IN THE OFFICE OF THE STATE ENGINEER

OF THE STATE OF NEVADA

IN THE MATTER OF APPLICATIONS 53991 AND 53992 FILED TO APPROPRIATE THE UNDERGROUND WATERS OF THE DELAMAR VALLEY HYDROGRAPHIC BASIN (182) SITUATED IN LINCOLN COUNTY, NEVADA	))))))))	**SOUTHERN NEVADA WATER AUTHORITY'S PROPOSED DELAMAR VALLEY RULING**

GENERAL

I. DESCRIPTION OF APPLICATIONS

Application 53991 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 Delamar 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 SE1/4 NE1/4 of Section 4, T.5N., R.63E., M.D.B.&M, within Lincoln County.[1]

Application 53992 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 10 cfs of underground water from the Delamar 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 NE1/4 NE1/4 of Section 15, T.6N., R.64E., M.D.B.&M, within Lincoln County.[2]

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 Clark, Lincoln, Nye and White Pine Counties,

[1] Exhibit No. SE_046.
[2] Exhibit No. SE_047.

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.[3] The Applicant submitted evidence at the hearing that by the year 2028, approximately 3,374,000 people in southern Nevada will be the recipients of the water sought in Applications 53991 and 53992 (the "Applications").[4]

The Applications were originally filed by the LVVWD and are now held by the Southern Nevada Water Authority ("SNWA" or "Applicant").[5]

II. PROCEDURAL HISTORY

Many persons and entities protested the Applications during the original protest period, which ended in August, 1990 for Application 53991 and in July, 1990 for Application 53992. 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

[3] Administrative Records of the Nevada Division of Water Resources, Water Rights File for each Application.
[4] Exhibit Nos. SNWA_189, p. 5-4; SNWA_209, p. 64; SNWA_215, p. vi.
[5] Administrative Records of the Nevada Division of Water Resources, Water Rights File for each Application.

asked Protestants to declare their intent to formally participate in the pre-hearing conference and future administrative hearings.[6]

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 an order dated March 8, 2006, the State Engineer denied the request, noting that the 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.[7] The State Engineer scheduled a hearing on the Spring Valley applications to begin on September 11, 2006.[8] A hearing on the Delamar Valley Applications was not scheduled at that time.

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.[9] 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.[10]

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.[11] 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

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[6] *In re Applications 53987-53992 & 54003-54030*, State Eng'r Intermediate Order & Hearing Notice, p. 1 (March 8, 2006).
[7] *In re Applications 53987-53992 & 54003-54030*, State Eng'r Intermediate Order & Hearing Notice, p. 7 (March 8, 2006).
[8] *In re Applications 53987-53992 & 54003-54030*, State Eng'r Intermediate Order & Hearing Notice, p. 11 (March 8, 2006).
[9] *In re Applications 53987-53992 & 54003-54030*, Protestants' Pet. for Decl. Order (July 6, 2006).
[10] *In re Applications 54003-54021*, State Eng'r Intermediate Order No. 3, p. 2. (July 27, 2006).
[11] *Great Basin Water Network v. Taylor*, No. CV 0608119, Pet. for Judicial Review (7th Judicial Dist. Ct. Nev. Aug. 22, 2006).

and re-open the protest period did not violate due process and denied the petition for judicial review.[12] Some Protestants appealed the district court's order to the Supreme Court of Nevada.

On October 4, 2007, the State Engineer scheduled a hearing for the applications in Cave, Dry Lake, and Delamar valleys.[13] On January 7, 2008, 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 Cave, Dry Lake, and Delamar valleys applications in exchange for, among other things, implementation of monitoring, management, and mitigation plans.[14] The Moapa Band of Paiute Indians also entered into a stipulation with the Applicant to withdraw its protests.[15]

The State Engineer held hearings on the Cave, Dry Lake, and Delamar valleys applications from February 4, 2008 to February 15, 2008. On July 9, 2008, the State Engineer issued Ruling 5875, approving in part Applications 53987, 53988, 53991, and 53992 and approving in full Applications 53989 and 53990 subject to monitoring and mitigation requirements.[16]

Some Protestants petitioned for judicial review of the State Engineer's Ruling 5875 to the Seventh Judicial District Court of the State of Nevada. The district court vacated the State Engineer's ruling and remanded to the State Engineer for further proceedings on October 15,

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[12] *Great Basin Water Network v. Taylor*, No. CV 0608119, Order, pp. 9-12 (7th Judicial Dist. Ct. Nev. May 30, 2007).
[13] *In re Applications 53987-53992*, State Eng'r Intermediate Order No. 1 & Hearing Notice, p. 15 (Oct. 4, 2007).
[14] Exhibit No. SE_080.
[15] Exhibit No. SE_079.
[16] State Eng'r Ruling No. 5875, pp. 39-40 (July 9, 2008).

2009.[17] The State Engineer and the Applicant appealed the decision to the Supreme Court of Nevada.

On review of the district court's decision regarding the re-notice and re-opening of the protest period, 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.[18] 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.[19]

On June 17, 2010, the Supreme Court granted, in part, the Applicant's and State Engineer's request for rehearing.[20] 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.[21] The Supreme Court concluded that "the proper and most equitable remedy is that the State Engineer must re-notice the applications and reopen the protest period" and remanded the matter to district court with instructions to remand it to the State Engineer for further proceedings.[22] The Supreme Court noted that its decision on the notice and protest issue rendered the appeal of Ruling 5875 moot because the State Engineer must re-decide the Cave,

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[17] *Carter-Griffin Inc. v. Taylor*, No. CV 0830008, Order (7th Judicial Dist. Ct. Nev. Oct. 15, 2009).
[18] *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).
[19] *Great Basin Water Network v. Taylor*, 126 Nev. Adv. Op. 2, 222 P.3d 665, 672 (2010), *withdrawn and superseded by* 126 Nev. Adv. Op. 20, 234 P.3d 912 (2010).
[20] *Great Basin Water Network v. Taylor*, 126 Nev. Adv. Op. 20, 234 P.3d 912, 913 (2010).
[21] *Great Basin Water Network v. Taylor*, 126 Nev. Adv. Op. 20, 234 P.3d 912, 913-14 (2010).
[22] *Great Basin Water Network v. Taylor*, 126 Nev. Adv. Op. 20, 234 P.3d 912, 920 (2010).

Dry Lake, and Delamar valley applications. The Supreme Court therefore dismissed the appeal of the district court's order vacating Ruling 5875.[23]

On remand, Applications 53991 and 53992 were sent for publication 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 the Applications 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.[24] 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.[25] The State Engineer further ordered that Protestants wishing to put on a case in chief notify the State Engineer by April 29, 2011.[26] 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.[27] 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.[28]

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.[29] The State Engineer further ordered that pre-hearing motions must be served by September 2, 2011, and

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[23] *Southern Nevada Water Authority v. Carter-Griffin Inc.*, No. 54986, slip op. (Nev. Sept. 13, 2010).
[24] Exhibit No. SE_001, pp. 1, 3.
[25] Exhibit No. SE_001, p. 1.
[26] Exhibit No. SE_001, p. 3.
[27] Exhibit No. SE_001, p. 4.
[28] Exhibit No. SE_001, p. 5.
[29] Exhibit No. SE_100, p. 3.

responses must be served by September 14, 2011.[30] The State Engineer allowed the parties to file written opening statements by September 19, 2011.[31] The State Engineer allowed the parties to file written closing briefs by December 23, 2011, and to file proposed rulings by January 27, 2012.[32] 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 valleys applications between September 26, 2011 until November 18, 2011.

III. LIST OF PROTESTANTS

Applications 53991 and 53992 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 protests were filed. The Applications were protested by the following persons as identified below:

In 1990 Application 53991 was protested by: Wess D. Mecham; George T. Rowe; Rosemary Maxwell; U.S. Bureau of Land Management; Helen Barton; Marian Lawrence; Stanley L. Wallis; John M. Wadsworth; County of Inyo, California; Pahranagat Valley Joint Services Board; Glenn Van Roekel; Town of Alamo Water and Sewer Board; City of Caliente; Joseph C. Fox Jr.; Wesley A. Holt; County of White Pine and City of Ely; Moapa Band of Paiute Indians; U.S. Fish and Wildlife Service; County of Nye; U.S. National Park Service; Unincorporated Town of Pahrump; Frank R. Wheeler;[33] and the Lincoln County Board of County Commissioners.[34]

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[30] Exhibit No. SE_100, p. 5.
[31] Exhibit No. SE_100, p. 6
[32] Exhibit No. SE_100, p. 7.
[33] Exhibit No. SE_052.
[34] Administrative Records of the Nevada Division of Water Resources, Water Rights file for Application 53991.

In 2011, Application 53991 was protested by: Col. James R. Byrne; Great Basin Water Network, et al; Defenders of Wildlife; Confederated Tribes of the Goshute Reservation; County of White Pine and City of Ely (Amended Protest); Ely Shoshone Tribe; Duckwater Shoshone Tribe; Central Nevada Regional Water Authority; County of Inyo, California (Amended Protest); Elko Band Council; Roderick G. McKenzie; Launce Rake, Preston Irrigation Co.; Nevada Department of Wildlife; and Toiyabe Chapter of the Sierra Club.[35]

In 1990 Application 53992 was protested by: U.S. Bureau of Land Management; Mariba Singleton; Charlotte M. Wallis; John M. Wadsworth; County of Inyo, California; Rose DeVuono; City of Caliente; Corporation of the Presiding Bishop of the Church of Jesus Christ of Latter-Day Saints dba Delamar Valley Cattle; Ely Shoshone Tribe; Wesley A. Holt; Lund Irrigation and Water Co.; County of White Pine and City of Ely; Moapa Band of Paiute Indians; U.S. Fish and Wildlife Service; County of Nye; U.S. National Park Service; and Unincorporated Town of Pahrump,[36] and the Lincoln County Board of County Commissioners.[37]

In 2011, Application 53992 was protested by: Col. James R. Byrne; Great Basin Water Network, et al; Defenders of Wildlife; Confederated Tribes of the Goshute Reservation; County of White Pine and City of Ely (Amended Protest); Ely Shoshone Tribe; Rob Mrowka; Duckwater Shoshone Tribe; Central Nevada Regional Water Authority; County of Inyo, California (Amended Protest); Elko Band Council; Great Basin Business & Tourism Council; Terry P. and Debra J. Steadman; Nevada Department of Wildlife; Toiyabe Chapter of the Sierra Club.[38]

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[35] Exhibit No. SE_058.
[36] Exhibit No. SE_053.
[37] Administrative Records of the Nevada Division of Water Resources, Water Rights file for Application 53992.
[38] Exhibit No. SE_059.

IV. WITHDRAWN PROTESTS

Of the above listed protests, several were later withdrawn for various reasons. As per 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.[39] As per the Stipulation for Withdrawal of Protests dated January 9, 2008, the protests by Moapa Band of Paiute Indians were withdrawn.[40] As per the Stipulation for Withdrawal of Protests dated January 7, 2008,[41] the protests by U.S. Fish and Wildlife Service, Bureau of Land Management, Bureau of Indian Affairs, and the National Park Service, were withdrawn on February 4, 2008.[42] As per the letter dated October 26, 2011, the Corporation of Presiding Bishop of the Church of Jesus Christ of Latter-Day Saints DBA Delamar Valley Cattle withdrew its protest to Application 53992.[43]

V. PARTICIPATING PROTESTANTS

The participants in the hearing that protested Applications 53991 and 53992 are: Confederated Tribes of the Goshute Reservation; Duckwater Shoshone Tribe; Ely Shoshone Tribe; Nye County, Nevada; Great Basin Water Network, et al. (GBWN); Defenders of Wildlife (with GBWN); Great Basin Business & Tourism Council (with GBWN); Inyo County, California (with GBWN); Launce Rake (with GBWN); Lund Irrigation & Water Co. (with GBWN); Preston Irrigation Co.(with GBWN); Roderick G. McKenzie (with GBWN); Terry and

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[39] Administrative Records of the Nevada Division of Water Resources, *see* agreement dated April 17, 2003, and recorded June 19, 2003 under Document Number 120355 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.
[40] Exhibit No. SE_079.
[41] Exhibit No. SE_080.
[42] Exhibit No. SE_081.
[43] Administrative Records of the Nevada Division of Water Resources, See letter dated October 26, 2011 RE: SNWA Application Number 53992 (Delamar Valley)

Debora Steadman (with GBWN); Toiyabe Chapter of the Sierra Club (with GBWN); and White Pine County and the City of Ely (with GBWN).[44]

VI. SUMMARY OF PROTEST GROUNDS

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

1. The Protestants claim that 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. The Protestants allege that, 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. They argue that 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.

3. The Protestants feel that the Applicant has not implemented a sufficient conservation plan in the proposed place of use or to protect the affected basins and claim that

[44] Exhibit Nos. SE_100, SE_052, SE_053, SE_058, SE_059

current conservation programs instituted by the Applicant are ineffective public-relations oriented efforts that are unlikely to achieve substantial water savings. It was also asserted that the Applications should be denied because the current per capita water consumption rate of the Las Vegas area is double that of other southwestern municipalities.

4. The appropriation and export of water proposed in the Applications is claimed by the Protestants to be detrimental to the public interest on environmental grounds in the basin of origin and in hydrologically connected and/or downwind basins, due to: harm to wildlife and wildlife habitat, degradation of air quality (dust storms), destruction of recreational and aesthetic values, degradation of water quality, degradation of cultural resources, harm to state wildlife management areas and parks and state and federal wildlife refuges and parks.

5. Protestants note that it is the public policy of the State of Nevada, per Governor Bob Miller's January 25, 1990, State of the State Address, to protect Nevada's environment, even at the expense of growth.

6. The granting or approval of the Applications is also asserted by the Protestants to be detrimental to the public interest in that it, individually and together with other applications of the water importation project, would jeopardize and harm endangered and threatened species, interfere with the conservation of those threatened or endangered species; and generally interfere with the purpose for which the federal lands are managed under federal statutes.

7. Protestants fear 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.

8. Protestants Town of Alamo Sewer Board and Pahranagat Valley Joint Services Board feel that a lowered water table would have tremendous impacts on the vegetative resources of Pahranagat Valley. They state that the valley provides important wildlife habitat including the only greenbelt and wetlands within the entire region and that loss of this vegetation would result in critical loss of diversity of both plant and wildlife species.

9. Protestants Town of Alamo Sewer Board and Pahranagat Valley Joint Services Board state that this is a major water importation project, comparable to Los Angeles Water and Power's water importation project from Owens Valley and Mono Basin during the early 1900's. They allege that the ramifications of approval of Application Number 53991 would result in "by far the greatest irreversible and irretrievable commitment of resources of any project ever proposed in the State of Nevada."

10. It is stated on several protests that air pollution in Las Vegas Valley is so bad that the valley has been classified a non-attainment area for national and state ambient air-quality standards. Some Protestants feel that the State Engineer should deny the Applications and the other applications associated with the water importation project since more water means more growth, and therefore more air pollution.

11. Several Protestants feel that appropriation in Delamar Valley, when added to the already approved appropriations and dedicated users in Basin 202, Pahranagat Valley, will exceed the annual recharge and safe yield of the basin.

12. It is stated on most protests that the appropriation of this water when added to the already approved appropriations and existing uses and water rights in the host water basin will exceed the annual recharge and safe yield of the basin.

13. Many Protestants also state that the granting or approval of the Applications would sanction water mining.

14. It is also stated in some protests that 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.

15. Many Protestants feel that there is insufficient unappropriated groundwater in the groundwater water basin to provide the water sought in the Applications and all other pending applications involving the utilization of surface and groundwater from the basin

16. Many Protestants state that appropriation and use of the requested water will lower the water table, degrade the quality of water from existing wells, cause negative hydraulic gradient influences, and threaten springs, seeps and phreatophytes which provide water and habitat that are critical to the survival of wildlife and grazing livestock, in the basins of origin and surrounding valleys including Basin 202 and areas in Inyo County, California.

17. The protests filed by the Confederated Tribes of the Goshute Reservation, the Ely Shoshone Tribe, and the Duckwater Shoshone Tribe, state that the appropriation and proposed use would violate the tribes' reserved water rights.

18. Charlotte Wallis is concerned for the water rights of her mother-in-law Grace Wallis to a hot spring, which is her main source of income. She states that "the hot springs also heats homes in the winter time, many for senior citizens. The geologic study in 1980 when dyes

were used at our location showed up later in Ash Springs." She further fears that taking away water from Delamar Valley will reduce water in their wells. She states that without further study, the granting of water rights will be detrimental to the water rights they already have.

19. Protestant Nye County, Nevada, likens the Applications to the dewatering processes of the mining industry. It states that unlike mining, the Applications 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.

20. While the Applications are located in Delamar Valley, some Protestants state that 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.

21. The protest filed by Col. James R. Byrne states that the Applications should be denied because of potential impacts to the Indian Springs Valley Basin, which is already over allocated. Protestant Col. James R. Byrne feels that such impacts may harm rights owned by the U.S. Air Force in the Indian Springs Valley Basin.

22. Protestant John Wadsworth states that Panaca Big Spring comes from deep aquifers and this appropriation would very likely be detrimental to the spring.

23. Protestants the Town of Alamo Sewer Board and Pahranagat Valley Joint Services Board state that "In the Pahranagat Valley surface spring discharges total approximately 25,000 acre-feet per year (NDWR, 1990), and annual recharge from precipitation may be as high as 1,800 acre-feet (Eakin, 1963), or as low as 1,000 acre-feet (NDWR, 1990). A detailed

research analysis is necessary to determine if the water resources of the Pahranagat Valley are part of a much larger groundwater regime."

24. Protestants the Town of Alamo Sewer Board and Pahranagat Valley Joint Services Board state that Application 53991 is located near Pahranagat Valley and Pahranagat Valley Joint Services Board ("PVJSB") wells serving the Town of Alamo. They feel that drawdown may occur in PVJSB wells, in other Pahranagat Valley wells and Delmar Valley, if the applications are approved. This could result in wells having to be drilled deeper or even moved to maintain production. They further fear that water quality could be degraded. If true, all of this would cause considerable hardship and additional expense to the PVJSB.

25. Protestants the Town of Alamo Sewer Board and Pahranagat Valley Joint Services Board also feel that granting Application 53991 would preclude increased usage by any of the current users over existing rights, as it is seeking appropriation of all unappropriated water. There would be no water available for expanding existing uses, or for new users. Community growth in Alamo could be severely curtailed or made prohibitively expensive.

26. Protestants the Town of Alamo Sewer Board and Pahranagat Valley Joint Services Board also state that the Town of Alamo water system currently faces severe deficiencies in both water quantity and quality. They say that it is currently unknown if there is sufficient water resources to correct the system and to provide for future growth. They state that the "water mining" of the Pahranagat Valley by the Applicant could severely impact the existing community water system both now and in the future.

27. Protestants the Town of Alamo Sewer Board and Pahranagat Valley Joint Services Board are further concerned about the ecosystems of Ash, Hiko and Crystal Springs, which support federally listed threatened and endangered species. They feel that impacts to

these springs need to be fully analyzed regarding potential impacts from the proposed water exportation project.

28. Protestant Nye County, Nevada, claims that 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. It feels that the subject Applications should be denied because the public has been denied relevant information and due process because of the stated confusion.

29. It was claimed by several Protestants that 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. It is also stated by some that 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.

30. It is stated in many protests that inasmuch as 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.

31. Nye County, Nevada, Unincorporated Town of Pahrump, Nevada, and the City of Caliente, Nevada, feel that 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 (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.

32. Lund Irrigation Company, in its protest, feels that sufficient information about the deep water aquifers and the interaction between the various levels of aquifers does not presently exist to allow an intelligent judgment as to what effects the granting of the Applications may have on the several (five) springs that supply their systems.

33. Protestants the Town of Alamo Sewer Board and Pahranagat Valley Joint Services Board feel that numerous impacts are possible which must be addressed and analyzed prior to any action on the Applications.

34. Many Protestants state that since the Applicant has a duplicative application filed in 2010 in this basin, that a duplicative hearing for the same groundwater may be required in the future.

35. Many Protestants claim that 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.

36. Many Protestants also claim that the Applicant has not shown a need for the water or the feasibility (technical and financial) of the water-importation project. Many further claim 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."

37. Some Protestants also state that 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.

38. Nye County, Nevada, in its protests, feels that 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.

39. Protestant Nye County, Nevada, also states that "The above-referenced Application and the other applications associated with 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 re-use, etc.) should be developed and assigned to the water-short lots and units."

40. Many Protestants state that "the proposed action is not an appropriate long-term use of Nevada's water."

41. Protestant Nye County, Nevada, feels that the Applications should be outright denied because the State Engineer has previously denied other applications for water from the basin.

42. Protestants Nye County, Nevada, Unincorporated Town of Pahrump, Nevada, the City of Caliente, Nevada, and Glenn Roekel state that the granting of 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.

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

44. Confederated Tribes of the Goshute Reservation, the Ely Shoshone Tribe, and the Duckwater Shoshone Tribe also claim 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.

45. Confederated Tribes of the Goshute Reservation, the Ely Shoshone Tribe, and the Duckwater Shoshone Tribe state 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.

46. Confederated Tribes of the Goshute Reservation, the Ely Shoshone Tribe, and the Duckwater Shoshone Tribe also feel that the appropriation and proposed use under the applications would violate the tribes' rights under the Treaty of 1863 in Ruby Valley.

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 argued that this report should be excluded because: 1) the authoring expert would not testify and be subject to cross-examination; 2) no traditional hearsay exception applied; 3) admission would violate the State Engineer's regulations; 4) the report is not subject to administrative notice; and 5) the report is unfit as an expert report without testimony of the author.

The Applicant also 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 argued that these reports should be excluded because: 1) the authoring experts would not testify and be subject to cross-examination; 2) Ms. Hutchins-Cabibi was not qualified as an expert in the prior hearing and her report was not qualified as an expert report; 3) no traditional hearsay exception applied; 4) admission would violate the State Engineer's regulations; and 5) the reports are not subject to administrative notice.

The Applicant also 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. The Applicant argued that these reports should be excluded because: 1) the authoring experts would not testify and be subject to cross-examination; 2) no traditional hearsay exception applied; 3) admission would violate the State Engineer's regulations; and 4) the reports are not subject to administrative notice.

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 Applicant generally argued that these witnesses and reports were not rebuttal material and should have been disclosed during the initial evidentiary exchange and that CPB Exhibit 11 (Jones and Mayo report) was untimely exchanged. The Corporation of the Presiding Bishop, 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).[45] 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).[46] The State Engineer denied the Applicant's motion to exclude Spring Valley

[45] Exhibit No. SE_090, p. 7.
[46] Exhibit No. SE_090, p. 10.

Exhibit 3040 (Lanner report), but also noted that only the first page of the exhibit is admissible.[47] 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).[48]

VIII. STATUTORY STANDARD TO GRANT

The State Engineer finds that NRS 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 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

The State Engineer finds that NRS 533.370(5) (2010)[49] 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.

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[47] Exhibit No. SE_090, p. 12.
[48] Exhibit No. SE_090, p. 13.
[49] NRS 533.370(5) (2010) was moved to subsection (2) by 2011 Nev. Stat. Ch. 166. For ease of reference, for those statutes that were amended by the Nevada Legislature in 2011, the citation numbering used here will refer to the more familiar 2010 numbering instead of using the updated 2011 numbering. Citations without a "(2010)" designation have the same numbering in the 2010 and 2011 version of the statutes.

X. STATUTORY STANDARD FOR INTERBASIN TRANSFERS

The State Engineer finds that NRS 533.370(6) (2010)[50] provides that in determining whether an application for an interbasin transfer of groundwater must be rejected, 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 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; (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.

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.[51] Beneficial use is the basis, the measure and the limit of the right to the use of water in the State of Nevada.[52]

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

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[50] NRS 533.370(6) (2010) was moved to subsection (3) by 2011 Nev. Stat. Ch. 166. For ease of reference, for those statutes that were amended by the Nevada Legislature in 2011, the citation numbering used here will refer to the more familiar 2010 numbering instead of using the updated 2011 numbering. Citations without a "(2010)" designation have the same numbering in the 2010 and 2011 version of the statutes.
[51] *See* NRS 533.030(1); NRS 533.035; NRS 533.045; NRS 533.060(1); NRS 533.070(1); NRS 533.370(6)(a) (2010).
[52] NRS 533.035.

"water development and necessity of the Project"[53]; (3) John Entsminger, the Applicant's Senior Deputy General Manager, an expert in "Colorado River water resources"[54]; 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."[55] These witnesses have all been responsible for managing Southern Nevada's water resource 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.[56]

The Protestants presented the following witness who testified regarding Southern Nevada's need for this water: Dr. Peter Gleick, President of the Pacific Institute, an expert in "water conservation and efficiency." 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.[57]

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.[58] 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.[59] Public advisory committees in Southern Nevada have determined that Southern

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[53] Transcript, Vol.1 p. 174:7-8 (State Engineer).
[54] Transcript, Vol.1 p. 191:1-3 (State Engineer).
[55] Transcript, Vol.1 p. 186:22-24 (State Engineer).
[56] Transcript, Vol.2 p. 328:1-4 (Holmes); p. 345:14-18 (Brothers); p. 347:3-20 (Entsminger).
[57] Transcript, Vol.23 pp. 5127:22-5128:25 (Gleick).
[58] Exhibit No. SNWA_189, p. 2-1.
[59] Exhibit Nos. SNWA_223; SNWA_224; SNWA_225; SNWA_226; SNWA_227; SNWA_228; SNWA_229.

Nevada needs this water and have recommended that the Applicant develop the project associated with the Applications.[60] The Applicant's board of directors has determined that the Applicant needs this water and has directed staff to pursue permitting of the Applications.[61]

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 Mexico. The Colorado River is divided into an upper basin and a lower basin, each of which is allocated 7.5 million acre-feet annually ("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.[62] 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.[63]

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[60] Exhibit No. SNWA_209, Appendix 2; Exhibit No. SNWA_201; Transcript, Vol.1 pp. 225:11-228:6 (Brothers).
[61] Exhibit No. SNWA_211; Transcript, Vol.1 pp. 235:25-236:4 (Brothers).
[62] Transcript, Vol.2 p. 262:24-25 (Entsminger).
[63] Transcript, Vol.2 p. 264:6-8 (Entsminger).

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.[64] 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.[65]

Southern Nevada is almost entirely dependent on the Colorado River as it supplies 90% of Southern Nevada's water.[66] 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.[67] 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.[68] 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.[69] 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.[70] 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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[64] Exhibit No. SNWA_189, p. 8-2, Figure 8-1; Transcript, Vol.2 p. 264:11-13 (Entsminger).
[65] Exhibit No. SNWA_189, p. 8-2, Figure 8-1; Transcript, Vol.2 p. 264:14-16 (Entsminger).
[66] Exhibit No. SNWA_189, p. 7-1; Transcript, Vol.2 p. 260:20-22 (Entsminger).
[67] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 261:13-16 (Entsminger).
[68] Exhibit No. SNWA_189, pp. 3-1, 3-4.
[69] Exhibit No. SNWA_189, p. 3-4.
[70] 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.[71]

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.[72] The water level elevation in Lake Mead dropped by roughly 130-140 feet.[73] 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.[74] As a point of reference, that reduction is equal to Nevada's Colorado River allocation for a period of 50 years.[75] 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.[76]

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.[77] 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

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[71] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 282:2-16 (Entsminger).
[72] Exhibit No. SNWA_232; Transcript, Vol.2 pp. 266:19-22 (Entsminger).
[73] Exhibit No. SNWA_189, p. 7-1; Exhibit No. SNWA_232; Transcript, Vol.1 p. 194:25 (Holmes).
[74] Exhibit No. SNWA_189, p. 7-1; Exhibit No. SNWA_403; Transcript, Vol.1 p. 195:2-6 (Holmes).
[75] Transcript, Vol.1 p. 195:6-9 (Holmes).
[76] Transcript, Vol.2 pp. 266:23-267:3 (Entsminger).
[77] Exhibit Nos. SNWA_189, p. 2-2; SNWA_203; SNWA_204; Transcript, Vol.2 pp. 269:9-272:11 (Entsminger).

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.[78] The amounts of those reductions are uncertain but are anticipated to be significantly larger than those quantified in existing agreements.[79]

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.[80] 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.[81] Furthermore, if Lake Mead elevation levels drop below 1,000 feet, which is the operational limit of the Applicant's pumping intake facilities, the Applicant might not be able to withdraw any of its Colorado River water from Lake Mead.[82] 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.[83]

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,

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[78] Exhibit No. SNWA_189, p. 6-3; Transcript, Vol.2 pp. 269:19-21, 277:11-17 (Entsminger).
[79] Exhibit No. SNWA_189, p. 1-2; Transcript, Vol.2 p. 277:11-17 (Entsminger).
[80] Exhibit No. SNWA_189, p. 2-3; Transcript, Vol.2 p. 414:4-9 (Entsminger).
[81] Transcript, Vol.2 pp. 303:13-15, 414:20-415:1 (Entsminger).
[82] Exhibit No. SNWA_189, p. 7-2.
[83] Exhibit No. SNWA_189, p. 8-4; Transcript, Vol.2 p. 269:3-6 (Entsminger).

occurred on the Colorado River system.[84] 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.[85] 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.[86] The Applicant has estimated, using a Bureau of Reclamation model, that based on past flow records, there is a 40 percent probability by 2020 and a 50 percent probability by 2025 that in any given year the lower basin will be in shortage,[87] 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 which state that the Colorado River basin is expected to warm between 5-6 degrees Fahrenheit during the 21st century which could have significant effects on the availability of water supplies.[88] 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.[89] 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.[90] When the upper basin states begin using that water, it will no longer flow to Lake Mead. There is a strong

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[84] Transcript, Vol.2 p. 268:10-12 (Entsminger).
[85] Transcript, Vol.2 pp. 267:24-268:5 (Entsminger), 333:14-21 (Brothers).
[86] Exhibit No. SNWA_189, pp. 7-2 to 7-3, Figure 7-1; Transcript, Vol.2 p. 334:4-9 (Brothers).
[87] Exhibit No. SNWA_189, pp. 7-2, A-5, A-6, Figure A-2.
[88] Exhibit No. SNWA_237, p. 25.
[89] Exhibit No. SNWA_189, p. 7-2; Transcript, Vol.2 pp. 335:21-336:20 (Brothers).
[90] Transcript, Vol.2 p. 336:18-22 (Brothers).

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.[91] The Bureau of Reclamation uses the CRSS model to evaluate long-term policy and address long-term planning for the Colorado River system.[92] 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."[93] CRSS allows the Bureau of Reclamation to evaluate proposed operating policies over a broad range of possible future hydrologic conditions.[94] 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 percent probability by 2020, and a 50 percent 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.[95] The CRSS model results show a 50 percent probability of shortage by 2035, with the probability of shortage reaching upwards of 60 percent by 2060.[96] 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-

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[91] Exhibit No. SNWA_189, p. A-1; Transcript, Vol.2 p. 337:4-11 (Brothers).
[92] Exhibit No. SNWA_189, p. A-1.
[93] Exhibit No. SNWA_189, p. A-1 to A-2.
[94] Exhibit No. SNWA_189, p. A-2.
[95] Exhibit No. SNWA_189, pp. A-5, A-6, Figure A-2.
[96] Exhibit No. SNWA_189, p. A-6, Figure A-2; Transcript, Vol.2 p. 339:10-13 (Brothers).

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.[97] That means that the CRSS model predicts on average that 30 years of shortage will occur during the Applicant's 50 year planning period.[98]

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.[99] 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.[100] 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).[101] 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.[102] 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

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[97] Exhibit No. SNWA_189, pp. A-5 to A-6.
[98] Exhibit No. SNWA_189, p. A-6, Table A-1; Transcript, Vol.2 p.340:16-21 (Brothers).
[99] Exhibit No. SNWA_189, Appendix A.
[100] Exhibit No. SNWA_189, Appendix A, pp. A-3 to A-5.
[101] Exhibit No. SNWA_189, p. 8-4; Transcript, Vol.2 p. 343:14-20 (Brothers).
[102] Exhibit No. SNWA_189, p. 8-4.

be taking emergency measures to deliver water from Lake Mead and the viability of those emergency measures is unknown.[103]

The Applicant's analysis graphically demonstrates the amount of water that the Applicant estimates could be available under shortage conditions on the Colorado River.[104] 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.[105] The assumptions in the Applicant's analysis may overestimate or underestimate 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.[106] 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.

Southern Nevada needs a water resource that is independent of the Colorado River. The State Engineer agrees with the Applicant 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

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[103] Exhibit No. SNWA_189, p. 8-4.
[104] Exhibit No. SNWA_189, p. 8-5, Figure 8-5.
[105] Exhibit No. SNWA_189, pp. A-10 to A-12.
[106] Transcript, Vol.2 p. 267:18-23 (Entsminger).

is over-appropriated, highly susceptible to drought and shortage, and almost certain to provide significantly less water to Southern Nevada in the future.[107]

B. Meeting Projected Demand

Even under normal (non-shortage) conditions on the Colorado River, the Applicant presented evidence to support a conclusion 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.[108] 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 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.[109] 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.[110] 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.[111] The current Water Resource Plan was revised in 2009 and that version was adopted without revision in 2010 and 2011.[112] 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

[107] Transcript, Vol.2 pp. 267:18-268:12 (Entsminger), 334:4-335:15, 345:14-18 (Brothers).
[108] Exhibit No. SNWA_209.
[109] Transcript, Vol.2 pp. 307:19-308:5 (Holmes).
[110] Transcript, Vol.2 p. 308:6-15 (Holmes).
[111] Transcript, Vol.2 p. 249:13-18 (Entsminger).
[112] Transcript, Vol.2 p. 250:1-16 (Entsminger).

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.[113] 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.[114] The State Engineer finds that the evidence demonstrates that without the water requested in these Applications, available resources 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.[115] 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 water, Las Vegas Valley groundwater, and other in-state groundwater.[116] Temporary supplies are one-time use resources that are not replenished and are used as a bridge until permanent

[113] Exhibit No. SNWA_209, p. 43, Figure 28.
[114] Exhibit No. SNWA_189.
[115] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 251:16-18 (Entsminger).
[116] Exhibit No. SNWA_189, pp. 3-1 to 3-3; Exhibit No. SNWA_209; Transcript, Vol.2 pp. 248-306 (Entsminger).

supplies can be developed.[117] Temporary supplies available to the Applicant include Brock Reservoir System Efficiency ICS water, Arizona banked water, California banked water, and Southern Nevada banked water.[118] 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,[119] as well as a total of 50,000 afa of Virgin/Muddy River Tributary Conservation ICS water. [120] The Applicant expects to develop some 9,000 afa of Coyote Spring Valley groundwater Imported ICS.[121] There are 46,340 afa available from Las Vegas Valley groundwater rights held by the City of North Las Vegas and LVVWD.[122] The Applicant expects to receive 40,000 afa from the Arizona water bank during the planning period. [123] Conservation savings are also considered a permanent water supply and conservation is built into the demand-line as further discussed below.[124] The Applicant expects to achieve conservation savings of more than 276,000 afa by 2035.[125] Finally, the Applicant

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[117] Exhibit No. SNWA_189, p. 3-3; Transcript, Vol.2 pp. 251:19-22 (Entsminger).
[118] Exhibit No. SNWA_189, pp. 3-3 to 3-5; Exhibit No. SNWA_209; Transcript, Vol.2 pp. 248-306 (Entsminger).
[119] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 261:13-16 (Entsminger).
[120] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 293:6-23 (Entsminger).
[121] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 294:15-18 (Entsminger).
[122] Exhibit No. SNWA_189, p. 3-2; Transcript, Vol.2 p. 255:5-17 (Entsminger).
[123] Exhibit No. SNWA_189, p. 3-4; Exhibit No. SNWA_209, p. 26.
[124] Exhibit No. SNWA_189, p. 3-3; Transcript, Vol.2 pp. 254:22-255:4 (Entsminger).
[125] Exhibit No. SNWA_189, p. 6-1, Figure 6-1; Exhibit No. SNWA_209, p. 39, Figure 24.

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 Applications.[126] The Applicant expects that it will continue to use return flow credits to extend available water supplies by roughly 70 percent.[127]

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.[128] 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. There is no evidence that the Applicant has available supplies that are not included in the Water Resource Plan. 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 and reliable for water planning purposes.

2. <u>Projected Demand</u>

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.[129] In the event that a municipal water provider under-forecasts demand, it may be difficult to correct that failure due to the long lead

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[126] Exhibit No. SNWA_189, p. 3-2.
[127] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 pp. 289:3-290:5 (Entsminger).
[128] Exhibit No. SNWA_189, p. 4-9, Figure 4-9; Exhibit No. SNWA_209, p. 43, Figure 28.
[129] Transcript, Vol.2 pp. 312:11-313:1 (Holmes).

time involved in capital construction projects.[130] 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. CBER forecasts are based on a regional economic model that is widely accepted throughout the United States.[131] CBER has monitored the Clark County economy for more than 25 years and has prepared population forecasts annually since the 1990's.[132] The Applicant has used CBER forecasts for every Water Resource Plan that it has adopted since 1996.[133] 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.[134] To protect against under-forecasting population, the Applicant conducts a continuous independent review of the CBER forecast and staff

[130] Transcript, Vol.2 p. 312:11-13 (Holmes).
[131] Exhibit No. SNWA_189, p. 5-1; Transcript, Vol.2 p. 311:15-16 (Holmes).
[132] Exhibit No. SNWA_189, p. 5-1; Transcript, Vol.2 pp. 310:24-311:22 (Holmes).
[133] Exhibit No. SNWA_189, p. 5-1.
[134] Exhibit No. SNWA_189, p. 5-2.

demographers make adjustments for water planning purposes.[135] 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.[136]

In the short-term, there is a high degree of uncertainty regarding the population increases that will occur in Southern Nevada. However, a comparison of the CBER forecasts from 2008 and 2010, the Applicant adjusted forecasts in its current Water Resource Plan and the Nevada State Demographer's forecasts from 2010 demonstrates that population forecasts converge in the long-term.[137] This means that although the current economic downturn has injected uncertainty into near-term population growth, in the long-term, the various population projections converge to show a movement toward consensus on projected long-term population growth. Southern Nevada was one of the fastest growing regions in the country leading up to the current economic downturn.[138] Southwestern states are expected to continue to experience some of the fastest population growth in the country over the next 30-40 years.[139] Water managers focus on long-term population forecasts for water planning purposes.[140] The evidence supports a conclusion that, 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.

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[135] Exhibit No. SNWA_189, p. 5-2; Transcript, Vol.2 pp. 312:17-313:1 (Holmes).
[136] Exhibit No. SNWA_189, p. 5-2; Transcript, Vol.2 p. 313:4-16 (Holmes).
[137] Exhibit No. SNWA_189, p. 5-4, Figure 5-1; Transcript, Vol.2 pp. 314:1-316:1 (Holmes).
[138] Exhibit No. SNWA_189, pp. 5-4 to 5-5;
[139] Exhibit No. SNWA_189, p. 5-5; Transcript, Vol.2 p. 318:15-22 (Holmes).
[140] Transcript, Vol.2 p. 317:3-8 (Holmes).

The Protestants claim that the Applicant is overestimating population increases in light of recent economic and demographic trends.[141] One report states "future demand projections 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."[142] During testimony, one of the witnesses for the Protestants stated that one of the factors that could eliminate need for the water is if population reached 3,130,000 by 2035.[143] However, no evidence was presented to support that number and the Protestants have not provided alternative population projections for the State Engineer to consider. The State Engineer recognizes that actual population increases may diverge from the population forecasts provided by the Applicant. However, the State Engineer also recognizes that actual population increases could be greater than forecasted, and there is no reliable evidence that actual population will be substantially less than the Applicant's forecasts. From the perspective of a water manager, the risk of underestimating 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 reasonable and therefore 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.[144]

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[141] Transcript, Vol.23 p. 5098:17-20 (Gleick).
[142] Exhibit No. GBWN_069, p. 5.
[143] Transcript, Vol.23 pp. 5124:22-5125:3 (Gleick).
[144] Exhibit No. SNWA_189, p. 5-1; Transcript, Vol.2 p. 309:12-17 (Holmes).

The Applicant uses GPCD to measure and compare its water use over time.[145] There is currently no standard measuring system for comparing water use between communities.[146] 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.[147] While no formal evaluation has been conducted, there is evidence 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.[148] Despite those limitations, GPCD is an effective tool for an individual community to use as a yardstick against its own water use.[149]

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 decreased from 344 to 240 due largely to intensive conservation efforts.[150] In 2009, the Applicant set a conservation goal of 199 GPCD by 2035.[151] The Applicant believes that conservation goal is "challenging" but also "realistic."[152] The demand forecast in the

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[145] Exhibit No. SNWA_189, p. 5-1.
[146] Transcript, Vol.1 pp. 107:16-109:16 (Mulroy); Transcript, Vol.2 p. 321:10-23 (Holmes).
[147] Exhibit Nos. SNWA_189, p. 5-1; SNWA_015, p. 66; SNWA_397, p. 8; Transcript, Vol.2 pp. 321:24-323:6 (Holmes).
[148] Transcript, Vol.2 pp. 322:10-13 (Holmes); Transcript, Vol.23 pp. 5204:15-5205:9 (Gleick).
[149] Exhibit No. SNWA_189, p. 5-1.
[150] Exhibit No. SNWA_189, p. 5-2.
[151] Exhibit No. SNWA_189, 5-2; Exhibit No. SNWA_004, p. 8-1; Transcript, Vol.2 p. 320:17-20 (Holmes).
[152] Transcript, Vol.2 p. 320:21-25 (Holmes).

Applicant's Water Resource Plan incorporates the conservation goal established in 2009 to achieve 199 GPCD by 2035.[153]

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.[154] However, as explained above, GPCD cannot be used to 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.[155] Additional conservation savings will be necessary to achieve the goal of 199 GPCD by 2035.[156] 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.[157] 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. Projected Shortfall

[153] Exhibit No. SNWA_209, p. 39.
[154] Transcript, Vol.23 pp. 5100:16-20, 5124:22-25 (Gleick).
[155] Exhibit No. SNWA_189, p. 5-2.
[156] Exhibit No. SNWA_189, p. 5-2.
[157] Transcript, Vol.4 p. 896:4-7 (Bennett).

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. If these Applications are not approved, there will be shortfalls between water supply and demand in the water resource portfolio for Southern Nevada.[158] 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, water from the Applications will be necessary to meet customer demand.[159] The Applicant anticipates that it could manage its use of temporary supplies in order to avoid shortfalls until 2028.[160] However, as explained above, temporary supplies are one-time use resources that are not replenished. Therefore, without water from the Applications, 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.[161]

Projected demand will require more and more water from these Applications until the full amount approved under the Applications is developed. By the end of the 50-year planning period, customer demand is projected to require the diversion of 897,087 afa.[162] Without any additional water resources, that projected demand would exceed available supplies by approximately 275,000 afa.[163] Under shortage conditions, shortfalls are projected to be greater and to occur sooner.[164] The Applicant's analysis of the CRSS model results and potential water

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[158] 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).
[159] Exhibit No. SNWA_189, p. 6-2, Figure 6-2; Exhibit No. SNWA_209, p. 43; Transcript, Vol.2 p. 326:13-18 (Holmes).
[160] Exhibit No. SNWA_189, p. 6-4, Figure 6-3; Transcript, Vol.2 p. 327:14-18 (Holmes).
[161] Transcript, Vol.2 p. 327:8-13 (Holmes).
[162] Exhibit No. SNWA_189, p. 6-4, Table 6-1.
[163] Exhibit No. SNWA_189, p. 6-4, Figure 6-3 and Table 6-1.
[164] Exhibit No. SNWA_189, p. 8-5, Figure 8-5, p. 6-5 and pp. A-10 to A-12.

resource management under the various scenarios demonstrates that projected customer demand will require water from the Applications. Under a dry scenario on the Colorado River, customer demand exceeds available supply by 184,655 as early as the year 2021.[165] 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.[166] 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.[167] Water from the Applications would be needed to fill these supply gaps.

