 6-6; Transcript, Vol.11 p. 2586:11-13 (Watrus).
[767] Exhibit No. SNWA_337, p. 6-6; Transcript, Vol.11 p. 2586:6-8 (Watrus).
[768] Exhibit No. SNWA_337, p. 6-8.

conflicts during this time and will require mitigation if unreasonable drawdown is likely to occur.

With respect to domestic wells, the Applicant reviewed the presence of domestic wells and determined that no domestic wells would be impacted by the Project. Protestants submitted no evidence to indicate the Project will conflict with protectable interests in existing domestic wells.

b. **Spring Rights**

The next group of water rights is spring rights. The model simulated greater than 50 feet of drawdown at claimed and unadjudicated Federal reserved rights associated with Unnamed Spring, Four Wheel Drive Spring, and Spring Creek Spring.[769] The Applicant entered into stipulations with the Federal Agencies and the U.S. Forest Service regarding these claimed reserved rights.[770] The State Engineer finds that any conflicts with Federal claims of reserved rights will be managed by the parties pursuant to those stipulations. However, regardless of the stipulations, if these claimed water rights are impacted by pumping pursuant to the Applications, the Applicant will also be required to address the impacts to the satisfaction of the State Engineer.

The model also simulated a reduction in spring flow greater than 15% at North and South Millick Springs, which are located on the valley floor.[771] There are CPB water rights on these springs. Also, Permits 10921 and 10993, not owned by CPB, have their source from North and South Millick Springs. While the model runs simulated a reduction of 15% at these springs, these springs were not included as calibration targets in the model and there is no certainty that this simulation is accurate.[772] The State Engineer notes that this drawdown may be exaggerated due to over-simulated pumping in the model and the lack of simulated geologic complexity on the valley floor. The State Engineer finds that there is a significant amount of monitoring occurring between these rights and the Application points of diversion, which will help detect the

[769] The Federal Reserve Water Rights Claims are R05274, R05237, R05269, R05272, R05278, R05279, R05280, R05292, R05292, R05292. Exhibit No. SNWA_337, p. 6-8. The State Engineer notes that none of these rights have been adjudicated. Transcript, Vol.11 p. 2590:4-7 (Watrus).
[770] Exhibit No. SE_041; Exhibit No. SE_095.
[771] Exhibit No. SNWA_337, p.6-8.
[772] Transcript, Vol.11, pp. 2591:23-2592:3 (Watrus).

spread of drawdown toward these rights for the purpose of preventing impacts or implementing mitigation measures, if needed.

c. **Stream Rights**

The final group of water rights analyzed is stream rights. The model simulated greater than 50 feet of drawdown at Cleve Creek, Bastian Creek, and Willard Creek.[773] Cleve Creek and Bastian Creek will be discussed in the Cleveland Ranch section below. The model simulated drawdown in excess of 50 feet at Willard Creek.[774] There are two senior water rights associated with Willard Creek, Permit 983 (Certificate 171) and Permit 1052 (Certificate 244).[775] The depth to groundwater in the vicinity of these rights is 14 feet and 80 feet, respectively.[776] CPB expert, Dr. Alan Mayo agreed that one of the requirements for impacts to stream rights from groundwater pumping is a saturated continuum between the stream and the groundwater table.[777] The parties did not dispute that there is no saturated continuum between the creek bed and the groundwater table. Therefore, the State Engineer finds that there will be no conflict with these existing water rights near Willard Creek.

The qualitative analysis results for the remaining steam rights owned by CPB are presented in later sections of this ruling.

d. **Environmental Areas of Interest**

There were a total of 36 environmental areas of interest within the model domain that were quantitatively analyzed. Only four of these environmental areas of interest were located in an area of Spring Valley where the model either simulated drawdown in excess of 50 feet or a spring discharge reduction in excess of 15%.[778] All of these springs will be monitored in accordance with the Management Plan and the Stipulated Agreements between the Applicant and the Federal Agencies and the U.S. Forest Service. A more detailed analysis of these areas of interest is included in the "Environmental Soundness" section of this ruling.