The Applicant has identified all available water supplies and has presented reasonable and appropriate water demand projections to demonstrate that it will not be able to meet Southern Nevada's water needs in the event that these Applications are not approved. 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.[168] However, this opinion was not supported by the same level of expertise, analysis, and documentation as was presented by the Applicant. Therefore, the State Engineer finds the Applicant's evidence regarding population and customer use is substantially more credible and reliable than other evidence available, including the limited evidence presented by the Protestants. 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

[165] Exhibit No. SNWA_189, Appendix A, Table A-2.
[166] Exhibit No. SNWA_189, Appendix A, Table A-3.
[167] Exhibit No. SNWA_189, Appendix A, Table A-4.
[168] Transcript, Vol.23 p. 5124:18-21 (Gleick).

for water in Southern Nevada would not be met.[169] The evidence supports a conclusion that Southern Nevada's future water demands will exceed available supplies during the Applicant's planning period, and that water from the Applications is needed for beneficial use by the Applicant.

C. Replacing Temporary Supplies

The Applicant needs water from the Applications because it is a permanent resource that will allow the Applicant to replace temporary resources. As explained above, temporary resources are one-time use resources that are exhausted when used and provide a bridge supply until the Applicant can develop permanent water supplies.[170] The Applicant has been successful in negotiating for temporary supplies such as surplus water and ICS on the Colorado River and water banks with California and Arizona.[171] When those temporary supplies were negotiated, there was a clear expectation on the part of the other basin states that the Applicant would develop permanent supplies to meet its long-term water needs.[172] If the Applicant were to fail to develop permanent supplies to replace those temporary supplies as they are exhausted, unmet demand would continue to grow during the Applicant's planning period.[173] Therefore, the Applicant must develop water from the Applications to replace its temporary supplies.

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the Applicant has demonstrated that this water is a critical component of the water resource portfolio for Southern Nevada and that water from the Applications will be put to beneficial use to protect against shortages on the Colorado River, meet projected demands,

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[169] Exhibit No. SNWA_189, p. 6-5.
[170] Transcript, Vol.2 pp. 251:19-252:4 (Entsminger).
[171] Exhibit No. SNWA_189, pp. 3-3 to 3-5.
[172] Transcript, Vol.2 pp. 273:16-274:4 (Entsminger).
[173] Transcript, Vol.2 p. 327:8-13 (Holmes); Transcript, Vol.1 p. 123 (Mulroy).

and replace temporary supplies. The State Engineer further finds that even if the Applicant were to implement extraordinary conservation measures and decrease its GPCD to the level suggested by the Protestants, the Applicant would still need water from the Applications to protect against shortages on the Colorado River and to replace the Applicant's limited temporary water supplies.

II. GOOD FAITH INTENTION AND FINANCIAL ABILITY

The Applicant must provide 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.[174] The purpose of these requirements is to protect against water speculation.

A. Good Faith Intention

The Applicant's demonstrated need for this water may be the most compelling evidence of its intention. 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.[175] The Big Bend Water District, the City of Boulder City, the City of Henderson,

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[174] NRS 533.370(1)(c).
[175] Exhibit No. SNWA_209, Appendix 2; Exhibit No. SNWA_201; Transcript, Vol.1 pp. 225:11-228:5 (Brothers).

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.[176] 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.[177] 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.[178] 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.[179] 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

[176] Exhibit Nos. SNWA_223; SNWA_224; SNWA_225; SNWA_226; SNWA_227; SNWA_228; SNWA_229.
[177] Exhibit No. SNWA_211; Transcript, Vol.1 pp. 235:24-236:4 (Brothers).
[178] Exhibit No. SNWA_190; Exhibit No. SNWA_191; Transcript, Vol.1 pp. 204:16-205:13 (Holmes).
[179] Transcript, Vol.1 p. 100:19-20 (Mulroy).

Applications.[180] 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 10 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.[181] Based upon the evidence in the record, including but not limited to that cited above, the State Engineer concludes 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.

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.[182] The engineering department is responsible for developing plans for the Applicant's capital construction projects.[183] The Applicant's and LVVWD's engineering departments have successfully developed 177 major capital projects since 1987.[184] Those projects include pumping stations, treatment plants, transmission lines and an assortment of other

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[180] Transcript, Vol.1 p. 238:14-18 (Brothers).
[181] Exhibit No. SNWA_195; Transcript, Vol.1 pp. 216:10-217:13 (Holmes).
[182] Exhibit No. SNWA_190; Transcript, Vol.1 pp. 201:16-204:15 (Holmes).
[183] Transcript, Vol.1 p. 198:3-5 (Holmes).
[184] Exhibit No. SNWA_235; Transcript, Vol.1 p. 199:4-6 (Holmes).

facilities. The engineering department is responsible for the planning, design, and construction management for some of the largest, most complex, and technically challenging water utility facilities in the country.[185]

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.[186] 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.[187]

The Applicant is complying with all federal permitting requirements in connection with the Project. A draft Environmental Impact Statement has been published for the Project. The comment period is closed and the Applicant expects a final Environmental Impact Statement in 2012.[188] The Applicant is working with the Fish and Wildlife Service in connection with a biological opinion which it also expects will be completed in 2012.[189] The Applicant has satisfied or is in the process of satisfying all federal permitting requirements at this stage of development of the Project. The State Engineer finds that construction of the Project has a feasible conceptual plan of development.

2. <u>Estimated Construction Costs</u>

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[185] Exhibit No. SNWA_235; Transcript, Vol.1 pp. 198:19-200:1 (Holmes).
[186] Transcript, Vol.1 p. 201:6-14 (Holmes).
[187] Transcript, Vol.1 p. 204:5-12 (Holmes).
[188] Transcript, Vol.1 p. 217:18-25 (Holmes).
[189] Transcript, Vol.1 p. 217:19-23 (Holmes).

The Applicant's engineering department has developed a cost estimate based on the conceptual plan of development for the Project.[190] The engineering department prepared this cost estimate using the same methods it has used to develop cost estimates for other capital construction projects.[191] The engineering department uses a cost estimating guide that contains "cost curves, or reasonable cost estimates, for various project components."[192] 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.[193] The guide was prepared in accordance with industry standards, including those set by the Association for Advancement of Cost Engineering ("AACE").[194] The engineering department has used this guide to generate cost estimates for projects since 2006, including projects in its 2011 Major Construction and Capital Plan.[195] The engineering department used this same cost estimating guide to develop the cost estimate for the Project.[196]

The Applicant's engineering department estimates that the capital costs for the Project will be approximately $3.224 billion.[197] Including contingency (15%) and inflation (4%), the engineering department estimates that the cost to construct the Project would be approximately $6.45 billion.[198] 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

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[190] Exhibit No. SNWA_195; Transcript, Vol.1 pp. 211-215:18-25 (Holmes).
[191] Exhibit No. SNWA_195; Transcript, Vol.1 p. 214:18-22 (Holmes).
[192] Exhibit No. SNWA_194; SNWA_195; Transcript, Vol.1 pp. 208:9-209:15 (Holmes).
[193] Exhibit No. SNWA_195, pp. 2-3; Transcript, Vol.1 p. 209:8-15 (Holmes).
[194] Exhibit Nos. SNWA_195, p. 2; SNWA_233; SNWA_234; Transcript, Vol.1 p. 210:3-15 (Holmes).
[195] Exhibit No. SNWA_195, p. 2; Transcript, Vol.1 pp. 207:25-208:19 (Holmes).
[196] Transcript, Vol.1 pp. 215:25-216:6 (Holmes).
[197] Exhibit No. SNWA_195, p. 4, Table 1; Transcript, Vol.1 p. 213:13-21 (Holmes).
[198] Exhibit No. SNWA_195, pp. 5, 7; Transcript, Vol.1 p. 214:4-6 (Holmes).

cost breakdowns for each phase.[199] The engineering department also developed cash flow projections to allow financial experts to evaluate potential funding requirements for the Project.[200]

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.[201] 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.[202] 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 we have prepared."[203]

The State Engineer finds that the evidence supports a conclusion that the Applicant's cost estimate is reasonable.

3. Ability to Finance Estimated Construction Costs

The Applicant provided the cost estimate, construction schedule and cash flow projections to John Bonow of Public Financial Management, and Guy Hobbs of Hobbs Ong and Associates.[204] Mr. Bonow and Mr. Hobbs are financial advisors to various Nevada

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[199] Exhibit No. SNWA_195, pp. 3-5.
[200] Exhibit No. SNWA_195, pp. 5, 7, Table 2.
[201] Exhibit No. SNWA_195, p. 2.
[202] Exhibit No. SNWA_189, p. 2.
[203] Transcript, Vol.1 pp. 215:25-216:6 (Holmes).
[204] Exhibit No. SNWA_383; Transcript, Vol.13 p. 214:11-17 (Holmes).

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.[205] 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.[206]

Mr. Bonow and Mr. Hobbs prepared an expert report that analyzed the Applicant's ability to issue bonds to finance the estimated cost of the Project.[207] 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.[208] 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.[209]

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.[210] 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.

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[205] Transcript, Vol.13 pp. 2836:1-25 (Bonow), 2840:11-23 (Hobbs).
[206] Transcript, Vol.13 pp. 2837:5-2838:3 (Bonow), 2841:17-2842:11 (Hobbs).
[207] Exhibit No. SNWA_383.
[208] Transcript, Vol.13 p. 2842:22-2843:19 (Hobbs).
[209] Transcript, Vol.13 p. 2846:1-5 (Hobbs).
[210] Exhibit No. SNWA_383, Section I.

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.[211]

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.[212] The Applicant's current plan of 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 LVVWD with level debt service over 30 years.[213] 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.[214] As of September 2011, 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.[215] The Applicant has never failed to make full and timely payment on its debt obligations.[216] Based on this review, Mr. Bonow and Mr. Hobbs concluded that the Applicant currently accesses the capital markets on agreeable terms.[217]

In summary, 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

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[211] Transcript, Vol.13 pp. 2844:11-15 (Bonow), 2854:18-20 (Hobbs).
[212] Exhibit No. SNWA_383, Section II.
[213] Exhibit No. SNWA_383, p. 22.
[214] Transcript, Vol.13 pp. 2847:23-2848:17 (Bonow).
[215] Exhibit No. SNWA_383, p. 22; Transcript, Vol.13 pp. 2853:11-19, 2860:10-15 (Hobbs).
[216] Transcript, Vol.13 p. 2858:3-6 (Hobbs).
[217] Transcript, Vol.13 p. 2860:12-15 (Hobbs).

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 is a high quality credit due to its past financing history and current status as a credit, 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.[218] 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.[219]

After analyzing the Applicant's past financing history and its current status as a credit, 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 typical plan of finance because that is the most cost effective approach at this time.[220] 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.[221]

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

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[218] Transcript. Vol.13 pp. 2856:7-2858:2 (Hobbs).
[219] Transcript, Vol.13 p. 2845:3-6 (Bonow).
[220] Transcript, Vol.13 pp. 2865:7-2866:11 (Hobbs).
[221] Transcript, Vol.13 pp. 2846:21-24, 2889:21-2891:16, 2906:22-2907:9, 2910:18, 2921:13-15 (Bonow).

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.[222]

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.[223] When the Applicant last accessed the capital markets in 2011, it achieved an interest rate of 4.06%.[224] 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.[225]

With regard to projected growth and development, the funding plan assumes almost non-existent population increases.[226] This assumption affects the amount of commodity charge revenues and connection charge revenues that are projected to be available under the funding plan.[227] 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.[228] 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.[229] If moderate growth were to occur, it would increase the amount of revenues available to pay debt

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[222] Transcript, Vol.13 p. 2846:12-24 (Bonow, Hobbs).
[223] Exhibit No. SNWA_383, Appendix F; Transcript, Vol.13 p. 2868:14-16 (Hobbs).
[224] Transcript, Vol.13 p. 2869:10-11 (Hobbs).
[225] Transcript, Vol.13 p. 2869:16-19 (Hobbs).
[226] Exhibit No. SNWA_383, Appendix C.
[227] 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.
[228] Transcript, Vol.13 p. 2879:10-19 (Bonow).
[229] Transcript, Vol.13 p. 2872:15-24 (Hobbs).

service on the bonds from sources other than the commodity charge. This would result in lower monthly water bills for southern Nevadans.

In addition, with regard to available revenues, the funding plan also assumes that only revenues from its commodity charge and reliability charge[230] would be used to pay debt service even though revenues from other charges could be available.[231] 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.[232] 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.[233] 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.[234] 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.[235]

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.[236] The vast majority of bonds in the marketplace, approximately 95% of bonds with a call option or prepayment feature, are refinanced at least once prior to maturity which allows the issuer to achieve interest cost

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[230] 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.
[231] Exhibit No. SNWA_383, p. 29.
[232] Exhibit No. SNWA_383, p. 33; Transcript, Vol.13 pp. 2851:14-21, 2871:23-2872:14 (Hobbs).
[233] Transcript, Vol.13 p. 2861:10-13(Hobbs).
[234] Transcript, Vol.13 pp. 2880:18-2882:7 (Hobbs).
[235] Transcript, Vol.13 p. 2896:21-23 (Hobbs).
[236] Transcript, Vol.13 pp. 2869:25-2870:10 (Hobbs).

savings.[237] 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.[238]

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 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.[239] However, the funding plan reflects coverage ratios that exceed that requirement.[240] That means that over time, the commodity charge rate levels could decrease since those inflated debt coverage ratios would not be required.[241]

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.[242] 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.[243]

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

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[237] Transcript, Vol.13 p. 2870:2-4 (Hobbs).
[238] Transcript, Vol.13 p. 2870:4-10 (Hobbs).
[239] Exhibit No. SNWA_383, p. 15.
[240] Exhibit No. SNWA_383, p. 35.
[241] Transcript, Vol.13 pp. 2877:15-2878:2 (Hobbs).
[242] Exhibit No. SNWA_383, p. 34; Transcript, Vol.13 p. 2870:16-23 (Hobbs).
[243] Transcript, Vol.13 pp. 2870:19-2871:4 (Hobbs).

planned capital projects other than the Project, and (3) existing debt and planned capital projects including the Project.[244] 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.[245] 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.[246] 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 thousand gallons of water, the resulting average monthly residential water bill in Southern Nevada would be $90.62 by the year 2026.[247]

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.[248] The comparison shows that as the commodity charge rate increases under the funding plan, the resulting average water bill in Southern Nevada

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[244] Exhibit No. SNWA_383, pp. 30, 33-35.
[245] Transcript, Vol.13 pp. 2863:13-2865:4 (Hobbs).
[246] Exhibit No. SNWA_383, p. 35.
[247] Exhibit No. SNWA_383, p. 36.
[248] Exhibit No. SNWA_383, p. 38; Exhibit No. SNWA_384; Transcript, Vol.13 pp. 2882:22-2885:18 (Bonow).

would continue to compare favorably to the average water bills in other metropolitan areas.[249] 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."[250] Ms. Leurig is an analyst at CERES which is a "non-profit research and advocacy group."[251] She is the author of a report titled "The Ripple Effect: Water Risk in the Municipal Bond Market."[252] Ms. Leurig has only four years of experience with issues relating to municipal bonds.[253] She has never advised a municipality on how to access the capital markets. She has never prepared a funding plan for a municipality.[254] She is not an expert regarding the Applicant's financial condition or the process the Applicant uses to finance its capital construction projects.[255] She did not prepare an independent analysis regarding the Applicant's past financing history, its current status as a credit, or its ability to finance the Project.[256] She did not analyze the Applicant's rate levels, ability to raise rates, or how those rates compare to other municipalities.[257]

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

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[249] Transcript, Vol.13 p. 2887:11-15 (Bonow).
[250] Transcript, Vol.22 p. 4831:1-3 (State Engineer).
[251] Transcript, Vol.22 p. 4868:19-21 (Leurig).
[252] Exhibit No. GBWN_116.
[253] Transcript, Vol.22 p. 4864:9-20 (Leurig).
[254] Transcript, Vol.22 p. 4865:6-9 (Leurig).
[255] Transcript, Vol.22 p. 4865:10-21 (Leurig).
[256] Transcript, Vol.22 p. 4866:9-23 (Leurig).
[257] Transcript, Vol.22 p. 4867:2-14 (Leurig).

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."[258]

Ms. Leurig pointed to a number of water related risk factors which 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."[259] 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 did not assert that financing the Project under current market conditions would be more expensive than the funding plan.

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, nor would she have the expertise to do so. 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."[260] However, based on Ms. Leurig's lack of qualifications and experience in the public financing field, the State Engineer gives this conclusion little weight.

Ms. Leurig's testimony and reports cannot support a determination that the Applicant lacks the requisite financial ability to finance the Project. There are any numbers of factors that

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[258] Transcript, Vol.1 pp. 93:17-95:7 (Mulroy).
[259] Transcript, Vol.13 p. 2889:6-13 (Hobbs).
[260] Transcript, Vol.22 p. 4891:1-13 (Leurig).

may ultimately affect financing for the Project. The financing of the Project will take place over decades and there are unforeseen events, contingencies, and forces that could be realized during that time period. However, the Applicant's financial experts focused on factors that are known at this time and made revenue limiting assumptions to develop a funding model that would allow the Applicant to finance the Project. Those financial experts, unlike Ms. Leurig, have been involved in hundreds of publicly financed capital projects. Mr. Bonow and Mr. Hobbs provided a level of analysis that surpasses the level of analysis presented by any applicant in the history of water rights hearings before the State Engineer. They used the same analysis that is used anytime a municipality determines whether it has the financial ability to construct a large capital project.[261] Based on their funding model and analysis, it was the opinion of those two experts that the Applicant would have the financial ability to construct the Project.[262] This evidence far outweighs the limited speculation presented by Ms. Leurig.

Based upon the evidence in the record, including but not limited to that cited above, 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

To grant the Applications, the State Engineer must find that there is unappropriated water in the proposed source of supply.[263] The amount of groundwater available for appropriation in a given hydrographic basin depends on two major components: 1) the perennial yield for the basin in question; and 2) the appropriated quantity of groundwater associated with existing rights in

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[261] Transcript, Vol.13 pp. 2842:20-2844:7, 2846:1-5 (Bonow).
[262] Transcript, Vol.13 pp. 2846:12-17, 2896:13-16 (Bonow).
[263] NRS 533.370(5) (2010).

that basin. The first component, the perennial yield, is the maximum amount of groundwater that can be developed over a long period of time without depleting the resource.[264] Under natural predevelopment 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 downgradient 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, 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. Any extra water that remains in the system is stored in vast quantities in underground reservoirs called aquifers. This is commonly referred to as groundwater storage.

Perennial yield is a guideline that is used in Nevada to manage groundwater development. Perennial yield sets an upper limit on the amount of groundwater than can be developed in a groundwater basin. 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. The use of perennial yield to determine the upper limit of groundwater use is a method that is more protective of the groundwater resource than is used in many other states, where groundwater development is not limited to perennial yield.

Perennial yield is estimated by developing a groundwater budget for a groundwater basin. Generally, groundwater systems are thought to be in steady state prior to human development of

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[264] Exhibit No. SNWA_300, p. 13 ¶ 2.

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 Applicant and all Protestants agreed that the use of the groundwater budget method is most appropriate to determine the range of perennial yield estimates for the basin. The State Engineer will use the groundwater budget method (also sometimes called the groundwater balance method) to make this determination.

To provide background and context for the determination of perennial yield in Delamar Valley, the Applicant initially conducted a comprehensive literature review of prior investigations by the U.S. Geological Survey ("USGS").[265] The Applicant's witness, Mr. Andrew Burns,[266] testified that he reviewed the following USGS reports: 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.[267]

To estimate recharge in Delamar Valley, the Applicant used a groundwater balance approach similar to the approach applied in the well-known Maxey-Eakin method. The Maxey-Eakin method was employed by the USGS in the Reconnaissance Series Reports in basins across Nevada, and those reports have been relied upon by the State Engineer in managing groundwater

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[265] Transcript, Vol.3 pp. 588:11-592:22 (Burns).
[266] Mr. Burns is a hydrologist for Southern Nevada Water Authority. Exhibit No. SNWA_256. He was qualified by the State Engineer as an expert in surface water and groundwater hydrology. Transcript, Vol.3 p. 576:11-14 (Burns).
[267] Transcript, Vol.3 pp. 588:11-592:22 (Burns).

in Nevada for decades. The Applicant's witness, Ms. Warda Drici,[268] testified that the differences between the Maxey-Eakin method used in the Reconnaissance Series Reports and the groundwater balance approach used in this analysis involve the quantity and quality of available data, which is greater now, and the advancements in computer power and spatial analysis techniques, which are now computer based as opposed to trial-and-error based.[269] Calculating recharge based on precipitation data requires a determination of the ratio of recharge to precipitation, which is referred to as recharge efficiency.[270] In this case, the goal of such an analysis is to develop recharge efficiencies for every one inch precipitation interval in the WRFS. Here, the Applicant used an Excel Solver which is designed to solve complex optimization problems using numerical methods, to develop the recharge efficiencies.[271] The objective function used in the Excel Solver was derived from the groundwater balance equation relating the groundwater budget components of the White River Flow System ("WRFS").[272] The Applicant distributed the recharge by applying the recharge efficiencies to the best available and current map of average annual precipitation. This is the same approach used in the Reconaissance Series Reports. This approach is necessary since basin-wide precipitation recharge cannot be measured in the field.

The approach was applied to the entire White River Flow System ("WRFS"), as opposed to just one valley. There are a total of 13 valleys within the WRFS. [273] The valleys are grouped together to increase the certainty of the recharge estimates for these basins. There is a significant

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[268] Ms. Drici is a hydrologist with the Southern Nevada Water Authority. Exhibit No. SNWA_257. She was qualified by the State Engineer as an expert in groundwater hydrology and modeling. Transcript, Vol.3 p. 579:14-17 (Drici).
[269] Transcript, Vol.6 p. 1348:16-1349:9 (Drici).
[270] Exhibit No. SNWA_258, p. F-6.
[271] Exhibit No. SNWA_258, p. F-7.
[272] Exhibit No. SNWA_258, p. F-15.
[273] Exhibit No. SNWA_274, p. 252.

amount of uncertainty associated with independent measurements of recharge; therefore, recharge is generally calculated as the equivalent of basin discharge, or groundwater ET and interbasin outflow. Of these two measurements, groundwater ET is the most certain field measurement of basin discharge. However, many of the basins within the WRFS do not contain measureable amounts of groundwater ET making independent analyses of the groundwater budgets for these basins infeasible. To address this problem, a groundwater budget is developed for the entire flow system to include basins with substantial amounts groundwater ET. The goal of this analysis is to make groundwater ET the largest component of groundwater discharge to increase the certainty of the system-wide recharge estimate, which is then distributed to the individual valleys of the flow system.

The primary reason for applying the groundwater balance method to the entire WRFS, as opposed to applying it directly to Delamar Valley, is because most of the discharge from this basin is by subsurface outflow. As the volume of groundwater ET in Delamar Valley is relatively small, a single-basin recharge solution would only be constrained by the estimate of subsurface outflow. Therefore, the method was applied to the entire WRFS where the estimate of recharge is constrained by field-based estimates of basin groundwater ET.

A. Groundwater ET

Groundwater ET is important because it is the only component in a groundwater balance calculation that can be observed and measured.[274] Groundwater may discharge to the atmosphere via evaporation from the soil or via transpiration through plants that draw groundwater through their roots. Evaporation and transpiration are often considered together and

[274] Exhibit No. GBWN_103, p. 17; Transcript, Vol.17 p. 3794:6-9 (Myers); Transcript, Vol.24 p. 5413:9–16 (Bredehoeft).

referred to as evapotranspiration ("ET"). The Applicant estimated the total volume of average annual groundwater ET in the WRFS to be 105,800 afa.[275] This value represents the estimated total annual volume for all basins of the WRFS. Over half of the groundwater-ET discharge in the WRFS occurs in White River Valley. The estimate of groundwater ET for White River Valley was obtained from new field investigations conducted between 2006 and 2010. The groundwater ET estimates for all other basins of the WRFS were obtained from the Applicant's conceptual model report for the BLM's draft Environmental Impact Statement.[276]

The draft Environmental Impact Statement ("DEIS") estimated groundwater ET by: delineating and classifying potential areas of groundwater ET; compiling, evaluating, and selecting published ET rates for each area; adjusting ET rates to local potential ET conditions; applying the ET rates to each area; determining precipitation for each area; and finally removing precipitation from total ET to arrive at groundwater ET.[277] The DEIS provides groundwater ET values as follows for valleys in the WRFS: 1,700 afa for Garden Valley, 400 afa for Jakes Valley, 3,000 afa for Long Valley, 1,300 afa for Cave Valley, 28,500 afa for Pahranagat Valley, and 6,000 afa for Muddy River Springs Area.[278] The Protestants did not take issue with these estimates of groundwater ET. Specifically, Dr. Myers considered the estimate of 1,300 afa of groundwater ET in Cave Valley and the estimate of 28,500 afa in Pahranagat Valley to be reasonable.[279]

To estimate groundwater ET in White River Valley, the Applicant relied on five years of direct ET measurements using state-of-the-art Eddy Covariance Towers in White River Valley

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[275] Exhibit No. SNWA_258, p. F-15.
[276] Exhibit No. SNWA_258, p. F-15.
[277] Exhibit No. SNWA_088, p. 7-5.
[278] Exhibit No. SNWA_088, p. 7-17.
[279] Exhibit No. GBWN_103, p. 19; Transcript, Vol.17 pp. 3854:25-3855:3 (Myers)

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 precipitation in White River Valley based on the best tool available to estimate precipitation in the groundwater ET areas.

The Applicant completed the following steps to estimate ET in White River Valley: (1) delineate groundwater-ET extent boundaries and land cover classes; (2) 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; (3) acquire and process satellite imagery to derive distributions of normalized difference vegetation indices ("NDVI"); (4) develop an empirical relationship between annual total ET measurements and NDVI values for corresponding ET measurement sites; (5) apply the empirical relationship to NDVI distributions to estimate the distribution of annual total ET rates within the groundwater discharge area; (6) subtract the distributions of annual precipitation rates from the annual total ET rates to arrive at distributions of annual groundwater ET rates; and (7) calculate the annual average basin-wide groundwater ET for the five-year period of ET data collection. [280] Dr. Myers generally agreed with this approach.[281]

The Applicant delineated groundwater-ET discharge areas in White River Valley using satellite imagery and previous mapping. The Applicant then classified land-cover classes within

[280] Exhibit No. SNWA_258, p. D-1.
[281] Exhibit No. GBWN_103, p. 17.

the groundwater-ET discharge area using NDVI values. The Applicant also verified the classifications in the field.[282] Dr. Myers notes that phreatophytic areas vary in areal extent and plant density over time.[283] However, he did not question the accuracy of the Applicant's areal extents at the time they were made.[284]

The Applicant estimated ET for wetland/meadow, phreatophytic/medium vegetation, and bare soil/low vegetation land-cover classes in the groundwater ET discharge area in White River Valley using an empirical relationship developed in cooperation with the Desert Research Institute. The empirical relationship is expressed by a linear 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. Dr. Fenstermaker is an Associate Research Professor at the Desert Research Institute.[285] She specializes in remote sensing which includes the use of satellite images to determine ET

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[282] Exhibit No. SNWA_258, pp. D-3 to D-5.
[283] Exhibit No. GBWN_103, pp. 17–18.
[284] Transcript, Vol.17 p. 3794:18-3795:2 (Myers).
[285] Exhibit No. SNWA_311.

conditions on the ground. Her Ph.D. research at the University of Nevada, Las Vegas focused on remote sensing.[286] Dr. Fenstermaker has worked with remotely sensed data since 1981 and has specifically researched the use of remotely sensed data to estimate ET at various scales since 1993.[287] She has conducted many studies and has authored several papers related to using remote sensing to estimate properties of plant communities.[288] She was qualified by the State Engineer as an expert in ET estimates using remote sensing.[289]

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.[290] NDVI is the most commonly used vegetation index.[291] 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.[292] 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 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

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[286] Transcript, Vol.3 p. 654:12-15 (Fenstermaker).
[287] Transcript, Vol.3 p. 653:16-19 (Fenstermaker).
[288] Transcript, Vol.3 pp. 654:23-656:3 (Fenstermaker).
[289] Transcript, Vol.3 pp. 657:7-9 (Fenstermaker).
[290] Exhibit No. SNWA_312, pp. 2-1 to 2-7; Transcript, Vol.4 pp. 806:24–808:5 (Fenstermaker).
[291] Transcript, Vol.3 p. 685:7-9 (Fenstermaker).
[292] Transcript, Vol.3 p. 695:24-696:1 (Fenstermaker).

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."[293] Mr. Burns[294] described the Eddy Covariance method as "state of the art."[295] The Eddy Covariance towers use sophisticated sensors to measure the components of ET.[296] The sensors were installed and calibrated according to manufacturer recommendations.[297] 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.[298] Dr. Fenstermaker testified that she was unaware of any other published study that used this many Eddy Covariance Towers.[299] 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.[300] The site selection was independently evaluated and approved by Dr. Travis Huxman of the University of Arizona.[301] Dr. Huxman has extensive experience in locating ET measurement sites in complex ecosystems.[302]

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[293] Exhibit No. SNWA_312, p. 3-1.
[294] 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 (Burns).
[295] Transcript, Vol.3 p. 670:10-13 (Burns).
[296] Exhibit No. SNWA_312, p. 3-2.
[297] Exhibit No. SNWA_312, p. 3-3; Transcript, Vol.4 p. 796:12–797:4 (Fenstermaker).
[298] Exhibit No. SNWA_312, pp. 3-1, 3-3.
[299] Transcript, Vol.4 p. 759:4–10 (Fenstermaker).
[300] Exhibit No. SNWA_312, p. 3-3.
[301] Transcript, Vol.3 pp. 674:22–675:16 (Fenstermaker).
[302] Transcript, Vol.3 pp. 674:25-675:12 (Fenstermaker).

The ET measurement sites did not include agriculture or open water.[303] 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 from 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 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.[304] The tower in White River Valley had measurements for all five years.[305] Mr. Burns testified that the ET data collected was "excellent."[306] Dr. Myers did not question the Applicant's measurement of ET rates.[307] Based on the evidence submitted and the testimony of Dr. Fenstermaker, the State Engineer finds the Applicant's ET measurements are scientifically sound.

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 percent or more cloud cover. After excluding

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[303] Exhibit No. SNWA_312, pp. 3-4 to 3-5.
[304] Exhibit No. SNWA_312, pp. 3-3, 3-10.
[305] Exhibit No. SNWA_312, p. 3-10.
[306] Transcript, Vol.3 p. 683:8-11 (Burns).
[307] Transcript, Vol.17 pp. 3794:18-19 (Myers).

scenes with 30 percent 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. Dr. Fenstermaker then replaced clouds and cloud shadows that remained in the images with the average NDVI values from cloud free dates.[308] 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.[309] Finally, Dr. Fenstermaker averaged the scenes for each year to obtain average growing-season NDVI images.[310] Based on this evidence, the State Engineer finds that the Applicant's method of determining average growing-season NDVI values for the basins is scientifically sound.

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 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.[311] 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.

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[308] Exhibit No. SNWA_312, p. 4-3.
[309] Transcript, Vol.4 p. 770:4-5 (Fenstermaker).
[310] Exhibit No. SNWA_312, pp. 4-4 to 4-5.
[311] Exhibit No. SNWA_312, pp. 4-5 to 4-7.

Dr. Fenstermaker ended up with 38 data points of annual ET and growing-season average footprint-weighted NDVI values.[312] 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.[313] Dr. Fenstermaker 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.[314] When evaluated against the seven reserved points, the analysis revealed no clear bias to over or under-estimate.[315] 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 and open water to obtain a total annual ET distribution for the remaining land-cover classes in the groundwater discharge area for each year in the period of record.[316] The Applicant queried the initial ET distribution grid to identify grid-cell values exceeding the average annual reference ET in White River Valley of 4.5 feet as measured

[312] Exhibit No. SNWA_312, p. 5-1.
[313] Exhibit No. SNWA_312, p. 5-4.
[314] Transcript, Vol.4 p. 726:2–5 (Fenstermaker).
[315] Exhibit No. SNWA_312, p. 5-7; Transcript, Vol.4 p. 730:8–19 (Burns).
[316] Exhibit No. SNWA_258, p. D-16.

by the Eddy Covariance stations. For those grid cells, the Applicant used the average annual reference ET value.[317]

As noted, the Applicant's goal was to develop an estimate of groundwater ET for White River 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 predevelopment ET rates for the agriculture land-cover class in White River Valley by assigning the ET rates derived from the empirical relationship for the natural vegetation surrounding the agricultural areas. For areas of open-water, the Applicant assigned a consumptive-use rate of 4.90 ft/yr based on Huntington and Allen (2010, Appendix 14, p. 246).[318] The Applicant estimated an average total ET of 64,900 afa in White River Valley for the period of record 2006 to 2010. The yearly total ET estimates, in acre-feet, were: 59,400 in 2006; 77,100 in 2007; 89,700 in 2008; 70,900 in 2009; and 27,600 in 2010.[319] 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.[320] Even Dr. Myers testified that the Applicant's total-ET estimates are probably as accurate as they can be.[321] The State Engineer finds that the Applicant provided the best available estimate of total ET in White River 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

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[317] Exhibit No. SNWA_258, pp. D-16 to D-17.
[318] Exhibit No. SNWA_258, p. D-17.
[319] Exhibit No. SNWA_258, p. D-18.
[320] Transcript, Vol.4 pp. 731:8–17; 731:25-732:7 (Fenstermaker).
[321] Transcript, Vol.20 p. 4442:3-7 (Myers).

groundwater-ET area for the period of record from 2006 to 2010.[322] PRISM is a model that estimates how much precipitation falls on specific areas throughout the United States.[323] 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, including for the period of record of the Applicant's ET measurements.[324] Ms. Drici testified that PRISM provided the best available method to estimate the precipitation distribution over the areas of interest.[325] Dr. Myers testified that PRISM is generally a good tool and probably the best tool available to distribute precipitation, though he asserts that it underestimates or overestimates in certain areas.[326]

PRISM provides an estimate of precipitation based on a model. 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. The Applicant determined that the PRISM grids underestimated precipitation on the valley floor in White River Valley for all years in the period of record except for 2007 by comparing the grids to precipitation data collected in the valley. The Applicant corrected for this underestimation by adding the average difference between the observed precipitation and the PRISM precipitation to the PRISM grid.[327] Protestants did not present any evidence challenging this adjustment to the

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[322] Exhibit No. SNWA_258, pp. 5-5, D-6 to D-15.
[323] Exhibit No. SNWA_258, p. B-2.
[324] Transcript, Vol.3 p. 608:10-13 (Drici).
[325] Transcript, Vol.3 p. 606:1–16 (Drici).
[326] Transcript, Vol.21 pp. 4649:18-4651:1 (Myers).
[327] Exhibit No. SNWA_258, pp. D-6 to D-15.

PRISM estimates. The Applicant's final estimates for precipitation on the valley floor in the White River Valley discharge area were, in, afa: 123,300 in 2006; 76,300 in 2007; 79,400 in 2008; 108,800 in 2009; and 167,100 in 2010.[328] This five-year period represents a range of hydrologic conditions.[329] Given the evidence submitted regarding the accuracy assessment of PRISM and the adjustments applied by the Applicant based on determined underestimates in the ET discharge area of White River Valley, the State Engineer finds that the Applicant's method of developing estimates of precipitation distribution for White River Valley is scientifically sound.

The Applicant's final estimate of average annual groundwater-ET in the groundwater discharge area of White River Valley is 64,900 acre-feet for the period of record from 2006 to 2010. The yearly groundwater-ET estimates, in acre-feet, were: 59,400 in 2006; 77,100 in 2007; 89,700 in 2008; 70,900 in 2009; and 27,600 in 2010.[330] In cases where the local precipitation exceeded the local ET, a value of zero was assigned rather than assigning negative groundwater-ET.[331]

The Applicant's estimate is within the range of prior estimates. Welch et al (2008), which is a USGS study published in 2007 as part of the BARCASS, estimated 76,700 afa, Maxey and Eakin (1949, p 42) estimated 34,000 afa, and Nevada Division of Conservation and Natural Resources (1971) estimated 37,000 afa.[332] Dr. Myers states that the Welch et al. estimate is the most accurate of the prior estimates, which is higher than the Applicant's estimate.[333]

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[328] Exhibit No. SNWA_258, p. D-14.
[329] Transcript, Vol.4 pp. 739:2–9, 810:19–25 (Burns).
[330] Exhibit No. SNWA_258, p. D-18.
[331] Transcript, Vol.6 p. 1331:6-8 (Burns).
[332] Exhibit No. GBWN_004, p. 26.
[333] Exhibit No. GBWN_004, p. 26.

The State Engineer finds that the Applicant has provided the most reliable estimate of groundwater ET in White River Valley based on the best available science. The Protestants do not challenge this estimate and no better estimate of groundwater ET has been offered. The Applicant's estimate is the only estimate based on five years of direct ET measurements that includes measurements in White River Valley and five years of satellite data to estimate vegetation health and density. The Applicant has used state-of-the-art Eddy Covariance Towers and satellite imagery to develop a scientifically sound estimate of ET in White River Valley. The Applicant also presented a scientifically sound estimate of precipitation in White River Valley. The five-year period represents a good long-term average for the basin.

B. <u>WRFS External Interbasin Flow</u>

Interbasin flow is another component of the groundwater budget analysis. Interbasin flow into and out of the system along with system groundwater ET are applied to the groundwater balance equation to derive an estimate of total recharge for the system. The Applicant evaluated interbasin flow into and out of the White River Flow System ("WRFS") using available geologic, hydrologic, and geochemical evidence. The Applicant's witness, Dr. Peter Rowley, who the State Engineer qualified as an expert in geology and hydrogeology, [334] identified the boundaries between the Project basins and adjoining basins where interbasin flow is either likely or permissible based on the geology of each area. Dr. Rowley focused much of his testimony on these five boundaries, which are where there were disputes about the likelihood of interbasin flow. These areas include the borders of Butte and Jakes valleys, Pahranagat and

[334] Transcript, Vol.5 p. 976:23-25 (Rowley).

Southern Tikaboo valleys, Coyote Spring and Hidden valleys; the Lower Meadow Valley Wash and the Muddy River Springs Area ("MRSA"); and the MRSA and the California Wash.[335]

The Applicant used the best available geologic information and analysis to support its interbasin flow analysis, including the best available geologic mapping, the most current geophysical data and most sophisticated geologic analysis.

(1) Mapping. The Applicant based its geologic interpretations on 1:250,000 scale mapping.[336] 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.[337] Previous geologic mapping included many other 1:250,000 and 1:100,000 scale maps that cover only portions of the Project basins.[338] The Applicant's 1:250,000 scale mapping includes previous work, provides greater detail, and shows the location of more faults,[339] confining units and aquifers.[340] The Applicant's 1:250,000 scale mapping is more valuable than larger scale maps for identifying features impacting interbasin flow. The Applicant's mapping was digital, allowing the Applicant to directly transfer the geologic information into the groundwater model.[341] Despite the existence of more detailed mapping, and his acknowledgment that 1:250,000 scale mapping is superior, Dr. Myers relied upon lower resolution 1:500,000 scale maps from Stewart and Carlson (1978) in his analysis of the Project

[335] Exhibit No. SNWA_258, p. E-6.
[336] Transcript, Vol.5 p. 1099:1-3 (Rowley).
[337] 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. 3644:23–3645:1-10 (Hurlow).
[338] Transcript, Vol.5 p. 982:15-22 (Rowley).
[339] Transcript, Vol.5 p. 985:4-11 (Rowley) (referencing Exhibit No. SNWA_61).
[340] Transcript, Vol.5 pp. 986:23-25; 987:1-4 (Rowley).
[341] Transcript, Vol.5 p. 1102:9-13 (Rowley).

area.[342] The State Engineer finds that it is not reasonable for a geologist, hydrogeologist, or hydrologist to rely solely on 1:500,000 mapping when a 1:250,000 map is available.[343]

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the Applicant's geologic mapping of Delamar Valley and the surrounding area is the best science available for characterizing the geologic framework of the region because it provides 1:250,000 scale geologic and hydrogeologic mapping based on multiple sources and field verification. Dr. Meyers' characterization of the geologic framework lacks credibility and does not meet professional standards for a hydrogeologist because he used a 1:500,000 geologic mapping even though higher resolution maps were available.

(2) Geophysical Data. In addition to using more detailed mapping, the Applicant worked with the USGS to collect and analyze gravity and audiomagnetotelluric ("AMT") data to help identify and interpret the subsurface geology.[344] AMT is a geophysical technique that uses the earth's natural electromagnetic fields as an energy source to determine the electrical resistivity structure of the subsurface.[345] AMT studies can indicate buried faults by mapping differences in resistivity or conductivity of the buried rock formations.[346] Gravity studies are an additional state-of-the-art geophysical approach that use gravity readings across a broad area to measure the density of the mass of the underlying rock.[347] Gravity maps characterize buried faults by

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[342] Exhibit No. GBWN_004, pp. 5-7 (Stewart and Carlson (1978) mapping); Transcript, Vol.20 p. 4446:16-25 (Myers) (acknowledging 1:250,000 scale superior); Transcript, Vol.20 p. 4445:1-3, pp. 4445:25-4446:4 (Myers) (1:500,000 scale mapping used in analysis of Spring Valley). Dr. Myers did rely on BARCAS for his analysis of those valleys, and the BARCAS report used 1:500,000 scale geologic mapping. Transcript, Vol.6 p. 1251:12-19 (Rowley).
[343] Transcript, Vol.5 p. 988:7-11 (Rowley).
[344] Transcript, Vol.5 pp. 989:1-15, 990:10-23 (Rowley).
[345] Transcript, Vol.5 pp. 1093:23-1094:1 (Rowley)
[346] Transcript, Vol.5 p. 1095:11-16 (Rowley).
[347] Transcript, Vol.5 p. 990:6-9(Rowley); Transcript, Vol.5 pp. 995:24-996:1 (Rowley).

indicating areas where there are changes in density.[348] The Applicant also used this technology to calculate the depth to basement rock in the Project basins.[349] Knowing the depth to basement rock allows the Applicant to determine the thickness of the basin-fill aquifers. Prior to the availability of gravity studies the primary way to determine depth to basement rock was to analyze drill hole data. Gravity studies allow for the collection of a broader range of data in areas without significant numbers of drill holes.

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the Applicant's use of AMT and gravity studies in Delamar Valley and the surrounding area is the best science available for characterizing buried faults, depth to basement rock and the thickness of the basin fill aquifers.

(3) Fault and Fracture Flow. The Applicant applied the principles of fracture flow as part of its interbasin flow analysis. USGS used a fracture flow analysis to explain groundwater movement in the extensive studies completed at the Nevada Test Site.[350] Geologists use both fracture flow and porous-media flow concepts to explain groundwater flow in basin-range topography.[351] However, most regional flow occurs via fracture flow.[352] The Project basins are located in basin-range topography consisting of primarily north-south trending normal faults aligned with the basins and ranges.[353]

A 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

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[348] Transcript, Vol.5 p. 998:10-13. (Rowley).
[349] Transcript, Vol.5 pp. 997:13-998:9 (Rowley).
[350]Transcript, Vol.5 p. 1122:1-12 (Rowley)
[351] Transcript, Vol.5 p. 1112:3-10 (Rowley).
[352] Exhibit No. SNWA_058, p. 2-5.
[353] Transcript, Vol.5 pp. 1107:12-13, 1112:7-10 (Rowley).

hydraulic properties of the rocks.[354] 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.[355] Despite the general rule, the experts in this case recognized there are no absolutes in nature.[356] Where the hydraulic gradient is perpendicular to a fault, the fault may not act as a perfect barrier, but in that instance the amount of cross-fault flow is likely small compared to fault-parallel flow.[357] There is extensive peer-reviewed scientific literature that explains the fracture flow approach and the role of faults as barriers and/or conduits to groundwater flow,[358] and both Protestant experts recognized the validity of this analytical method.[359]

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. In instances in which the fault-fracture zone does not act as a complete barrier to groundwater flow perpendicular to the fault, the amount of cross-fault flow is likely small compared to fault-parallel flow.

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[354] Transcript, Vol.5 pp. 1111:22-1113:18 (Rowley).
[355] Transcript, Vol.5 p. 1112:20-25 (Rowley).
[356] Transcript, Vol.5 p. 1132:22-24 (Rowley).
[357] Exhibit No. MILL_011, p. 7.
[358] Exhibit No. SNWA_058, p. 2-9; Exhibit No. SNWA_063, pp. 1025-1028.
[359] Transcript, Vol.16 p. 3643:8-20 (Hurlow); Transcript, Vol.20 p. 4448:22 – 4449:7 (Myers).

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the principle of fracture flow and porous-media flow is the best available science to describe groundwater movement in the Project area and adjacent basins. The State Engineer also recognizes that such flow can also be constrained by the hydraulic properties of the basin-fill material, particularly at significant depths where the permeability is likely reduced by overburden pressure.

(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.[360] The Applicant started its analysis with Dr. Rowley's development of a geologic framework and conceptual model based on fracture flow.[361] Mr. Burns then applied hydrologic information, including groundwater elevations data, hydraulic gradients, and aquifer properties to Dr. Rowley's framework.[362] 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.[363] Conversely, 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.[364] Areas of permissible flow occur in situations where topographic and geologic data

[360] Exhibit No. SNWA_058, p. 4-34, Figure 4-9.
[361] Transcript, Vol.5 p. 1134:7-23 (Rowley).
[362] Transcript, Vol.5 p. 1136:11-13 (Rowley).
[363] Transcript, Vol.5 p. 1134:7-23 (Rowley).
[364] Exhibit No. SNWA_058, p. 2-10, Figure 2-5; Transcript, Vol.5 p. 1115:20-24 (Rowley).

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.[365]

BARCASS 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."[366] These boundaries were based on obsolete, 40-year-old 1:500,000-scale geologic maps that did not portray existing faults in the digital file of the maps.[367]

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the Applicant's interbasin flow boundary map is more reliable and credible than the BARCASS map depicting interbasin flow boundaries.

Where the hydrologic data was available, the Applicant applied Darcy's Law to calculate interbasin flow.[368] Darcy's Law is expressed as Q = (K x b) x I x 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. Hydraulic conductivity is the rate at which water moves 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 formation in the flow section area. The permeability of these formations control the depth at which groundwater can move through the aquifer. "I" is the horizontal hydraulic gradient, expressed in feet per feet, which is the slope of the water table. "W" is the width of the flow section also expressed in feet.[369] None of the parties disputed that Darcy's Law is an

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[365] Transcript, Vol.5 pp. 1135:25-1136:6 (Rowley).
[366] Exhibit No. SNWA_068, p. 34.
[367] Transcript, Vol.6 p. 1251:12-19 (Rowley).
[368] Exhibit No. SNWA_258, pp. E-1, E-8.
[369] Exhibit No. SNWA_258, p. E-1. The term (365/43560) is a unit conversion from ft^3 per day to afa.

appropriate method for calculating groundwater flow. Rather, the Protestants disputed the values used by the Applicant in the Darcy analysis.

1. Butte Valley to Jakes Valley

The first boundary flow section identified by Dr. Rowley is located on the border of Butte and Jakes Valley. Mr. Burns testified that the saturated and fractured carbonate rock formation in the graben that extends from the Butte Mountains in the west toward the Egan Range in the east could support groundwater flow.[370] Dr. James Thomas, the Interim Director of the Division of Hydrologic Science at the Desert Research Institute, is a recognized expert in geochemistry. He stated that stable isotopic data supports groundwater flow from southern Butte Valley to Jakes Valley in the White River Flow System as well as to the regional warm springs in northern White River Valley.[371] Using available hydrologic data, the Applicant applied a Darcy analysis. The Applicant calculated a 0.003487 ft/ft hydraulic gradient for the flow section between a carbonate well in Butte Valley, 178B-7, and the only representative well in Jakes Valley located near the flow section, 174-10.[372] The Applicant applied a mean hydraulic conductivity value derived from numerous aquifer tests performed in wells completed in carbonate rocks throughout the Basin and Range region of Nevada and from studies conducted at the Nevada Test site and for the Death Valley Flow System ("DVFS") model.[373] For the purpose of assessing the saturated depth of the aquifer, the 45,000 foot wide flow section was divided into two parts. For the northern part of the flow section, which was approximately 30,000 feet wide, the Applicant estimated the saturated thickness of the aquifer contributing to interbasin flow was 500 feet deep

[370] Transcript, Vol.6 p. 1402:20-1403:8(Burns); Exhibit No. SNWA_258, p. E-7.
[371] Exhibit No. SNWA_079, p. 1.
[372] Exhibit No. SNWA_258, pp. E-5 to E-8.
[373] Exhibit No. SNWA_258, p. E-8.

due to the greater thickness of lesser permeable volcanic and clastic rocks near the ground surface.[374] The southern section, which was approximately 15,000 feet wide, had a larger estimated saturated thickness, 1,500 feet, due to a thinning of the surficial lesser permeable rock.[375] Applying these values to Darcy's Law resulted in an estimated inflow of 6,700 afa from Butte Valley to Jakes Valley.[376]

Dr. Myers also considered this boundary flow for his analysis. It appears that Dr. Myers adopted the inflow estimate of 16,000 acre-feet for this flow section boundary reported in BARCASS.[377] Dr. Myers argued that a greater amount of flow was possible because the Applicant's geologic analysis showed that the thickness of the carbonate rock aquifer could be much greater given the depth of the carbonate rocks.[378] However, Dr. Myers did not present any geologic or hydrologic evidence to support his assumption. In addition, Dr. Myers admitted that he was not as knowledgeable and credible of an expert in geology as Dr. Rowley.[379] Also, Dr. Myers failed to adopt the total BARCASS inflow to the WRFS, mistakenly leaving out 8,000 afa that flows from Steptoe Valley directly into White River Valley.[380] Dr. Myers admitted that this was an error in his analysis[381], and the State Engineer finds that this calls his interbasin flow estimates into question and undermines Dr. Myers' groundwater balance for the flow system.

The BARCASS interbasin flow estimate was based upon on an imbalance in the groundwater budget for southern Butte Valley. BARCASS estimated that southern Butte Valley received 35,000 afa of recharge and discharged 12,000 afa, leaving 23,000 afa to discharge from

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[374] Exhibit No. SNWA_258, p. E-5.
[375] Exhibit No. SNWA_258, p. E-5.
[376] Exhibit No. SNWA_258, p. E-8.
[377] Transcript, Vol.17 pp. 3807:13-3808:5 (Myers).
[378] Transcript, Vol.17 pp. 3807:13-3808:5 (Myers).
[379] Transcript, Vol.19 p. 4286:9–14 (Myers).
[380] Transcript, Vol.19 p. 4536:3-21 (Myers).
[381] Transcript, Vol.19 p. 4536:11-21 (Myers).

the basin as interbasin flow.[382] The USGS recently published an updated groundwater budget for southern Butte Valley in GBCAAS.[383] GBCAAS estimated that southern Butte Valley received 21,000 afa of recharge and discharged 12,000 afa, leaving 9,000 afa to discharge from the basin as interbasin flow. The reduction in the groundwater budget components reduced the potential for interbasin flow by 14,000 afa, or 61 percent.[384] Interestingly, if the BARCASS interbasin flow estimate is reduced by 61 percent, the new interbasin flow estimate is 6,240 afa, which is just slightly lower than the Applicant's estimate. Based on this evidence, the State Engineer adopts the Applicant's estimate of interbasin flow from Butte Valley to Jakes Valley because it is based on a detailed analysis of site specific hydrologic, geochemical and geologic conditions at the boundary and is a reasonable estimate of interbasin flow when compared with the updated groundwater budget for southern Butte Valley reported in GBCAAS.

2. <u>Pahranagat Valley and Tikaboo Valley</u>

The next external flow boundary of the WFRS that the Applicant analyzed is between the Pahranagat Valley and Tikaboo Valley South.[385] In this area, the Pahranagat Sheer Zone is an area where there are many significant faults, including the Maynard Lake fault that make flow possible from Pahranagat Valley to Tikaboo Valley.[386] Dr. Thomas stated that isotopic data also suggests that flow from Pahranagat Valley (in the WRFS) to Tikaboo Valley South (in the DVFS) is possible.[387] Due to a lack of hydrologic data in this area, the Applicant based its estimate of external boundary flow on prior investigations. For this flow section, Kirk and

[382] Exhibit No. SNWA_068, pp. 44-45.
[383] Exhibit No. MILL_038.
[384] Exhibit Nos. MILL_033, p. 4; MILL_034, p. 4.
[385] Exhibit No. SNWA_058, p. 4-43, Figure 4-11.
[386] Transcript, Vol.5 p. 1194:17-1197:4(Rowley).
[387] Exhibit No. SNWA_079, p. 3.

Campana (1988), in a published Desert Research Institute study, estimated 4,400 afa, 4,400 afa, and 3,700 afa of outflow from Pahranagat Valley to Tikaboo Valley South for three different flow scenarios. Winograd and Thordarson (1975) estimated 6,000 afa of outflow in this area. Dr. Thomas, in a USGS report published in 1996, estimated 7,000 afa of outflow occurs at this area.[388] The Applicant used the average of these estimates, 5,100 afa, as its estimated outflow for this analysis.[389] Dr. Frank D'Agnese, an expert in groundwater modeling whose background includes extensive experience in the DVFS, testified that based on his experience, flow from Pahranagat Valley to the DVFS was reasonable.[390]

Dr. Myers suggested that groundwater may actually flow in the opposite direction from the DVFS to the WRFS, based on the DVFS Conceptual Model Report. Based on this report, Dr. Myers estimated that a net 6,500 afa enters the WRFS from the DVFS.[391] However, the potentiometric surface map from the conceptual model report does not support this conclusion. The potentiometric map shows approximately 1,000,000 meters^3 per year entering Pahranagat Valley from the DVFS, which is only about 800 afa.[392] Furthermore, groundwater flow should always be represented as perpendicular to a potentiometric contour line in the direction of descending water elevations. This is referred to as the prevailing gradient. Dr. Myers' suggested direction of the groundwater flow on this particular potentiometric map is parallel to the potentiometric contours, calling into question the accuracy of his opinion.[393]

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[388] Exhibit No. SNWA_258, p. E-9; Transcript, Vol.6 p. 1409:7-9 (Burns).
[389] Exhibit No. SNWA_258, p. E-9; Transcript, Vol.6 p. 1409:5-9 (Burns).
[390] Transcript, Vol.9 pp. 2025:12–2026:6 (D'Agnese).
[391] Exhibit No. GBWN_103, p. 13.
[392] Exhibit No. SNWA_299.
[393] Exhibit No. SNWA_299.

The weight of the evidence supports the Applicant's interbasin flow estimate for this flow section. The Applicant reviewed three different studies that all concluded that there is outflow to Tikaboo Valley South within a limited range of 3,700 afa to 7,000 afa.[394] Dr. Myers, on the other hand, only identified one study, which concluded that there is the potential for 800 afa inflow to the WRFS from the DVFS. However, further analysis of the potentiometric map suggests that the flow may be even less than 800 afa given the fact that such interbasin flow would not follow the prevailing gradient. Therefore, the State Engineer finds that there are significant scientific reports that conclude outflow occurs from the WRFS at this boundary and further finds that the Applicant's estimate, which is an average of estimates from the prior investigations, is the most credible.

3. Coyote Spring Valley to Hidden Valley

Further south, the Applicant calculated interbasin flow of 8,600 afa from Coyote Spring Valley to Hidden Valley using available hydrologic data and Darcy's Law.[395] Dr. Thomas' memorandum supports the conclusion that interbasin flow occurs from Coyote Spring Valley to Hidden Valley. He stated that the most likely source of groundwater in Hidden Valley and Garnet Valley is groundwater from the carbonate aquifer underlying Coyote Spring Valley and Upper Moapa Valley (aka Muddy River Springs Area). His opinion is based on isotopic values of groundwater samples extracted from carbonate wells in Garnet Valley that are significantly more negative than the local recharge but match well with the groundwater from the carbonate-rock aquifer underlying Coyote Spring Valley and Upper Moapa Valley.[396]

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[394] Exhibit Nos. SNWA_285; SNWA_301; SNWA_304.
[395] Exhibit No. SNWA_258, p. E-11.
[396] Exhibit No. SNWA_079, p. 2.

The Applicant's geologic analysis identified the Meadow Valley Mountain Range on the west side of the valley as carbonate,[397] as well as a fractured carbonate rock formation estimated to be 30,000 feet long and potentially supporting groundwater flow between the valleys.[398] The range-front fault that defines the west side of the Arrow Canyon Range is likely the main conduit for the flow into Hidden Valley.[399] Scheirer and Andreason of the USGS confirmed the existence of this major fault in a gravity study published in 2011.[400] The Applicant calculated a relatively flat hydraulic gradient, 0.00016 ft/ft, between monitor wells CSVM-2 and GV-1, which would initially suggest little or no flow in this section.[401] However, the Applicant estimated a relatively high transmissivity, 213,035 square feet per day, using a geometric mean transmissivity value derived from the aquifer tests performed on test wells located in the vicinity of the flow section. The relatively small hydraulic gradient is likely an artifact of the large transmissivities of the highly fractured carbonate rocks. Such large transmissivities would support flow in spite of the small hydraulic gradient.[402]

Referencing the small hydraulic gradient, Dr. Myers suggested that flow in this area is much closer to zero. Dr. Myers suggested that a groundwater divide potentially exists in this area, which would limit or prevent outflow.[403] Dr. Myers also questioned the Applicant's transmissivity value, testifying that the Applicant selected wells that were "high producers."[404] On cross-examination by the Applicant's counsel, Dr. Myers conceded that the relatively flat

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[397] Transcript, Vol.6 p.1223:11-13 (Rowley).
[398] Exhibit No. SNWA_258, p. E-10.
[399] Transcript, Vol.6 p.1222:3-5 (Rowley).
[400] Transcript, Vol.6 pp.1220:21-1221:7 (Rowley)
[401] Exhibit No. SNWA_258, pp. E-9, E-11.
[402] Exhibit No. SNWA_258, p. E-11.
[403] Exhibit No. GBWN_103, p. 13; Exhibit No. GBWN_271, Slide 37; Transcript, Vol.17 p. 3811:4-21 (Myers).
[404] Exhibit No. GBWN_103, p. 13; Exhibit No. GBWN_271, Slide 37; Transcript, Vol.17 p. 3811:4-21 (Myers).

gradient could be the result of high transmissivity in the carbonate rocks.[405] With respect to the representativeness of the transmissivity value calculated by the Applicant, Dr. Myers conceded that transmissivity values should be determined based on available data. This, in fact, is what the Applicant did.[406] Dr. Myers did not present any alternative data to refute the Applicant's transmissivity estimate.[407] Likewise, the presence of a groundwater divide is not evident in any of the exhibits or Dr. Myers' testimony. The State Engineer finds that the Applicant's interbasin flow estimate between Coyote Spring Valley and Hidden Valley is a reasonable estimate and supported by the evidence.

4. <u>Muddy River Springs Area to California Wash</u>

The final WRFS system boundary that the Applicant analyzed for interbasin flow is the very southern portion of the Muddy River Springs Area ("MRSA"), around the source of the Muddy River.[408] Both the Applicant and the Protestant, Great Basin Water Network, found that the MRSA accommodates inflow from the northern part of the MRSA, Lower Meadow Valley Wash, and outflow to the south to the California Wash.[409] Dr. Thomas testified that isotopic data shows the Muddy River springs discharge is a mixture of water from Pahranagat, Delamar, Coyote Spring, and Kane Springs Valleys, and probably also Lower Meadow Valley Wash.[410] The only dispute between the parties is the net amount of interbasin flow in this area. From prior investigations, the Applicant estimated that 8,000 afa flows into the WRFS at the MRSA.[411] The

[405] Transcript, Vol.20 pp. 4569:4-4570:12 (Myers).
[406] Transcript, Vol.20 pp. 4572:20-4573:8 (Myers).
[407] Transcript, Vol.20 p. 4566:6-10 (Myers).
[408] Exhibit No. SNWA_258, p. E-6.
[409] Exhibit No. SNWA_258, p. E-6; Exhibit No. GBWN_103, p. 13.
[410] Exhibit No. SNWA_079, pp. 1–2.
[411] Exhibit No. SNWA_258, p. E-8.

estimate is within the range of prior investigations, which ranged from 4,500 afa (Kirk and Campana, 1988) to 13,000 afa (Prudic, et al., 1995). GBWN did not dispute this estimate.

Dr. Myers instead suggested that the inflow to the WRFS at the MRSA is equal to the outflow from the MRSA to California Wash.[412] However, Dr. Myers did not present any evidence to support this statement. On the other hand, the Applicant analyzed the potential outflow to the California Wash with available geologic and hydrologic data. Dr. Rowley identified a 16,500 foot section that could accommodate interbasin flow from the MRSA to the California Wash.[413] This section consists of a large normal fault trending northwest and traversing the edge of Lake Mead. [414] This interpretation is further supported by photographs showing the linear nature of the Overton Arm of Lake Mead in the same location of the fault, as well as the Scheirer and Andreason (2011) gravity studies.[415]

The Applicant calculated the hydraulic gradient across the flow section to be 0.00652 ft/ft, using average measurements from 13 wells in the MRSA and four wells in the California Wash.[416] The top 2,000 feet of this flow section consists of basin fill material comprised of Tertiary Horse Spring and Muddy Creek formation, and the Applicant assumed that all subsurface flow out of the MRSA occurs in this section. This was not disputed by the Protestants. The Applicant calculated the transmissivity of the basin-fill material, 11,000 ft^2 per day, using the geometric mean transmissivities derived from aquifer tests performed on basin fill wells located in the MRSA and Virgin River Valley.[417] The Applicant applied this data using

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[412] Exhibit No. GBWN_103, p. 13.
[413] Exhibit No. SNWA_258, pp. E-13-14.
[414] Transcript, Vol.6 p. 1225:12-15(Rowley); Exhibit SNWA, p. 4-62, Figure 4-18
[415] Transcript, Vol.6 p. 1225:16-25(Rowley).
[416] Exhibit No. SNWA_258, p. E-12.
[417] Exhibit No. SNWA_258, p. E-14.

Darcy's Law and calculated 9,900 afa of interbasin outflow for this boundary. In addition, the Applicant also determined that 33,700 afa flows out of the MRSA to California Wash as Muddy River streamflow, and that the source of the streamflow is the groundwater discharge from regional springs located in the MRSA. This brings the total outflow from the WRFS at the MRSA to 43,600 afa.[418]

Based on the evidence in the record, the difference between the inflow to and outflow from the MRSA is quantifiable and can be adopted by the State Engineer. The Applicant's estimated inflow to the MRSA was based on a prior investigation, was within the range of previously reported estimates, and was not disputed by any of the Protestants. The Applicant used a site-specific analysis to determine outflow from the MRSA, which carries more weight than Dr. Myers' simple assumption that inflow and outflow estimates were equivalent to each other. Accordingly, the State Engineer finds that the Applicant's estimate of interbasin flow in this area is sound.

5. <u>Steptoe Valley</u>

Dr. Myers suggests there is inflow to the WRFS from Steptoe Valley.[419] Dr. Myers also testified that the isotopic data presented by Dr. Thomas supports flow from Cave and southern Steptoe Valleys to White River Valley.[420] Dr. Thomas, however, testified that he did not conclude that groundwater flows from southern Steptoe Valley to White River Valley.[421]

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[418] *See* Exhibit No. SNWA_258, p. G-5.
[419] Transcript, Vol.17 p. 3801:5-13 (Myers).
[420] Exhibit No. GBWN_103, p. 22.
[421] Transcript, Vol.5 p. 1045:12–14 (Thomas).

Also, Dr. Myers appears to adopt this inflow estimate from BARCASS.[422] However, Dr. Myers failed to adopt the total BARCASS inflow to the WRFS, mistakenly leaving out 8,000 afa that flows from Steptoe Valley directly into White River Valley.[423] Dr. Myers admitted that this was an error in his analysis,[424] which calls his interbasin flow estimates into question and undermines his groundwater balance for the flow system. The BARCASS estimate for interbasin flow was based on an imbalance in the groundwater budget for Steptoe Valley. In BARCASS, the groundwater budget for Steptoe Valley had an unprecedented amount of recharge, 154,000 afa, and only 101,000 afa of discharge, leaving 53,000 afa of an imbalance. The BARCASS authors then routed the water from this imbalance to adjacent basins as interbasin flow.[425] 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 and southern Spring Valleys. The latter two flow paths from central and southern Steptoe Valley <u>have not been identified in previous investigations.</u>" The Applicant's geologic expert, Dr. Rowley, testified that the geologic framework shows both westerly flow paths from Steptoe Valley are unlikely flow paths because the Egan Range in this area is bounded by faults perpendicular to the proposed flow path.[426] In arguing that there is flow into Jakes Valley from Steptoe Valley, Dr. Myers also claims that this area supports westerly flow because the mines in the area have required "significant dewatering over the years."[427] Dr. Myers cites a report from Leggette, Brashears, and Graham (1959)[428] that details "how the water levels in an early shaft would fill as

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[422] Exhibit No. SNWA_068, pp. 5, 44-45; Transcript, Vol.17 p. 3801:5-13 (Myers).
[423] Transcript, Vol.19 p. 4536:3-21 (Myers).
[424] Transcript, Vol.19 p. 4536:11-21 (Myers).
[425] Exhibit No. SNWA_068, pp. 44, Table 5; 45, Table 6.
[426] Exhibit No. SNWA_058, p. 6-12; Transcript, Vol.6 p 1243:12-18 (Rowley).
[427] Exhibit No. GBWN_ 103, p. 9.
[428] Exhibit No. GBWN_ 108.

the shaft encountered highly fractured rock zones."[429] This report, however, does not claim this water originates from interbasin flow. Instead on the very next page, the report states that "[t]he limestones that produce water in the Deep Ruth Mine crop out extensively at the land surface, where they are readily recharged whenever moderately heavy precipitation occurs."[430] Therefore, this localized groundwater occurs as a result of a local precipitation recharge area perched above an impermeable layer of weathered monzonite and the beds of shale, not as a result of interbasin flow. [431]

The BARCASS analysis that resulted in this suggested flow path was subsequently updated by the USGS in GBCAAS.[432] 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 the Basin and Range Carbonate Aquifer System [BARCAS] study."[433] Using this information, GBCAAS recalculated the groundwater budget components for Steptoe Valley.[434] 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.[435] The new groundwater budget for Steptoe Valley leaves a recharge deficit of 24,000 afa. Accordingly, interbasin flow must occur *into* Steptoe Valley to balance the groundwater budget. Therefore, the USGS no longer finds that there is outflow from southern Steptoe Valley to Jakes Valley and White River Valley. Dr. Myers did not update his analysis based on this new information from USGS.

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[429] Exhibit No. GBWN_ 108, p. 1033.
[430] Exhibit No. GBWN_ 108, p. 1034.
[431] Transcript, Vol.6 p. 1245:11-16 (Rowley).
[432] Exhibit No. SNWA_065; Exhibit No. MILL_38.
[433] Exhibit No. MILL_038, p. 1.
[434] Exhibit No. MILL_033, p. 4; Exhibit No. MILL_034, p. 4.
[435] Exhibit Nos. MILL_033, p. 4; MILL_034, p. 4; SNWA_068, pp. 44 to 45.

C. Recharge

The Applicant calculated total recharge for the White River Flow System using the groundwater-balance method. Once estimates of groundwater ET and system inflow and outflow values were made, the groundwater balance equation was simply used to compute total recharge for the WRFS. After adding up all groundwater discharge from the WRFS (105,800 afa of groundwater ET and 57,300 afa of external boundary outflow) and subtracting external boundary inflow (14,700 afa), the Applicant arrived at a recharge value of 148,400 afa in the WRFS.[436] In order to estimate how much recharge occurs in individual basins within the WRFS, this quantity of recharge was mathematically distributed within the basins of the WRFS. The first step in this recharge distribution was to estimate the amount of precipitation that occurs in recharge areas in the WRFS. The second step was to calculate recharge efficiencies to estimate the amount of precipitation that actually becomes recharge.

D. Precipitation Distribution in WRFS

The Applicant selected the most accurate available to map the spatial distribution of precipitation in the WRFS, which is the PRISM 800-meter grid representing the normal period 1971-2000. The PRISM precipitation grid was derived using the PRISM computer program developed to model spatial distributions of climatic variables including precipitation. The program uses precipitation-station data and topographical data and takes into account orographic effects. The PRISM precipitation grid represents an annual average for a 30-year period (1971 to 2000) and is based on station data collected during that period of time. Dr. Myers conceded that PRISM is "as of right now…the best tool that we can use."[437] Using this distribution, the

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[436] *See* Exhibit No. SNWA_452.
[437] Transcript, Vol.21 p. 4650:12-15 (Myers).

Applicant generated contour lines representing average annual precipitation throughout the WRFS recharge area that are spaced at one-inch precipitation intervals.[438]

Based on the following evidence, the State Engineer finds that the selection and use of the PRISM precipitation distribution grid by the Applicant represents a significant upgrade from the Hardman map and the way it was applied to the Maxey Eakin method in the Reconnaissance Series Reports. As compared to PRISM, the Hardman map had less precipitation station data, particularly at higher elevations and was generated using less precise hand-contouring methods.[439] The substitution of topographic maps for the Hardman map in the application of the Maxey-Eakin method to certain basins in Nevada caused error. For the Reconnaissance Series Report for Delamar Valley, the precipitation intervals in the Hardman maps were assumed to coincide with topographic contours from the topographic map available at that time.[440] However, as mentioned above, there are a number of different processes that control precipitation rate aside from elevation.

The Applicant completed an analysis to determine the accuracy of the PRISM precipitation distribution. The Applicant's witness Ms. Drici testified that the PRISM grid precipitation estimates were analyzed against precipitation station data. Ms. Drici concluded that the precipitation estimates of the PRISM precipitation grid matched well with the actual normal precipitation station measurements.[441] PRISM also matched well with precipitation data from non-normal stations with more than 20 years of non-zero data.[442] For precipitation stations located within the recharge areas of the WRFS, the PRISM precipitation estimate was within the

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[438] Exhibit No. SNWA_258, p. F-12.
[439] Transcript, Vol.3 pp. 626:19-627:4 (Drici).
[440] Transcript, Vol.3 p. 626:12-18 (Drici).
[441] Transcript, Vol.3 p. 615:10-16 (Drici); Exhibit No. SNWA_258, p. B-14.
[442] Transcript, Vol.3 pp. 616:18-617:7 (Drici); Exhibit No. SNWA_258, p. B-15.

range of uncertainty of the period-of-record mean of each precipitation station.[443] From a statistical standpoint, this information indicates that PRISM and the long term mean are the same.[444] Ms. Drici also concluded that PRISM provided the most current and accurate estimates of precipitation distribution for the Project basins.[445] The State Engineer agrees and finds that the Applicant's use of the PRISM precipitation distribution grid in the recharge analysis was proper.

Taking into account all of the factors that control precipitation, including elevation, PRISM estimated 236,385 afa of precipitation in Delamar Valley which was 91,778 afa more than the Applicant calculated by digitizing the Hardman Map.[446] The Applicant reported that prior estimates of precipitation in Delamar Valley were 236,000 afa (SNWA 2009a); 140,000 afa (Scott, et al., 1971); 176,000 afa (LVVWD, 2001).[447] PRISM's total annual precipitation estimate for Delamar Valley is within the range of these previous estimates.

E. <u>Recharge Distribution</u>

To develop recharge efficiencies, the Applicant used the 800-meter PRISM precipitation distribution and the Excel Solver, which is designed to solve optimization problems using numerical methods. In this case, the Excel Solver was used to find the optimal value for recharge efficiencies for each 1-inch precipitation interval in the WRFS. In doing so, the Applicant expressed the recharge efficiencies as a function of precipitation coupled with an objective function derived from the groundwater-balance equation relating groundwater ET to

[443] Transcript, Vol.3 p. 619:8-16 (Drici).
[444] Transcript, Vol.3 p. 619:20-22 (Drici).
[445] Transcript, Vol.3 p. 629:11-17 (Drici).
[446] Exhibit No. SNWA_258, p. 3-13.
[447] Exhibit No. SNWA_258, p. 3-7.

the other groundwater budget components of the WRFS.[448] The recharge efficiency is expressed as a mathematical equation representing the ratio of recharge to precipitation, in which recharge is a function of precipitation as a power function.[449] In the initial development of this relationship, in order to keep the calculated recharge efficiency values reasonable, the Applicant placed constraints (limits or ranges) on those values. For example, constraints were placed on the power function coefficients to ensure recharge efficiencies increase with increased precipitation.[450] To ensure the Excel Solver calculated representative recharge efficiencies for the WRFS, the Applicant set a maximum recharge efficiency value of 49 percent for the WRFS based on prior studies.[451] Areas where recharge was not expected to occur were also excluded from the Excel Solver analysis. Recharge efficiencies with values of zero were applied to 1) areas on the valley floor; 2) areas of groundwater ET discharge; and 3) areas that received less than 8 inches of precipitation annually.[452] Notably, none of the Protestants disputed these constraints. With these constraints in place, the Excel Solver yielded optimal solutions for recharge efficiencies for each 1-inch precipitation interval.[453] Having reviewed the method by which the Applicant utilized the Excel Solver, the State Engineer finds that the Applicant's use of the Excel Solver in this case is fundamentally sound.

The Applicant's recharge efficiencies were then applied to the spatial distribution of precipitation for Delamar Valley.[454] Recharge volumes were calculated for each 1-inch precipitation interval by multiplying the precipitation rate for the interval, by the surface area

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[448] Exhibit No. SNWA_258, p. F-15.
[449] Exhibit No. SNWA_258, p. F-6.
[450] Exhibit No. SNWA_258, p. F-18.
[451] Exhibit No. SNWA_258, p. F-19.
[452] Exhibit No. SNWA_258, p. F-8.
[453] Exhibit No. SNWA_258, pp. F-22, F-24 to F-25.
[454] Exhibit No. SNWA_258, p. 6-14.

within the valley for the corresponding interval (not including areas of no recharge), and by the recharge efficiency.[455] The Applicant calculated total recharge by summing the recharge volumes for each precipitation interval in Delamar Valley, which equaled 6,600 afa.[456] The Applicant reported the following recharge estimates from prior investigations: 6,627 afa (SNWA, 2009a); 1,000 afa (Reconnaissance Series and Scott, et al. 1971); 2,000 afa (Kirk and Campana, 1988); 5,000 afa (LVVWD, 2001); 3,119 afa, 12,930 afa, 10,248 afa, 3,567 afa, and 21,442 afa (Epstein, 2004); 7,764 afa and 6,404 afa (Flint, et al. 2004); 1,000 afa (Brothers, et al, 1996).[457] The State Engineer finds that the Applicant's recharge estimate is well within the range of prior estimates, and is appropriate for use in the determination of perennial yield for Delamar Valley.

Dr. Myers appears[458] to urge the State Engineer to adopt the recharge estimate in the Reconnaissance Series report as the perennial yield for Delamar Valley.[459] This approach is inconsistent with his recharge analysis for Spring Valley. The State Engineer notes that for Spring Valley, Dr. Myers adopted a recharge estimate that was based on an average of estimates from prior investigations.[460] Interestingly, if this approach was applied to Delamar Valley, Dr. Myers' recharge estimate would have been much higher than the Reconnaissance Series estimate.[461] Dr. Myers did not document the reason for deviating from this approach or his criteria for selecting the Reconnaissance Series estimate over other estimates. As mentioned above, there are improvements in the modern precipitation data over the data that were available

[455] Transcript, Vol.6 p. 1365:3-7 (Drici).
[456] Exhibit No. SNWA_258, p. 6-17.
[457] Exhibit No. SNWA_258, p. 6-18.
[458] The State Engineer notes that Dr. Myers' reports and testimony do not explicitly state his groundwater budget components for Cave, Dry Lake, or Delamar Valleys.
[459] Transcript, Vol.20 p. 4577:2-10 (Myers).
[460] Transcript, Vol.20 p. 4432:8-10 (Myers).
[461] Exhibit No. SNWA_258, p. 6-15.

at the time of the Reconnaissance Series investigations. In addition, there have been dramatic advancements in the computing power and spatial-analysis techniques which now lead to more accurate estimates of recharge as opposed to the method applied in the Reconnaissance Series estimates.[462] Because of these scientific advancements, the State Engineer finds that the Reconnaissance Series report does not contain the most current and accurate estimate for recharge in Delamar Valley.

With respect to the Applicant's analysis, Dr. Myers questioned whether the Applicant could accurately calculate recharge for individual basins using the PRISM 800-meter precipitation distribution. The Applicant's analysis acknowledged that PRISM generally overestimates precipitation, but that nearly all the PRISM estimates fall within plus or minus ten percent of the station values.[463] However, using the Applicant's method, overestimating precipitation does not yield more recharge. As the Applicant pointed out, the total recharge for the WRFS was determined using the groundwater balance equation and was constrained or limited by estimates of groundwater ET and interbasin flow.[464] Therefore, any overestimation of precipitation does not yield a greater value for recharge in the WRFS as a whole.

Dr. Myers also expressed concern that PRISM inaccurately distributed precipitation in the WRFS. Specifically, Dr. Myers questioned whether PRISM simulated greater precipitation in a 12 to 15 inch precipitation band that extended from southern Cave Valley down through eastern Dry Lake and Delamar Valleys, which according to Dr. Myers, would cause the Excel Solver analysis to distribute more recharge to these areas.[465] However, the Applicant presented

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[462] Transcript, Vol.6 p. 1349:4-9 (Drici).
[463] Exhibit No. SNWA_258, p. B-15.
[464] Transcript, Vol.6 pp. 1359:4-10, 20-23 (Drici).
[465] Transcript, Vol.17 p. 3822:17-22 (Myers).

evidence of a precipitation station, Station 26, which had greater than 20 years of measurable precipitation data and was located in this particular band of precipitation. The average annual precipitation for Station 26 was greater than the PRISM simulated precipitation for that station location.[466] Therefore, in this particular precipitation band, PRISM does not overestimate precipitation. Dr. Myers did not submit any evidence to refute this fact.

Dr. Myers also argued that the system-wide approach used by the Applicant to calculate recharge efficiencies was improper. Dr. Myers testified that the Excel Solver analysis distributed recharge without any concern for locations of potential discharge, referring to the analysis as a "Black Box." [467] However, Dr. Myers did not provide any examples of basins in the Applicant's Excel Solver analysis where the distributed recharge was insufficient to balance discharge from the basin. In fact, upon questioning from the Applicant's counsel, Dr. Myers conceded that the Applicant's analysis yields enough recharge in the northern part of the WRFS to satisfy discharge in the White River Valley.[468] Further, the "Black Box" approach is ultimately the same approach that was used by Maxey-Eakin, which Dr. Myers implicitly adopted by selecting the Reconnaissance Report Series recharge estimates for the WRFS project basins.[469] When Maxey and Eakin developed the recharge efficiencies that were ultimately used throughout Nevada to calculate recharge, they considered the WRFS as one unit, just as the Applicant does. Accordingly, the State Engineer finds Dr. Myers' criticisms of the Applicant's Solver analysis unpersuasive.

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[466] Exhibit No. SNWA_258, pp. B-8, Table B-1, Map ID 26; B-10, Figure B-2, Map ID 26; Transcript, Vol.21 pp. 4594:20-4595:4 (Myers).
[467] Transcript, Vol.17 pp. 3794:4-5; 3852:3-7 (Myers).
[468] Transcript, Vol.21 p. 4652:18-21 (Myers).
[469] Transcript, Vol.20 pp. 4429:19-4430:8 (Myers).

The State Engineer finds that the Applicant properly applied the groundwater balance method by calculating recharge efficiencies using the PRISM precipitation distribution grid and updating estimates of groundwater ET and external boundary flows.[470] The State Engineer further finds that the Applicant's analysis is the most current and fundamentally sound method for estimating recharge in Delamar Valley.

F. Delamar Valley Groundwater ET

The parties do not dispute that there is little or no measurable groundwater ET in Delamar Valley.

G. Delamar Valley Inflow

The magnitude and direction of inflow from Dry Lake Valley to Delamar Valley is disputed by the parties. The Applicant's geologic and hydrologic evidence shows that Dry Lake and Delamar Valleys are separated by a low alluvial divide, but are considered geologically and hydrologically connected. All of the significant structures occurring in the basin are associated with north-south trending normal faults that formed the basins and ranges except only one east-west structure that intersects the Dry Lake Valley and the adjacent basin of Pahranagat Valley. This fault is located between the North Pahroc and South Pahroc ranges, an east-west zone of faulted rocks that runs along the boundary of Dry Lake Valley and Delamar Valley.[471] Transverse zones are very deep-seated features that do not have any effect on groundwater flow.[472] Gravity anomalies in Dry Lake and Delamar valleys and their basin boundary show expression of the Timpahute transverse zone east and west of the basin boundary but not at the

[470] Exhibit No. SNWA_294; Exhibit No. SNWA_448.
[471] Exhibit No. SNWA_058, p. 4-51; Transcript, Vol.5 pp. 1188:12-15, 1189:7-11 (Rowley).
[472] Transcript, Vol. 5 p. 1190:2-10 (Rowley).

boundary.[473] A buried north-trending bedrock ridge between the North Pahroc and South Pahroc ranges is depicted in gravity maps even though it is crossed at right angles by the Timpahute transverse zone.[474] Detailed geologic mapping [475]and gravity surveys[476] have identified parts of the east-trending Timpahute transverse zone in the bedrock on both (western and eastern) sides of the valley where Dry Lake Valley passes into Delamar Valley.[477] East-trending faults may be traced to the west as far west as Pahroc Summit Pass, between the North and South Pahroc ranges where US 93 crosses into Six Mile Flat and north of which a SNWA monitoring well was sited. The Timpahute transverse zone, however, has not been identified in the Six Mile Flat area and at the approximate location of a SNWA monitor well.[478] Perhaps the most significant evidence that the Timpahute transverse zone fails to provide a conduit for east-west interbasin flow is the cross section[479] (basin-boundary profile) and geologic map[480] which show a series of large, north-trending normal faults that define the range fronts on either sides of Dry Lake and Delamar valleys, essentially connecting the two basins by these structures. These faults are oriented parallel to the potentiometric gradient and are likely conduits to southward groundwater flow and barriers to westward flow.[481]

Dr. Rowley's geologic analysis indicates that the primary flow paths for groundwater between the valleys is through the basin fill and the north-south trending range front faults of the North Pahroc and Burnt Spring Ranges. This conclusion is supported by the Applicant's

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[473] Exhibit No. SNWA_058, pp. 5-15, 6-9.
[474] Exhibit No. SNWA_058, p. 5-18 (Fig. 5-12).
[475] Exhibit No. SNWA_058, pp. 4-52 to 4-53.
[476] Exhibit No. SNWA_058, pp. 5-13 to 5-18.
[477] Exhibit No. SNWA_058, p. 6-9.
[478] Exhibit No. SNWA_058, pp. 6-9 to 6-10 (referencing Plates 4 and 8).
[479] Exhibit No. SNWA_058, Plate 4, Cross Section S—S'.
[480] Exhibit No. SNWA_058, p. 4-53 (Fig. 4-15) and Plates 1 and 6.
[481] Exhibit No. SNWA_058, p. 6-9 to 6-10.

hydrologic evidence, which demonstrated that the prevailing hydraulic gradient in the carbonate rock and basin fill material in Dry Lake and Delamar Valleys is to the south toward Coyote Spring Valley and the Pahranagat Shear Zone.[482]

H. Delamar Valley Outflow

Since there is no groundwater ET in the basin,[483] this groundwater is discharged from the valley as interbasin outflow. The magnitude and direction of this flow is disputed by the parties. The Applicant contended that all of the water in Delamar Valley discharged to the Pahranagat Shear Zone ("PSZ") or directly to Coyote Spring Valley.[484] The Applicant's geologic analysis evaluated the movement of this water within Delamar Valley. The only significant east-west structure that intersects the South Pahroc Range between the Project basins and Pahranagat Valley is the Timpahute transverse zone, an east-west zone of faulted rocks that runs along the boundary of Dry Lake Valley and Delamar Valley.[485] Transverse zones are very deep-seated features that do not have any effect on groundwater flow.[486] Gravity anomalies in Dry Lake and Delamar valleys and their basin boundary show expression of the Timpahute transverse zone east and west of the basin boundary but not at the boundary.[487] A buried north-trending bedrock ridge between the North Pahroc and South Pahroc ranges is obvious in gravity maps even though it is crossed at right angles by the Timpahute transverse zone.[488] Detailed geologic mapping [489]and gravity surveys[490] have identified parts of the east-trending Timpahute transverse zone in

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[482] Exhibit No. SNWA_258, Plate 2, Carbonate Wells Map ID's 181-6 and 181-25; and Basin Fill Wells 181-7, 181-3, 181-1, 181-19, 181-20, 181-21, 182-4, and 182-3.
[483] Exhibit Nos. SNWA_258, p. 5-1; GBWN_004, p. 25.
[484] Exhibit No. SNWA_258, pp. 7-18, 20-21.
[485] Exhibit No. SNWA_058, p. 4-51; Transcript, Vol.5 pp. 1188:12-15, 1189:7-11 (Rowley).
[486] Transcript, Vol.5 p. 1190:2-10 (Rowley).
[487] Exhibit No. SNWA_058, p. 5-15, 6-9.
[488] Exhibit No. SNWA_058, p. 5-18 (Fig. 5-12).
[489] Exhibit No. SNWA_058, pp. 4-52 to 4-53.

the bedrock on both (western and eastern) sides of the valley where Dry Lake Valley passes into Delamar Valley.[491] East-trending faults may be traced to the west as far west as Pahroc Summit Pass, between the North and South Pahroc ranges where US 93 crosses into Six Mile Flat and north of which a SNWA monitoring well was sited. The Timpahute transverse zone, however, has not been identified in the Six Mile Flat area.[492] Perhaps most telling is the cross section[493] (basin-boundary profile) and geologic map[494] of which show a series of large, north-trending normal faults that define the range fronts on either sides of Dry Lake and Delamar valleys and bifurcate the valley itself. These faults oriented parallel to the potentiometric gradient, are conduits to southward groundwater flow and barriers to westward flow.[495]

The Pahranagat Sheer Zone ("PSZ"), is an area where there are many basin-range faults including the Maynard Lake fault that make flow possible for flow to Tikaboo Valley.[496] The interbasin flow from Delamar Valley to Pahranagat Valley is geologically likely at the southernmost end of those valleys through multiple faults in the PSZ with the most significant flow likely through the PSZ's Maynard Lake Fault.[497] However, other than the PSZ, there are no geologic structures that make it permissible or likely for groundwater to flow from Dry Lake or Delamar Valley to Pahranagat Valley.[498]

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[490] Exhibit No. SNWA_058, pp. 5-13 to 5-18.
[491] Exhibit No. SNWA_058, p. 6-9.
[492] Exhibit No. SNWA_058, pp. 6-9 to 6-10 (referencing Plates 4 and 8).
[493] Exhibit No. SNWA_058, Plate 4, Cross Section S—S'.
[494] Exhibit No. SNWA_058, p.4-53 (Fig. 4-15) and Plates 1 and 6.
[495] Exhibit No. SNWA_058, pp. 6-9 to 6-10.
[496] Transcript, Vol.5 p 1141:3-5 (Rowley).
[497] Exhibit No. SNWA_058, p. 4-52; Transcript, Vol.5 p. 1197:7-23 (Rowley).
[498] Transcript, Vol. 5 p. 1191:19-25 (Rowley).]