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[773] Exhibit No. SNWA_337, p. 6-10.
[774] Exhibit No. SNWA_337, p. 6-10.
[775] Exhibit No. SNWA_337, p. 6-10.
[776] Transcript, Vol.11 pp. 2594:19--2595:11 (Watrus).
[777] *See* Transcript, Vol.27 p. 6085:3-15 (Mayo).
[778] Exhibit No. SNWA_337, p. 6-12.

e. Cleveland Ranch and the Corporation of the Presiding Bishop of the Church of Jesus Christ of Latter-Day Saints Water Rights

The CPB filed protests to Applications 54009 - 54018 and 54020 - 54021, which are located in the vicinity of the CPB-owned Cleveland and Rogers Ranches in northern Spring Valley, Nevada.[779] The basis for each of the protests is the assertion that development of the Applications will conflict with CPB's existing rights associated with these ranches.[780] The general geographic locations of the CPB protested applications are shown on page 10 of CPB Exhibit 11.[781] In vacated Ruling 5726, the State Engineer denied Applications 54016, 54017, 54018 and 54021, which are located on the Cleve Creek alluvial fan.[782] The State Engineer found that the remaining applications were located in areas where the monitoring and mitigation plan would provide early warning of potential impacts to existing rights and provide for mitigation of unforeseen unreasonable impacts.[783]

Drs. Norman Jones and Alan Mayo testified on behalf of CPB regarding potential impacts on the CPB water rights. Dr. Jones was qualified as an expert in groundwater modeling, and Dr. Mayo was qualified as an expert in hydrogeology. The witnesses authored a report on the impacts of the Applications on CPB water rights.[784] The report uses the Applicant's groundwater model for all simulations, and includes drawdown maps and tables. Three modeling scenarios were used for the analysis: (1) a scenario representing the development of the full application volume for the Applications; (2) a scenario representing the development of the full application volume for all of the Applications except Applications 54016 - 54018 and 54021, which were previously denied; and (3) a scenario representing the development of the full application volume for all of the Applications except Applications 54009 - 54018 and 54020 - 54021 that were protested by CPB.[785] The pumping schedule was as provided by the Applicant: 35,000 afa of pumping from year 2028 to 2038, 64,544 afa from 2028 to 2042, and 91,222 afa from 2042 to 2242.

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[779] CPB Protests to Applications 54009-54018, and 54020-21 (filed March 28, 2011).
[780] CPB Protests to Applications 54009-54018, and 54020-21 (filed March 28, 2011).
[781] Exhibit No. CPB_011, p. 10.
[782] *See, vacated Ruling 5726*, p. 36.
[783] *See, vacated Ruling 5726*, p. 37.
[784] Exhibit No. CPB_011.
[785] Exhibit No. CPB_011, p. 22.

The use of the model for site specific analyses was criticized by the Applicant's experts as being beyond the ability of the model.[786] However, the model is recognized as providing potential drawdowns in the intermediate flow systems in the model area.[787] In describing what the model is not designed for, there is no mention of uses as provided by the CPB witnesses.[788] Furthermore, Dr. Mayo notes that the Applicant used the model in the same fashion, as documented in their conflicts analysis.[789] He agrees that site specific modeling results must be viewed with caution, but the collective results indicate substantial drawdown in areas of the Cleveland Ranch.[790]