The South Pahroc Range forms a north-south boundary between Delamar Valley and Pahranagat Valley,[499] and terminates to the south at the PSZ.[500] The geologic framework indicates that there are range-front faults on both sides of Dry Lake and Delamar valleys, along with additional major faults internal to the valley, all of which are oriented parallel to the hydraulic gradient and provide likely geologic pathways for groundwater flow from north to south in Dry Lake and Delamar.[501] Because these faults are oriented north-south, it is also likely that they act as barriers to any east-west movement of groundwater.[502] Gravity mapping supports the existence of significant north-south faults in Dry Lake and Delamar that would act as barriers to east-west groundwater flow.[503]

Dr. Thomas testified that isotopic data suggests that groundwater flows from Delamar Valley south or southwest into Coyote Spring Valley and possibly into the very southern part of Pahranagat Valley.[504] He stated that the isotopic data shows that little if any groundwater from Delamar Valley supplies the warm springs in White River Valley.[505] Dr. Thomas and Dr. Myers agree that little, if any, groundwater flows from Delamar Valley to the warm springs in Pahranagat Valley based on isotopic data.[506]

Nevertheless, Dr. Myers suggested that all of the recharged groundwater in Dry Lake and Delamar Valley flows to Pahranagat Valley.[507] This argument is not supported by the Applicant's hydrologic evidence, which demonstrated that the prevailing gradient in the

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[499] Exhibit No. SNWA_058, p. 4-51.
[500] Exhibit No. SNWA_058, p. 4-51.
[501] Exhibit No. SNWA_058, p. 4-52; Transcript, Vol.5 p. 1191:9-10 (Rowley).
[502] Transcript, Vol.5 p. 1191:11-14 (Rowley).
[503] Exhibit No. SNWA_058, Fig. 5-18; Transcript, Vol.5 pp. 1191-1193 (Rowley).
[504] Transcript, Vol.5 p. 1040:7–11 (Thomas); Exhibit No. SNWA_077, p. iii.
[505] Exhibit No. SNWA_077, p. iii.
[506] Transcript, vol. 5, p. 1040:12–22 (Thomas); Transcript, Vol.20 pp. 4555:24-4556:4 (Myers).
[507] Exhibit No. GBWN_4, p. 34.

carbonate rock and basin fill material in Dry Lake and Delamar Valleys is to the south toward the PSZ and Coyote Spring Valley.[508] While there is hydrologic potential (i.e. the water level in Pahranagat Valley is lower than the water level in Dry Lake Valley) between these valleys[509], the geologic and geochemical evidence does not support this suggested flow path. According to Millard County's witness, Dr. Hugh Hurlow[510], if these three lines of evidence are available, they should be considered in making this determination.[511] And a determination of interbasin flow cannot be made based on water levels alone when geologic and geochemical evidence contradicts the existence of interbasin flow. Dr. Myers did not submit any evidence which refuted the geologic and geochemical findings of the Applicant's experts.

The Applicant was unable to perform a Darcy analysis for the PSZ given the limited availability of hydrologic data. However, the hydraulic potential between Delamar Valley and Pahranagat Valley is 350 ft,[512] and 1,550 to 1,280 ft between Delamar Valley and Coyote Spring Valley.[513] In addition, the hydraulic potential between Pahranagat Valley and Coyote Spring Valley is approximately 1,400 feet.[514] The State Engineer concludes that the Applicant's hydrologic, geologic, and geochemical analyses all support the finding that groundwater outflow from Delamar Valley is to south toward Coyote Spring Valley and southern Pahranagat Valley.

When the evidence supports such a determination, the State Engineer will reserve from the perennial yield the quantity of interbasin flow that supports existing rights or sensitive

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[508] Exhibit No. SNWA_258, Plate 2, Carbonate Wells Map ID's 181-6 and 181-25; and Basin Fill Wells 181-7, 181-3, 181-1, 181-19, 181-20, 181-21, 182-4, and 182-3.
[509] Exhibit No. SNWA_258, Plate 2.
[510] Dr. Hurlow is a senior scientist with the Utah Geologic survey. The State Engineer qualified Dr. Hurlow as an expert in hydrogeology. Transcript, Vol.16 pp. 3582:9-10; 3593:5-6 (Hurlow).
[511] Transcript, Vol.16 p. 3627:10-22 (Hurlow).
[512] Exhibit No. SNWA_258, p. 7-21. See well Map ID's 182-9, 182-10, 209-16, and 209-20.
[513] SNWA Exhibit 258, p. 7-21 § 7.3.4.
[514] SNWA Exhibit 258, p. 7-21 § 7.3.4.

environmental areas of interest in an adjacent basin. Crystal, Hiko and Ash springs are areas of environmental concern in Pahranagat Valley. There is no geologic evidence suggesting that Dry Lake or Delamar valleys could provide a water source for the primary springs in Pahranagat Valley, including Hiko, Ash, and Crystal springs.[515] Those springs are all located north of the PSZ, and in light of the fact that the hydraulic gradient in Pahranagat Valley is southward, not likely supplied with water from Dry Lake Valley or Delamar Valley.[516] Therefore, the State Engineer finds that the groundwater discharge from Delamar Valley does not support spring discharge and there is no need to reserve water from the perennial yield.

I. Perennial Yield for Delamar Valley Conclusion

In sum, the State Engineer finds that the perennial yield for Delamar Valley is the Applicant's estimated recharge, 6,600 afa. The State Engineer finds that existing water rights in adjacent basins do not rely on the interbasin flow from Delamar Valley. Therefore, 6,600 afa is available for appropriation in Delamar Valley.

J. 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.[517] The Applicant suggests that the perennial yield of a basin is at least as much as the amount of groundwater-ET discharge and no more than the amount of recharge.[518] The Applicant argues that the perennial yield guideline for managing groundwater basins is an

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[515] Transcript, Vol.6 p. 1210:6-11 (Rowley).
[516] Transcript, Vol.6 p. 1209:19-25 (Rowley); Exhibit No. SNWA_058, p. 6-10.
[517] Exhibit No. GBWN_003, p. 3; Transcript, Vol.24 pp. 5369:16–5370:8 (Bredehoeft).
[518] Exhibit No. SNWA_258, pp. 10-1 to 10-2.

accounting assumption and it does not imply that pumping must literally capture all discharge.[519] The Applicant further argues that the definition of perennial yield is unrelated to the system reaching a new equilibrium within a specific time frame and notes that if the goal were to reach equilibrium within a short amount of time, this goal could be achieved by increasing pumping to levels beyond the perennial yield until the new equilibrium is reached.[520]

Assuming climatic conditions remain reasonably constant, under natural conditions, inflow to a groundwater system should equal outflow over the long term.[521] Capture refers to pumping that results in a reduction of ET discharge due to a lowering of the water table. Transitional storage refers to "the quantity of water in storage in a particular groundwater reservoir that is extracted during the transition period between natural equilibrium conditions and new equilibrium conditions under the perennial-yield concept of groundwater development."[522] Pumping of transitional storage is equivalent to using a "bridge" on the way to a new equilibrium.

Dr. Myers' model does not simulate Delamar Valley reaching equilibrium after 2,000 years of continuous pumping of the full application amounts in Cave, Dry Lake, and Delamar Valleys.[523] The model results are not reliable, as discussed below, Dr. Myers testified that the reasonableness of time to equilibrium depends on a case by case basis.[524] The proposed pumping in Delamar is at a large scale in a dry basin. Equilibrium is expected to take a long time. As long as pumping is limited by the perennial yield of the basin, equilibrium will be approached.

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[519] Exhibit No. SNWA_407, p. 3.
[520] Exhibit No. SNWA_407, p. 2.
[521] Exhibit No. SNWA_300, p. 12.
[522] Exhibit No. SNWA_300, p. 13.
[523] Exhibit No. GBWN_004, pp. 49–50.
[524] Transcript, Vol.20 pp. 4525:2–4528:24 (Myers).

The State Engineer finds that there is no requirement that pumping reach a new equilibrium in any set amount of time. Water rights may allow pumping indefinitely and new pumping may not cause an unreasonable lowering of the water table such that it conflicts with existing rights. The protection of existing water rights is assured by this requirement, not a requirement that a new equilibrium be reached in a set amount of time. In addition, hydrologic considerations weigh against requiring that equilibrium be reached in a certain amount of time. Drs. Bredehoeft and Myers testified that true equilibrium, where absolutely no water is withdrawn from storage, is impossible. Even in an infinite aquifer, a small amount of water will continue to be removed from storage indefinitely.[525] Dr. Bredehoeft testified that it was initially believed by hydrologists that a new equilibrium could be reached in a short amount of time in Nevada. Later experience challenges this belief. The time to reach a new equilibrium is greater for larger systems and must be considered on a case-by-case basis. Whatever assumptions regarding time to capture that may have underlain early thoughts on perennial yield in Nevada, they are clearly no longer valid. The State Engineer finds that it will often take a long time to reach near-equilibrium in large basins and flow systems, and that this is no reason to deny water right applications. The State Engineer finds that even if there was a requirement that pumping reach a new equilibrium within a reasonable amount of time, 500 years would be a reasonable time for such a large-scale pumping project within an area as large as the White River Flow System.

Furthermore, there is no apparent reason why, all else being equal, a longer time to reach equilibrium alone would favor denial of water right applications. A pumping regime that lowers the water table one tenth of an inch for 100 years is no more harmful to existing rights and the

[525] Transcript, Vol.21 pp. 4644:19–4645:7 (Myers); Transcript, Vol.24 p. 5447:25–5448:9 (Bredehoeft).

environment than a regime that lowers the water table 10 inches in one year. In many ways, the slower lowering of the water table is less harmful to existing rights and the environment as it allows for slow, gradual adjustments in plant communities. Thus, the State Engineer finds that the estimated time a pumping project takes to reach a new equilibrium does not affect the perennial yield of a basin.

1. 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.[526] 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.

Furthermore, the statutes require the State Engineer to consider the "unappropriated water in the proposed source of supply." The amount of water available is based on what is in the supply, not on the specifics of the method of extraction. The State Engineer thus manages groundwater on a basin-wide scale. Each basin has a perennial yield based on its hydrology. It

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[526] *See* Exhibit No. GBWN_009, p. 3; Exhibit No. GBWN_013, p. 342; Transcript, Vol.24 p. 5371:3–5 (Bredehoeft).

is not practical, nor the intent of the perennial yield concept, to determine separate perennial yields for each applicant based on the placement of their proposed wells. In sum, the unappropriated water in the proposed source of supply may be developed anywhere in the basin, and the State Engineer finds that the Applicant is not required to prove capture of ET as a prerequisite to approval of the Applications.[527]

2. Limiting Perennial Yield to Half the Discharge

Delamar Valley is located in the carbonate aquifer terrain of the White River Flow System ("WRFS"). Many of the basins in the carbonate aquifer terrain, including Delamar Valley, are dry basins because they have very little groundwater ET and most discharge occurs via interbasin outflow to adjacent basins.[528] In basins such as these, groundwater discharge is difficult to quantify; therefore, the State Engineer traditionally uses precipitation recharge and subsurface inflow as the basis for perennial yield.[529]

Historically, the State Engineer has sometimes set the perennial yield to half the estimated recharge and inflow from other basins. The State Engineer developed this policy to prevent over-appropriation of the flow system due to uncertainties associated with quantifying the amount of interbasin flow that can actually be captured.[530] When setting the perennial yield estimate in a dry basin based on outflow, the State Engineer has taken care to avoid double-appropriation of the water in downgradient basins.[531] In determining the amount of water available for appropriation in basins where outflow from one basin is part of the inflow to

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[527] *See* Exhibit No. SNWA_460 Cave Valley Inventory p. 1, at p. 186 ("Groundwater is managed by the State Engineer on a basin-wide scale, and can be developed anywhere in the basin, with certain practical considerations such as accessibility, the location of aquifers or existing rights.").
[528] State Engineer's Ruling 5986, p. 5.
[529] State Engineer's Ruling 5986, p. 5.
[530] State Engineer Ruling 5986, p. 5.
[531] State Engineer Ruling 5465, p. 39 (Jan. 4, 2005).

another basin, the State Engineer has discounted the amount of water appropriated in the upgradient basin from inflow into the downgradient basin to avoid double accounting and regional over appropriation.[532] However, full appropriation of the perennial yield is permitted if there is evidence showing that existing rights in down gradient basins will not be impacted by groundwater production in the subject basin.[533]

In this case, the parties do not dispute that there is minimal groundwater ET in Delamar Valley.[534] The Applicant argues that the State Engineer should depart from the one-half outflow method for Delamar Valley. In 1971, Scott et al. estimated that the amount that could be taken from storage with a dewatering of 50 feet was roughly 50% of a basin's outflow and provided estimates of the transitional storage reserve for Nevada basins based on an average dewatering of 30 to 40 feet.[535] This method was a reconnaissance-level tool to estimate perennial yield when little information was available. The method should not be adhered to when more information is available, as is the case presently. Thus, the assumptions underlying Scott et al.'s conclusion that the perennial yield in dry basins may be set to 50% of the outflow are not applicable in this case. The Legislature has encouraged the State Engineer to "consider the best available science in rendering decisions concerning the available surface and underground sources of water in Nevada."[536] Thus, historical estimates of and methods for determining perennial yield should be rejected when the best available science dictates. Therefore, the State Engineer finds that the majority of groundwater discharge in Delamar Valley occurs through subsurface outflow and that the recharge estimate for Delamar Valley should be used as the basis for perennial yield,

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[532] State Engineer Ruling 5712, p. 14 (Feb. 2, 2007).
[533] *See* NRS 533.370(5) (2010).
[534] Exhibit No. SNWA_258, pp. 5-14; Exhibit No. GBWN_004, pp. 20, 35.
[535] Exhibit No. SNWA_300, p. 13.
[536] NRS 533.024(c) (2010).

subject to the amount of outflow, as determined above, that is needed to satisfy existing rights in down gradient basins.[537] This avoids double-counting because the amount available for appropriation within a basin is based on the amount of recharge occurring within that basin without including inflow from upgradient basins.

K. "One River" Argument

The Protestants have often argued that groundwater flow in the WRFS should be considered "one river." The "one river" argument analogizes the WRFS to a surface water river where diversion of water upstream results in less total water in the river for downstream water users. Dr. Myers' groundwater water budget accounting for the basins within the WRFS treats the system in this manner.[538] The State Engineer finds numerous sources of error in this analysis.

First, from a conceptual standpoint, the WRFS cannot be characterized as a river for the purpose of determining the potential availability of water in downgradient or upgradient basins. On this point, the Applicant admitted a USGS report authored by Ralph Heath, which addressed misconceptions about groundwater movement.[539] Mr. Heath states, in relevant, part that "Common misconceptions include the belief that groundwater occurs in underground rivers resembling surface streams."[540]

According to Mr. Heath, this misconception finds its roots in the fact that

> The ground-water environment is hidden from view except in caves and mines, and the impressions that we gain even from these are, to a large extent, misleading. From our observations on the land surface, we form an impression of a "solid" Earth. This impression is not altered very much

[537] NRS 533.370(5) (2010).
[538] Exhibit No. GBWN_004, pp. 35, 38.
[539] Exhibit No. SNWA_283.
[540] Exhibit No. SNWA_283.

> when we enter a limestone cave and see water flowing in a channel that nature has cut into what appears to be solid rock. In fact, from our observations, both on the land surface and in caves, we are likely to conclude that ground water occurs only in underground rivers and "veins." We do not see the myriad openings that exist between the grains of sand and silt, between particles of clay, or even along the fractures in granite.[541]

Based on this discussion, Mr. Heath concludes the following:

> In order for the Nation to receive maximum benefit from its ground-water resource, it is essential that everyone, from the rural homeowner to managers of industrial and municipal water supplies to heads of Federal and State water-regulatory agencies, become more knowledgeable about the occurrence, development, and protection of ground water…[542]

The State Engineer finds Mr. Heath's points instructive as it pertains to this "one river" argument. Simply put, groundwater movement is much more complex and much slower than surface water. Dr. Thomas testified that, in general, groundwater takes thousands of years to travel through groundwater flow systems.[543] Specifically, Dr. Thomas stated that it can take thousands of years for groundwater to travel from recharge areas through numerous basins to discharge in warm spring areas throughout the White River Flow System.[544] The State Engineer finds that suggesting that the groundwater in a flow system such as the WRFS is akin to a river ignores these fundamental differences and oversimplifies the analysis.

Second, fundamental problems with Dr. Myers' WRFS groundwater budget make that budget incapable of supporting the assertion that the WRFS should be managed as one unit. For example, Dr. Myers' groundwater budget analysis is inconsistent. He draws estimates for recharge from the Reconnaissance Series Reports for all the basins in the WRFS except for

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[541] Exhibit No. SNWA_283, p. 1.
[542] Exhibit No. SNWA_283.
[543] Transcript, Vol.5 pp. 1057:7–12, 1058:10–1059:1 (Thomas).
[544] Exhibit No. SNWA_077, p. iii.

Coyote Spring Valley and Kane Springs Valley, which were adopted from the Kirk and Campana report.[545] In addition, Dr. Myers' groundwater ET estimate for White River Valley was adopted from BARCASS.[546] Each of these assumptions reflects inconsistent use of available data, but consistently leads Dr. Myers to conclusions that less water is available for appropriation in the flow system.

Dr. Myers also violated the groundwater balance method by using these recharge and discharge estimates from different studies to develop a groundwater budget for the WRFS.[547] Groundwater budget accounting that uses the Reconnaissance series recharge estimates must also use the Reconnaissance series groundwater ET estimate. The Reconnaissance series recharge estimates cannot be used if groundwater ET estimates are based on BARCASS estimates of groundwater ET and external boundary flow, as Dr. Myers has done here.[548] In fact, Dr. Myers admitted during testimony that the recharge estimates for the Reconnaissance Series reports are dependent on the Reconnaissance Series estimates for groundwater ET.[549] Further, Dr. Myers simply reduced the outflow estimates for the basins in the WRFS without accounting for potential capture of groundwater discharge.[550]

With respect to interbasin flow, Dr. Myers treats each basin as a single cell, with a set amount of recharge, discharge, and boundary flow. Dr. Myers provides no analysis of any of these components within the individual basins, which is a clear source of error given the complexities of the system.[551] In addition, Dr. Myers' analysis appears to cause a reversal of

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[545] Exhibit No. GBWN_004, p. 35; Transcript, Vol.21 pp. 4603:4–4609:14 (Myers).
[546] Exhibit No. GBWN_004, pp. 26 and 35.
[547] Exhibit No. GBWN_004, p. 35.
[548] Exhibit No. SNWA_425, p. 2.
[549] Transcript, Vol.20 p. 4430:1-8 (Myers); Exhibit No. SNWA_425, p. 2.
[550] Exhibit No. GBWN_004, p. 39.
[551] Exhibit No. GBWN_004, p. 39.

outflow for some basins, such as Pahranagat Valley, by reporting the interbasin flow as a negative value.[552] This effect is exaggerated due to the fact that Dr. Myers selected the Reconnaissance recharge estimates, which are some of the lowest reported estimates for Dry Lake and Delamar Valleys,[553] and then assumed that the Applicant would develop the full Application volumes as opposed to the unappropriated perennial yield.[554] With respect to this analysis, Dr. Myers indicated that the apparent reversal of flow was just "an accounting;"[555] however, in his expert report he concluded that "developing either SNWA's application amount or the published perennial yield will cause discharge from Pahranagat Valley to become negative once steady state becomes established."[556]

It is undisputed that the WRFS is a highly complex groundwater system. Given these complexities and the fundamental flaws in Dr. Myers' analysis, the State Engineer cannot find, with any amount of certainty, that removing water in upgradient basins will ultimately reduce the availability of water for users in downgradient basins based on a simple groundwater budget accounting analysis. Therefore, the State Engineer rejects Dr. Myers' WRFS groundwater budget conclusions. Instead, the State Engineer finds that the determination of the amount of water available for appropriation is made on a case by case or, more precisely, a basin by basin basis.[557]

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[552] Exhibit No. GBWN_004, p. 39.
[553] Exhibit No. SNWA_258, p. 6-18.
[554] Exhibit No. GBWN_004, pp. 38-39.
[555] Transcript, Vol.17 p. 3859:19-24 (Myers).
[556] Exhibit No. GBWN_004, p. 38.
[557] Transcript, Vol.21 p. 4611:14-21 (Myers).

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.[558] Committed groundwater rights are the portion of groundwater rights that actually deplete water from the groundwater reservoir. The Applicant undertook a complete and comprehensive evaluation of committed groundwater rights in Delamar Valley. The Applicant's evaluation was presented through exhibits and the testimony of expert water rights surveyor, Michael Stanka of Stanka Consulting, LTD.[559] Mr. Stanka presented an expert report which quantified the total amount of committed groundwater rights in Delamar Valley.[560] Mr. Stanka's report identified every groundwater right in Delamar Valley and then made adjustments for (i) groundwater rights that are supplemental to other groundwater rights, and (ii) the amount of groundwater from domestic wells that is estimated to be consumed for domestic uses.[561] There are no groundwater irrigation rights in Delamar Valley so it was not necessary to include adjustments for (i) groundwater irrigation rights that are supplemental to groundwater irrigation rights, (ii) groundwater irrigation rights that are supplemental to surface water, or (iii) the amount of groundwater that is estimated to be consumed for irrigation purposes.

In addition, the State Engineer has undertaken an independent evaluation and has prepared an inventory of all water rights in Delamar Valley pursuant to NRS 533.364.[562] The results of Mr. Stanka's analysis conform closely to the results of the basin inventory prepared by

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[558] NRS 533.370(5) (2010); NRS 534.110(3).
[559] Mr. Stanka holds professional engineering licenses in Nevada and Florida and is a water rights surveyor in the State of Nevada. He was qualified by the State Engineer as an expert in water rights research and quantification. Exhibit No. SNWA_096; Transcript, Vol.2 p. 420:19-21 (Qualification of Mr. Stanka).
[560] Exhibit No. SNWA_097.
[561] Exhibit No. SNWA_097, p. 1-7.
[562] Exhibit No. SNWA_460.

the State Engineer. Thus, these hearings have yielded the most current and accurate estimate of committed groundwater rights in Delamar Valley.

When calculating the total amount of committed groundwater rights in a basin, it is inappropriate to simply sum the number of acre-feet listed on each water right. Each water right has a place of use limitation and a total combined duty limitation so that even if a certain place of use has more than one water right associated with it, the amount of water used on that piece of land is limited by the total combined duty. In order to accurately account for the total amount of committed groundwater rights in a basin, a water rights surveyor adjusts the total water rights by accounting for water rights limited by total combined duties, water rights that are supplemental (i.e. not used every year), and for consumptive use.

Mr. Stanka's report identified the committed groundwater rights in four hydrographic basins. At the hearing, Mr. Stanka explained the methodology used in connection with Spring Valley, in order to describe the methodology used generally in connection with all four basins. That testimony is cited below to the extent it describes the methodology used to identify committed groundwater rights in Delamar Valley.

A. <u>Active Water Rights</u>

Mr. Stanka reviewed the on-line database and physical files of the Division of Water Resources and identified every single water right and record in Delamar Valley, including applications, permits, certificates, claims of reserved rights and claims of vested rights. Mr. Stanka listed those water rights and records in various tables and appendices in his report based on the manner of use, source of the water, and status of the water right or record. Mr. Stanka then identified the total duty of the permits, certificates, claims of reserved rights and claims of

vested rights.[563] Mr. Stanka did not identify the total duty of applications currently pending in the office of the State Engineer. The State Engineer finds this was the correct approach because an application is not a committed groundwater right, but rather is simply a record of a pending application to acquire a water right or to change an existing water right.[564] Thus, an application may never result in a water right and it would be speculative and thus improper to attempt to quantify them.

B. Groundwater Rights Supplemental to Groundwater Rights

Mr. Stanka identified every groundwater right that is supplemental to another groundwater right in Delamar Valley.[565] A groundwater right is not a committed groundwater right to the extent that it is supplemental to another groundwater right because the supplemental amount exceeds the maximum allowed duty. A water right holder is prohibited from pumping and applying more water than allowed by the duty, so amounts in excess of the maximum duty can never be used and are therefore available for appropriation by other water users.[566]

Mr. Stanka reviewed the terms of the water right permits or certificates to determine whether they were supplemental to another groundwater right.[567] If two or more groundwater rights have a combined duty not to exceed a certain amount, then the total duty in excess of that amount is supplemental. There are no groundwater irrigation rights in Delamar Valley which means that there are no groundwater irrigation rights that are supplemental to other groundwater irrigation rights in Delamar Valley.[568] Mr. Stanka identified a total of 7.24 afa of non-irrigation

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[563] Exhibit No. SNWA_097, Section 4.2, pp. 4-4 to 4-8.
[564] Exhibit No. SNWA_097, p. 4-4; Transcript, Vol.2 p. 430:5-18 (Stanka).
[565] Transcript, Vol.2 p. 449:4-9 (Stanka).
[566] Transcript, Vol.2 pp. 439:12-440:5 (Stanka).
[567] Exhibit No. SNWA_097, Section 4.2, pp. 4-4 to 4-8.
[568] Exhibit No. SNWA_097, Section 4.3, p. 4-8; Transcript, Vol.2 pp. 428:6-11, 439:2-11 (Stanka).

groundwater rights in Delamar Valley, none of which were supplemental.[569] Therefore, the entire 7.24 afa of non-irrigation groundwater rights are committed groundwater rights and are not available for appropriation under these Applications.

C. Groundwater Irrigation Rights Supplemental to Surface Water Rights

There are no groundwater irrigation rights in Delamar Valley, which means that there are no groundwater irrigation rights that are supplemental to surface water irrigation rights in Delamar Valley.[570] Therefore, it is not necessary to adjust for supplemental use in this context.

D. Consumptive Use of Groundwater Irrigation Rights

There are no groundwater irrigation rights in Delamar Valley which means it is not necessary to make adjustments for the consumptive use of groundwater irrigation rights by crops.[571]

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.[572] 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. This does not impact domestic well users because their ability to divert up to 2 afa is not restricted or changed in any manner.

Mr. Stanka estimated the amount of water that is consumptively used by domestic wells in Delamar Valley by estimating the number of domestic wells in the basin and then estimating

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[569] Exhibit No. SNWA_097, p. 4-5, 4-9.
[570] Exhibit No. SNWA_097, Sections 4.5 & 4.6, p. 4-9; Transcript, Vol.2 pp. 454:14-455:11 (Stanka).
[571] Exhibit No. SNWA_097, Section 4.7, p. 4-9; Transcript, Vol.3 pp. 507:16-508:12 (Stanka).
[572] NRS 534.180.

the acre-foot amount of water pumped at a given domestic well.[573] This estimate is necessary because data does not exist regarding the actual number of domestic wells and pumping records for those wells.[574] It was not appropriate to assume that each domestic well actually used 2 afa because evidence showed that while domestic wells are allowed to pump up to 2 afa without a permit, domestic wells do not actually consume and deplete 2 afa from the aquifer. Due to the significant depth to water within Delamar Valley, Mr. Stanka assumed that no water pumped from domestic wells would return to the basin via secondary recharge from septic systems.[575] Because it was assumed that no secondary recharge from domestic wells in Delamar Valley would return to the groundwater system, Mr. Stanka's analysis treated all of the water pumped from domestic wells as being fully consumptively used.

To estimate the amount of water pumped from domestic wells, Mr. Stanka multiplied the estimated number of wells in Delamar Valley by the estimated number of people per well by the estimated per capita water use in Delamar Valley.[576] The estimated number of wells in Delamar Valley was equal to the number of wells identified in the Nevada Division of Water Resources Well-Driller Log database with a casing diameter of 5 to 9 inches, which is within the diameter range for a domestic well casing.[577] Mr. Stanka reviewed the mean number of people per household in six Nevada counties as identified by the State Demographer and then, in order to not underestimate water use, Mr. Stanka assumed that the estimated number of people per well in Delamar Valley was equal to the highest mean number identified.[578] The estimated per capita

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[573] Exhibit No. SNWA_097, Section 4.8, pp. 4-9, 4-11.
[574] Exhibit No. SNWA_097, p. 4-11; Transcript, Vol.3 pp. 515:4-19, 516:13-24 (Stanka).
[575] Exhibit No. SNWA_097, p. 4-11.
[576] Exhibit No. SNWA_097, p. 4-11.
[577] Exhibit No. SNWA_097, p. 4-11; Transcript, Vol.3 p. 517:13-16 (Stanka).
[578] Exhibit No. SNWA_097, p. 4-11; Transcript, Vol.3 p. 517:17-23 (Stanka).

water use in Delamar Valley was equal to per capita water use estimates prepared by Brown and Caldwell (2005) for Carson City, Lyon County and Douglas County.[579] As a result of this analysis, Mr. Stanka estimated that 1.71 afa are being pumped from domestic wells in Delamar Valley and are committed groundwater rights.[580]

F. Results and Comparison to State Engineer's Basin Inventory

In order to determine the entire amount of committed groundwater rights in Delamar Valley, Mr. Stanka added (i) the non-supplemental groundwater rights, and (ii) the groundwater rights expected to be consumptively used by domestic wells. The result is that Mr. Stanka identified a total of 8.95 afa of committed groundwater rights in Delamar Valley.[581]

The results of Mr. Stanka's analysis are almost identical to the results of the basin inventory prepared by the State Engineer pursuant to NRS 533.364.[582] These two analyses were prepared independently and the basin inventory was not yet available when Mr. Stanka prepared his expert report. Each of the analyses identified all groundwater rights in Delamar Valley and then adjusted for supplemental use and consumptive use. As explained above, Mr. Stanka's analysis identified 8.95 afa of committed groundwater rights, while the State Engineer's basin inventory identified 8 afa of committed groundwater rights.[583] Therefore, the difference is only 0.95 afa.[584] The fact that two analyses were prepared independently but arrived at nearly the same results provides strong evidence of the reliability of those results. The Protestants did not present any evidence quantifying the committed groundwater rights in Delamar Valley.

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[579] Exhibit No. SNWA_097, p. 4-11; Transcript, Vol.3 pp. 517:24-518:4 (Stanka).
[580] Exhibit No. SNWA_097, p. 4-11; Transcript, Vol.3 p. 523:7-16 (Stanka).
[581] Exhibit No. SNWA_097, p. 4-12, Table 4-4.
[582] Exhibit No. SNWA_460.
[583] Exhibit No. SNWA_097, p. 4-12, Table 4-4; Exhibit No. SNWA_460 – Delamar Valley, p. 1, Table 1.
[584] Transcript, Vol.3 p. 515:4-19 (Stanka).

The State Engineer's basin inventory was a reasonable estimate of the water rights in Delamar Valley. However, the State Engineer finds that Mr. Stanka's analysis provides additional evidence and supporting analysis regarding the committed groundwater rights in Delamar Valley. The Protestants did not present any evidence quantifying the committed groundwater rights in Delamar Valley. The State Engineer finds that the methodology used by Mr. Stanka is reasoned, thorough, documented, and transparent and the State Engineer will use the results of Mr. Stanka's analysis to determine the amount of groundwater available for appropriation in Delamar Valley.

G. Application to Junior Rights

In Delamar Valley, there are no existing water rights that have priority dates junior to the Applications.

Based on the evidence in the record, including but not limited to that cited above, and on the State Engineer's water right files, the State Engineer finds that there are a total of 8.95 afa of committed groundwater rights in Delamar Valley.

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.[585] To address this requirement, the Applicant prepared an expert report describing a three part analysis. [586] First, a qualitative analysis was performed, which assessed potential conflicts based on water right ownership,

[585] NRS 533.370(5) (2010).
[586] Exhibit No. SNWA_337, p. 1-1, 3.

geographical location, and priority date.[587] 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.[588] Third, a qualitative site specific analysis of each of the areas of concern identified in the model to assess the potential for conflicts was performed.[589]. Additionally, the Applicant prepared a management plan for Delmar, Dry Lake and Cave Valleys ("DDC Valleys") 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 Delamar, Dry Lake, and Cave Valleys (the "Management Plan") part of the permit terms for the Applications.[590]

A. DDC Management Program

The Project proposed by the Applicant is of a size and scope that requires a comprehensive management 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. The management program 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 that in order to determine that the Applications will not conflict with existing rights, a

[587] Transcript, Vol.11 p. 2540:16-18 (Watrus).
[588] Transcript, Vol.11 p. 2540:18-19 (Watrus).
[589] Transcript, Vol.11 p. 2540:19-21 (Watrus).
[590] Exhibit No. SNWA_148, p.1; Transcript, Vol.8 p. 1795:16-22 (Prieur).

regulatory regime must be in place to control Project development. For that reason, 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 Applicant's primary witness regarding the hydrologic aspects of the Management Plan for Delamar, Dry Lake, and Cave Valleys was Mr. James Prieur. Mr. Prieur is an expert in hydrogeology and, more specifically, hydrologic monitoring and management.[591] The record reflects that Mr. Prieur has extensive professional experience in this field. Mr. Prieur is currently a senior hydrologist for the Applicant.[592] Mr. Prieur developed and implemented the Applicant's hydrologic monitoring program for the DDC Valleys.[593] He is responsible for the monitoring program that includes hydrologic monitoring, permit compliance, and reporting, as well as the aquifer testing program in the DDC Valleys.[594] Mr. Prieur also manages the hydrologic monitoring, permit compliance, and reporting for the Applicant's artificial recharge and recovery program in the Las Vegas Valley.[595]

Prior to his work with SNWA, Mr. Prieur's experience included a variety of monitoring and management projects with the Safe Drinking Water Program in Illinois,[596] the Argonne National Laboratory,[597] and Superfund Projects managed by N.U.S. Corporation, a Halliburton subsidiary.[598] Mr. Prieur also gained extensive experience with carbonate aquifers. Mr. Prieur

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[591] The State Engineer qualified Mr. Prieur as an expert in hydrogeology, which covered hydrologic monitoring and management. Transcript, Vol.8 p. 1788:22-23 (Prieur).
[592] Transcript, Vol.8 pp. 1778:14-16 (Prieur).
[593] Transcript, Vol.8 p. 1781:8-10 (Prieur).
[594] Transcript, Vol.8 pp. 1779:20-1780:12 (Prieur).
[595] Transcript, Vol.8 p. 1780:8-12 (Prieur).
[596] Transcript, Vol.8 p. 1782:13-15 (Prieur).
[597] Transcript, Vol.8 p. 1782:21-25 (Prieur).
[598] Transcript, Vol.8 p. 1783:11-19 (Prieur).

performed aquifer testing and implemented a monitoring program for a contaminated carbonate aquifer well field in Puerto Rico and in other locations.[599] Mr. Prieur also co-founded a company that specialized in hydrogeologic and hydrologic investigations, remedial investigations, aquifer restoration, water resource assessments, and sustainability assessments.[600] For this company, Mr. Prieur primarily worked in the carbonate aquifers of Florida.[601] Mr. Prieur also consulted and performed volunteer work around the world on water resource issues and environmental issues.[602] Based on his extensive experience in monitoring and management projects and, in particular his work with carbonate aquifers, the State Engineer finds that Mr. Prieur has significant expertise in assessing the effectiveness of the Management Plan in DDC.

Prior to development of the monitoring and management plan in DDC, the Applicant had a history of supporting its Applications through data collection. The record reflects that the Applicant has been collecting data related to groundwater hydrology in the DDC Valleys since it filed the Applications.[603] The monitoring plan was initially completed as a component of the Stipulation between the Applicant and the Bureau of Indian Affairs, the Bureau of Land Management, National Park Service, and the U.S. Fish and Wildlife Service ("Federal Agencies") that resulted in the withdrawal of the Federal Agencies' protests against the Applications.[604] The monitoring plan was finalized to comply with permit terms for the Applications after the Applications were approved in Ruling 5875.

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[599] Transcript, Vol.8 pp. 1783:20-1784:3 (Prieur).
[600] Transcript, Vol.8 p. 1784:10-17 (Prieur).
[601] Transcript, Vol.8 p. 1784:20-22 (Prieur).
[602] Transcript, Vol.8 p. 1785:4-9 (Prieur).
[603] Transcript, Vol.9 pp. 2080:25-2081:2 (Prieur).
[604] Transcript, Vol.9 p. 2081:3-7 (Prieur); Exhibit No. SE_080.

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 DDC Management Plan. Second, the Stipulation addresses how the Federal Agencies and the Applicant will resolve issues between themselves that are related to federal 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 attached exhibit, set forth the guidelines for the elements of the monitoring plan. Exhibit A established the technical framework and structure for the hydrologic and biologic elements of the monitoring, management and mitigation program.[605] The monitoring area includes the project basins as well as adjacent basins. Mr. Prieur testified that the area of interest for monitoring efforts is Cave Valley, Dry Lake Valley, Delamar Valley, the southern portion of White River Valley and Pahranagat Valley.[606]

The parties agreed upon mutual goals to guide the development of these monitoring plans. The common hydrologic goals of the parties are to manage the development of groundwater by SNWA without 1) causing any injury to federal water rights and 2) any

[605] Transcript, Vol.9 p. 2081:11-16 (Prieur).
[606] Transcript, Vol.9 p. 2081:20-23 (Prieur).

unreasonable adverse effects to federal resources and special status species within the area of interest.[607]

The Stipulation established a Technical Review Panel ("TRP"), for the hydrologic plan, a Biological Resource Team ("BRT"), for the biological plan, and an Executive Committee to oversee implementation and execution of the agreement.[608] The TRP and BRT 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.[609]

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 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.[610] The Applicant's representatives regularly meet with the TRP and the BRT to discuss ways to best utilize each group's data and to discuss any additional hydrologic data that may be needed under the plan.[611]

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

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[607] Transcript, Vol.9 pp. 2082:25-2083:6 (Prieur); Exhibit No. SNWA_080, p. 4, § H.
[608] Transcript, Vol.8 p. 1800:6-10 (Prieur); Transcript, Vol.9 pp. 2081:8-10, 2083:7-10 (Prieur).
[609] Transcript, Vol.8 p. 1802:6-10 (Prieur).
[610] Transcript, Vol.8 p. 1837:12-17 (Prieur).
[611] Transcript, Vol.8 p. 1837:18-21 (Prieur).

effects on federal resources or injury to federal water rights.[612] 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.[613]

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 Tribe's 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 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 Plan 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 5875. That plan was approved by the State Engineer on December 22, 2009.[614] The Applicant submitted an updated monitoring and mitigation plan for this hearing and requested that the State Engineer include compliance with the plan as part of the permit terms.[615] The proposed monitoring and mitigation plan includes all of the elements from the previous plan, and was

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[612] Transcript, Vol.8 pp. 1802:17-1803:8 (Prieur).
[613] Exhibit No. State Engineer_041, Exhibit A, p. 14, § II(2).
[614] Transcript, Vol.11 p. 2332:6-20 (Prieur); Exhibit No. SNWA_152.
[615] Exhibit No. SNWA_149.

updated to include survey information and construction information obtained since the plan was approved. Additionally, the plan addresses non-federal water rights.[616]

Data collection is a key component of the monitoring 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.[617] 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.[618]

The Applicant has established a monitoring network of wells and springs as part of the monitoring plan. Mr. Prieur testified that the Applicant spent well over $10,000,000 to develop the monitoring, test, and exploratory well network.[619] Mr. Prieur testified that the well network provides spatial distribution across the valleys in different hydrologic and geologic settings.[620] The object of the hydrologic monitoring plan was to assess the hydrologic interrelationship between the DDC Valleys and adjacent basins, primarily White River Valley, Pahranagat Valley, and Northern Coyote Spring Valley.[621]

In addition to the monitoring well network, the plan also calls for a test well network. Test wells will provide geologic data and hydrologic aquifer property data.[622] Similar to the monitoring wells, these wells collect water level elevation information that is plotted on a

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[616] Transcript, Vol.11 pp. 2332:23-2333:8 (Prieur).
[617] Transcript, Vol.8 p. 1840:17-23 (Prieur).
[618] Transcript, Vol.8 p. 1841:1-6 (Prieur).
[619] Transcript, Vol.8 p. 1841:1-6 (Prieur).
[620] Transcript, Vol.11 p. 2334:1-5 (Prieur).
[621] Transcript, Vol.11 p. 2336:3-7 (Prieur).
[622] Transcript, Vol.9 p. 2072:4-12 (Prieur).

hydrograph.[623] 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.[624] 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.[625] Installing the test wells in the Project basins has cost the Applicant over $10,000,000.[626]

The major area of concern is the relationship between Dry Lake and Delamar Valleys and Pahranagat and Coyote Spring Valley. Here, the Applicant has installed one carbonate well at Pahroc summit, 209M-1, located between Dry Lake Valley and Pahranagat Valleys. The Applicant is also monitoring two existing basin fill wells to the east of Hiko Springs in Six Mile Flat and has committed to constructing a carbonate well between the basin fill wells and Hiko Springs.[627] In southern Delamar Valley, the Applicant has constructed two monitoring wells in volcanic material, and has committed to construct an additional monitoring wells further south between Delamar Valley and Pahranagat Valley.[628] Mr. Prieur specifically identified monitoring well 209M-1 as a potential indicator of any flow from Dry Lake and Delamar Valleys to Pahranagat Valley.[629] The Applicant will compare the water elevation in this well, located at Pahroc Summit, with the water elevation in the new carbonate well on the eastside of the Hiko Range and the other basin fill wells in the area to assess the prevailing hydraulic gradient.[630] In addition, water chemistry samples from this well will also be compared against samples from the

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[623] Transcript, Vol.9 p. 2073:18-22 (Prieur).
[624] Transcript, Vol.9 pp. 2073:22-2074:8 (Prieur).
[625] Transcript, Vol.9 p. 2075:12-21 (Prieur).
[626] Exhibit No. SNWA_147, p. 3-4, Figure 3-1.
[627] Transcript, Vol.11 p. 2337:7-12 (Prieur).
[628] Transcript, Vol.11 p. 2343:13-20 (Prieur).
[629] Transcript, Vol.11 pp. 2342:20-2343:20 (Prieur).
[630] Transcript, Vol.11 p. 2343:13-20 (Prieur).

other wells to determine the sources of water in this area.[631] The well completion and testing report for irrigation well PW-1 located in Dry Lake Valley, which is not part of the monitoring network, will provide additional data on water level elevation, water chemistry, transmissivity, and aquifer storage for this analysis.[632]The State Engineer finds that these continued monitoring efforts will provide an informed understanding of the hydrologic system in this area and further confirm the State Engineer's finding that there is no hydrologic connection 1) between Dry Lake and Pahranagat Valleys, and 2) between Delamar and Pahranagat Valleys except in the area of southern Delamar Valley near the Pahranagat Shear Zone.

Due to the significant depth to water in the DDC Valleys, the spring monitoring network consists of eight springs that are either located in the mountain block or are sourced by local water.[633] These springs are monitored biannually, even at Cave Spring which is monitored in the fall when it is historically dry and again in the spring when it is flowing.[634] The remaining eight springs are located in White River Valley or Pahranagat Valley. The springs were selected by the TRP after meeting with water right owners in these valleys. Hiko Springs is equipped with a continuous flow meter and an 18-inch discharge line installed by the Applicant.[635] At Flag Springs Complex, a flume and continuous gauging station were installed with assistance from the Nevada Department of Wildlife.[636] The Applicant also worked with the State Engineer's office to obtain permission to install a flume at Hardy Springs, which is associated with Sunnyside

[631] Transcript, Vol.11 p. 2343:18-20 (Prieur).
[632] Transcript, Vol.11 p. 2344:2-17 (Prieur).
[633] Transcript, Vol.11 p. 2346:4-8 (Prieur).
[634] Transcript, Vol.11 p. 2347:12-24 (Prieur).
[635] Transcript, Vol.11 p. 2346:21-22 (Prieur).
[636] Transcript, Vol.11 pp. 2346:25-2347:3 (Prieur).

Ranch.[637] In addition, there is continuous monitoring of discharge and diversions at Hot Creek and Crystal and Ash Springs by the USGS.[638]

The Monitoring Plan includes other hydrologic elements that provide a comprehensive view of the hydrologic system. For example, there is a requirement in the plan to establish a precipitation measurement network. 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 recording and collection.[639] The Applicant also has standard procedures for database entry and management. The collected data is brought to the office and entered into the database.[640] 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.[641] The hourly continuous data is processed using Aquarius software and then it is placed into the database.[642] Any erroneous data must go through an audit process in order for it to be removed from the database.[643]

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

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[637] Transcript, Vol.11 p. 2347:4-7 (Prieur).
[638] Transcript, Vol.11 p. 2348:15-20 (Prieur).
[639] Transcript, Vol.9 pp. 2066:11-2067:13 (Prieur).
[640] Transcript, Vol.9 p. 2067:14-23 (Prieur).
[641] Transcript, Vol.9 pp. 2067:24-2068:12 (Prieur).
[642] Transcript, Vol.9 p. 2068:13-14 (Prieur).
[643] Transcript, Vol.9 pp. 2068:25-2069:2 (Prieur).

chemistry analysis, and a summary of precipitation data provided by other agencies.[644] These reports have been submitted to the State Engineer for 2008, 2009, 2010, and 2011 and are available to the public.[645] Electronic data is also provided to the State Engineer on a quarterly basis.

Dr. Bredehoeft, a witness for Great Basin Water Network, provided general opinions that monitoring will not be effective. Although Dr. Bredehoeft implied in his written report that monitoring may not effectively detect pumping signals at long distances or if detected, it may be too late to effectively react to it, during his testimony he admitted that the system can indeed be monitored effectively.[646]

Dr. Bredehoeft provided a simple hypothetical model of a groundwater system to support his conclusions.[647] Dr. Bredehoeft testified that, based on his hypothetical example, impacts due to pumping may not be detected for up to 75 years.[648] Dr. Bredehoeft testified that his hypothetical model differs from the conditions found in the project basins, and that these differences would affect the results in some instances.[649] Mr. Prieur testified that the example does not reflect the reality of Cave, Dry Lake, and Delamar Valleys because of differences in pumping locations and rates, aquifer properties, and interbasin flow and the lack of an extensive monitoring network.[650] Though this hypothetical model illustrates some general principles, it carries little weight when considering the specific effects of the proposed pumping. His example

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[644] Transcript, Vol.11 p. 2349:8-10 (Prieur).
[645] Transcript, Vol.11 p. 2349:8-21 (Prieur); Exhibit Nos. SNWA_165 through 168.
[646] Transcript, Vol.24 pp. 5455:19–23, 5495:16–5496:6 (Bredehoeft).
[647] Exhibit No. GBWN_109, p. 9; *see, e.g.*, GBWN_011.
[648] Transcript, Vol.24 pp. 5400:17–5401:7 (Bredehoeft).
[649] Transcript, Vol.24 p. 5450:12–20 (Bredehoeft).
[650] Transcript, Vol.11 p. 2369:1-20 (Prieur).

does not reflect the reality of the WRFS because it has more dispersed recharge, more dispersed springs, more dispersed wells, and an extensive network of monitoring wells.[651]

Dr. Bredehoeft's example also does not replicate the proposed pumping regime. Specifically, it allows pumping to continue without any management decisions or maintenance periods and has pumping occur directly in between the sole recharge area and the sole discharge area represented in the system. Local hydrogeologic conditions affect the pumping response.[652] Because local hydrogeologic conditions are not reflected in Dr. Bredehoeft's example, it does not demonstrate the response that can be expected in the WRFS due to the proposed pumping. Furthermore, the State Engineer has available detailed models designed to represent the project basins and surrounding basins and the proposed pumping plan. Therefore, the State Engineer finds Dr. Bredehoeft's hypothetical examples are of little value.

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.[653] With a network of monitoring wells, deviations among different wells at different locations can be compared to determine the likely source of the effect.[654] Even with Dr. Bredehoeft's example of a single monitoring well nearly 50 miles from the pumping source and very close to the spring of interest, early detection of drawdown at the monitoring well allows the water manager to halt pumping and prevent significant impacts to the spring.[655] Dr. Bredehoeft testified that if one placed a monitoring well between the pumping site and the area of interest, one could see the

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[651] Transcript, Vol.11 pp. 2367:16–2368:25 (Prieur).
[652] *See* Exhibit Nos. GBWN_009, p. 3; GBWN_013, p. 342; SNWA_428, p. 4; Transcript, Vol.24 p. 5371:3–5 (Bredehoeft).
[653] Exhibit No. GBWN_011.
[654] Exhibit No. SNWA_428, pp. 17–18.
[655] Exhibit No. SNWA_428, p. 19; Transcript, Vol.11 pp. 2372:1–2375:14 (Prieur).

propagation of the drawdown cone prior to it reaching the area of interest.[656] One could then determine the level of impact at the monitoring site that would lead to a certain impact at the site of interest and cease or reduce pumping once that impact is seen at the monitoring well to prevent the impact from reaching the site of interest.[657] More monitoring wells closer to the pumping would allow for even earlier detection.[658]

Though monitoring may be more difficult the farther away the monitoring point is from the pumping site, the propagation of drawdown is greatest near the well. The rate of drawdown decreases logarithmically with time and with distance from the well.[659] Therefore, monitoring is more effective where drawdowns are expected to be greatest. Monitoring can adequately detect the largest impacts closer in time to the start of pumping and closer in distance to the wells and then management decisions can be made to mitigate impacts as necessary. Therefore, monitoring, even at distance, will be effective.[660]

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, particularly because of the spatial distribution across the DDC Valleys and the WRFS. 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 Applicant has provided significant hydrologic data regarding the DDC Valleys and the WRFS for four years. Finally, the State Engineer finds that the Applicant has provided persuasive scientific evidence that the monitoring efforts and data

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[656] Transcript, Vol.24 p. 5458:1–7 (Bredehoeft).
[657] Transcript, Vol.24 pp. 5479:19–5480:15 (Bredehoeft).
[658] Transcript, Vol.11 pp. 2375:17–2376:11 (Prieur).
[659] Exhibit No. SNWA_428, p. 7; Transcript, Vol.11 pp. 2378:20–2379:15 (Prieur).
[660] Exhibit No. SNWA_428, p. 18.

collection in the DDC Valleys and the WRFS will provide scientifically sound baseline information from which changes to the system and potential impacts can be diagnosed, assessed, and addressed. In summary, the State Engineer finds that the Applicant's monitoring plan will be effective.

2. Management Plan Requirements

The Management Plan requires the data collection efforts from the monitoring plan to be coordinated with the development and refinement of a groundwater model for the purpose of managing the water resource in the DDC Valleys.[661] 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 without causing impacts.[662] 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 State Engineer acknowledges that it received two models into evidence at the hearing. Though the models are poor tools to make local predictions at present, they can be improved. The Applicant's model will be improved in the future as more data is collected.[663] 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.[664] Dr. Myers admitted that once data from large-scale stresses are available, the Applicant's model

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[661] Transcript, Vol.9 pp. 2063:24-2064:1 (Prieur).
[662] Transcript, Vol.9 p. 2063:17-23 (Prieur).
[663] Exhibit No. SNWA_087, pp. 1, 20.
[664] Transcript, Vol.20 pp. 4473:21-4474:4 (Myers); Exhibit No. SNWA_428, p. 10.

could be calibrated to allow experts to make local scale predictions on impacts from pumping.[665] Dr. Bredehoeft also stated that models can be improved through an iterative process of monitoring.[666] As the model continues to improve, it will be used as a management tool by the Applicant to monitor and manage its 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 prevent many of the impacts currently predicted by the models in this hearing. For the reasons stated below, the State Engineer will use the Applicant's model for monitoring and management purposes in the development of the Applications. The State Engineer further finds that stressing the aquifer will improve the predictive capabilities of the model. The State Engineer requires that the model be updated and run every 5 years to incorporate collected data and run predictive drawdown simulations for the purpose of assessing any emerging potential conflicts with existing rights.

Protestant GBWN asserts that the absence of quantitative standards, or triggers, in the Applicant's Management Plan will limit its effectiveness. However, GBWN's expert witness, Dr. Robert Harrington, acknowledged that the Applicant has neither the ability nor the need to set quantitative standards at the present time and at this stage in the development process.[667] Dr. Harrington, a protestant witness, is the Director of the Inyo County Water Department and has experience with implementation of monitoring and management plans for the Owens Valley project.[668] In order to set quantitative standards, well locations and other variables, such as

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[665] Transcript, Vol.21 pp. 4598:14–4599:11 (Myers).
[666] Exhibit No. GBWN_009, p. 7.
[667] Transcript, Vol.23 pp. 5291:20-5292:14 (Harrington).
[668] Transcript, Vol. 23 p. 5278:3-5 (Harrington).

pumping timing and duration, must be known. Stress placed on the system through pumping also helps determine these standards because it shows 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.[669] The same situation is not present in Delamar Valley. Because well locations and pumping amounts have not been determined, and no large-scale pumping has occurred in Delamar Valley, it would be premature to complete a pumping management program.[670] Therefore, it is not currently possible to set quantitative standards or triggers for mitigation actions.

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.[671] 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.[672] The proper time to address pumping management concerns, including quantitative standards or triggers for mitigation, is when pumping determinations are made for each well.[673] Dr. Harrington stated that inclusion of

[669] Transcript, Vol.23 p. 5294:15-21 (Harrington).
[670] Transcript, Vol.23 p. 5307:17-24 (Harrington).
[671] Transcript, Vol.23 p. 5292:9-14 (Harrington).
[672] Transcript, Vol.23 pp. 5286:19-5287:8 (Harrington).
[673] Transcript, Vol.23 p. 5308:15-17 (Harrington).

quantitative standards in a plan for well operations would satisfactorily address any concerns he had regarding such standards.[674]

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.[675] 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.[676] 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.[677] Mr. Prieur testified that there is a wide range of mitigation alternatives[678] Dr. Harrington also agreed that determining whether mitigation is needed in the first place and then determining what type of mitigation to implement is done on a site by site basis.[679] Possible mitigation alternatives could include modifying the pumping regime, changing the location of pumping, drilling new wells, lowering a pump, or providing alternative sources of water.[680] A wide range of environmental mitigation alternatives also are available, and are discussed in the "Environmental Soundness" section below.

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,

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[674] Transcript, Vol.23 p. 5308:11-15 (Harrington).
[675] Transcript, Vol.9 p. 2078:10-19 (Prieur).
[676] NRS 533.370(5); 534.110(6) (2010).
[677] Transcript, Vol.9 p. 2078:19-23 (Prieur); Transcript, Vol.23 pp. 5301:3-5302:15 (Harrington).
[678] Transcript, Vol.9 p. 2078:19-23 (Prieur).
[679] Transcript, Vol.23 p. 5302:8-15 (Harrington).
[680] Transcript, Vol.9 p. 2079:4-13 (Prieur).

exploratory and test well network. The Applicant spent approximately $78,000 to acquire property, surface and groundwater rights and grazing allotments in the Project area that can be used to supplement or mitigate unreasonable Project impacts.[681] 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.[682] The State Engineer finds that the Applicant's financial commitment to monitoring in the DDC Valleys is overwhelming evidence of its financial commitment to the Project as a whole.

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. However, these impacts will be the least in magnitude. Recovery will be quicker and more effective near the wells,[683] where drawdowns are expected to be greatest.

Dr. Bredehoeft believes that reduction of pumping is unrealistic due to a lack of political will to stop or lessen water imports once they are started.[684] These opinions are not based on hydrology. Dr. Bredehoeft testified that reducing or ceasing pumping is a technically feasible way to mitigate impacts of pumping and that stopping pumping would allow the basin to recover.[685] He notes, however, that it may not achieve full recovery and that recovery may take a long time.[686] Dr. Bredehoeft also testified that the Endangered Species Act may effectively force the reduction or cessation of pumping.[687] In addition, the federal stipulations may require the

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[681] Transcript, Vol.10 p. 2397:3-10 (Entsminger).
[682] Transcript, Vol.10 pp. 2397:17-2398:8 (Entsminger).
[683] Exhibit No. SNWA_428, p. 9; Transcript, Vol.10 pp. 2397:17-2398:8 (Prieur).
[684] Exhibit No. GBWN_009, p. 9.
[685] Transcript, Vol.24 pp. 5464:22–5465:4 (Bredehoeft).
[686] Transcript, Vol.24 pp. 5378:1–17, 5402:9–13 (Bredehoeft).
[687] Transcript, Vol.24 p. 5465:13–23 (Bredehoeft).

Applicant to reduce pumping.[688] 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. In particular, pumping impacts were successfully mitigated in northeastern Illinois by ceasing pumping and substituting surface water. Mr. Prieur testified that the hydraulic properties of this aquifer are similar to those found in Nevada.[689]

Dr. Bredehoeft believes cloud-seeding may provide some mitigation through increased precipitation, but only up to about ten percent.[690] The Applicant has not presented evidence or testimony that suggests it plans to use cloud-seeding as a mitigation technique. The State Engineer finds that cloud-seeding may be a potential mitigation method, but that it is not presently contemplated.

The State Engineer finds that the Applicant has presented the most comprehensive monitoring, management and mitigation plan for a municipal water development project in Nevada. 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 the Applicant is committed to managing the development of the Applications in a sustainable manner, and will take steps to manage the Project in a method to avoid conflicts with

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[688] Transcript, Vol.11 pp. 2384:11–2385:3 (Prieur).
[689] Transcript, Vol.11 pp. 2385:4–2389:15 (Prieur).
[690] Exhibit No. GBWN_009, p. 9.

existing rights.[691] 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 the State Engineer has authority to order any mitigation activities that may be necessary to avoid conflicts with existing rights.[692] Accordingly, in addition to other permits terms that will be required, the State Engineer will make the DDC Management Plan a part of the permit terms for the Applications.

B. <u>Analysis for Conflicts with Existing Rights</u>

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 existing rights and environmental areas of interest located in the DDC Valleys. The Applicant's expert, Mr. James Watrus,[693] conducted a conflicts analysis by first identifying the Application points of diversion, existing rights and environmental areas of interest within the DDC Valleys and adjacent basins.[694] The existing rights were queried from the Division of Water Resources database in September, 2010 and updated in April, 2011.[695] Federal water rights and resources

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[691] Transcript, Vol.11 p. 2398:9-21 (Entsminger).
[692] *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) (2010) (where pumping exceeds recharge, State Engineer may restrict pumping based on priority rights); and NRS 534.110(5) (2010) (unreasonable adverse effects to domestic wells may be mitigated or pumping limited).
[693] Mr. Watrus is a senior hydrologist with the Southern Nevada Water Authority. The State Engineer qualified Mr. Watrus as an expert in groundwater hydrology. Transcript, Vol.11 pp. 2537:13-2538:16 (Watrus).
[694] Transcript, Vol.11 pp. 2540:24-2541:2 (Watrus).
[695] Transcript, Vol.11 p. 2551:16-18 (Watrus); Exhibit No. SNWA 337, Appendix A.

were included in this analysis.[696] 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.[697] Mr. Watrus testified that he analyzed all of the identified water rights and environmental areas of interest in his conflicts analysis.[698] Protestants have not challenged this assertion. The State Engineer finds that Mr. Watrus performed a comprehensive review of the existing water rights and environmental areas of interest potentially impacted by groundwater development.

With this information, Mr. Watrus followed three steps in his analysis. First, he conducted a qualitative analysis, which assessed potential conflicts based on water right ownership, geographical location, and priority date.[699] 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.[700] 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.[701]

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 were owned by the Applicant were excluded from further analysis.[702] Water rights that were junior in priority to the Applications were excluded from further analysis since Nevada follows

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[696] Transcript, Vol.11 p. 2551:8-13 (Watrus).
[697] Transcript, Vol.11 p. 2551:1-7 (Watrus); Exhibit No. SNWA_337, pp. 3-7.
[698] Transcript, Vol.11 pp. 2552:11-2555:3 (Watrus).
[699] Transcript, Vol.11 p. 2541:1-3 (Watrus).
[700] Transcript, Vol.11 p. 2541:3-5 (Watrus).
[701] Transcript, Vol.11 p. 2541:5-6 (Watrus).
[702] Transcript, Vol.11 p. 2574:2-8 (Watrus).

the doctrine of prior appropriation.[703] The prior appropriation doctrine does not protect a junior water right from impacts caused by a senior appropriator. Instead, the prior appropriation system ensures that senior water rights are satisfied first before a junior water right may be pumped. Accordingly, Nevada law does not require a review of potential impacts from the Applications on junior water rights. 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.[704] Since mountain block springs are likely perched and fed from a different water source than the Applications, there can be no impact on these springs. None of the Protestants disputed this step of the analysis. Finally, water rights on the valley floor of Delamar Valley were excluded because the depth to water in the basin is 800 to 1,000 feet ruling out any connection with the groundwater aquifer.[705] After the first qualitative analysis was complete, there were no water rights in Delamar Valley that were part of the conflicts analysis.[706] The State Engineer finds the Applicant's first qualitative analysis was necessary and appropriate for assessing potential conflicts between the development of the Applications and existing rights.

2. <u>Quantitative Analysis with Groundwater Model</u>

The Applicant next used a 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

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[703] Transcript, Vol.11 p. 2573:12 (Watrus).
[704] Transcript, Vol.11 p. 2574:13-16 (Watrus).
[705] Transcript, Vol.11 p. 2572:20-24 (Watrus).
[706] Exhibit No. SNWA_337, p. 6-11.

groundwater system. Two numerical groundwater models were submitted for this hearing to simulate pumping in the DDC Valleys: the Applicant's model, originally designed for the BLM's Draft Environmental Impact Statement ("DEIS") and Dr. Myers' DDC model. Both of the models contain significant uncertainties when used to predict the effects of the proposed pumping, but the State Engineer finds that the Applicant's model is the most reliable.

a. BLM DEIS Model

The Applicant's numerical model was originally developed for the U.S. Bureau of Land Management ("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.[707] The Applicant provides assistance as needed to BLM as BLM complies with NEPA by preparing a DEIS that considers the environmental consequences of the BLM's decision and provides an opportunity for public involvement.[708] As part of the DEIS process, the BLM determined that a groundwater model was needed.[709]

Ms. Luptowitz is the Environmental Resources Division Manager for the Applicant.[710] 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.[711] 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.[712]

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[707] Exhibit No. SNWA_089, p. 1-1.
[708] Transcript, Vol.9 pp. 1881:4–1882:1 (Luptowitz).
[709] Transcript, Vol.9 p. 1882:7–9 (Luptowitz).
[710] Exhibit No. SNWA_362.
[711] Transcript, Vol.9 pp. 1882:24–1883:11 (Luptowitz).
[712] Transcript, Vol.9 p. 1883:12–18 (Luptowitz).

The BLM will conduct more specific analysis when site-specific right of way applications are made for wells.[713] Under NEPA, the BLM can grant the right-of-way even if the model simulates impacts to existing rights and environmental resources.[714] Ms. Luptowitz testified that "the model is used for general regional drawdown patterns and trends, but it is not necessarily appropriately used to attempt to identify a specific effect at a specific location or a specific point in time."[715] For the purposes of the current DEIS, the model does not need to predict absolute or specific values at specific locations.[716]

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 representatives from the BLM and consulting experts.[717] A representative from the State Engineer's office also participated in technical meetings on model development.[718] The model was reviewed by the cooperating agencies for the NEPA process.[719] The Applicant prepared the groundwater model under the direction of the BLM Hydrology Technical Group. The BLM is ultimately responsible for the groundwater model.[720]

The Hydrology Technical Group collaborated on the model development from November 2006 to November of 2009, including an 18-month period of intense collaboration.[721] The Hydrology Technical Group consisted of local, regional, and national representatives from the

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[713] Transcript, Vol.9 pp. 1883:19–1885:3 (Luptowitz).
[714] Transcript, Vol.9 pp. 1887:16–1888:2 (Luptowitz).
[715] Transcript, Vol.9 p. 1887:1–4 (Luptowitz).
[716] Transcript, Vol.9 p. 1887:10–13 (Luptowitz).
[717] Exhibit No. SNWA_087, p. 5; Transcript, Vol.9 pp. 1895:18–1896:18 (D'Agnese).
[718] Exhibit No. SNWA_087, p. 6.
[719] Exhibit No. SNWA_087, p. 2.
[720] Transcript, Vol.9 p. 1882:10–20 (Luptowitz); Transcript, Vol.9 p. 1899:9–11 (D'Agnese).
[721] Exhibit No. SNWA_087, p. 5; Transcript, Vol.9 pp. 1898:2–1899:4 (D'Agnese).

BLM as well as Dr. Eileen Poeter from the Colorado School of Mines and Dr. Keith Halford from the USGS.[722] Dr. Poeter has been involved in hydrogeologic and groundwater research for 30 years and is considered an international authority in groundwater modeling.[723] Dr. Halford is an experienced groundwater modeler who has developed and published numerous models in many parts of the country.[724] In addition, representatives from the State Engineer's office participated as observers.[725] Earth Knowledge, Inc. itself spent approximately 15,000 person-hours on the project.[726] Dr. D'Agnese, President of Earth Knowledge and an expert in groundwater modeling,[727] 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.[728] He opined that the level of time and collaboration significantly benefited the model.[729]

The model was developed using the MODFLOW-2000 modeling code with some customizations.[730] The development of the model was completed according to Hill and Tiedeman's 14 Guidelines for effective model calibration.[731] Dr. D'Agnese testified that Hill and Tiedeman's 14 Guidelines are accepted as authoritative in the field of groundwater modeling.[732] The State Engineer finds that following Hill and Tiedeman's 14 Guidelines enhances the reliability of a groundwater model.

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[722] Transcript, Vol.9 p. 1896:10-18 (D'Agnese).
[723] Transcript, Vol.9 p. 1897:9-14 (D'Agnese).
[724] Transcript, Vol.9 pp. 1897:21–1898:1 (D'Agnese).
[725] Transcript, Vol.9 p. 1896:15-18 (D'Agnese).
[726] Transcript, Vol.9 p. 1900:5–8 (D'Agnese).
[727] Dr. D'Agnese is a President of Earth Knowledge, Inc. Exhibit No. SNWA_086. He was qualified by the State Engineer as an expert in groundwater modeling. Transcript, Vol.9 p. 1895:11–12 (D'Agnese). 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).
[728] Transcript, Vol.9 p. 1899:12–23 (D'Agnese).
[729] Transcript, Vol.9 pp. 1899:24–1900:2 (D'Agnese).
[730] Exhibit No. SNWA_087, pp. 4–5.
[731] Exhibit No. SNWA_087, pp. 4, 15–20.
[732] Transcript, Vol.9 p. 1913:13–21 (D'Agnese).

For purposes of the hearing on the Applications, the Applicant used a model that differed slightly from the model used by 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.[733] 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.[734] Dr. Myers notes that the per-basin recharge in the Applicant's numerical model is different than that in the Applicant's conceptual model.[735] The State Engineer finds that the groundwater modeling exercise is not meant to exactly replicate the conceptual model. Instead, 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. Scope of BLM DEIS Model

In light of the model's purpose - to support analysis under 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.[736] Due to its regional nature, the

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[733] Exhibit No. SNWA_090, pp. 3-1 to 3-3.
[734] Exhibit No. GBWN_103, p. 27; Exhibit No. GBWN_104, p. 15.
[735] Exhibit No. GBWN_104, p. 10.
[736] Exhibit No. SNWA_087, p. 1; Transcript, Vol.9 p. 1909:18–25 (D'Agnese).

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 flowsystem boundaries. Dr. D'Agnese testified that predictions in cells where wells are located should not be relied on.[737]

The model covers 20,688 square miles, including Spring, Cave, Dry Lake, and Delamar valleys.[738] Though there are other regional models of similar size in the United States, they typically have much more available data.[739] The model grid-cells are each one kilometer by one kilometer.[740] The Applicant's model has 474 rows, 202 columns, and 11 layers with a total of 589,391 active cells.[741] Dr. D'Agnese testified that the data resolution for the area did not justify using smaller grid cell sizes.[742] 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.[743]

The complexity and large size of the region modeled and the sparseness of available data result in uncertainties in the Applicant's model simulations.[744] Furthermore, the lack of good historical data on anthropological uses of groundwater provides further uncertainty to the model simulations.[745] Because of the model's regional scale, local-scale features are not accurately simulated. All layers in the Applicant's model are simulated as confined.[746] Dr. Myers states that

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[737] Exhibit No. SNWA_087, p. 2; Transcript, Vol.9 pp. 1908:12–1909:17 (D'Agnese).
[738] Exhibit No. SNWA_089, pp. 1-2, 4-2; Transcript, Vol.9 p. 1902:20–21 (D'Agnese).
[739] *See* Transcript, Vol.9 pp. 1903:1–1906:6 (D'Agnese).
[740] Exhibit No. SNWA_087, p. 11; Exhibit No. SNWA_089, p. 4-1; Transcript, Vol.9 p. 1907:2–4 (D'Agnese).
[741] Exhibit No. SNWA_089, pp. 3-4, 4-2.
[742] Exhibit No. SNWA_087, p. 11; Transcript, Vol.9 pp. 1907:5–1908:11 (D'Agnese).
[743] Transcript, Vol.9 pp. 1906:20–1907:1, 2026:5–2027:19 (D'Agnese).
[744] Exhibit No. SNWA_087, p. 9.
[745] Exhibit No. SNWA_087, p. 12.
[746] Exhibit No. SNWA_089, p. 4-2.

the use of a confined top layer biases the Applicant's model to under-predict drawdowns.[747] 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.[748] 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 of a confined layer for the top layer made the model inappropriate to use for this hearing.[749] 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 effect on model results.[750] The State Engineer finds that the use of a confined top layer in the Applicant's model does not limit its usefulness in the consideration of the Applications.

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.[751] 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.[752] The State Engineer finds that the scope of the Applicant's model carries with it inherent uncertainties involving representation of local conditions and the coarseness of its grid. However, the State

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[747] Transcript, Vol.18 pp. 4091:2-5, 4094:4-7 (Myers).
[748] Exhibit No. SNWA_089, pp. 4-2, 4-4.
[749] Transcript, Vol.9 pp. 1918:17–1919:16 (D'Agnese).
[750] Transcript, Vol.18 pp. 4108:2–4109:18 (Myers).
[751] Exhibit No. GBWN_104, pp. 14–15.
[752] Exhibit No. GBWN_104, p. 15.

Engineer finds that the level of detail in the Applicant's model is appropriate for a regional model and reflects the data available for the region.

2. Model Construction

Dr. Myers asserts that the Applicant's model has a bias towards negative residuals in Dry Lake and Pahroc Valleys and positive residuals to the east in Patterson, Lake, and Cave Valleys due to difficulty in modeling a geologic fault along the boundary. Dr. Myers suggests that this may be due to over-simulation of recharge in the east of Dry Lake Valley, similar to that seen in PRISM, which prevents the model from simulating a high drop in head from Patterson to Dry Lake using HFBs.[753] Dr. D'Agnese admitted that the Applicant's model does not represent the gradient from Patterson to Dry Lake Valley as steep enough.[754]

The State Engineer finds that the Applicant's use of HFBs to represent geologic faults is appropriate. HFBs are not always intended to act as complete barriers to flow. Furthermore, the HFBs approximate faults, but the model is not expected to exactly reflect the large groundwater system on a local scale. The State Engineer finds that Dr. Myers has not pointed out any material problems with faults in the Applicant's model.

Dr. Myers also alleges 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 plastic clay and that the fill should typically have a lower specific storage value. This results in the model releasing more water form storage per foot of drawdown.[755] Dr. D'Agnese testified that the storage parameters were selected based on analysis of literature and aquifer test results

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[753] Exhibit No. GBWN_104, pp. 2–3; Transcript, Vol.18 pp. 4080:6–4082:15 (Myers).
[754] Transcript, Vol.9 p. 1990:2–15 (D'Agnese).
[755] Exhibit No. GBWN_104, p. 9; Transcript, Vol.18 pp. 4084:23–4085:11 (Myers).

with the concurrence of the Hydrology Technical Group.[756] The State Engineer finds that the Applicant has adopted reasonable storage values for its model.

Dr. Myers criticizes the Applicant's use of Constant Head Boundaries to allow discharge to flow out of the modeled area from Pahranagat Valley to Tikaboo Valley. He asserts that this was done to make up for the over-estimation of recharge in the White River Flow system, especially in Dry Lake and Delamar Valleys.[757] Dr. D'Agnese responds that many other conceptual models have flow from Pahranagat Valley to Tikaboo Valley in the Death Valley Flow System. He notes that the decision to have flow from Pahranagat Valley to Tikaboo Valley was made through collaboration with the Hydrology Technical Group.[758] Dr. D'Agnese testified that based on his experience the amount of simulated flow from Pahranagat Valley to the Death Valley Flow System was reasonable.[759] The State Engineer finds that the Applicant's representation of flow from Pahranagat Valley to Tikaboo Valley is reasonable and scientifically sound.

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.[760] 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

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[756] Transcript, Vol.9 pp. 1923:22–1924:14 (D'Agnese).
[757] Exhibit No. GBWN_104, p. 14.
[758] Transcript, Vol.9 pp. 1927:18–1928:17 (D'Agnese).
[759] Transcript, Vol.9 pp. 2025:10–2026:11 (D'Agnese).
[760] Transcript, Vol.9 pp. 1914:17–1915:2 (D'Agnese).

conditions.[761] The Applicant used both manual trial-and-error and automated-regression methods to calibrate the model.[762] 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.[763] The Applicant weighted observations so that more reliable measurements were given more weight during calibration.[764] Only a subset of the regional and intermediate springs in the model was used for calibration targets.[765] 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. Thus, one can have little confidence in the precision of spring flow predictions for such springs that were not included in the calibration process.[766]

Dr. D'Agnese testified that the model simulates the regional intermediate spring flows that were used as calibration targets quite well over time.[767] He also states that, though the model does not accurately simulate individual ET locations, it simulates aggregate ET well.[768] 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. Application of Model to Consider Impacts from Project

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[761] Exhibit No. SNWA_087, p. 3.
[762] Exhibit No. SNWA_087, p. 6.
[763] Exhibit No. SNWA_087, p. 17.
[764] Exhibit No. SNWA_087, p. 7.
[765] Transcript, Vol.9 pp. 1910:1–1911:1 (D'Agnese).
[766] Exhibit No. SNWA_407, p. 5.
[767] Transcript, Vol.9 p. 1915:16–24 (D'Agnese).
[768] Exhibit No. SNWA_087, p. 14.

Two model simulations were run, one using a baseline scenario and one that simulated pumping the full volume of the Applications.[769] Drawdown maps were prepared based on the difference in model results between the two scenarios.[770] In addition, changes in spring flow volumes were analyzed.[771] Mr. Watrus used the baseline pumping scenario to set the initial conditions of the water table.[772] He then used the full volume scenario to simulate the water elevations under pumping stresses.[773] 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.[774] The baseline water level elevations and spring flows were subtracted from the pumping water elevations and spring flows to determine drawdown of the aquifer and changes in spring flow resulting from simulated pumping of the Applications.[775]

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.[776] 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.[777] Both Dr. D'Agnese[778] and Dr. Myers testified that the original

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[769] Transcript, Vol.11 p. 2574:20-2575:4 (Watrus).
[770] Transcript, Vol.11 p. 2575:1-4 (Watrus).
[771] Transcript, Vol.11 p. 2575:3-4 (Watrus).
[772] Transcript, Vol.11 p. 2555:6-10 (Watrus).
[773] Transcript, Vol.11 p. 2555:14-19 (Watrus).
[774] Transcript, Vol.11 p. 2557:1-19 (Watrus); Exhibit No. SNWA_337, p. 4-3, 4.
[775] Transcript, Vol.11 p. 2555:13-25 (Watrus).
[776] Exhibit No. SNWA_090, pp. 3-1 to 3-3.
[777] Transcript, Vol.11 p. 2550:13-15 (Watrus).
[778] Dr. D'Agnese is a President of Earth Knowledge, Inc. Exhibit No. SNWA_86. He was qualified as an expert in groundwater modeling. Transcript, Vol.9 p. 1895:11–12 (D'Agnese). 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).

version used by the Applicant during this hearing is likely a more accurate representation of the hydrogeology of Big Springs.[779]

Dr. Myers suggested that the conflicts analysis should have used the pumping scenarios identified in the DEIS.[780] The DEIS alternative pumping scenarios mainly simulate distributed pumping.[781] 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.[782] The State Engineer finds that at the hearing on the DDC Applications, the only other Application points of diversion that were at issue were in the DDC Valleys. None of the DEIS pumping scenarios analyze just pumping at the DDC 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.[783] 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 provides enough lead time to meet that demand.[784] Mr. Holmes further testified that other entities such as

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[779] Transcript, Vol.18 p. 4087:8–12 (Myers).
[780] Exhibit No. GBWN_110, p. 15.
[781] Transcript, Vol.11 pp. 2562:17-2563:12 (Watrus).
[782] Transcript, Vol.11 pp. 2562:17-2563:12 (Watrus).
[783] Transcript, Vol.11 p. 2559:13-18 (Watrus).
[784] Transcript, Vol.2 pp. 307:22-308:5 (Holmes).

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.[785] None of the Protestants provided a practical justification for running a 200 year simulation period and it is undisputed that the 200 year simulation periods were less certain than the 75 year simulation period.[786] 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 appropriate for this conflicts analysis given the practical considerations provided by the Applicant and the substantial amount of uncertainty for longer prediction periods. Further, the State Engineer will require model updates every five years following the start of groundwater production and longer simulation periods may be required if it appears to the State Engineer that because the model was updated with actual pumping data, predictions for longer simulation periods become more certain.

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. In reality, the Project would be developed in a manner that responded to impacts before the drawdowns that are predicted in the model would occur.[787]

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[785] Transcript, Vol.2 pp. 308:6-13 (Holmes).
[786] Transcript Vol.20 p. 4489:3-6 (Myers).
[787] Transcript, Vol.11 pp. 2558:6-2559:1 (Watrus).

Second, as stated above, the model is a regional model that cannot make site-specific predictions. The model cannot currently represent the complex geologic stratification in the DDC Valleys and the WRFS.[788] Therefore, the model represents uniform drawdown in an area that has potentially numerous confined units which would influence and limit potential drawdown.[789] 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.[790]

The State Engineer understands that the Applicant's model is not a perfect predictor of reality and that there are practical water management considerations that simply cannot be accounted for in the model simulations. The State Engineer finds that these model limitations cause the model to exaggerate pumping impacts and that the conflicts analysis must be viewed in this light.

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.[791] Mr. Watrus did not consider the model results sufficiently accurate to predict specific drawdowns and specific spring discharges.[792] 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.

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[788] Transcript, Vol.11 p. 2585:3-12 (Watrus).
[789] Transcript, Vol.11 p. 2584:13-23 (Watrus).
[790] Transcript, Vol.11 pp. 2566:5-9; 2567:24-2568:13 (Watrus).
[791] Transcript, Vol.11 p. 2575:5-17 (Watrus).
[792] Transcript, Vol.11 pp. 2575:5-17 (Watrus).

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 percent.

For the DEIS analysis, different threshold values were used. In particular, the DEIS used a drawdown threshold of 10 feet and a five percent change in spring discharge for the purpose of comparing the potential impacts from the different pumping scenarios.[793] 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 effects between the different alternatives.[794] 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.[795] The State Engineer finds that the purposes of the DEIS are different than the purpose of this hearing. The DEIS is meant to disclose a regional comparison of alternatives without having site-specific pumping locations.[796] 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 law.[797] On the other hand, the State Engineer must look at the specific Applications before him. He is statutorily required to reject applications if impacts to existing rights are shown. Therefore, the State Engineer requires a greater amount of certainty in predicted impacts than what the modeling results provide.

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[793] Transcript, Vol.9 p. 1890:4-7 (Luptowitz).
[794] Transcript, Vol.9 p. 1890:4-7 (Luptowitz).
[795] Transcript, Vol.9 p. 1890:20-23 (Luptowitz).
[796] Transcript, Vol.9 p. 1889:19-24 (Luptowitz); Exhibit No. SNWA_337, p. 6-2.
[797] Exhibit No. SNWA_408, p. 3.3-93.

The State Engineer finds that predictions of the models are so uncertain beyond a period of 75 years that they cannot be used as a basis to reject Applications in this instance. 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 for this time period. 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 percent. The State Engineer acknowledges that Protestants provided detailed model predictions that predicted exact numeric amounts of drawdown. However, because the model is unable to represent local-scale geologic and hydrogeologic features that control whether or not a drawdown will actually occur in reality, these exact numeric drawdown predictions are unreliable. Even if the model simulates, for example, a 45 foot drawdown at a specific water right location, because of the limitations and uncertainties in the model predictions, the State Engineer finds the model predictions at that level of specificity are not credible. The State Engineer recognizes that there is conflicting evidence between what the model predicts and what the hydrogeologic understanding of the area shows. Because of the uncertainty in the models, when model simulations contradict the hydrogeologic understanding of an area, the State Engineer finds that the hydrogeologic understanding is more persuasive and reliable.[798]

Therefore, the State Engineer finds that the Applicant's approach to the conflicts analysis is appropriate given the limitations in the model and the purpose of this analysis.

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[798] *See* Exhibit No. SNWA_337, p. 6-2; Exhibit No. SNWA_408, p. 3.3-111.

3. Site-Specific Qualitative Analysis of Impacts to Existing Rights and Environmental Areas of Interest

As discussed above, the qualitative assessment of water rights in Delamar Valley ruled out the possibility of any impacts from the proposed applications. Therefore, there were no water rights analyzed with the model in Delamar Valley.[799]

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.

There were a total of 36 environmental areas of interest within the model domain that were quantitatively analyzed. None of the 36 locations were simulated to be impacted by pumping in Delamar Valley.

4. Staged Development

Staged development is a tool used in appropriate circumstances if there is uncertainty that groundwater withdrawals may conflict with existing rights, domestic wells or sensitive environmental areas. There is no evidence that this preventative measure is needed in Delamar Valley because there is certainty in the Applicant's estimate of perennial yield and interbasin flow. First, the State Engineer found that the Applicant's method for estimating recharge in the basin is fundamentally sound and that the Applicant has presented the best and most accurate estimate of recharge in the basin to date. There is little concern that the Applicant's groundwater development will cause conflicts due to overappropriation of the resource. Second, the evidence clearly demonstrates that the entire interbasin outflow from Delamar Valley enters either Coyote

[799] Exhibit No. SNWA_337, p. 6-11.

Spring Valley or southern Pahranagat Valley through the Pahranagat Shear Zone. The State Engineer found that the overwhelming amount of groundwater that supports existing rights in Coyote Spring Valley is interbasin flow from Pahranagat Valley. The State Engineer also found that the existing rights in southern Pahranagat Valley are not dependent on the interbasin outflow from Delmar Valley. Based on these findings, staged development is not needed for the purpose of determining the reserve amount of perennial yield needed to satisfy existing rights in these adjacent downgradient basins. Third, there is a very small quantity of existing groundwater rights in Delamar Valley itself, all of which may be mitigated under the Applicant's monitoring and mitigation plan if there are conflicts from full project development in this basin. Accordingly, the State Engineer finds that the entire quantity of the unappropriated perennial yield in Delamar Valley is available for development.

5. Myers DDC Model

a. Model Construction

Dr. Myers used the Regional Aquifer System Analysis ("RASA") groundwater model developed by the USGS to analyze impacts of the Applicant's proposed pumping in the DDC Valleys.[800] The RASA model was developed by Prudic et al. in 1995 as a conceptual model to improve understanding of the region. Schaefer and Harrill later used the RASA model to run simulations of the effects of pumping.[801] Dr. D'Agnese testified that the RASA model was never intended to predict water level declines or reductions in spring flow due to pumping.[802] Dr.

[800] Exhibit No. GBWN_004, p. 42.
[801] Exhibit No. GBWN_004, p. 42.
[802] Transcript, Vol.9 pp. 1952:17–24, 1955:13–16 (D'Agnese).

Myers agrees that the RASA model was not designed to make local-scale drawdown predictions.[803]

The original RASA model had two layers, 61 rows, and 60 columns. Each cell was 5 miles by 7.5 miles, or 37.5 square miles for a total area of approximately 137,000 square miles. Both layers were simulated as confined.[804] Dr. Myers refined the model by telescoping the grid cell sizes so that smaller cells were used in the model in the area of the pumping in the DDC Valleys. Dr. Myers, however, did not change any of the property parameters other than the simulation of the proposed pumping wells at issue in this hearing.[805]

The RASA model contains many limitations. The RASA model does not include geologic faults, which may lead to inaccurate predictions because propagation of effects are not constrained by geologic structures in the model. Dr. Myers specifically suggested that this could result in inaccuracy in the simulation of the effects of pumping in Cave Valley to regional springs in White River Valley.[806]

Prudic et al. calibrated the RASA model to steady state. Though Schaefer and Harrill used the model for transient simulations, the model was never fully calibrated to transient conditions. Calibration refers to the process of trying to match simulated values in the model to actual observed field values. Instead, Schaefer and Harrill assigned storage-parameter values based on then-existing literature.[807] Schaefer and Harrill admit that the storage values were not

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[803] Transcript, Vol.20 p. 4497:8–14 (Myers).
[804] Exhibit No. GBWN_242, p. 63.
[805] Exhibit No. GBWN_242, p. 72; Transcript, Vol.9 pp. 1955:17–1956:2 (D'Agnese); Transcript, Vol.20 p. 4499:21–24 (Myers).
[806] Transcript, Vol.21 p. 4676:3–15 (Myers).
[807] Exhibit No. SNWA_405, pp. 1, 6; Transcript, Vol.9 p. 1955:9–12 (D'Agnese); Transcript, Vol.20 p. 4500:15–24 (Myers).

well known and may cause the results of the model to vary significantly.[808] Schaefer and Harrill state that the "adequacy of the model in simulating the effects of the proposed pumping will remain untested until actual pumping stresses have been in place long enough to cause measurable effects within the system."[809] Dr. D'Agnese states that the storage values used by Schaefer and Harrill were rather conservative, causing simulated drawdown to be larger and ET to be captured more quickly.[810]

The RASA model is a regional model. Prudic et al. state that the model is "not suited to predict accurate water-level declines that would result from pumping ground water in the province," and that "the model is not suited to predict the accurate rate of change in natural discharge caused by pumping because the model has not been calibrated to any transient simulations."[811] Schafer and Harrill state that the RASA model is "adequate to develop first approximations of probable regional-scale effects, but is not adequate to support detailed predictions."[812] The State Engineer agrees with these limitations and accordingly will reject any predictions of specific drawdowns or spring flow declines presented from the RASA model.