South of the Cleve Creek alluvial fan, CPB has groundwater rights associated with Permits 18841, 18842, and 18843.[791] Groundwater Permits 18841 through 18843 were analyzed as part of the Applicant's conflicts analysis, where greater than 50 feet of drawdown is predicted after 50 years of pumping.[792] The wells corresponding to these water rights are listed as flowing under artesian pressure on the water right certificates.[793] The Applicant suggests the water bearing zones for these wells may be completely confined and insulated from the effects of pumping, i.e., drawdown would be much less that simulated.[794] The analyses of the CPB indicate a drawdown of approximately 160 feet after 200 years of pumping all wells, and approximately 80 feet of drawdown after 200 years of pumping all wells except the four on the Cleve Creek fan, what they call their "Minus4" scenario. The Minus4 scenario indicated approximately 40 to 50 feet of drawdown by the year 2117, 91 years after initiation of simulated pumping and 75 years after full pumping. The Protestant's expert testified that confining clay layers are unlikely to be laterally extensive to the extent that drawdown will not occur throughout the aquifer.[795] The State Engineer finds the Protestant's arguments and analyses more persuasive, and disagrees with the Applicant's witness that a local confining layer at a depth of less than 200 feet could prevent drawdown at this location for an extended period of Applicant's

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786 Exhibit No. SNWA_337, pp. 5-1 to 5-6; Transcript, Vol.9 p. 1909:7-10 (D'Agnese).
787 Exhibit No. SNWA_087, p. 2.
788 Exhibit No. SNWA_087, p. 2.
789 Transcript, Vol. 27, p. 6010; Exhibit No. SNWA_337.
790 Transcript, Vol. 27, p. 6010 - 6011 (Mayo).
791 Exhibit No. SNWA_337, Plate 1; Exhibit No. CPB_11, p. 5; V010073, V010074, V010075, V010076, V010077.
792 Exhibit No. SNWA_337, pp. 6-5, 6-7.
793 Exhibit No. SNWA_337, p. 6-5.
794 Exhibit No. SNWA_337, p. 6-5.
795 Transcript, Vol.27 pp. 6031 - 6032.

pumping. CPB and their expert witnesses and testimony have provided substantial evidence that Applications 54016, 54017, 54018 and 54021, on the Cleve Creek alluvial fan and up-gradient of numerous CPB water rights will impact those rights to the extent that mitigation is not possible or practical.

CPB recently filed vested claims for water rights on Unnamed Spring #7 and #8, South Bastian Spring, South Bastian Spring 2, and Layton Spring. Claimed Federal reserved water rights R05278, R05272 and R05269 are associated with or in the vicinity of Unnamed Springs in this area.[796] The claimed reserved rights are for 67.24, 67.24 and 3.59 acre-feet of spring discharge, respectively.[797] Pursuant to the Stipulation for Withdrawal of Protests between the Applicant and the Federal Agencies, a common goal of the Parties is "1) management of the development of groundwater by [the Applicant] in the Spring Valley HB without causing injury to Federal Water Rights..."[798] In accordance with the Stipulation, a monitoring plan was developed by the Applicant and approved by the State Engineer.[799] The Applicant's Plan incorporates all of the elements from the approved plan.[800] Under the approved plan, a piezometer was installed at Four Wheel Drive Spring, which is located a quarter mile from Unnamed Springs.[801] The vested rights to discharge from these springs have not been adjudicated; therefore, the State Engineer cannot determine whether the CPB has any right to the spring discharge from Unnamed Spring #7 and #8.[802] However, the State Engineer will treat the vested claims at face value, which could change upon adjudication. The State Engineer finds that the mandates of the required Management Plan will protect these rights. Finally, CPB has vested claims to water rights on South Bastian and Layton Springs. Both of these sites have been selected for monitoring.[803] Mr. Watrus testified that these monitoring efforts will help the Applicant determine the aquifer characteristics and the connection of these surface water features with groundwater development.[804] The State Engineer finds that the potentially impacted CPB water rights are or will be monitored and that this monitoring will allow for early warning of

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796 Exhibit No. SNWA_337, Plate 1.
797 Exhibit No. SNWA_337, pp. 6-8.
798 Exhibit No. SE_041, p. 3, G.
799 Exhibit No. SNWA_153.
800 Transcript, Vol.8 p. 1840:12-17 (Prieur).
801 Exhibit No. SNWA_337, p. 6-9.
802 Transcript, Vol.11 p. 2590:6-25 (Watrus).
803 Exhibit No. SE_095, Exhibit A, p. 5.
804 Transcript, Vol.11 pp. 2589:19-2590:25 (Watrus).