Prudic et al. note that the RASA model is only suitable to infer "broad concepts and large-scale features" due to its coarse resolution.[813] The original authors used a target range of 250 feet to calibrate the model.[814] Though Dr. Myers telescoped the model grid, he did this after the coarse model was calibrated to set model parameters. Dr. Myers did not update any of the model parameters. Dr. D'Agnese points out, and Dr. Myers agrees, that the telescoping of the

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[808] Exhibit No. SNWA_406, p. 36.
[809] Exhibit No. SNWA_406, p. 42.
[810] Exhibit No. SNWA_405, p. 7.
[811] Exhibit No. SNWA_297, p. D93.
[812] Exhibit No. SNWA_406, p. 2.
[813] Exhibit No. SNWA_297, p. D15.
[814] Exhibit No. SNWA_297, p. D32.

model does little to improve the accuracy of its predictions, though it does result in a smoother representation of drawdown near the wells.[815]

Prudic et al. also note that there is uncertainty in the RASA model due to uncertainties in the distribution of recharge and the lack of knowledge regarding water levels in much of the region at that time.[816] Prudic et al. state that the errors in estimates of recharge could be in excess of 100%, which affect the tramissivities and vertical leakances, and that transmissivity estimates may be off by a factor of five.[817] In addition, many of the spring discharge rates in the RASA model were off from the target values by ten percent or more.[818]

Dr. D'Agnese also notes that the RASA model assumes steady state conditions though many areas in the model region were likely undergoing transient conditions.[819] According to Dr. D'Agnese, Dr. Myers did not resolve the limitations of the RASA model or fix any of the uncertainties described by Prudic et al. and Schaffer and Harrill.[820] Dr. Myers agrees that the limitations of the RASA model mentioned by the authors exist and remain in his version of the model.[821] Dr. Myers notes that Halford and Plume of the USGS recently used the RASA model to simulate effects of pumping in Snake Valley.[822] Halford and Plume, however, unlike Dr. Myers, used observations within the valleys of interest and up-to-date parameter estimation techniques to update the model parameters.[823] Myers made no adjustments to the RASA model

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[815] Exhibit No. SNWA_405, p. 3; Transcript, Vol.9 p. 1956:3–12 (D'Agnese); Transcript, Vol.20 pp. 4501:15–4502:19 (Myers).
[816] Exhibit No. SNWA_297, p. D38.
[817] Exhibit No. SNWA_297, pp. D38–D39.
[818] Exhibit No. SNWA_405, pp. 4–5.
[819] Exhibit No. SNWA_405, p. 4; Transcript, Vol.9 p. 1959:7–24 (D'Agnese).
[820] Transcript, Vol.9 p. 1960:20–23 (D'Agnese).
[821] Transcript, Vol.19 p. 4250:5–8 (Myers); Transcript, Vol.20 p. 4501:12–14 (Myers).
[822] Exhibit No. GBWN_004, p. 43.
[823] Exhibit No. GBWN_002, p. 2; GBWN_004, p. 43; Transcript, Vol.20 pp. 4505:9–4507:15 (Myers).

that would change the limitations of the model that were documented by the authors of the RASA model.

The State Engineer finds that there is no reason to use the RASA model instead of the Applicant's model to make predictions of impacts due to pumping in Cave, Dry Lake, and Delamar Valleys. The RASA model was never intended to be used to make such predictions. It is very coarse and has many limitations, which its original authors and Dr. Myers acknowledge. Indeed, according to Dr. Bredehoeft, one of the Protestant's experts, most observers think that the RASA model was too simplistic and coarse to yield a good estimate of the local impacts.[824] Dr. Bredehoeft appears to place very little confidence in the RASA model due to its lack of a good underlying conceptual model.[825] However, Dr. Myers states that it is appropriate to consider estimates using the RASA model as long as the low precision of those estimates is understood.[826] On the other hand, Dr. D'Agnese opines that the RASA model was never intended to be and should never be used for predictions.[827]

Dr. Myers testified that the RASA model is better than nothing.[828] In this case, the alternative is not nothing, but the Applicant's competent model. Dr. Myers testified that he would not solely rely on the RASA model, but still suggested that it should be one of the tools considered.[829] In the end, however, Dr. Myers stated that he did not disagree with the

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[824] Exhibit No. GBWN_173, p. 3.
[825] Transcript, Vol.24 pp. 5394:15–17, 5396:19–21, 5420:2–5 (Bredehoeft).
[826] Exhibit No. GBWN_004, p. 43.
[827] Exhibit No. SNWA_405, p. 7; Transcript, Vol.9 pp. 1960:24–1961:7 (D'Agnese).
[828] Transcript, Vol.20 p. 4497:18–20 (Myers).
[829] Transcript, Vol.20 p. 4499:10–12 (Myers).

Applicant's model, but simply wanted to provide an alternative tool to the State Engineer.[830] He finally admitted that the RASA model is not as accurate as the Applicant's model.[831]

Thus, the State Engineer concludes that the best scientific tool he has to evaluate potential impacts due to pumping in the DDC Valleys is the Applicant's model. The RASA model may still be considered in comparison, but it bears very little weight due to the high level of uncertainty of its predictions. The State Engineer finds that when the Applicant's model and the RASA model provide conflicting simulations, he rejects the RASA projections and relies on the Applicant's model instead.

b. Model Predictions

Dr. Myers used the RASA model to simulate pumping for 2,000 years in Cave, Dry Lake, and Delamar Valleys.[832] Simulations indicated some wells had extreme simulated drawdown at the initial locations due to the presence of simulated low-transmissivity zones, so Dr. Myers adjusted their locations to adjacent higher-transmissivity zones.[833] Dr. Myers states that any impacts due to pumping in the DDC Valleys will mostly occur in downgradient basins because there are few discharge areas in the DDC Valleys.[834]

Dr. Myers' simulations overestimate impacts due to pumping because they do not account for any management decisions during the simulation period that would result in reduced pumping or shifts in pumping locations in order to protect existing water rights and

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[830] Transcript, Vol.21 p. 4672:3–5 (Myers).
[831] Transcript, Vol.21 p. 4642:22–23 (Myers).
[832] Exhibit No. GBWN_004, p. 49. Dr. Myers admitted that his water budget accounting is a way to determine whether there is water available in the system rather than an effects analysis that would evaluate potential drawdowns and other impacts. Transcript, Vol.20 p. 4522:10–14 (Myers).
[833] Exhibit No. GBWN_004, p. 43.
[834] Exhibit No. GBWN_004, p. 42.

environmental resources, or simply to conduct maintenance on pumping wells.[835] This problem is not unique to Dr. Myers' simulations. Because the groundwater models do not simulate management decisions, they generally overestimate impacts.

Dr. Myers provides simulated impacts for pumping periods beyond 75 years. The Applicant limited simulations to 75 years of pumping because that is the expected life of the equipment and infrastructure and because predictions become increasingly uncertain the further into the future they are made. Little is gained by examining pumping simulations of greater than 75 years. Dr. Myers' RASA model is already extremely coarse and uncertain. Simulations beyond 75 years become more uncertain.[836] In addition, 75-year simulations provide the State Engineer with an adequate basis to determine the probable impacts of pumping. The Applicant's conflicts analysis utilized a 75-year simulation combined with a qualitative analysis to analyze impacts to specific existing rights. Dr. Myers did not conduct an analysis of effects on specific existing rights at all. Thus, Dr. Myers' simulated impacts for pumping periods of more than 75 years will be given little weight.

Dr. Myers' RASA model also simulates impacts to Pahranagat Valley Springs from the Applicant's pumping in the DDC Valleys. The Pahranagat Valley Springs flow is reduced by about 2 cfs from an initial rate of about 32 cfs within 20 years. After 2,000 years, the spring flow decreases by about one third, but still flows at about 20 cfs.[837] Dr. Myers' RASA model simulates a reduction in flow of about 15 percent at Panaca Springs after 2,000 years of simulated pumping.[838] The model simulates essentially no impacts to Mormon Springs or the

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[835] Transcript, Vol.18 p. 4105:17–24 (Myers); Transcript, Vol.20 pp. 4391:3–11, 4476:15–4477:2 (Myers).
[836] Transcript, Vol.20 pp. 4471:16–4472:22, 4489:3–4489:16 (Myers).
[837] Exhibit No. GBWN_004, pp. 51, 56.
[838] Exhibit No. GBWN_004, pp. 51–52.

warm springs in Northern White River Valley after 2,000 years.[839] The State Engineer finds, however, that these predictions cannot be considered reliable given the uncertainties in the RASA model.

In sum, Dr. Myers' simulations do not alter the State Engineer's analysis of impacts. The impacts simulated by Dr. Myers are all highly uncertain and unrealistic given the amount of simulated drawdown or reduction in flow spread over hundreds or thousands of years. In addition, any predicted impacts may be dealt with through monitoring, management, and mitigation as discussed above.

In conclusion, based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that pumping under the Applications will not conflict with existing rights, will not unreasonably lower the static water table, and will not interfere with protectable interests in existing domestic wells.

VI. PUBLIC INTEREST

According to NRS 533.370, the State Engineer must reject an application if the proposed use "threatens to prove detrimental to the public interest." There are many elements that comprise the public interest, both on a statewide level and on a county specific basis. Evidence was presented by the Applicant and the Protestants regarding economic and environmental factors and tribal concerns. The economic and tribal concerns are addressed here, while the environmental issues are addressed below in the "Environmental Soundness" section below.

A. Economic Public Interest Issues

Both the Applicant and the Protestants presented evidence regarding the economic effects of approving or denying the Applications. As described in detail above in this ruling, the

[839] Exhibit No. GBWN_004, pp. 51–52.

Applicant anticipates a significant shortage in water supply in southern Nevada absent water from these Applications.[840] The Applicant called Jeremy Aguero to testify to the possible economic consequences of a water shortage. Mr. Aguero is a principal analyst at Applied Analysis, an economic and fiscal policy research firm, and was qualified by the State Engineer as an expert in economic analysis.[841] He explained that the exact economic impacts of a future shortage cannot be forecasted.[842] However, any water shortage will likely result in economic impacts in southern Nevada.[843] The exact nature of the water limitation could be anything that leads to a water shortage in southern Nevada, including drought or the failure to construct the groundwater Project in order to meet demand.[844] Mr. Aguero provided a range of economic impacts over a three-year period from a 1.7 percent to 10.5 percent reduction in economic output based on a water supply limitation.[845] However, he did not attempt to tie these percentage declines to any specific amounts of decline in the water supply.[846]

Mr. Aguero opined that the effects of such a water limitation in southern Nevada would be "devastating."[847] The total economic output in the Las Vegas-Paradise metropolitan statistical area was $91.7 billion in 2009.[848] Using the predicted range of declines in economic output, the southern Nevada region's annual economic output would decline by $1.6 billion to $9.6 billion due to a water supply interruption.[849]

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[840] Exhibit No. SNWA_022, pp. 2-3.
[841] Exhibit No. SNWA_021; Transcript, Vol.15 pp. 3477:20-3478:6 (Aguero).
[842] Transcript, Vol.15 p. 3544:10-21 (Aguero).
[843] Exhibit No. SNWA_022, pp. 6-7.
[844] Transcript, Vol.15 p. 3483:11-25 (Aguero).
[845] Exhibit No. SNWA_022, p. 8.
[846] Transcript, Vol.15 pp. 3544:22-3546:24 (Aguero).
[847] Transcript, Vol.15 p. 3484:1-5 (Aguero).
[848] Exhibit No. SNWA_022, p. 6.
[849] Exhibit No. SNWA_022, p. 9.

As of March 2011, the Las Vegas-Paradise metropolitan statistical area had approximately 800,000 employees.[850] Using the predicted range of declines in economic output, the southern Nevada region would suffer 14,000 to 84,000 jobs lost.[851] This would also result in a decline in the area's wages and salaries by $480 million to $3.0 billion, or $590 million to $3.6 billion if payments such as employer contributions to pensions are included.[852]

Mr. Aguero testified that every business in southern Nevada is dependent on a reliable supply of water.[853] Uncertainty in water supply—both real and perceived—discourages business investment in southern Nevada.[854] In addition, 10-k forms show that many businesses in southern Nevada are concerned with the stability of their water supply.[855]

Any impact to the hospitality and tourism sector will affect the entire state. Southern Nevada's largest single sector in terms of gross domestic product, employment and wages and salaries is the tourism and hospitality sector. This sector is heavily dependent on water.[856] Southern Nevada draws nearly 40 million visitors per year who account for nearly 16 percent of statewide sales and use tax.[857] Approximately 18 percent of the visitors to Las Vegas are international.[858] The average visitor to Las Vegas spends approximately $1,018 per trip or $220 per day.[859] Nevada's resort industry provides approximately 46.2 percent of state general fund tax revenues through the payment of more than $2 billion annually in sales tax, property tax and

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[850] Exhibit No. SNWA_022, p. 6.
[851] Exhibit No. SNWA_022, p. 9.
[852] Exhibit No. SNWA_022, p. 10.
[853] Transcript, Vol.15 pp. 3489:18-3490:1 (Aguero).
[854] Exhibit No. SNWA_022, pp. 10, 18; Transcript, Vol.15 pp. 3497:7-3499:22 (Aguero).
[855] Exhibit No. SNWA_025 through Exhibit No.SNWA_031.
[856] Exhibit No. SNWA_022, p. 10.
[857] Exhibit No. SNWA_022, p. 13.
[858] Exhibit No. SNWA_393, p. 8.
[859] Exhibit No. SNWA_393, p. 21.

gaming tax.[860] Water limitations in southern Nevada would likely result in a decline in hotel occupancy.[861] Mr. Aguero testified that for every one percent decline in occupancy, Las Vegas hotels and casinos would lose $163 million.[862]

In addition, impacts to southern Nevada would be felt statewide via effects on tax revenue. Nevada already reports the largest general fund deficit percentage in the nation at a $1.5 billion shortfall for fiscal year 2012.[863] Clark County accounts for 74 percent of statewide sales tax. In general, approximately three-quarters of major fiscal revenues from other sources, such as room tax, gaming tax and property tax are collected in Clark County, with the remaining 16 counties in the state accounting for about one-fourth.[864] An economic output decline of 1.7 percent due to water uncertainty would result in at least a 9.7 percent decline in local and state government fiscal revenues.[865]

The economic benefit to southern Nevada of a water supply secured by these Applications would be shared by Lincoln and White Pine Counties. Mr. Aguero notes that Lincoln and White Pine Counties stand to see an influx of investment for construction, management, and design of the Project which would generate thousands of jobs and other direct and indirect beneficial economic impacts throughout the areas of the Project.[866] Under Nevada's education funding plan, tax generated in Clark County subsidizes per-student funding in Lincoln and White Pine Counties. Under Nevada's Medicaid Disproportionate Share Hospital allocation system, Clark County provides financial support in excess of its share to hospitals throughout

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[860] Exhibit No. SNWA_022, p. 13.
[861] Transcript, Vol.15 pp. 3493:11-3495:24 (Aguero).
[862] Transcript, Vol.15 p. 3496:6-21 (Aguero).
[863] Exhibit No. SNWA_022, p. 14.
[864] Exhibit No. SNWA_022, p. 13.
[865] Exhibit No. SNWA_022, pp. 13-14.
[866] Exhibit No. SNWA_393, p. 2.

rural Nevada. In addition, Lincoln and White Pine Counties are Guaranteed Counties which are subsidized by Point of Origin Counties like Clark County under Nevada's consolidated tax system.[867] Under this system in 2009, Clark County subsidized the balance of the state by approximately $704 million.[868] Should Clark County no longer be able to provide as much revenue to these systems, Lincoln and White Pine County will experience a negative impact.

Mr. Aguero concludes that the perception that southern Nevada does not have sufficient water resources has the potential to cause dramatic loss of jobs, loss of income, and decline in Nevada's economy.[869] He determined that receiving water from the Applications would protect 290,000 jobs, $11.5 billion in wages and salary payments, and $37.5 billion in economic activity.[870] Mr. Aguero opined that the failure to secure a stable water supply for southern Nevada could slow the state's fragile economic recovery or put Nevada into a relatively significant recession.[871] As noted, impacts to southern Nevada will affect the entire state.[872] The public interest will be served by the Applicant's proposed Project in many ways.

The Protestants do not dispute the economic figures and predictions provided by Mr. Aguero. GBWN's economics expert Dr. Maureen Kilkenny presented evidence in an attempt to show the potential economic detriment that Lincoln and White Pine Counties may suffer due to the proposed Project. Further, she too acknowledged the strength of perceptions regarding the economy and that southern Nevada suffers from the same threat of expectations if the denial of these Applications leads to fear of a future shortage.[873]

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[867] Exhibit No. SNWA_393, p. 3.
[868] Transcript, Vol.15 p. 3508:11-19 (Aguero).
[869] Transcript, Vol.15 pp. 3536:16-3537:11 (Aguero).
[870] Transcript, Vol.15 pp. 3537:12-3538:2 (Aguero).
[871] Transcript, Vol.15 pp. 3538:21-3540:9 (Aguero).
[872] Transcript, Vol.15 pp. 3540:10-3541:3 (Aguero).
[873] Transcript, Vol.22 pp. 4988:6-4989:16, 5010:11-23 (Kilkenny).

Through her reports and testimony, Dr. Kilkenny advanced a passionate plea, concluding that approving the Applications would result in the loss of all water, even existing water rights, not only in the Project basins, but on a countywide basis in White Pine and Lincoln Counties.[874] None of these assertions are supported by hydrologic evidence. Dr. Kilkenny's initial report suggests an economic loss of $74 million annually and a loss of about 3,400 jobs if the Applications are approved.[875] Both in her report and in her testimony she states that these estimates likely underestimate the actual values at risk.[876] She further states that the mere threat of the proposed groundwater project may already be causing negative economic effects in Lincoln and White Pine Counties.[877] Her analysis, however, is misplaced and overbroad in that it is premised upon the erroneous belief that approving these Applications will "strip the water" from Lincoln and White Pine Counties and her understanding that "[i]t appears that the land becomes useless without the water in this location."[878]

As Delamar Valley is located wholly within Lincoln County, this ruling will focus on Dr. Kilkenny's testimony related to Lincoln County. Dr. Kilkenny presented evidence that Lincoln County has a population of 5,345 and employs 2,172 people.[879] Dr. Kilkenny concludes that 10 percent of jobs in Lincoln County depend on water in the county—the mining, ranching and farming, forestry, hunting, and recreation sectors.[880] She states that tourism, recreation, and retail activity are associated with these sectors.[881] She estimates a total employment impact of

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[874] *See* Exhibit No. GBWN_066.
[875] Exhibit No. GBWN_066, p. 17.
[876] Exhibit No. GBWN_066, p. 17; Transcript, Vol.22 p. 5008:11-17 (Kilkenny).
[877] Exhibit No. GBWN_114, p. 2.
[878] Transcript, Vol.22 pp. 5008:18-5009:22 (Kilkenny).
[879] Exhibit No. GBWN_066, p. 6.
[880] Exhibit No. GBWN_066, p. 6.
[881] Exhibit No. GBWN_066, p. 6.

746 jobs lost in the county due to a total loss in local water.[882] She defers to evidence submitted by the Applicant with regard to the population of Delamar Valley.[883]

While the analysis in Dr. Kilkenny's report focused on impacts to the counties as a whole, during her testimony she suggested that based upon her understanding of the evidence presented at the hearing, the scope of impacts may not be as broad as what was suggested in her report. To remedy this problem she suggested that the State Engineer could "scale" her estimated impacts.[884] However, even this suggestion is misplaced as it appears to be, at least in part, based upon the belief that even agricultural production using existing water rights will be eliminated if the Applications are granted.[885]

Dr. Kilkenny's countywide analysis is derived from economic values for groundwater in the basins from: (1) income and employment which she estimates as directly related to the use of water by businesses such as agriculture and mining; (2) expenditures of the hunters and recreational users required to enjoy the natural resources; (3) indirect or inter-industry multiplier linkages that arise when businesses or people involved in direct use buy local inputs or services, or pay local employees; (4) the non-market use value that people who visit the areas derive from experiencing the natural amenities; and (5) the non-use non-market value that people anywhere place on the existence of the natural amenities.[886]

Dr. Kilkenny did not provide an analysis of the economic activity specific to Delamar Valley, but concludes that the groundwater in the counties have an agriculture production value

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[882] Exhibit No. GBWN_066, p. 7.
[883] Transcript, Vol.22 p.5028:10-13 (Kilkenny).
[884] Transcript, Vol.22 p. 5031:10-20 (Kilkenny).
[885] Transcript, Vol.22 pp. 4997:16-4998:15, 5033:15-5034:7, 5041:6-5042:6 (Kilkenny).
[886] Exhibit No. GBWN_066, p. 3.

of $30,511,000 with an additional indirect value of $22,273,030.[887] Thus, Dr. Kilkenny's concludes that the agricultural sector in the two counties has a value of $53 million and supplies 518 jobs.[888] Dr. Kilkenny concludes in her report that the groundwater in the Project basins has a hunting and fishing expenditure value of $4,900,000 with an additional indirect value of $3,000,000 for a total of $7.9 million annually.[889] To arrive at this number, she assumes that each hunter in the area spent $70 per day and then uses an output multiplier to account for indirect effects.[890] She testified that her report, in general, was not original work and was not prepared using the process she would have for original work.[891] In particular with regard to the values for hunting and fishing she testified that she relied upon the prior work of Karen Rajala for the basis of these figures.[892] On cross examination this information was shown to have both minor and significant errors and in the words of Dr. Kilkenny "relatively sloppy reporting."[893]

Dr. Kilkenny concludes that the groundwater in the project basins supports a park visitation expenditure value of $6,750,000 with an additional indirect value of $4,000,000.[894] As described below, the State Engineer finds this conclusion unsupported. Dr. Kilkenny finds that there are 55,633 party visitor days to the Great Basin National Park and assumes that each party spends $70 per day for a total of $3.89 million.[895] Great Basin National Park is not located in Delamar Valley. After applying a multiplier to account for indirect effects, she concludes that

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[887] Exhibit No. GBWN_066, p. 4.
[888] Exhibit No. GBWN_066, p. 8.
[889] Exhibit No. GBWN_066, pp. 4, 10.
[890] Exhibit No. GBWN_066, p. 10.
[891] Transcript, Vol.22 pp. 4994:2-4, 5020:7-5021:7 (Kilkenny).
[892] Transcript, Vol.22 pp. 4999:16-5002:9, 5043:6-5053:4 (Kilkenny).
[893] Transcript, Vol.22 pp. 5043:6-5053:4 (Kilkenny).
[894] Exhibit No. GBWN_066, p. 4.
[895] Exhibit No. GBWN_066, p. 10.

the total economic annual impact of visitors to Great Basin National Park is $6.2 million.[896] However, as with the valuations for hunting and fishing, her testimony related to Park visitation revealed that although she had based her work upon the information obtained in 2006 by Ms. Rajala she had again departed from that base data, resulting in Dr. Kilkenny's conclusion of a larger possible impact.[897] Though Ms. Rajala assumed the loss in visitors would be 25%, in her calculations Dr. Kilkenny assumed there would be a 100% loss in visitors if the Applications were granted. Again, she suggested in testimony that her use of 100% rather than 25% would allow for the "people to scale linearly."[898] It is noted by the State Engineer that Dr. Kilkenny admitted during her testimony that the term "scaling" was not used in her report,[899] and that the Applicant was therefore denied a meaningful opportunity to address whether such "scaling" would be appropriate.

In Spring Valley, Dr. Kilkenny conceded to an error of an order of magnitude, tenfold, regarding her calculation of visitation to Cleve Creek.[900] Thus, her calculations regarding Cleve Creek and Mt. Moriah Wilderness Area were also incorrect. Dr. Kilkenny relied upon Ms. Rajala's assumption that each visitor party spends $70 per day, and even though Dr. Kilkenny did not know the basis for that figure, and could not explain it, Dr. Kilkenny chose to adopt it.[901]

Mr. Aguero, however, notes that the $70 is actually based on the National Park Service's figure of $67.85 per party day expenditures for the camp-in segment. Mr. Aguero notes that the nature of the recreational areas at issue may be closer to the back-country camper segment,

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[896] Exhibit No. GBWN_066, p. 11.
[897] Transcript, Vol.22 pp. 5053:5-5056:19 (Kilkenny).
[898] Transcript, Vol.22 p. 5055:19-25 (Kilkenny).
[899] Transcript, Vol.22 pp. 5078:17-5079:10 (Kilkenny).
[900] Transcript, Vol.22 pp. 5001:24-5002:9, 5057:21-5058:5 (Kilkenny).
[901] Transcript, Vol.22 pp. 4999:16-5000:25, 5053:20-5055:3 (Kilkenny).

which the National Park Service determined a per party day expenditure of $31.43.[902] Mr. Aguero suggests that even this number is high as it includes $6.54 for souvenirs and $6.25 for restaurants and bars, which do not exist within Delamar Valley. Mr. Aguero suggests that a more realistic number for visitor per day expenditure might be $20.[903] The State Engineer recognizes the significant value of Great Basin National Park to Nevada and the country, but finds that the per party day expenditures at Great Basin National Park or at the other parks and recreation areas cannot be determined based on the evidence presented by Dr. Kilkenny. The State Engineer does not find Dr. Kilkenny's work persuasive or credible and it has been given little weight. Likely the true value lies somewhere within the range presented. However, whether it is truly closer to $70 or $20, it does not alter the final analysis of the public interest criterion.

Dr. Kilkenny concludes that the groundwater in the project basins has a recreational non-market value of $756,000.[904] This is the economic value that people who visit the areas derive from their experience.[905] Dr. Kilkenny admits that these values are difficult to measure.[906] To do so, she relies on a benefit transfer study performed by Dr. Moeltner in 2006.[907] Dr. Moeltner himself relied on a benefit transfer study done by Rosenberger and Loomis in 2001.[908] The Rosenberger and Loomis study provided benefit measures for 21 recreational activities based on individual studies but was not designed to estimate benefits for a specific site or policy

[902] Exhibit No. SNWA_393, pp. 19-20.
[903] Exhibit No. SNWA_393, pp. 20-21.
[904] Exhibit No. GBWN_066, p. 4.
[905] Exhibit No. GBWN_066, p. 14.
[906] Exhibit No. GBWN_066, p. 14.
[907] Exhibit No. GBWN_066, p. 14.
[908] Exhibit No. GBWN_068, p. 11.

context.[909] Dr. Moeltner took the average of the study's per person, per visitation day values for camping ($40) and picnicking ($45.50) to arrive at a figure of approximately $42.[910] He computed low and high ends for the range of $6 to $202 and noted that he would expect the actual benefits to be in the lower half of the range.[911] Adopting a per visitation day use-value of $42 and rounding up the visitation counts in the Cleve Creek Campground and the Sacramento Pass Recreation Area to 6,000 and 12,000 respectively, Dr. Kilkenny finds that the non-market use values for these areas is $756,000 per year.[912] Neither of these areas are located in Delamar Valley.

Mr. Aguero points out that Dr. Kilkenny has assigned a visitor expenditure value for visitors to Cleve Creek as well as a non-market value for visitors to Cleve Creek Campground. This may result in some double-counting of economic value.[913] He also notes that this value does not refer to any real money that is actually spent by anyone and that this value does not correspond to any actual jobs.[914] Dr. Kilkenny agrees but argues that it has value even though no one pays.[915] The State Engineer finds that the Cleve Creek Campground and the Sacramento Pass Recreation Area are not located within Delamar Valley and that there is no hydrologic evidence that suggests that pumping in Delamar Valley could affect these areas. Therefore, the State Engineer rejects Dr. Kilkenny's estimate of non-market recreational use values for these areas as it relates to the Delamar Valley Applications.

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[909] Exhibit No. GBWN_068, p. 12.
[910] Exhibit No. GBWN_068, p. 12.
[911] Exhibit No. GBWN_068, p. 12.
[912] Exhibit No. GBWN_066, pp. 14-15.
[913] Exhibit No. SNWA_393, p. 24.
[914] Transcript, Vol.15 pp. 3525:5-3526:3 (Aguero).
[915] Transcript, Vol.22 p. 5002:20-23 (Kilkenny).

Dr. Kilkenny's report concludes that the groundwater in the project basins has an existential non-market non-use value of approximately $2,000,000.[916] Non-market non-use value refers to the value that people anywhere in the world place on knowing that certain natural amenities exist, even if they will never personally visit them. Dr. Kilkenny relied on Dr. Moeltner's 2006 meta-regression benefit transfer study to estimate the non-market non-use value of the Swamp Cedar Natural Area and the Shoshone Ponds Natural Area, both of which are not located in Delamar Valley.[917] However, as with the information she relied upon from Ms. Rajala, Dr. Kilkenny failed to include all of the foundational information in her report or completely describe the limitations of Dr. Moeltner's study.[918] Consequently, the State Engineer finds Dr. Moeltner's original report, which explains its limitations, rather than Dr. Kilkenny's summary of it, of greater assistance.

Dr. Moeltner used nine surveys of willingness-to-pay to develop his regression. He recognizes that this sample is smaller than ideal.[919] In addition, Dr. Moeltner relied on survey studies on areas in Kentucky, Nebraska, California, Wisconsin, South Dakota, Minnesota, West Virginia, and Canada.[920] The studies did not address areas in Nevada or Utah. He notes that the assumption that the underlying study populations have the same preferences for wetland preservation as households in the Great Basin is questionable.[921] He further notes that the small sample size and lack of detailed information on specific attributes of the wetland areas prevented a thorough examination of the effect of features other than acreage. He states that "[e]ach of the

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[916] Exhibit No. GBWN_066, p. 4.
[917] Exhibit No. GBWN_066, p. 15.
[918] Transcript, Vol.22 pp. 5064:8-5074:25 (Kilkenny).
[919] Exhibit No. GBWN_068, p. 6.
[920] Exhibit No. GBWN_068, p. 16.
[921] Exhibit No. GBWN_068, p. 10.

wetlands underlying these studies is unique in some sense, and wetland size in acres alone is not necessarily a reliable proxy for wetland quality attributes."[922] Dr. Moeltner even finds problems with the acreage factor, noting that "the true impact of wetland size on [willingness-to-pay] is not well captured by our model."[923]

Dr. Moeltner developed a willingness-to-pay estimate for Nevada and Utah households of $1.35 based on his meta-regression. Dr. Moeltner's willingness-to-pay estimate for just Nevada households was $1.20 and his estimate for just the four counties surrounding the wetlands was $0.61.[924] He assumes that one percent of the population of Nevada and Utah also actually visit the sites "[i]n the absence of any existing information on actual visitation," but does not address this potential for double counting non-market non-use and non-market use values.[925] Dr. Kilkenny adopts the average willingness to pay of $1.35 per household per year and applies it to every household in Utah and Nevada for a total estimated non-market non-use value of $1,966,122.[926] While testifying, in addition to agreeing with the caveats contained in the original work, Dr. Kilkenny also discussed some additional limitations and pitfalls to this statistical method.[927] These included the problem of non-response bias and how that can bias results, small sample size, a concern Moeltner voiced in his report, and the fact that it appears clear that this concern may be compounded as four of his 12 data points came from the same study of the same group of Kentuckians.[928]

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[922] Exhibit No. GBWN_068, p. 10.
[923] Exhibit No. GBWN_068, p. 10.
[924] Exhibit No. GBWN_068, p. 19.
[925] Exhibit No. GBWN_068, p. 8; Transcript, Vol.15 p. 3529:5-20 (Aguero).
[926] Exhibit No. GBWN_066, p. 16.
[927] Transcript, Vol.22 pp. 5066:22-5071:11 (Kilkenny).
[928] Transcript, Vol.22 pp. 5067:2-5071:11 (Kilkenny).

Dr. Moeltner notes that his estimates of non-market non-use values "cannot fully substitute for thorough primary data collection and research."[929] He argues that "primary valuation studies in the Spring Valley area are both warranted and justified."[930] Despite Dr. Moeltner's admonitions, no primary study of non-market non-use wetlands values has been presented to the State Engineer.

Mr. Aguero acknowledges that surveys to determine non-market non-use values are often used in environmental impact assessments. However, he notes that the method is subject to significant criticism regarding its validity and reliability and the effects of bias and errors.[931] Mr. Aguero further notes that even if the non-market non-use value is represented accurately, it represents a value that will never be financially recognized.[932] The non-market non-use value will never create a single job nor correspond to payment of a single dollar in wages or salary.[933] The State Engineer finds that Dr. Moeltner's method of determining non-market non-use value is generally sound but recognizes it is subject to a great deal of uncertainty and was not appropriately applied by Dr. Kilkenny.

However, the State Engineer finds that the proper inquiry is the value of the areas to the people of Nevada, not those of Utah. As Dr. Kilkenny herself points out: "[t]he owners of the groundwater in the basins of origin are the citizens of the entire state of Nevada."[934] Even if the State Engineer were to accept the figures in Dr. Moeltner's study, considering only Nevada

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[929] Exhibit No. GBWN_068, p. 2.
[930] Exhibit No. GBWN_068, p. 2.
[931] Exhibit No. SNWA_393, pp. 12-14.
[932] Exhibit No. SNWA_393, p. 14.
[933] Transcript, Vol.15 pp. 3528:24-3529:4 (Aguero).
[934] Exhibit No. GBWN_114, p. 5; *see* NRS 533.025 ("The water of all sources of water supply within the boundaries of the State whether above or beneath the surface of the ground, belongs to the public.").

households' willingness-to-pay would reduce the total estimated value by over one half.[935] In the ultimate analysis, however, whether the estimate of non-market non-use value includes Utah households or not does not alter the State Engineer's public interest conclusion. The State Engineer finds that no evidence was presented regarding the non-market non-use value of groundwater within Delamar Valley and that there is no hydrologic evidence that suggests that pumping in Delamar Valley could affect the non-market non-use values derived from Dr. Moeltner's study. Therefore, the State Engineer rejects Dr. Kilkenny's estimate of non-market non-use values as it relates to the Delamar Valley Applications.

All of Dr. Kilkenny's valuations are generally aggressive in that when a range of values is possible, she uses the value at the highest end. Dr. Kilkenny's analysis assumes a total loss of water in White Pine and Lincoln counties if the Applications are approved. She then assumes that the result of the total loss of water will completely obliterate the agriculture, mining, ranching, farming, forestry, hunting, tourism, recreation, lodging, and restaurant sectors in the entirety of White Pine and Lincoln counties. She further assumes that the result of the total loss of water will reduce to zero visitor spending and the value individuals derive from the 75-million acre[936] Great Basin National Park, Swamp Cedar Natural Area, Shoshone Pond Natural Area, Cleve Creek Recreation Area, and Sacramento Pass Recreation Area (none of which are located in Delamar Valley).

The State Engineer finds that Dr. Kilkenny's estimated values are a clear overestimate and contain great uncertainty. This uncertainty is only compounded by the inclusion and reliance upon the transfer of results from a willingness to pay study and the failure to present a

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[935] Exhibit No. GBWN_068, pp. 19-20.
[936] Exhibit No. SNWA_393, p. 22.

primary willingness-to-pay study that is specific to Delamar Valley. Though Dr. Kilkenny explained several times during her testimony that her estimates can be "scaled" to derive values that are actually calibrated to a level other than a 100% negative impact, she did not provide instructions, evidence, or the methodology for doing so. The State Engineer finds Dr. Kilkenny's work to be unreliable, incomplete, and fraught with errors. Therefore, the State Engineer is unable to place a value on the water proposed to be diverted from Delamar Valley and questions the assumption that the unused water, if it remains idle, has value to White Pine or Lincoln counties.

Many Protestants testified that they and the organizations they represent do not object to the granting of additional water rights in Delamar Valley, but they did object to the granting of the Applications filed by SNWA and the use of the water outside of Delamar Valley.[937] Others candidly testified to their belief that "water should be developed ….for cows and for wildlife" and similar uses, but not to support development in Las Vegas.[938] Others testified directly to their view of the public policy issues. A representative of the Nevada State Farm Bureau presented the policy position of his organization and confirmed that organization's support for the first in time first in right law and policy of the State of Nevada.[939] Mr. Busselman also confirmed the Nevada State Farm Bureau's support of the existing laws regarding appropriation of water generally including those related to interbasin transfer.[940] This same position was generally echoed by the representative of the Nevada Cattlemen's Association.[941] These

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[937] Transcript, Vol.16 pp. 3739:7-3740:6 (Anderson); Transcript, Vol.21 p. 4764 (Wadsworth); Transcript, Vol.21 pp. 4780:14-24, 4782:21- 4783:13 (Carter); Transcript, Vol.22 p. 4911:7 - 4911:20 (Poulsen); and Transcript, Vol.24 pp. 5520:21 – 5522:22 (Gloekner).
[938] Transcript, Vol.22 pp. 4921:9-4922:24 (Hatch).
[939] Transcript, Vol.23 pp. 5210-5218:16 (Busselman).
[940] Transcript, Vol.23 pp. 5220:3-5220:13 (Busselman).
[941] Transcript, Vol.24 pp. 5527-5538:3 (Spratling).

organizations also called for the development of a baseline and an inventory of the current water rights in the basin.[942] The State Engineer has completed an inventory for each basin and the Applicant has also undertaken an independent review and inventory of the existing rights. Thus, these public interest issues have been considered by the State Engineer and are addressed in greater detail elsewhere in this ruling. As to these public policy concerns raised by the Protestants, the State Engineer finds that interbasin transfers of water are not illegal and that Nevada water law must be applied fairly and equally to all water right applicants.

The Applicant presented evidence of the economic value of the Project to the State of Nevada and Protestants presented evidence of potential economic harms to Lincoln and White Pine Counties. The Protestants' evidence of economic harm to Lincoln and White Pine Counties, however, is not credible. The State Engineer finds that there is no credible or persuasive evidence of any threatened economic detriment to the public interest due to the proposed Project. Additionally, though not dispositive, the economic benefits of the proposed Project to the entire State of Nevada are large. The State Engineer finds that the economic benefits Las Vegas provides to the public interest of the state are compelling and these economic benefits outweigh any alleged detriment, but this is not the deciding factor in the public interest determination. Because the State Engineer is required to focus on possible detriments to the public interest, the State Engineer is not relying on this information in reaching a decision. Instead, the State Engineer finds that the Protestants did not submit credible and persuasive evidence of any threatened economic detriment to the public interest due to approval of the Applications. Therefore, from an economic standpoint, the State Engineer finds the proposed use of the water does not threaten to prove detrimental to the public interest.

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[942] Transcript, Vol.23 pp. 5218:17-5219:17 (Busselman); Transcript, Vol.24 pp. 5531-5532 (Spratling).

B. Tribal Issues

The Tribal Protestants (the Confederated Tribes of the Goshute Reservation, the Duckwater Shoshone Tribe, and the Ely Shoshone Tribe) assert many arguments against the Applications under the broad category of threats to the public interest. They argue that the proposed pumping will negatively affect their hunting, gathering, and cultural traditions and conflict with their reserved water rights. They also argue that the Applications should be denied because the federal government did not properly consult with them or consider their interests during the federal environmental review of the proposed Project and the execution of the Stipulations with the Applicant.

1. Hunting, Gathering, and Cultural Interests in Delamar Valley

The Tribal Protestants argue the State Engineer should consider their aboriginal hunting and gathering rights and ceremonial use and historic value of natural resources as part of the public interest analysis,[943] but did not present testimony regarding any of these uses or resources within Delamar Valley. The State Engineer must consider the public interest and the environmental soundness of the Project and his consideration of these issues applies in the same manner for the Tribal Protestants as it does for all other Protestants in the case. Since no evidence was presented regarding current tribal hunting, fishing or gathering activities within Delamar Valley, the State Engineer is unable to consider these uses in his evaluation of the public interest regarding the Applications. However, he has considered impacts to recreational hunting or fishing activities—whether by tribal members or non-tribal members—in his evaluation.

2. Conflicts with Existing Rights

[943] *See, e.g.*, Transcript, Vol.1 p. 48:13-20 (Echohawk) (discussing the importance of elk hunting to the Tribes).

The Tribal Protestants also argue that approving the Applications will negatively impact their existing reserved water rights. The State Engineer notes that the Tribes' reserved water rights have not been formally adjudicated, and it is unclear whether the Tribal Protestants own reserved water rights. However, the State Engineer finds that in the absence of an adjudication of tribal reserved water rights, he will take a conservative approach and assume that each tribe has reserved water rights on their reservations, and will then determine whether pumping pursuant to the Applications will impact these water rights.

The State Engineer notes that it appears that the Tribal Protestants are concerned with pumping in Spring Valley and not in Delamar Valley.[944] The land of the Confederated Tribes of the Goshute Reservation is located in Deep Creek, Tippett, Pleasant, and Snake valleys.[945] The Duckwater Shoshone Tribe's reservation is located in Duckwater Valley/Railroad Valley in Nye County, Nevada.[946] The Ely Shoshone Tribe's lands are located near the City of Ely in Steptoe Valley and in White River Valley in White Pine County, Nevada.[947] No evidence was presented at the hearing that suggests any unreasonable impacts to the Tribal Protestants' reservation lands or reserved water rights due to pumping pursuant to the Applications. On cross-examination, the Tribal Protestants' own witness, Dr. Myers, indicated that there are essentially no predicted impacts to the Tribal Protestants' reservation lands.[948] Dr. Myers' model results show essentially no drawdown in central Tippett Valley and Deep Creek Valley for over 100 years of simulated pumping. The results show only minimal drawdown in Deep Creek Valley, even after 10,000

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[944] *See* Transcript, Vol.25 pp. 5793:19-5794:4 (Marques); Transcript, Vol.25 p. 5778:5-17 (Sanchez).
[945] Exhibit No. SE_060 (Confederated Tribes of the Goshute Reservation Protest to Application 54003, at 3).
[946] Exhibit No. SE_060 (Duckwater Shoshone Tribe Protest to Application 54003, at 1–2).
[947] Exhibit No. SE_060 (Ely Shoshone Tribe Protest to Application 54003, at 3).
[948] Transcript, Vol.26 pp. 5957:8-5958:7 (Myers).

years of pumping.[949] No evidence was presented showing drawdown near the City of Ely or Railroad Valley.[950]

The Tribal Protestants also suggest that where potential impacts are uncertain to their interests, they should not bear the risk that any future impacts occur. However, the State Engineer is unable to deny a water right application in the absence of credible evidence of impacts due to the remote possibility of impacts. The State Engineer finds that no credible evidence was presented of conflicts with reserved water rights of the Tribal Protestants and thus the Applications will not be denied on this ground.

3. Federal laws and duties

In addition, the Tribal Protestants argue that the State Engineer should deny the Applications because the BLM and other federal agencies have not complied with federal law and because the U.S. Bureau of Indian Affairs has violated its trust responsibility to the Tribal Protestants.

The Tribes argue that the BLM has not complied with the government to government consultation process during the federal permitting process for the Project. Federal permitting processes protect tribal interests that may relate to Delamar Valley and adjacent basins. Through a programmatic agreement being promulgated in accordance with the National Historic Preservation Act,[951] the Tribes have been invited to participate, to both help identify and assess impacts to historic properties in Delamar Valley and adjacent basins, and to participate in the

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[949] Exhibit No. CTGR_014, p. 3.
[950] *See* Transcript, Vol.25 pp. 5813:23-5814:3 (Chairman Alvin Marques, testifying that the fear that the proposed pumping will affect the water supply for the City of Ely and therefore his tribe is not based on hydrologic data); Transcript, Vol.25 p. 5784:1-5 (Chairwoman Virginia Sanchez, testifying that she is aware of no model showing impacts to Railroad Valley due to the proposed pumping).
[951] Exhibit No. SNWA_408, pp. 29-75.

preservation of those properties.[952] This process, known as the Section 106 process, affords tribes an opportunity to participate in federal environmental review processes associated with the Project.[953] The draft programmatic agreement reflects that the Tribal Protestants in this hearing were invited to participate in the Section 106 process.[954]

Although this process is conducted on a government to government basis between tribal governments and the federal government, and the Applicant is not a participant in the process, the Applicant has provided funding for the BLM to conduct a workshop for the Tribes to educate them about the NEPA process and assist in identifying for them how they may participate in the process and provide comments.[955] The Applicant has also funded the preparation of an ethnographic assessment report, which is a specific report that's conducted by interviewing Tribes to identify properties of concern to the Tribes, also known as traditional cultural properties, in the Project area.[956] The Applicant has contributed more than $420,000 and numerous staff hours in support of these efforts.[957] Funding provided by the Applicant has directly compensated tribal members for their participation in the tribal consultation process, including reimbursement for travel time and expenses so they can attend meetings, workshops and field trips.[958]

Tribal Protestants argue government-to-government consultation did not occur. However, there was evidence presented of ongoing tribal consultation activities.[959] In any event,

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[952] Transcript, Vol.12 pp. 2772:18-2773:12 (Luptowitz).
[953] Transcript, Vol.12 p. 2774:2-6 (Luptowitz).
[954] Exhibit No. SNWA_408, pp. 71-73 (Programmatic Agreement, Appx. C); Transcript, Vol.12 p. 2780:6-17 (Luptowitz).
[955] Transcript, Vol.12 p. 2774:21-24 (Luptowitz).
[956] Transcript, Vol.12 pp. 2774:24-2775:5 (Luptowitz).
[957] Transcript, Vol.12 p. 2775:6-16 (Luptowitz).
[958] Transcript, Vol.12 pp. 2775:20-2776:3 (Luptowitz).
[959] Exhibit No. SNWA_408, pp. 76-80 (DEIS Appx. F3.17).

because the State Engineer finds he does not have jurisdiction to review the actions of the BLM or BIA in complying with the National Historic Preservation Act and other federal statutes, he declines to rule on the issue.

Whether or not the federal government has met its trust responsibilities to the Tribal Protestants, the State Engineer's obligation to the Tribal Protestants is to accord them due process of law and consider their evidence and protests as required by Nevada law. Ed Naranjo, Tribal Council member and Tribal Administrator for the Goshute, testified that the State Engineer listened to and heard the concerns of the Tribes.[960] The Tribes participated in the process of consideration of the Applications by filing a written protest.[961] The Tribes presented testimony during both the public comment session and through direct examination by their attorney.[962] The Tribes presented expert testimony by two expert witnesses,[963] and they cross-examined the Applicant's witnesses.[964]

The Tribal Protestants also argue that the State Engineer should not have admitted the Stipulations between the Applicant and the federal agencies into evidence. The Tribal Protestants claim they were not involved with the Stipulations and the monitoring and management programs that came out of the Stipulations. The Tribal Protestants also allege certain terms of the Stipulations were violated.[965] Whether or not the parties to the Stipulations have violated provisions of the Stipulations is not relevant to the State Engineer's determination. The State Engineer is not a party to the Stipulations and must independently review the

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[960] Transcript, Vol.25 p. 5748:8-13 (Naranjo).
[961] Transcript, Vol.25 p. 5749:1-4 (Naranjo).
[962] Transcript, Vol.25 pp. 5749:7-5752:11 (Naranjo).
[963] Transcript, Vol. 25 pp. 5749:19-5750:1 (Naranjo).
[964] Transcript, Vol.1 pp. 144:10-151:11 (Mulroy); Transcript, Vol.25 p. 5751:12-25 (Naranjo).
[965] Duckwater/Ely Joint Closing Statement pp. 7-9.

Applications and comply with Nevada law. The parties to the Stipulations must address any violations among themselves. While both the Applicant and the Tribal Protestants offered evidence and testimony regarding the federal Stipulations, the State Engineer declines to rely on this evidence in order to make his public interest determination.

The State Engineer finds that no credible evidence was presented that suggests any negative impacts to the Tribal Protestants' interests in the natural resources of Delamar Valley or any potential reserved water rights that the Tribal Protestants may possess. In addition, the State Engineer finds that it is not his responsibility to ensure that the federal government fulfills its responsibilities to the Tribal Protestants; determinations regarding violations of the trust responsibility and consultation requirements the federal government has towards the Tribal Protestants is beyond the State Engineer's jurisdiction and such alleged violations do not affect his determination to grant or deny an application pursuant to Nevada law.

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that approving the Applications will not threaten to prove detrimental to the public interest.

VII. INTERBASIN TRANSFER CRITERIA

Water from all sources within the boundaries of the State of Nevada, whether above or beneath the surface of the ground, belongs to the public.[966] Water in a groundwater basin does not belong exclusively to the inhabitants of that basin. Instead, the water belongs to the people of the State of Nevada. Nevada water law explicitly provides for the interbasin transfer of groundwater to the places where water is needed for beneficial use and provides procedural

[966] NRS 533.025.

requirements for such transfers.[967] Interbasin transfers of groundwater are necessary in most metropolitan areas of this country. With the exception of cities located on a water source like the Great Lakes, interbasin transfers are necessary in order to allow metropolitan areas to grow. Other metropolitan areas such as Phoenix, Tucson, Scottsdale, Long Beach, Los Angeles, San Francisco, Oakland and New York City have all developed water from outside the basin in which those cities are located.[968] The State Engineer finds that southern Nevada must now do the same.

VIII. JUSTIFICATION OF NEED TO IMPORT WATER

The Applicant has justified its need to import water from another basin.[969] As discussed in the "Beneficial Use and Need for Water" section above, the Applicant has demonstrated a need to beneficially use this water. The Applicant has justified its need to import water from another basin because there are no other water supplies available in the Las Vegas Valley - Hydrographic Basin 212.

For the reasons stated in the "Beneficial Use and Need for Water" section above, the State Engineer has already determined that the Applicant's projected water demands will exceed available water supplies and that the Applicant will need to put this water to beneficial use during the Applicant's planning period. The Applicant presented evidence of how this water will be used as part of the water resource portfolio in Southern Nevada.[970] The Applicant presented evidence that if the water from the Applications is not available, there will be shortfalls between

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[967] NRS 533.007; NRS 533.364; NRS 533.370.
[968] Transcript, Vol.1 pp. 91:10-92:13 (Mulroy).
[969] NRS 533.370(6)(a) (2010).
[970] Exhibit No. SNWA_189, p. 6-2, Figure 6-2; Exhibit No. SNWA_209, p. 43, Figure 28.

projected demands and available supplies during normal conditions on the Colorado River and that shortfalls would be even greater during shortage conditions on the Colorado River.[971]

There are no other water supplies available in the Las Vegas Valley - Hydrographic Basin 212. The Applicant has maximized local groundwater and surface water resources in the Las Vegas Valley. The Las Vegas Valley groundwater basin is fully appropriated.[972] There are simply no additional groundwater resources available in the Las Vegas Valley to meet Southern Nevada's water needs.

The Applicant cannot expect to receive additional Colorado River water. First, it is not realistic for Southern Nevada to expect to receive an increased allocation from the Colorado River. The Colorado River basin states are highly protective of their Colorado River allocations. The basin states view their Colorado River allocation as their "birth right" and if Southern Nevada were to gain water, it means that another basin state would lose water.[973] The basin states are prepared to litigate in front of the U.S. Supreme Court to protect their water rights if necessary.[974] Even if certain states were somehow able to reach agreement, any amendment to the Colorado River Compact would require ratification by seven state legislatures, seven governors, the United States Congress, and the President of the United States.[975] Second, it is not realistic for Southern Nevada to expect that transfers and exchanges will allow it to receive additional Colorado River water from users in other states. Even if a user were willing to sell Colorado River rights, the user would lack the power to transfer those rights outside of the state

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[971] Exhibit No. SNWA_189, p. 6-4, Figure 6-3, p. 6-5, Figure 6-4.
[972] Exhibit No. SNWA_189, p. 3-2.
[973] Transcript, Vol.2 pp. 264:24-266:1 (Entsminger).
[974] Transcript, Vol.2 pp. 265:23-266:1 (Entsminger).
[975] Transcript, Vol.2 p. 265:10-13 (Entsminger).

because the states are the ultimate owners of the rights and users are simply licensees.[976] Third, system augmentation projects are long-term projects between the basin states that are not expected to make additional water available on the Colorado River for decades.[977] These augmentation projects have been described as "conceptual in nature" and cannot be reasonably relied upon by water managers for immediate or intermediate water planning purposes.[978] At the same time, even if the Applicant were able to develop additional Colorado River water, such as through desalination or another method, it would not resolve supply issues relating to drought and shortage conditions on the Colorado River because Lake Mead water levels need to be sufficient to allow withdrawal of the new water.[979]

Southern Nevada cannot expect that the federal government or other states will solve its water supply issues. The other basin states are facing their own water supply issues and have expressed a reluctance to help Nevada unless Nevada helps itself by developing permanent in-state supplies.[980] The only way for Southern Nevada to become self-sufficient is to develop available in-state water supplies. There are no available water supplies in Las Vegas Valley. Therefore, an interbasin transfer is the only way for the Applicant to develop in-state water supplies and provide for Southern Nevada's water needs. Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the Applicant has justified its need to import water from another basin.

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[976] Transcript, Vol.2 p. 266:5-12 (Entsminger).
[977] Transcript, Vol.2 pp. 297:9-298:23 (Entsminger).
[978] Transcript, Vol.2 p. 299:2-7 (Entsminger).
[979] Exhibit No. SNWA_189, p. 3-3.
[980] Transcript, Vol.1 pp. 137:15-23 (Mulroy), 234:23-235:11 (Brothers); Transcript, Vol.2 p. 361:7-23 (Brothers).

IX. CONSERVATION

In determining whether an application for an interbasin transfer of groundwater must be rejected, the State Engineer shall determine whether a plan for conservation of water is advisable for the basin into which the water is to be imported, and if so "whether the applicant has demonstrated that such a plan has been adopted and is being effectively carried out."[981] The State Engineer determines that a plan for conservation of water is advisable for the basin into which the water is to be imported, and the Applicant has demonstrated that such a plan has been adopted and is being effectively carried out.

The Applicant presented expert testimony on this subject by Mr. Douglas Bennett. Mr. Bennett is the Applicant's Conservation Manager. Mr. Bennett was qualified by the State Engineer as an expert in water conservation planning, municipal water conservation, and xeriscaping.[982] Mr. Bennett testified about the Applicant's Conservation Plan and the many programs promulgated under the plan, its rate-setting practices, and reductions in southern Nevada's water use. Great Basin Water Network presented expert testimony on this subject from Dr. Peter Gleick. Dr. Gleick was qualified by the State Engineer as an expert on water conservation and efficiency.[983] Dr. Gleick testified about the Applicant's conservation program and his organization's 2007 Hidden Oasis report on the Applicant's conservation program. However, he admitted that he has never read the Applicant's 2009-2013 Conservation Plan.[984]

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[981] NRS 533.370(6)(b) (2010).
[982] Transcript, Vol.4 p. 823:16-19 (Joseph-Taylor).
[983] Transcript, Vol.23 p. 5091:10-12 (Joseph-Taylor).
[984] Transcript, Vol.23 p. 5145:21-25 (Gleick).

The Applicant has had a Conservation Plan in effect since 1999.[985] In accordance with NRS Chapter 540, the Applicant has submitted a conservation plan to the State Engineer for approval at five-year intervals since 1999.[986] The State Engineer last approved the Applicant's Conservation Plan on April 22, 2009.[987] In addition, pursuant to the Reclamation Reform Act, § 210(a) & (b) and 43 C.F.R. § 427.1, the Bureau of Reclamation requires the Applicant to develop "appropriate water conservation measures," resulting from the "full consideration and incorporation of prudent and responsible water conservation measures." The Bureau of Reclamation found the Applicant has met these requirements, and approved the Applicant's Conservation Plan on May 14, 2009.[988]

The Applicant's conservation planning has made a significant difference in the way Southern Nevadans use water.[989] Conservation "is not an event for [SNWA]. This is a journey."[990] The Applicant has set and achieved aggressive conservation goals over time. Achieving these goals has resulted in what Protestants' conservation expert Dr. Peter Gleick acknowledged to be a "dramatic reduction" in per capita water use.[991] In 1990, the Applicant service area's gallons-per-capita-per-day ("GPCD") use was 347.[992] Mr. Bennett testified that the Applicant's first conservation goal was to reduce use to 291 GPCD by 2010.[993] The Applicant exceeded that goal six years ahead of schedule.[994] In 2005, the Applicant adopted a

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[985] Exhibit No. SNWA_004, p. 1-1; Transcript, Vol. 4 pp. 825:3-5 (Bennett).
[986] Transcript, Vol.4 pp. 824:17– 825:1 (Bennett); Exhibit No. SNWA_005 (State Engineer approval of SNWA's Conservation Plan for the years 2009-2013).
[987] Exhibit No. SNWA_006.
[988] Exhibit No. SNWA_007.
[989] Transcript, Vol.1 p. 69:24-25 (Mulroy).
[990] Transcript, Vol.1 p.70:9-10 (Mulroy).
[991] Exhibit No. GBWN_118, p. 3.
[992] Transcript, Vol.4 p. 894:4-7 (Bennett).
[993] Transcript, Vol.4 p. 894:8-10 (Bennett).
[994] Transcript, Vol.4 p. 894:11-14 (Bennett).

new goal of 250 GPCD by 2010 and again surpassed the goal ahead of schedule. Once again, in response to achieving its goal ahead of schedule, the Applicant established a new, more aggressive goal of 199 GPCD by 2035.[995] When compared to the 274 GPCD use of 2004, the 199 GPCD goal will reduce annual demand by 276,000 acre-feet of water by the year 2035.[996] The Pacific Institute report "Municipal Deliveries of Colorado River Basin Water," recognized the Applicant has achieved a 31 percent reduction in per capita deliveries in southern Nevada from 1990 to 2008 over a period when total population increased by almost 160 percent.[997] Those savings outpace the seven Colorado River basin states as a whole, where from 1975 to 2005 per capita water use declined by 21 percent.[998]

The Applicant has achieved this dramatic success through effective implementation of its Conservation Plan. The Applicant has a Conservation Plan in place that employs a four-part strategy to ensure active, community-wide participation in conservation.[999] The four, interwoven strategies are regulation, pricing, incentives and education.[1000] Protestants asserted the Applicant's efforts with respect to these strategies could be more robust, but many of their criticisms were proved to be unfounded. Protestants' expert Dr. Gleick concurred that the Applicant had already adopted many of the recommendations in the Hidden Oasis report that had formed the basis for his criticisms of the Applicant's Conservation Plan.[1001]

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[995] Transcript, Vol.4 pp. 894:15-22, 895:20 (Bennett).
[996] Exhibit No. SNWA_209, p. 39; Transcript, Vol.4 p. 895:21-25 (Bennett).
[997] Exhibit No. SNWA_397, p 25.
[998] Exhibit No. SNWA_397, p 3.
[999] Exhibit No. SNWA_004, p. 2-1; Transcript, Vol.4 pp. 831:22-832:9 (Bennett).
[1000] Exhibit No. SNWA_004, p. 2-1; Transcript, Vol.4 p. 832:1-2 (Bennett).
[1001] Transcript, Vol.23 p. 5199:17-22 (Gleick).

Indeed, Dr. Gleick admitted he had not read or reviewed the Applicant's Conservation Plan prior to opining on the Applicant's conservation efforts.[1002] In addition, Dr. Gleick admitted he failed to update his analysis of SNWA member agencies' rate structures in his initial expert report[1003] and his rebuttal report[1004] to reflect two subsequent rate adjustments that enhanced the conservation effect of SNWA member agencies' rate structures.[1005] Dr. Gleick's reports relied on the Hidden Oasis report, prepared in 2007, for most of the analysis,[1006] and, thus, did not adequately consider the current status of the Applicant's conservation efforts, including its 2009-2013 Conservation Plan. Dr. Gleick also lacked familiarity with and understanding of the impact of the Applicant's re-use return flow credits on the Applicant's water portfolio.[1007] Accordingly, the State Engineer finds that Dr. Gleick lacks credibility, and his opinions will be given minimal weight.

Contrary to Protestants' assertion that approval of the Applications will encourage the willful waste of water, regulatory programs throughout the SNWA service area curb consumptive use through development codes and water use restrictions.[1008] Examples of Las Vegas Valley-area development codes include the Clark County Unified Development Code[1009] and the Henderson Municipal Code.[1010] These examples are representative of the development

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[1002] Transcript, Vol.23 p. 5148:21-25 (Gleick).
[1003] Exhibit No. GBWN_069.
[1004] Exhibit No. GBWN_118.
[1005] Transcript, Vol.23 pp. 5176:14-5177:2 (Gleick).
[1006] Transcript, Vol.23 pp. 5129:19-5130:3 (Gleick).
[1007] Transcript, Vol.23 pp. 5207:18-5208:7 (Gleick), (conceding upon questioning by Mr. Felling that reducing indoor use does not increase SNWA's water portfolio, permitting the service of new users who, necessarily, must engage in some consumptive uses).
[1008] Exhibit No. SNWA_004, p. 3-1.
[1009] Exhibit No. SNWA_012.
[1010] Exhibit No. SNWA_013.

codes adopted by other member agencies throughout the SNWA service area.[1011] These development codes restrict turfgrass to no more than 50% of the landscape area of residential backyards, and prohibit turfgrass altogether on residential front yards and commercial properties.[1012] They restrict the use of water for ornamental water features and man-made lakes.[1013] They limit the size and scale of swimming pools.[1014] And they require resort hotels to submit water efficiency plans describing their current or projected uses of water and their water efficiency plans.[1015]

Water use restrictions throughout the Las Vegas Valley limit customers' water use through mandatory landscape watering groups.[1016] They also prohibit water waste, sanctioning violators who allow water to run down the street or flow off the customer's property.[1017] Enforcement of water waste restrictions is aggressive; the Las Vegas Valley Water District assesses fees in excess of $5,000 per violation to chronic violators.[1018] They have assessed more than $400,000 a year in penalty fees against water wasters.[1019] Golf courses that violate water waste restrictions by exceeding their water budgets can be fined up to 900 percent of their top tier water rate.[1020]

Pricing of water throughout the SNWA service area encourages conservation and discourages water waste. The Applicant is not a retail rate-setting agency, but through a Memorandum of Understanding, all SNWA member agencies have committed to using tiered

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[1011] Transcript, Vol.4 p. 846:22-25 (Bennett).
[1012] Transcript, Vol.4 pp. 841:6-842:5 (Bennett).
[1013] Transcript, Vol.4 p. 845:14-15 (Bennett).
[1014] Transcript, Vol.4 p. 845:16-17 (Bennett).
[1015] Transcript, Vol.4 p. 845:18-24 (Bennett).
[1016] Transcript, Vol.4 p. 842:14-24 (Bennett).
[1017] Transcript, Vol.4 p. 843:4-8 (Bennett).
[1018] Exhibit No. SNWA_004, pp. 3-4; Transcript, Vol.4 p. 857:1-22 (Bennett).
[1019] Transcript, Vol.4 pp. 860:23-861:1 (Bennett).
[1020] Transcript, Vol.4 p. 863:2-5 (Bennett).

block-rate structures.[1021] In accordance with the water resource policy of the State of Nevada, member agencies' water pricing maximizes water conservation with due consideration to the essential service needs of customers and the economic burdens on businesses, public services, and low-income households.[1022] The rate structures have remained affordable in the first pricing tier, which is intended to meet basic health and sanitation needs, and in the upper tiers the rate structure has been steepened and compressed over time to incentivize conservation.[1023] Top tier rates may be 350 percent more costly than the first tier.[1024] Member agencies have committed to reviewing and adjusting rates frequently to ensure the conservation effect is sustained.[1025] The member agencies have to balance their desire for conservation with a public utilities' obligation to raise adequate operating revenue without exceeding their actual costs.[1026] Protestants conceded they did not consider these factors in their analysis.[1027] Protestants also conceded their criticisms of SNWA member agencies' tiered rate structures were based on rates as reported in 2004[1028] and they did not update their analysis in either their initial report[1029] or rebuttal report[1030] to reflect the two subsequent adjustments steepening the rate tiers.[1031]

The Applicant has created substantial, long-term water savings by providing financial incentives and products to customers.[1032] Its Water Smart Landscapes program has incentivized customers to replace high water-use lawns with water-efficient xeric landscaping, resulting in the

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[1021] Transcript, Vol.4 p. 864:8-14 (Bennett); Exhibit No. SNWA_004, p. 4-1.
[1022] *See* NRS 540.011.
[1023] Exhibit No. SNWA_004, p. 4-1; Transcript, Vol.4 pp. 865:10-867:1 (Bennett).
[1024] Exhibit No. SNWA_395, p. 7.
[1025] Exhibit No. SNWA_395, p. 7.
[1026] Transcript, Vol.4 pp. 920:12-19 (Bennett).
[1027] Transcript, Vol.23 pp. 5174:21-5175:13 (Gleick).
[1028] Transcript, Vol.23 p. 5176:10-13 (Gleick).
[1029] Exhibit No. GBWN_069.
[1030] Exhibit No. GBWN_118.
[1031] Transcript, Vol.23 pp. 5176:14-5177:2 (Gleick).
[1032] Exhibit No. SNWA_004, p. 5-1.

removal of more than 150 million square feet of turfgrass and a demand reduction of more than 127,000 acre-feet of water over the past ten years.[1033] It is the largest incentive program in the nation, paying customers an average of $16 million per year for turfgrass conversion.[1034] The Applicant appropriately focuses on the program because of its effectiveness in reducing consumptive use; studies showed the program results in a 75% reduction in outdoor, consumptive water demand.[1035] Recent changes to the program allowing for re-conversion will allow participants greater flexibility and may incentivize more customers to participate in the landscape conversion program.[1036]

Protestants' criticisms that the Water Smart Landscapes program must do more in order to be considered effective are without merit. Dr. Gleick indicated that the Water Smart Landscapes program should pay participants more per square foot, although he conceded the program as a whole outspends other programs.[1037] The State Engineer finds it is not economically rational, nor is it necessary, to increase incentives when the savings achieved by the program demonstrate the current incentive level already encourages large-scale participation.

Consumptive water use, the type targeted by the Water Smart Landscapes program, justifiably is the primary focus of the Applicant's conservation efforts because reducing consumptive use extends water resources.[1038] Reducing non-consumptive uses, such as indoor household uses, does not extend the Applicant's water resources because the Applicant receives return flow credits for its treated wastewater, nearly 100 percent of which is directly or indirectly

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[1033] Exhibit No. SNWA_004, p. 5-1; Transcript, Vol.4 pp. 872:19-22, 873:13-18 (Bennett).
[1034] Transcript, Vol.4 pp. 869:20-21, 870:16-22 (Bennett).
[1035] Transcript, Vol.4 p. 872:16-18 (Bennett).
[1036] Transcript, Vol.4 pp. 876:10-879:4 (Bennett).
[1037] Transcript, Vol.23 p. 5107:4-11 (Gleick).
[1038] Transcript, Vol.4 p. 833:10-13 (Bennett).

reused.[1039] In response to Mr. Felling's question concerning whether indoor conservation would actually allow the Applicant to serve more customers, Dr. Gleick acknowledged that conservation of non-consumptive uses would allow the Applicant to serve new customers only if those new customers added no consumptive uses,[1040] which would be implausible under even the most conservative scenarios.

Even though indoor conservation does not reduce overall consumptive use of water, as part of its commitment to fostering a conservation ethic, the Applicant promotes indoor conservation, as well.[1041] Protestants' charges that the Applicant has "largely ignore[d] the potential for indoor efficiency improvements,"[1042] are without merit. The Applicant produced evidence of indoor conservation programs and incentives including its Water Efficient Technologies program, which has facilitated large-scale conservation efforts primarily for commercial and industrial clients, and indoor retrofit kits providing free components for indoor water efficiency retrofits that exceed current plumbing standards.[1043]

Similar to its incentive programs, the Applicant's education programs also ensure community-wide participation in conservation efforts throughout the Las Vegas Valley. Protestants suggested the Applicant should "[c]reate a culture of conservation by developing a consistent message about the importance of indoor and outdoor conservation" and "[o]ffer public awards for innovative conservation programs."[1044] The Applicant demonstrated it has already implemented this recommendation. Its award-winning website logs more than 450,000 visits

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[1039] Exhibit No. SNWA_004 at ES-1; Exhibit No. SNWA_402; Transcript, Vol.2 pp. 283:21-284:22 (Entsminger).
[1040] Transcript, Vol.23 pp. 5207:18-5208:7 (Gleick).
[1041] Transcript, Vol.4 p. 834:6-20 (Bennett).
[1042] Exhibit No. GBWN_072, p.2.
[1043] Exhibit No. SNWA_004, pp. 5-3 to 5-4; Exhibit No. SNWA_399.
[1044] Exhibit No. GBWN_072, p. 4.

annually; it produces a Water Smart Living quarterly newsletter; it circulates an annual calendar with water-saving tips; and it has located community demonstration gardens throughout the Las Vegas Valley to maximize exposure to xeriscaping techniques.[1045] Public/private partnerships, including the Water Upon Request and Water Smart Homes programs, help promote the conservation message.[1046] Awards that encourage community conservation include the Water Hero Award and the annual SNWA Landscape Awards, now in its fourteenth year.[1047] Indeed, Protestants' Hidden Oasis Report, in its Appendix A[1048] acknowledged many of these programs.

"One of the major conclusions" of Dr. Gleick's rebuttal report "was per capita water use is declining, but more can be done."[1049] This conclusion was founded on Dr. Gleick's comparison of the Applicant's system-wide GPCD with the system-wide GPCDs of other water agencies, such as Denver, Albuquerque, Tucson, and Los Angeles.[1050] Dr. Gleick opined, "there's nothing inherently special or different about the Las Vegas Valley that justifies this higher per capita use."[1051] However, Dr. Gleick did recognize that, "a city in a hot, dry climate like Las Vegas, would likely have higher outdoor demand requirements than a city in a cool, wet climate."[1052]

The Applicant challenged Dr. Gleick's use of cross-utility GPCD comparison. The Applicant introduced evidence from authoritative sources, including publications by the American Water Works Association ("AWWA") and the organization Dr. Gleick founded and leads, the Pacific Institute, stating that cross-utility GPCD comparisons are inappropriate due to

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[1045] Exhibit No. SNWA_004, p. 6-1; Transcript, Vol.4 pp. 887:18 - 888:22 (Bennett).
[1046] Exhibit No. SNWA_004, pp. 7-1 to 7-2; Transcript, Vol.4 pp. 889:21 - 891:11 (Bennett).
[1047] Exhibit No. SNWA_395, p. 9; Transcript, Vol.4 p. 891:15-23 (Bennett),
[1048] Exhibit No. SNWA_396.
[1049] Transcript, Vol.23 p. 5099:1-3 (Gleick).
[1050] Exhibit No. GBWN_118, pp.5-6; Transcript, Vol.23 p. 5099: 3-12, p. 5102:7-15 (Gleick).
[1051] Transcript, Vol.23 p. 5099:13-15 (Gleick).
[1052] Transcript, Vol.23 p. 5141:7-13 (Gleick); Exhibit No. GBWN_072, p. 18.

such differences as climate and functional population, the measure of population that takes into account a high influx of daily visitors that normally are not included in population for GPCD calculations.[1053] Mr. Bennett testified that if the Applicant accounted for functional population, The Applicant's GPCD would be reduced by as much as 40 GPCD.[1054] In response to questioning from the State Engineer, Dr. Gleick stated that he had no reason to dispute Mr. Bennett's calculation of the 40 GPCD reduction due to functional population.[1055] Dr. Gleick also testified on cross examination that he had failed to account for either functional population or climatic differences in his analysis.[1056]

Dr. Gleick testified that in addition to system-wide GPCD, he also compared the cross-utility uses in the single family sector in order to correct for many of the biases in cross-utility GPCD comparisons. He testified that this made the single-family account GPCD metric a relatively valuable one for comparing the effectiveness of different conservation programs.[1057] However, on cross-examination, Dr. Gleick admitted that a recent AWWA article found that even comparisons of single-family use accounts did not eliminate differences across different utilities due to local climate conditions and the influence of several other factors such as housing density or average lot size, average number of people per household, marginal price of water availability, cost of reclaimed irrigation water, median household income, and other characteristics of the single-family residential sector.[1058]

[1053] Exhibit No. SNWA_014, pp. 8-14; Exhibit No. SNWA_397, p. 8.
[1054] Transcript, Vol.4 p. 904:6-8 (Bennett).
[1055] Transcript, Vol.23 p. 5204:21-24 (Gleick).
[1056] Transcript, Vol.23 pp. 5142:25-5143:6 (Gleick).
[1057] Transcript, Vol.23 p. 5203:7-11 (Gleick).
[1058] Transcript, Vol.23 p. 5145:12-22 (Gleick).

The State Engineer finds that due to the inaccuracies inherent in comparing GPCD between utilities, the fact that the Applicant has a higher GPCD than other western cities does not mean that the Applicant's Conservation Plan is ineffective.

Mr. Bennett opined that the Applicant has effectively carried out its Conservation Plan judged by the progress at reducing water demand by 30 percent. This has resulted in a savings of more than 9.5 billion gallons a year.[1059] Even Protestants' expert, after acknowledging that the Applicant has adopted most of the suggestions made in the Hidden Oasis report, admitted that pieces of the Applicant's Conservation Plan were effectively carried out.[1060] Dr. Gleick's main argument is that the Applicant could do even more.[1061]

However, the statutory standard does not require the Applicant to develop and effectively implement the most severe Conservation Plan possible, or to outpace every conservation effort in the nation.[1062] There is substantial evidence that, not only does the Applicant have a Conservation Plan in place that is effectively implemented, it has also addressed, at least in part, every recommendation offered by Protestants to improve its conservation efforts. Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds a plan for conservation of water is advisable for the basin into which the water is imported and finds the Applicant has demonstrated that such a plan has been adopted and is being effectively carried out.

[1059] Transcript, Vol.4 p. 912:14-23 (Bennett).
[1060] Transcript, Vol.23 p. 5200:3 (Gleick).
[1061] Transcript, Vol.23 p. 5203:21 (Gleick).
[1062] NRS 533.370(6)(c) (2010).

X. ENVIRONMENTAL SOUNDNESS

The State Engineer must consider whether approval of the Applications is environmentally sound as it relates to the Delamar Valley – the basin from which the water is exported.[1063]

The Applicant presented expert testimony on this subject by three witnesses, Mr. Zane Marshall, Ms. Lisa Luptowitz and Dr. Terry McLendon. Mr. Marshall is the director of the the Applicant's Environmental Resources Department. Mr. Marshall was qualified by the State Engineer as an expert in the area of biological resources, including conservation biology, environmental compliance and environmental monitoring.[1064] Mr. Marshall testified about the Applicant's baseline investigations, the nature of the environmental areas of interest, the projected impacts on the environmental resources in the DDC Valleys and adjacent basins, the tools available to the Applicant to minimize or mitigate environmental impacts, the oversight by other agencies on the environmental monitoring and adaptive management plans and the Applicant's commitment to operating an environmentally sound Project. Ms. Luptowitz testified about the federal, state and local environmental permitting for the Project and how the Bureau of Indian Affairs and tribal governments were involved in the federal permitting processes. Dr. McLendon was qualified by the State Engineer as an expert in the areas of ecology and range science.[1065] Dr. McLendon testified about the effect of change in depth to water ("DTW") on individual plants and plant communities, plant succession and blowing dust from playas and dry lake beds.

[1063] NRS 533.370(6)(c) (2010).
[1064] Transcript, Vol.8 p. 1776:15-24 (Marshall).
[1065] Transcript, Vol.7 p. 1611:23-25 (McLendon).

GBWN presented expert testimony on this subject from three witnesses, Dr. James Deacon, Dr. Duncan Patten and Dr. Robert Harrington. The Long Now Foundation presented expert testimony on this subject from two witnesses, Mr. Clifford Landers and Dr. Clay Robinson. Other Protestants provided lay testimony about the feared impact on the environmental resources of the DDC Valleys and adjacent basins. Dr. Deacon was qualified by the State Engineer as an expert in the area of desert aquatic ecology.[1066] Dr. Deacon testified about the fragility of springsnails and fish species in general, potential impacts of decreasing spring flow on springsnail and fish species, the effectiveness of the federal oversight process and the history in Nevada of species extinction caused by water diversions. Dr. Patten was qualified by the State Engineer as an expert in the area of plant ecology and hydroecology.[1067] Dr. Patten testified about the effect of change in DTW on individual plants and plant communities, plant succession and the effectiveness of monitoring and mitigation plans for preventing impacts to desert vegetation communities. Dr. Robinson was qualified by the State Engineer as an expert in the area of soils and plant ecology.[1068] Dr. Robinson testified about the effect of change in DTW on individual plants and plant communities, plant succession and how plant succession could cause blowing dust.

A. Environmental Baseline

The Applicant has performed significant work toward establishing the environmental baseline in the basins from which water is to be exported, and in adjacent basins, as well.[1069] The Applicant has studied a broad array of biotic communities within the DDC Valleys and

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[1066] Transcript, Vol.19 p. 4140:17-23 (Deacon).
[1067] Transcript, Vol.18 p. 3938:20-21 (Patten).
[1068] Transcript, Vol.28 p. 6309:16-20 (Robinson).
[1069] Exhibit No. SNWA_363, pp. 4-1 to 4-43; Transcript, Vol.12 pp. 2681:17–2691:2, pp. 2723:3–2724:20 (Marshall).

adjacent basins. Areas of focus included: aquatic ecosystems;[1070] amphibians;[1071] birds;[1072] mammals, including bats and small mammals;[1073] reptiles;[1074] fish, including the Pahrump poolfish and Moapa dace;[1075] invertebrates, including terrestrial and aquatic invertebrates;[1076] and vegetation, including endangered, threatened and sensitive plant species, cactus and yucca, weeds and phreatophytic vegetation.[1077] The Applicant also assessed environmental areas of interest throughout the DDC Valleys and adjacent basins,[1078] focusing on groundwater-influenced habitats and associated special status species, including federally threatened, endangered, proposed or candidate species under the Endangered Species Act ("ESA"), Nevada BLM sensitive species, Nevada and Utah state-protected species, and species ranked critically imperiled or imperiled across their entire range by NatureServe.[1079] These environmental areas of interest provide a good representation of the key groundwater-influenced habitats and areas of focus in and around the project basins.[1080] The State Engineer finds that the Applicant's effort and investment in gathering baseline information has been unprecedented and greatly expands knowledge of the region's biota.[1081]

[1070] Exhibit No. SNWA_363, pp. 4-2 to 4-5; Exhibit No. SNWA_422; Exhibit No. SNWA_374; Transcript, Vol.12 pp. 2691:5–2697:13 (Marshall).
[1071] Exhibit No. SNWA_363, pp. 4-5 to 4-8; Transcript, Vol.12 pp. 2697:14 – 2698:5 (Marshall).
[1072] Exhibit No. SNWA_363, pp. 4-8 to 4-17; Transcript, Vol.12 pp. 2698:6–2706:10 (Marshall).
[1073] Exhibit No. SNWA_363, pp. 4-17 to 4-21; Transcript, Vol.12 pp. 2706:11–2713:12 (Marshall).
[1074] Exhibit No. SNWA_363, pp. 4-22 to 4-24; Transcript, Vol.12 pp. 2713:13–2714:11 (Marshall).
[1075] Exhibit No. SNWA_363, pp. 4-25 to 4-26; Transcript, Vol.12 pp. 2714:12–2717:2 (Marshall).
[1076] Exhibit No. SNWA_363, pp. 4-25, 4-27 and 4-27 to 4-28; Transcript, Vol.12 p. 2717:3-25 (Marshall).
[1077] Exhibit No. SNWA_363, pp. 4-27, and 4-29 to 4-36; Transcript, Vol.12 pp. 2718:1–2722:23 (Marshall).
[1078] Transcript, Vol.12 pp. 2671:18-20, 2741:7-20, 2743:4-16 and 2744:25-2745:7 (Marshall) (Delamar Valley); Transcript, Vol.12 pp. 2749:8–2751:21 (Marshall) (Pahranagat Valley).
[1079] Exhibit No. SNWA_363, p. 2-1.
[1080] Transcript, Vol.12 p. 2752:2-4 (Marshall).
[1081] Transcript, Vol.12 p. 2723:6-16 (Marshall).

GBWN argued in their written closing that the baseline data was inadequate in kind and quality,[1082] but they did not provide an expert witness opinion, report or exhibit that explained or substantiated that argument. In fact, Dr. Deacon testified he had no criticism of Dr. McLendon or Mr. Marshall's baseline work.[1083] Dr. Patten similarly testified he had no criticism of Dr. McLendon's work.[1084]

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the Applicant gathered and presented the appropriate environmental resource baseline material and that the environmental resource baseline information provides a platform for sound, informed decision-making. Notwithstanding this finding, the State Engineer reserves the right to require additional types and/or years of baseline information as set forth below.

B. Permitting

The baseline information collected by the Applicant informs federal, state and local resource managers[1085] who have permitting authority over the Project.[1086] Federal and state laws, including the National Environmental Policy Act ("NEPA"), the ESA, the Clean Water Act ("CWA"), and Nevada water law, require environmental protection through comprehensive permitting and regulatory processes.[1087] These permitting processes impose strict environmental controls on the Project that ensure it will be environmentally sound.[1088] Protestants' witness Rebecca Mills, former superintendent at Great Basin National Park, conceded it is the mission of

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[1082] GBWN Closing Brief at 24.
[1083] Transcript, Vol.18 pp. 4028:4-4029:11 (Patten).
[1084] Transcript, Vol.18 pp. 4028:4-4029:11 (Patten).
[1085] Transcript, Vol.12 p. 2723:20-24 (Marshall).
[1086] Transcript, Vol.12 pp. 2752:21-2753:1 (Luptowitz).
[1087] Exhibit No. SNWA_363, p. 5-3, Table 5-2: Potentially Required Federal and State Permits and Reviews.
[1088] Transcript, Vol.12 pp. 2783:25-2784:8 (Luptowitz) (federal agency oversight of the project has been rigorous, resulting in a lengthy, thorough, comprehensive permitting process).

federal agencies to zealously enforce the environmental protections with which they are charged.[1089]

NEPA requires a full consideration of environmental impacts resulting from the project.[1090] NEPA compliance will result in substantive protections that can ensure environmental soundness. For instance, an Environmental Impact Statement can identify and consider mitigation measures, and those mitigation measures become part of a Record of Decision for the Project and are then required under the terms of any right of way grant.[1091] With respect to the Project, the Applicant has prepared more than 300 Applicant Committed Measures aimed at minimizing and mitigating Project impacts.[1092]

The ESA imposes strict substantive protections, in the form of reasonable and prudent alternatives, that include minimization and mitigation measures that prevent jeopardy to listed species or their critical habitat.[1093] The Applicant agreed to inclusion of even non-listed species for the Project ESA consultation, resulting in an even greater breadth of coverage.[1094]

Protestants' expert Dr. James Deacon raised concerns regarding the extinction of species due to water development, but those concerns arise in the context of historical water development practices that preceded the ESA.[1095] The Applicant's expert, Mr. Marshall noted that the Applicant has learned from others' mistakes of the past to act in a more environmentally

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[1089] Transcript, Vol.22 p. 4952:15-20 (Mills); *see also* Transcript, Vol.25 p. 5743:7-10 (Naranjo) (federal employees do their best to follow the law).
[1090] Transcript, Vol.12 p. 2763:10-21 (Luptowitz) (the EIS for the project will assess direct, indirect and cumulative effects of the project, and will consider the human, biological, and physical environment).
[1091] Transcript, Vol.12 pp. 2764:23-2765:11 (Luptowitz).
[1092] Transcript, Vol.12 pp. 2765:16-24 (Luptowitz).
[1093] Transcript, Vol.12 pp. 2755:21-2756:1, 2756:22-2757:2 (Luptowitz).
[1094] Transcript, Vol.12 p. 2758:8-16 (Marshall).
[1095] Transcript, Vol.12 pp. 2823:22-2824:3 (Marshall).

sound manner.[1096] Protestants' expert Dr. Bredehoeft agreed that under the ESA, federal agencies would exercise their power to alter Project operations to curtail impacts to listed species.[1097]

Protestants have argued that NEPA, the ESA and other federal and state permitting requirements do not relieve the State Engineer of his responsibility to determine the Project is environmentally sound.[1098] Protestants also expressed doubts about a future State Engineer's resolve to halt groundwater withdrawals if adverse environmental impacts occurred.[1099]

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that he has the jurisdiction and responsibility to determine the Project's environmental soundness independently of other federal and state permitting requirements and will do so. The State Engineer considers the regulatory background of the Project as evidence that other agencies with diverse regulatory responsibility and environmental expertise will also exercise continuous authority to regulate the Project in a manner that protects the environment. While the State Engineer rejects the argument that he should consider the possibility that some future State Engineer may not have the resolve to perform statutory duties, the ongoing jurisdiction of the diverse state and federal agencies with regulatory authority over the Project demonstrates redundancies in environmental regulation of the Project that will ensure continuous oversight regardless of the resolve of a future State Engineer.

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the oversight provided by federal and state agencies will supplement the

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[1096] Transcript, Vol.12 pp. 2823:22-2824:7 (Marshall).
[1097] Transcript, Vol.24 p. 5465:20-23 (Bredehoeft).
[1098] GBWN, et al. Closing Statement at 21.
[1099] GBWN, et al., Closing Statement at 26.

State Engineer's ability to ensure the environmental soundness of the Project. The State Engineer's water right permitting requirements will ensure the Project's environmental soundness.

C. Compliance with the Federal Stipulation

On January 7, 2008, SNWA and four Department of the Interior agencies, the U.S. Fish and Wildlife Service, the Bureau of Indian Affairs, the Bureau of Land Management, and the National Park Service, entered into a Stipulation for Withdrawal of Protests regarding Application Nos. 53987-53992 in Delamar, Dry Lake, and Cave Valley Hydrographic Basins.[1100]

The Goals of the DDC Stipulation included:

> • To manage the development of groundwater by SNWA in DDC without causing injury to Federal Water Rights and/or unreasonable adverse effects to Federal Resources and Special Status Species within the Area of Interest as a result of groundwater withdrawals by SNWA in DDC; and,
>
> • Taking actions that protect and recover those Special Status Species that are currently listed pursuant to the Endangered Species Act and avoid listing of currently non-listed Special Status Species.

The Stipulation created a Biological Resources Team ("BRT"), which includes representatives from the Applicant, the Bureau of Indian Affairs, the Bureau of Land Management, the National Park Service, and the U.S. Fish and Wildlife Service.[1101] These representatives are biologists who provide scientific and technical expertise.[1102] The Nevada Department of Wildlife, and the Nevada State Engineer have also participated in BRT meetings

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[1100] Exhibit No. SE Ex._080. The Tribes argue the Stipulation is not properly in evidence because it bars discussion of the Stipulation without the presence of federal representatives.. SNWA explained that the Stipulation provides it "may be used in any future proceeding to interpret and/or enforce its terms." Exhibit No. SE_80, p. 10; SNWA Closing Statement at 17-18. In any event, because the State Engineer's ruling relies on the incorporation of the BMP, rather than the Stipulation, arguments about the admissibility of the Stipulation are not relevant to the State Engineer's environmental soundness determination..

[1101] Exhibit No. SNWA_366, p. ix (DDC Biological Monitoring Plan).

[1102] Transcript, Vol.8 p. 1809:10-19 (Marshall); Transcript, Vol. 9, p. 2083:7-9 (Prieur).

developing and implementing the Biological Monitoring Plan ("BMP").[1103] The State Engineer finds that he can utilize the biological expertise of the BRT as an advisory panel throughout the administration of the Project.

The role of the BRT is to develop and implement a "BMP".[1104] The BMP requires the development of conceptual models and the identification of indicators and ecological attributes to be monitored throughout the DDC Valleys and adjacent basins that will allow for the thorough assessment of the health and integrity of the full range of groundwater-influenced resources in the DDC Valleys and adjacent basins.[1105] Development of the monitoring plan involves significant interaction between the BRT and the hydrologic Technical Review Panel ("TRP"). This interaction is integral to enhancing the technical understanding of monitoring processes and results under the BMP.[1106] The coordination between hydrologic and biologic experts improves the ability of the State Engineer to assure that environmental resources will be properly protected as the hydrologic decisions are made to regulate the Project. Detailed management and mitigation approaches will be included in the BMP when enough data and information has been gathered to support their development. The BMP envisions and establishes a framework for such management and mitigation approaches.[1107] The BMP provides for significant interaction between the BRT and the hydrologic TRP, and approach that is integral to enhancing technical understanding of monitoring processes and results under the BMP.[1108]

[1103] Transcript, Vol.9 p. 2084:12-21 (Marshall).
[1104] Exhibit No. SE_080, Exhibit A.
[1105] Exhibit No. SNWA_ 366, pp. 2-1 to 2-4.
[1106] Transcript, Vol.8 p. 1813:8-12 (Marshall).
[1107] *See* Exhibit No. SNWA_366.
[1108] Transcript, Vol.8 p. 1813:8-12 (Marshall).

The BMP provides for monitoring potential impacts to both the DDC Valleys and adjacent basins.[1109] The BMP establishes an Area of Interest that includes all or parts of five hydrographic basins ("HB"): the three basins in which the Applicant has applied for groundwater rights (Cave, Dry Lake, and Delamar Valleys HBs) and two down-gradient basins (Pahranagat Valley HB and the southern portion of White River Valley HB that is south of Hardy Springs).[1110] Southern White River Valley and Pahranagat Valley HBs are included in the Area of Interest because of the potential for interbasin groundwater.[1111] Pahroc Valley HB, which lies between the Cave Valley and Pahranagat Valley HBs, is excluded from the Area of Interest because no surface water features are present.[1112] Notably, 97.9% of this Area of Interest is federally held land; only 1.5% is privately owned.[1113] Protestants' expert, Dr. James Deacon, agreed the monitoring sites identified by the BMP will produce a "good body of information."[1114]

The BMP was approved by representatives from the Applicant, the Bureau of Indian Affairs, the Bureau of Land Management, the National Park Service, and the U.S. Fish and Wildlife Service in January 2011.[1115] In addition, it has been made available to the State Engineer as SNWA Exhibit No. 366.[1116] These reports provide valuable information to the State Engineer, which will inform his continued regulatory control over the Project. Through this ruling, the State Engineer expressly incorporates the DDC BMP into the terms of the approved permits.

[1109] Exhibit No. SNWA_366, pp. 1-8 to 1-9, Transcript, Vol.9 p. 2087:17-21 (Marshall).
[1110] Exhibit No. SNWA_366, p. 1-8.
[1111] Exhibit No. SNWA_366, p. 1-8.
[1112] Exhibit No. SNWA_366, p. 1-8.
[1113] Exhibit No. SNWA_366, p. 1-10.
[1114] Transcript, Vol.19 p. 4181:22-24 (Deacon).
[1115] Transcript, Vol.9 p. 2089:23-25 (Marshall).
[1116] Transcript, Vol.11 pp. 2523:17-2524:1 (Marshall).

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds the monitoring and reporting aspects of the BMP comprehensively address the groundwater-influenced environmental resources of the DDC Valleys and adjacent basins. The sites and species identified for monitoring are representative of sites and species found throughout the federal, state and private resources within the DDC Valleys and adjacent basins. The State Engineer finds that incorporation of the BMP in the permit terms for the Applications and the State Engineer's continued regulatory control over the Project will ensure proper monitoring and oversight of the Project and its environmental soundness as it relates to groundwater-influenced environmental resources.

D. <u>Adaptive Management</u>

The BMP provides flexibility for future modifications to the monitoring plan based on new information and technologies and future management considerations.[1117] In addition, the monitoring methodology instituted by the BMP provides an adaptive management framework, in other words, instituting the steps of setting goals and priorities, developing monitoring and conservation strategies, taking needed action, measuring results, and refining the plan.[1118] Protestants' expert Dr. Patten emphasized that monitoring is a critical element of adaptive management, which can result in the successful management of systems if resource managers adhere to the steps of researching, learning, testing ideas, adapting, reconsidering conceptual ideas, and trying again.[1119] A central component of the BMP, adaptive management calls for

[1117] Exhibit No. SNWA_366, p. 2-1.
[1118] *See* Exhibit No. SNWA_366, p. 1-2.
[1119] Exhibit No. SNWA_461, p. 17; Transcripts, Vol.18 pp. 4024:20-4025:24 (Patten).

continual evaluation of the BMP and its success, and it provides for alteration of the BMP as necessary to achieve environmental soundness-related goals.[1120]

Protestants assert adaptive management plans are not "learn-as-you-go" plans, and criticize the Applicant's BMP on this ground. However, Dr. Patten conceded repeatedly that learning, and adapting to what scientists learn through monitoring, is an important part of understanding the ecological function of systems and managing those systems.[1121] Dr. Patten further conceded that monitoring programs can achieve ecological sustainability of spring areas through appropriate water management.[1122] Protestants' witness, Dr. Robert Harrington, Director of the Inyo County Water Department, acknowledged that the adaptive management process is one he employs in the Owens Valley,[1123] and that adaptive management has had success there.[1124]

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds the adaptive management approach incorporated in the BMP is an accepted scientific approach that is appropriate and advisable for managing a long-term Project such as this one. The State Engineer finds that adaptive management is the best way to ensure water development occurs in a manner that is environmentally sound. This finding is subject to the discussion below on triggers and thresholds, and subject to the right to review, approve, deny and/or modify the adaptive management plan and BMP as warranted throughout the life of the Project.

E. Triggers and Thresholds

[1120] Transcript, Vol.8 p. 1815:10-16 (Marshall).
[1121] Transcripts, Vol.18 pp. 4023:10-4025:20 (Patten).
[1122] Transcripts, Vol.18 pp. 4027:10-4028:1 (Patten); Exhibit No. GBWN_59, p. 12.
[1123] Transcript, Vol.23 p. 5271:2-14 (Harrington).
[1124] Transcript, Vol.23 pp. 5208:23-5209:13 (Harrington).

The BMP lays out a process for developing triggers for action in the event an unreasonable adverse impact to a resource is anticipated.[1125] The process includes the identification of conservation targets and their key ecological attributes and indicators and the development of adequate baseline data.[1126] The DDC BMP provides for three to ten years of baseline data collection, depending on the site and impacts predicted by empirical and modeling data.[1127] This data will provide valuable information to the State Engineer, informing his continuing jurisdiction over pumping pursuant to the Applications.

Protestants argue the BMP provides inadequate assurances of the Project's environmental soundness because it has not yet identified the specific quantifiable standards that will be used to provide early warning to impacts in the ecosystem.[1128] However, under the BMP, the BRT is working to develop suitable conservation targets and parameters that in concert with hydrologic monitoring will provide early warning of impacts to the ecosystem.[1129] Factors such as natural variation in the environmental resources must be understood before any standars or triggers are set.

Selecting specific standards before a full baseline is developed would be premature.[1130] It would not lead to sound scientific decisions.[1131] Indeed, Protestants' expert Cliff Landers stated, "[Y]ou really have to have baseline data in order to be able to make intelligent decisions."[1132] Dr. Harrington agreed the collection of baseline data prior to groundwater withdrawal makes the

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[1125] Exhibit No. SNWA_366, pp. 4-1 and 7-5.
[1126] Transcript, Vol.8 p. 1815:4-16 (Marshall).
[1127] Transcript, Vol.9 p. 2089:14-22 (Marshall).
[1128] Transcript, Vol.23 p. 5276:6-17 (Harrington).
[1129] Transcript, Vol.8 p. 1836:3-15 (Marshall).
[1130] Transcript, Vol.14 p. 3211:7-15 (Marshall); Transcript, Vol. 12, p. 2683:16-21 (Marshall).
[1131] Transcript Vol.12 p. 2686:2-9 (Marshall).
[1132] Transcript, Vol.28 p. 6289:10-11 (Landers).

Project far better positioned to ensure water development occurs in a sustainable manner than was the case in the Owens Valley.[1133]

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the BMP establishes a sound process for developing triggers and decisional thresholds to be employed in the adaptive management plan. Furthermore, it is premature to set management triggers and decision thresholds until additional years of data have been collected and natural variation and other factors are thouroughly understood. The State Engineer finds that failure to set triggers or thresholds at this time does not invalidate the BMP or undercut the development of an effective adaptive management plan; to the contrary, it demonstrates the Applicant's determination to proceed in a scientifically informed, environmentally sound manner.

F. <u>Enforcement and Dispute Resolution</u>

Protestants argued the protections provided by the BMP are inadequate because the Stipulation between the Applicant and the Department of the Interior agencies lacks adequate enforcement mechanisms.[1134] However, as Mr. Marshall identified, " SNWA [Applicant] is bound by any decision made by the State Engineer."[1135] As the State Engineer admonished, the regulation of water rights is in the State Engineer's purview, and the State Engineer proactively monitors impacts to existing rights and the environment.[1136] The State Engineer always retains

[1133] Transcript, Vol.23 pp. 5286:22-5287:5 (Harrington).
[1134] *See* Transcript, Vol.11 p. 2495:1-10 (Question by Paul Hejmanowski).
[1135] Transcript, Vol.11 p. 2496:13-14 (Marshall).
[1136] Transcript, Vol.11 p. 2499:7-22 (State Engineer King).

the authority to monitor water rights and any impact to them,[1137] and the dispute resoulution process in the Stipulation has no impact on that authority.

Although Dr. Deacon has criticized the Stipulation based on his belief that final or controversial decisions would be made by management personnel rather than scientists, Mr. Marshall testified that decision-makers act on the basis of the recommendations made by the scientifically trained staff that comprise the technical committees, such as the biologists who develop and implement the BMP.[1138] Protestants' witness, former Great Basin National Park superintendent Rebecca Mills, acknowledged that federal agency management takes seriously and follows the recommendations of scientific personnel.[1139]

The State Engineer finds that enforcement of the Stipulation is a matter between the parties to it, and that he is not relying on the Stipulation to make his environmental soundness determination. The State Engineer finds that any future disputes regarding the environmental soundness of the Applications will be addressed through the ongoing jurisdiction of the State Engineer over pumping pursuant to the Applications, and that this is adequate to ensure the environmental soundness of the Project.

G. <u>Environmental Effects Analysis</u>

The Applicant identified those environmental areas of interest in the DDC Valleys and adjacent basins that could be sensitive to groundwater withdrawal.[1140] The Applicant applied both a qualitative and a quantitative analysis to predict whether environmental areas of interest

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[1137] Transcript, Vol.11 p. 2499:16-22 (State Engineer King).
[1138] Transcript, Vol.12 pp. 2822: 25-2823:17 (Marshall).
[1139] Transcript, Vol.22 p. 4953:13-23 (Mills).
[1140] Transcript, Vol.12 p. 2738:8–2739:23, 2742:4–2743:3; 2743:17-2744:9 (Marshall) (Cave Valley); Vol.12 pp. 2747:15–2749:4 (Marshall) (White River Valley); Transcript, Vol.12 pp. 2749:11–2751:21 (Marshall) (Pahranagat Valley).

were susceptible to impacts from pumping pursuant to the Applications.[1141] Under the qualitative approach, hydrologists assessed local hydrology, specifically connectivity to the regional aquifer, to determine whether a site could be impacted by groundwater withdrawal.[1142] If a site lacked connectivity to the regional aquifer, no quantitative analysis was warranted because no impacts can occur when the site is not linked to the regional aquifer.[1143] If quantitative analysis was warranted, results from the Applicant's groundwater model were consulted, using criteria reflective of the limitations in using a regional model.[1144] This criteria was a 50-foot or greater drawdown in depth to groundwater or a 15 percent reduction in spring flow.[1145] This 50-foot, 15 percent criteria did not provide the definition of a reasonable or unreasonable impact, it does not set monitoring priorities or establish monitoring sites, and it does not form the basis for biological evaluations.[1146] The Applicant used the 50-foot, 15 percent criteria for an initial evaluation of the appropriateness of the monitoring network established by the BRT.[1147] Due to the inability of the groundwater model to make site specific predictions, the Applicant, the federal regulators and the State Engineer's office will rely on the broad monitoring network put in place by the BRT to determine the actual environmental effects and the mitigation required.[1148]

This measured approach to assessing impacts contrasts sharply with the impacts analysis provided by Protestants' expert, Dr. James Deacon.[1149] Dr. Deacon did not use a qualitative or

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[1141] Transcript, Vol.12 p. 2796:11-17 (Marshall).
[1142] Transcript, Vol.12 pp. 2796:21-2797:1 (Marshall).
[1143] Transcript, Vol.12 p. 2797:2-4 (Marshall).
[1144] Transcript, Vol.12 p. 2797:7-8 (Marshall).
[1145] Transcript, Vol.12 p. 2797:12-14 (Marshall).
[1146] Transcript, Vol.12 pp. 2797:25-2799:15 (Marshall).
[1147] Transcript, Vol.12 p. 2798:18-23 (Marshall).
[1148] Transcript, Vol.12 p. 2799:9-19 (Marshall).
[1149] *See* Exhibit No. GBWN_014.

quantitative approach. Instead he assumed all springs, even mountain block springs that are disconnected from the regional aquifer, would dry up and thus all species dependent on those springs would die.[1150] He did not do any other analysis on the effect of merely reducing flows or of drying up some springs as opposed to all springs. Dr. Deacon's analysis is generalized, and it relies on the results from Dr. Myers' modeling, which the State Engineer has already found carry little weight.[1151] However, even Dr. Myers did not assume that the Applicant pumping would dry up mountain block springs.[1152] Dr. Deacon stated that even if Dr. Myers was wrong he would not change his opinion, because Dr. Myers' modeling conclusions were consistent with the BLM DEIS model results.[1153] However Dr. Deacon conceded on cross examination that the BLM cautioned their model results "did not have the level of accuracy required to predict absolute values at specific points in time (especially decades or centuries into the future)."[1154] He also agreed that because of the regional nature of the groundwater model it is not possible to accurately predict site specific changes in flow for springs and streams.[1155] As a result, Dr. Deacon concluded on cross examination that groundwater models only permit a generalized understanding and therefore require testing through a monitoring plan.[1156] The State Engineer finds Dr. Deacon's opinion concerning the affect on aquatic species due to Project pumping effects is not credible because no evidence in the record supports his underlying assumptions that all springs would go dry and he did no further analysis to quantify the impacts of pumping on any particular species at any specific location.

[1150] *See* Exhibit No. GBWN_014, pp. 2-3; Exhibit No. GBWN_138, pp. 5-8; Exhibit No. GBWN_248, pp. 4, 6-7; Transcript, Vol.12 p. 2821:14-21 (Marshall).
[1151] Transcript, Vol.19 p. 4162: 2-5 (Deacon).
[1152] Transcript, Vol.20 p. 4468:22-25 (Myers).
[1153] Transcript, Vol.19 p. 4162:10-13 and p. 4190:2-12 (Deacon).
[1154] Transcript, Vol.19 p. 4184:12-22 (Deacon).
[1155] Transcript, Vol.19 p. 4185:11-18 (Deacon).
[1156] Transcript, Vol.19 p. 4186:1-8 (Deacon).

In addition, Dr. Deacon relied on Bredehoeft's erroneous application of the "time to capture" theory.[1157] He acknowledged the models upon which he relied so extensively for site-specific analysis provide predictions that, applied even more generally, are "uncertain at best."[1158] His report does not take into consideration the realities of federal and state environmental compliance and the authority that the State Engineer holds.[1159] Accordingly, his analysis lacks scientific rigor.[1160] Dr. Deacon also demonstrated he did not understand that the 50-foot, 15 percent criteria formed the basis for an effects analysis, rather than the definition of an unreasonable impact.[1161] The State Engineer finds Dr. Deacon's testimony lacks credibility, and it is given minimal weight.

The Applicant's effects analysis predicted no impacts to Delamar Valley environmental areas of interest.[1162] However, even though no sites met or exceeded the 50 foot, 15 percent criteria, monitoring is in place to provide early warning of any unanticipated effects, and the BMP applies to ensure there would be adequate monitoring, management, and mitigation.[1163] Similarly, the effects analysis predicted no impacts to the Pahranagat Valley environmental areas of interest.[1164] However, although no sites met or exceeded the 50 foot, 15 percent criteria, monitoring is in place to provide early warning of any unanticipated effects,[1165] and the BMP applies to ensure there would be adequate monitoring, management, and mitigation.

[1157] Transcript, Vol.19 p. 4189:6-15 (Deacon).
[1158] Transcript, Vol.19 pp. 4185:17-4186:4 (Deacon).
[1159] Exhibit No. GBWN_014, p. 4.
[1160] Transcript, Vol.12 p. 2820:18-24 (Marshall).
[1161] Transcript, Vol.19 pp. 4179:11-4181:2 (Deacon).
[1162] Transcript, Vol.12 p. 2805:15-18 (Marshall).
[1163] Transcript, Vol.12 p. 2805:19-23 (Marshall).
[1164] Transcript, Vol.12 pp. 2810:21-2811:4 (Marshall).
[1165] Transcript, Vol.12 p. 2811:5-7 (Marshall).

Protestants left unrebutted the Applicant's testimony that depth to water in Delamar Valley is so great that vegetation resources in those valleys are not connected to the groundwater. Therefore, the State Engineer finds that development of groundwater will not impact vegetation resources in Delamar Valley.[1166]

In addition to the Applicant's environmental effects analysis, the State Engineer considered the effects analysis prepared by the BLM as part of its DEIS.[1167] This analysis by its nature more broadly describes all possible impacts and includes pumping alternatives that are not being considered by the State Engineer during this hearing.[1168] The DEIS analysis did not consider the State Engineer's ability to curtail injurious well depletions or impose protective terms and conditions.[1169] While the DEIS included many useful analyses, because it was prepared for a different function than the State Engineer's environmental soundness determination, the State Engineer places minimal weight on the DEIS effects analysis.

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the Applicant has adequately described the potential environmental effects of the Project in a manner that allows the State Engineer to make an informed environmental soundness determination.

H. <u>Ability to Mitigate Potential Effects</u>

In both the DDC Valleys and adjacent basins, the Applicant indicated it will implement effective monitoring, management and mitigation programs that will protect environmental areas of interest. Dr. Patten, Dr. Harrington and Mr. Landers all acknowledged the effectiveness of

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[1166] Transcript, Vol.7 p. 1612:6-10 (McLendon).
[1167] *See generally* Exhibit No. GBWN_110.
[1168] Exhibit No. GBWN_110, p. 1 (Letter from Penny Woods, Project Manager, BLM, to Reader, dated June 10, 2011).
[1169] Transcript, Vol.12 pp. 2814:24-2815:3 (Marshall).

monitoring, management and mitigation programs.[1170] The Applicant's approach is first avoidance, then minimization, then mitigation of impacts, avoiding as many conflicts as possible as the Project is developed.[1171]

Voluntary commitments by the Applicant pursuant to its participation with Fish Recovery Implementation Teams and as a signatory to Candidate Conservation Agreements with Assurances provide an additional layer of environmental protections to such species as the Greater Sage-Grouse and the native fishes of the White River and Pahranagat valleys.[1172]

The Applicant has acquired extensive properties that include land, surface water and groundwater rights, and grazing allotments ("Northern Resources"), which give numerous options for implementing management and mitigation actions that will protect the environment.[1173] The Northern Resources provide a platform for using integrated resource management techniques. Integrated resource management techniques coordinate the management of water, land, vital ecosystems, special status species, and other related natural resources to ensure their long-term sustainability."[1174] The Applicant purchased private landholdings totaling approximately 23,500 acres in Spring, Dry Lake, and Steptoe Valleys.[1175] Four of the ranch properties are base properties to federal grazing allotments that are managed by BLM or U.S. Forest Service.[1176] The grazing allotments span eight hydrographic areas (Tippett, Spring, Steptoe, Hamlin, Lake, Dry Lake, Patterson, and Pahroc Valleys) and total

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[1170] Exhibit No. GBWN_059, p.12; Transcripts, Vol.18 pp. 4027:10-4028:1 (Patten); Transcript, Vol.23 pp. 5308:23-5309:13 (Harrington); Transcripts, Vol.28 p. 6297:19-22 (Landers).
[1171] Transcript, Vol.12 pp. 2799:23-2800:1 (Marshall).
[1172] Exhibit No. SNWA_363, p. 6-1, Table 6-1: Conservation Initiatives in which SNWA Voluntarily Participates; Transcript Vol.12 pp. 2784:12-2785:14 (Marshall).
[1173] Transcript, Vol.12 pp. 2790:23–2791:3 (Marshall); Exhibit No. SNWA_363, p. 6-5.
[1174] Exhibit No. SNWA_363, p. 6-5; Transcript, Vol.12 pp. 2789:22 – 2790:11 (Marshall).
[1175] Exhibit No. SNWA_363, p. 6-6.
[1176] Exhibit No. SNWA_363, p. 6-6.

approximately 900,000 acres, or 1,400 square miles.[1177] While these lands are not in Delamar Valley, the management of those lands will assist in the mitigation of potential impacts from the Project as a whole. Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that no unreasonable adverse impacts are anticipated at Dry Lake Valley. The State Engineer finds that in the event unexpected impacts occur, the Applicant has the ability to identify impacts of the Project through its environmental monitoring plan. If the Applicant is unable to avoid or minimize the impacts, it has the resources in place to mitigate any unreasonable impact.

The Applicant has demonstrated its commitment to environmental protection and informed, scientifically sound decision-making.[1178] The State Engineer finds that by requiring the collection of biological baseline data in concert with hydrologic data and a significant monitoring, management and mitigation plan through the incorporation of the BMP as conditions to development of the Applications, there are sufficient safeguards in place to ensure that the interbasin transfer of water from Delamar Valley will be environmentally sound. The State Engineer finds that any impacts to hydrologically related resources in the DDC Valleys and adjacent basins will be reasonable, and the basins will remain environmentally viable. Therefore, based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that pumping pursuant to the Applications is environmentally sound.

XI. FUTURE GROWTH AND DEVELOPMENT IN THE BASIN OF ORIGIN

Pursuant to NRS 533.370(6)(d) (2010), in determining whether to approve or reject an application for an interbasin transfer of groundwater, the State Engineer must consider whether

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[1177] Exhibit No. SNWA_363, p. 6-6.
[1178] Transcript, Vol.12 p. 2724:9-20 (Marshall).

the proposed action is an appropriate long-term use of the water, which will not unduly limit the future growth and development in the basin from which the water is exported. In considering the criterion of NRS 533.370(6)(d) (2010), the State Engineer has reviewed the evidence presented by the Applicant and the Protestants to determine whether the evidence supports the conclusion that there will be any future growth or development in Delamar Valley which would be unduly limited by approving the Applications.

The Protestant position, generally, is that some or all of the Applications should be denied; arguing that the granting of the Applications will limit growth, adversely affect growth and development which has already occurred, and that the threat of these Applications have affected growth during their pendency. The Applicant argues that future development in Delamar Valley that requires significant new water resources is highly unlikely to occur in the foreseeable future and, therefore, the use of water as described in the Applications is an appropriate long-term use that will not unduly limit future growth and development in Delamar Valley.

In reviewing what constitutes future growth and development, the State Engineer has elected to adopt a broad, conservative interpretation; however, the State Engineer has determined that a definition encompassing every type of potential growth and development that might possibly occur at some point in the future is too broad and speculative. The State Engineer need not accept anything anyone can think up as a possibility and leave water in a basin for that purpose in hopes that the proposed or hoped for use someday occurs. Such a policy would be wasteful and contrary to Nevada law as water which could have been put to beneficial use would

likely never be used.[1179] The State Engineer considers evidence of growth that is reasonably foreseeable to occur given current and historic conditions and trends. This includes projects that are planned or being developed and are currently or likely in the future to be economically, financially and technically feasible.

Additionally, the State Engineer notes that the Nevada Legislature has not mandated that any water be reserved for the basin of origin.[1180] Rather, pursuant to statute the State Engineer is required to consider "[w]hether 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."[1181] In determining the likelihood of future growth and development in Delamar Valley, the State Engineer has considered the evidence submitted relevant to residential, commercial, industrial, agricultural and other categories of growth and development. The State Engineer has then, based upon that evidence, determined what, if any, future water needs may be reasonably foreseeable to occur given current and historic conditions and trends.

The Applicant undertook a complete and comprehensive evaluation of the future rural economic development that would require significant water resources in Delamar Valley, also referred to as the basin of origin.[1182] Specifically, the Applicant submitted evidence related to future agricultural use. This evidence primarily took the form of an investigation by experts retained by the Applicant, their summary report, and their supporting testimony.[1183] The Applicant submitted evidence regarding commercial, industrial, and alternative energy

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[1179] NRS 533.025 *et seq.* (2010).
[1180] NRS 570.370(6)(d) (2010).
[1181] NRS 570.370(6)(d) (2010).
[1182] Exhibit No. SNWA_241.
[1183] Exhibit No. SNWA_103, 104, 105 and 241; Transcript, Vol.13 pp. 2947-3053 (Carter and Peseau). *See also*, Transcript, Vol.15 pp. 3357-3361 (Holmes).

development within Delamar Valley.[1184] The Applicant offered evidence related to possible residential development within Delamar Valley.[1185] The Applicant also submitted evidence related to possible economic development and growth issues related to mining, manufacturing, tourism, hunting and general population growth.[1186] The Applicant also presented evidence and foundational testimony from Mr. Dylan Frehner regarding Lincoln County and the Lincoln County Water District's intentions in Delamar Valley.[1187] In other words, the evidence submitted by the Applicant provided the State Engineer with a comprehensive evaluation of economic development and growth issues for Delamar Valley and included an analysis of all current and proposed categories of development known to be relevant to the basin.

A. <u>Future Economic Activity in Delamar Valley</u>

The Applicant undertook a comprehensive review of the historic and existing economic activity in Delamar Valley. The Applicant submitted its findings and Mr. Richard Holmes[1188] testified regarding the examination he and his staff had undertaken. Mr. Holmes testified that it is very unlikely that residential, commercial and industrial development will occur within the Delamar Valley basin in the foreseeable future that would require additional water resources to be reserved for the basin.

[1184] Exhibit No. SNWA_241. *See also*, Exhibit Nos. SNWA_113 through SNWA_142; Transcript, Vol.14 pp. 3273-3331, Vol.15 pp. 3321-3390 (Holmes); Transcript, Vol.13 pp. 3053-3083, Vol.14 pp. 3084-3144 (Candelaria and Linvill).
[1185] Exhibit No. SNWA_241; Transcript, Vol.14 pp. 3273-3331, Vol.15 pp. 3321-3390 (Holmes).
[1186] Exhibit No. SNWA_241; Transcript, Vol.14 pp. 3273-3331, Vol.15 pp. 3321 3390 (Holmes).
[1187] Exhibit No. SNWA_347 and 346; Transcript, Vol.14 pp. 3146, 3153-3156 (Frehner).
[1188] Mr. Holmes holds bachelor degrees in civil engineering and industrial economics as well as a master's degree in urban planning. Mr. Holmes additionally has approximately 40 years of experience working as a city and rural planner—20 years of which was spent as a planner in Clark County, Nevada, which has ranked as one of the fastest growing counties in the history of the United States. Exhibit No. SNWA_186. He was qualified by the State Engineer as an expert in land use planning. *See* Transcript Vol.14 pp. 3279:4-5 (Holmes).

In determining the likelihood of future economic growth and development in Delamar Valley, Mr. Holmes reviewed federal, state and local publications and data resources and applied that information to general growth factors that he determined were particularly relevant in assessing the economic growth and development trends in Delamar Valley.[1189] Mr. Holmes testified that the most fundamental factors which would lead to economic growth within Delamar Valley include close proximity to large, established metropolitan centers and markets, sufficient population size, an educated labor force, a diversity of employment opportunities, location along the major transportation corridor, and substantial infrastructure, including electricity, roads, access to modern communications and the availability of basic public utilities and services.[1190]

In applying those factors to Delamar Valley, Mr. Holmes testified that the presently non-existent population in Delamar Valley is unlikely to show an upward trend.[1191] To support this conclusion, Mr. Holmes testified that the State of Nevada was the fastest growing state in the country for each of the last five decades, yet the population in Delamar Valley remained virtually unchanged with an estimated population of approximately 0 to 3 persons during this period of extreme growth within the state.[1192] The Applicant provided evidence that the Tenacity Perlite Mine on the southwestern edge of Delamar Valley is estimated to be the sole employer within Delamar Valley with an estimated work force of seven persons.[1193] The Protestant witness Dr. Kilkenny not only conceded that the population statistics utilized by Mr. Holmes were correct, but she deferred to his numbers when presenting rebuttal testimony.[1194] Thus, based on the

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[1189] Exhibit No. SNWA_241, pp. 1-1 to 1-2; Transcript, Vol.14 pp. 3285-3299 (Holmes).
[1190] Exhibit No. SNWA_241, p. 2-1; Transcript, Vol.14 pp. 3285-3299 (Holmes).
[1191] Exhibit No. SNWA_241, pp. 2-6 to 2-11; Transcript, Vol.14 pp. 3305-3308 and Vol.15 pp. 3321-3332 (Holmes).
[1192] Exhibit No. SNWA_241, pp. 2-6 to 2-11; Transcript, Vol.14 pp. 3305-3308 and Vol.15 pp. 3321-3332 (Holmes).
[1193] Transcript, Vol.15 pp. 3336 (Holmes); Exhibit No. SNWA_241, p.2-14.
[1194] Transcript, Vol.22 p. 5028 (Kilkenny).

extremely low population of Delamar Valley, Mr. Holmes concluded that there is little to no labor force for future business expansion within Delamar Valley.[1195]

Additionally, Mr. Holmes testified that Delamar Valley is extremely isolated and is located well over 100 miles from the nearest metropolitan city.[1196] The extreme isolation of Delamar Valley is further exacerbated by the lack of infrastructure within the valley, the lack of access to utilities such as sewer, electricity and natural gas, as well the absence of basic services such as medical services and police and fire protection.[1197] Mr. Holmes further testified that given the high expenses associated with developing the infrastructure and services needed to support economic growth within Delamar Valley, it is unlikely that there will be any public or private investment to develop such infrastructure as Delamar Valley will not generate significant return on the investment.[1198] The Applicant additionally provided evidence that over 99 percent of Delamar Valley is owned by the federal government.[1199] The remaining one percent of land within Delamar Valley includes one abandoned mining parcel and the Tenacity Perlite Pine that employs seven people.[1200] As such, the Applicant concluded that there is little opportunity to privately develop land for future business or residential use.[1201]

Furthermore, Mr. Holmes concluded that there is limited potential for the establishment of new types of land uses or expansion of existing land uses in Delamar Valley in the foreseeable future. For example, Mr. Holmes testified that water consumption for tourism and recreation

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[1195] Transcript, Vol.15 pp. 3332:8-12, 333:1-7 (Holmes).
[1196] Exhibit No. SNWA_241, p. 2-4
[1197] Transcript, Vol.14 pp. 3294-3305, Vol.15 pp. 3345-3350 (Holmes).
[1198] Transcript, Vol.15 pp. 3347-3349 (Holmes).
[1199] Exhibit No. SNWA_241 p. 3-3.
[1200] Transcript, Vol.15 pp. 3336 (Holmes); Exhibit No. SNWA_241 p.3-3, 3-8, 3-9.
[1201] Exhibit No. SNWA_241 p. 3-3.

within the basin will be minimal as the basin has stagnant hunting and fishing numbers.[1202] Additionally, there is a lack of new development or expansion of mining operations despite the current high demand for metals.[1203] As such, based on all these factors, Mr. Holmes concluded that it is highly unlikely that Delamar Valley will sustain any economic growth requiring significant water resources in the foreseeable future.[1204]

The Protestants provided evidence and testimony from Dr. Kilkenny to rebut Mr. Holmes' evaluation of the likelihood of future growth and development within Delamar Valley. Dr. Kilkenny argued that the Applicant failed to consider the Central Place Theory Model and Rank-Size rule to predict future urban areas in Nevada.[1205] Dr. Kilkenny further argued in her rebuttal report that Mr. Holmes conceded in his expert report that the approval of the Applications will impact water resources in surrounding areas such as Ely, Baker and Caliente.[1206] Dr. Kilkenny additionally contends that the appropriate geographic scope for the analysis of the economic and social impact of the proposed water withdrawals and transfers is, at a minimum, the rural counties of White Pine and Lincoln.[1207] Finally, Dr. Kilkenny testified that the threat of these Applications has affected growth during their pendency.[1208]

The Applicant provided testimony and evidence to rebut Dr. Kilkenny's arguments and demonstrated that Dr. Kilkenny's testimony and expert report was based on fundamental errors.[1209] It is evident from Mr. Holmes' report and testimony that the Applicant does not concede that the approval of the Applications will impact water resources in areas such as Ely,

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[1202] Exhibit No. SNWA_241, pp. 3-10 to 3-11; Transcript, Vol. 15 pp. 3379-3381 (Holmes).
[1203] Exhibit No. SNWA_241, pp. 3-8 to 3-11; Transcript, Vol.15 pp. 3373-3374 (Holmes).
[1204] Exhibit No. SNWA_241, pp. 5-1 to 5-2; Transcript, Vol.14 pp. 3380-3381 (Holmes).
[1205] Exhibit No. GBWN_114, pp. 12 to 13.
[1206] Exhibit No. GBWN_114, p. 4
[1207] Exhibit No. GBWN_114, pp. 4 to 6.
[1208] Transcript, Vol.22 pp. 4988-4989, 5022-5023 (Kilkenny).
[1209] Transcript, Vol.15 pp. 3349-3355 (Holmes); Vol.13 pp. 3009-3013 (Peseau and Carter).

Baker and Caliente; rather, Mr. Holmes was referring to the impacts of increased tourism and recreation, not to the impacts of groundwater pumping.[1210] Additionally, Dr. Kilkenny testified that her arguments were misunderstood and that she did not intend to argue that hydrologic impacts would occur in the areas surrounding Delamar Valley.[1211] Furthermore, while NRS 533.370(6)(d) (2010) does not require the State Engineer to look beyond the basins in examining future growth and development, the Applicant utilized county-wide data in assessing future growth and development when appropriate, and considered economic development within the county containing Delamar Valley.[1212] In contrast, Dr. Kilkenny admitted to speculation, utilized unduly strong and unsupported statements in her report, failed to correctly extrapolate figures from the source material she was updating, and admitted to numerous errors in her report.[1213] Critically, Dr. Kilkenny rests her conclusions upon a fundamental misunderstanding or disregard of Nevada water law and the prior appropriation doctrine. This is clear from her report and testimony, as she assumed the loss of all water in both White Pine and Lincoln counties as a result of pumping under the Applications.[1214] Additionally, Dr. Kilkenny's testimony regarding the lack of growth within the basins due to the mere threat of the Applications is highly speculative.[1215] Moreover, it is beyond the purview of the State Engineer. The State Engineer must make rulings based upon fact and science. The State Engineer cannot control or police the beliefs of the public and, contrary to the assertion of Dr. Kilkenny, the State Engineer cannot make decisions based upon those beliefs rather than the evidence submitted.[1216] As such, the

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[1210] Transcript, Vol.15 pp. 3352-3354 (Holmes).
[1211] Transcript, Vol.23 pp. 5234-5236 (Kilkenny).
[1212] Exhibit No. SNWA 241, p. 1-1; Transcript, Vol.14 pp 3285-3291 and Vol.15 pp. 3435- 3438 (Holmes).
[1213] Transcript, Vol.22 pp. 5039, 4999-5002, 5039-5040, 5043-5058 (Kilkenny).
[1214] Exhibit No. GBWN_066, p. 1; Transcript Vol.22 pp. 5008-5009, 5023-5024 (Kilkenny).
[1215] Transcript, Vol.22 pp. 4988-4989 (Kilkenny).
[1216] Transcript, Vol.22 pp. 4988-4989 (Kilkenny).

State Engineer finds that Dr. Kilkenny did not provide any opinion regarding the likelihood of future growth and development within Delamar Valley, nor did she provide evidence of specific future growth and development which was planned, being considered, or which might even occur.

In addition, the Applicant has presented testimony and evidence as to Lincoln County's Master Plan to show that Lincoln County does not have any plans for development within Delamar Valley which would require any water resources.[1217] Instead, development in Lincoln County is targeted towards the Toquop Area near Mesquite as well as Coyote Springs.[1218] This evidence and testimony is consistent with the testimony from Lincoln County Water District General Counsel Dylan Frehner, who testified that Lincoln County has no current plans to utilize water from the Applications in Delamar Valley.[1219] Resolutions passed by Lincoln County and the Lincoln County Water District state that the Lincoln County Water Plan does not anticipate any proposed development or use of water within Delamar Valley.[1220] The Resolutions further state that the Lincoln County Master Plan does not anticipate any proposed development or municipal use of water within Delamar Valley.[1221] The Protestants have not presented any contradicting evidence or testimony to refute the lack of any current development plans in Delamar Valley.

B. <u>Renewable Energy Development in Delamar Valley</u>

The Applicant offered the expert testimony of Dr. Carl Linvill and Mr. John Candelaria to address the possible future water needs of Delamar Valley related to future alternative energy

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[1217] Transcript, Vol.15 pp. 3331-3332 (Holmes).
[1218] Transcript, Vol.15 pp. 3331-3332 (Holmes).
[1219] Exhibit No. SNWA_353; Transcript, Vol.14 pp. 3151-3153 (Frehner).
[1220] Exhibit No. SNWA 346; Exhibit No. SNWA_347.
[1221] Exhibit No. SNWA 346; Exhibit No. SNWA_347.

development.[1222] The State Engineer finds that the approach utilized by Dr. Linvill and Mr. Candelaria for determining the likelihood of renewable energy development within Delamar Valley in the foreseeable future is fundamentally sound. In reaching their conclusions, Dr. Linvill and Mr. Candelaria reviewed and relied upon numerous sources, which have been submitted as exhibits.[1223] These included, for example, the information published by the Western Electric Coordinating Council, also known as WECC. This source shows demand for renewable energy in each of the western states and how much remaining unmet demand there is in those states.[1224] They also relied upon information from the National Renewable Energy Lab, which evaluates the effectiveness of renewable energy technologies and evaluates policies relative to renewable energy resources and the effect of those policies on renewable energy development in the western United States.[1225] They referenced the Renewable Energy Transmission Initiative in California which brings together persons from varying interests to evaluate renewable energy and transmission in California.[1226] They also considered the Western Renewable Energy Zone, Resource Plans filed by NV Energy, Sierra Pacific Power Company, Nevada State Office of Energy, and Regional plans by Lincoln County and White Pine County utility companies, and Western States' legislative policies with emphasis on Nevada and California for regional portfolio standards for renewable energy.[1227]

The evidence submitted by the Applicant demonstrates to a reasonable certainty that the quality of renewable energy resources available in Delamar Valley are not as competitive as

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[1222] Exhibit No. SNWA_113; Transcript, Vols.13 and 14 pp. 3053-3144 (Candelaria and Linvill).
[1223] Exhibit Nos. SNWA_114 through 142.
[1224] Transcript, Vol.13 pp. 3075:10-3076:20 (Candelaria and Linvill).
[1225] Transcript, Vol.13 pp. 3076:21-3077:10 (Candelaria and Linvill).
[1226] Transcript, Vol.13 pp. 3077:11-3079:22 (Candelaria and Linvill).
[1227] Transcript, Vol.13 pp. 3079–3082 (Candelaria and Linvill).

those available in other areas within Nevada and the western region and, therefore, development of these resources in a fashion that would require significant water resource is very improbable. Furthermore, Mr. Candelaria testified and submitted cost figures to demonstrate that utility companies prefer to use geothermal energy as it produces a constant output much like conventional resources, whereas solar and wind power are more intermittent.[1228] Mr. Candelaria testified that solar energy, the resource type within Delamar Valley, is currently the most costly renewable energy to develop.[1229] Based on the high cost to develop solar energy and the general preference in developing geothermal over solar and wind energy, the experts' report at Figure 1-3 demonstrates that Nevada produces over 10,000 GWh of highly competitive geothermal energy, and these resources make up the bulk of Nevada's renewable energy portfolio standard.[1230]

Dr. Linvill's testimony and Figures 1-6 and 1-7 in his report demonstrate that the highest quality solar resources within any of the four basins that were the subject of the hearing are located in Delamar Valley.[1231] However, Dr. Linvill and Mr. Candelaria explained that even though there are high quality solar resources in Delamar Valley, those resources are not competitive with other resources that are located closer to markets.[1232] Dr. Linvill and Mr. Candelaria testified that the solar resources in Delamar Valley will not likely be developed.[1233] Dr. Linvill's testimony and Figure 1-1 of his report explain that solar energy primarily utilizes two different technologies, concentrated solar technologies (trough system) and photovoltaic

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[1228] Transcript, Vol.14 pp. 3098:17-3101:13 (Candelaria and Linvill).
[1229] Transcript, Vol.14 p. 3099:7-9 (Candelaria and Linvill).
[1230] Exhibit No. SNWA_113, Figures 1-3 and 4-2.
[1231] Exhibit No. SNWA_113, p. 1-5; Transcript, Vol.14 p. 3103:12-19 (Candelaria and Linvill).
[1232] Transcript, Vol.14 pp. 3102:21-3119:1 (Candelaria and Linvill).
[1233] Exhibit No. SNWA_113, pp.1-5 to 1-8; Transcript, Vol.14 pp. 3102:21-3119:1, 3131:21-3133:16, 3133:19-3141:16 (Candelaria and Linvill).

("PV").[1234] PV bypasses the turbine process and requires little to no water.[1235] The Applicant presented evidence and testimony that the only water required for PV-based solar energy is approximately 1.9 gal/MWh of water use for mirror/panel washing.[1236] Furthermore, the evidence demonstrates that PV costs are rapidly declining, making the technology more competitive than concentrated solar.[1237]

Based upon this evidence, the State Engineer concludes that the quality of the solar resource in Delamar Valley is such that it is not competitive and will not likely be developed. Furthermore, the Applicant has presented sufficient evidence that even if eastern Nevada solar energy were to become competitive in the energy market, such development would be PV-based, occur in the very distant future, and require very little water to no water given emerging cleaning technologies.[1238] Thus, the State Engineer finds that no reservation of water will be necessary, even in the distant future, to support the development of solar power resources in Delamar Valley.

The State Engineer notes that there was no evidence presented by any Protestant demonstrating current or even future alternative energy development plans in Delamar Valley which would require additional water resources. Based upon the evidence received, the State Engineer finds that it is improbable that future development will occur that would require additional water resources and that no water should be reserved for future renewable energy development within Delamar Valley.

C. Agricultural Development in Delamar Valley

[1234] Exhibit No. SNWA_113, p. 1-10; Transcript, Vol.14 pp. 3090:20-3092:9 (Candelaria and Linvill).
[1235] Exhibit No. SNWA_113, Transcript, Vol.14 pp. 3090-3094 (Candelaria and Linvill).
[1236] Exhibit No. SNWA_113, p.1-10; Transcript Vol.14 pp. 3090:17-3094:22 (Candelaria and Linvill).
[1237] Exhibit No. SNWA_113, pp. 1-9; Transcript, Vol.14 pp. 3094-3099 (Candelaria and Linvill).
[1238] Exhibit No. SNWA_113, p. 7-1 to 7-5; Transcript, Vol.14 pp. 3138-3141 (Candelaria and Linvill).

The Applicant submitted the testimony of two economic experts who examined the likelihood from an economic perspective of future agricultural development which would require additional water resources.[1239] The State Engineer finds that the Applicant's approach for determining the likelihood of agricultural development within Delamar Valley in the foreseeable future is fundamentally sound. Dr. Dennis Peseau and George Carter explained that they researched and reviewed data and literature which they believed would be particularly relevant to predict agriculture operations in this area of Nevada and memorialized their research in their report.[1240] The information reviewed and relied upon included U.S. Department of Agriculture ("USDA") historical data and trends, and University of Nevada, Reno and University of California, Davis extension studies prepared to assist farmers in determining typical expenses for starting and maintaining an operation.[1241] Additionally, Dr. Peseau and Mr. Carter visited Delamar Valley and reviewed satellite maps to determine terrain and existing infrastructure and current operations within Delamar Valley.[1242]

The Applicant submitted uncontroverted evidence that there is no reasonable expectation that Delamar Valley will experience expansion of its agricultural economy in the future.[1243] This undisputed opinion was primarily based upon their observation that the parcels of private land in Delamar Valley are located on the west slope of the Delamar Mountains and appear to have no potential to raise commercial crops.[1244]

[1239] Transcript, Vol.13 pp. 2947-3053 (Carter and Peseau).
[1240] Exhibit No. SNWA_103, pp.26-28; Transcript, Vol.13 pp. 2959-2961, 2965-2967 (Carter and Peseau).
[1241] Exhibit No. SNWA_103, pp.26-28; Transcript, Vol.13 pp. 2959:14-2960:15 (Carter and Peseau).
[1242] Transcript, Vol.13 pp. 2966:4-2968:1 (Carter and Peseau).
[1243] Exhibit No. SNWA_103; Transcript, Vol.13 pp. 3018-3021:1, 3050:24-3052:24 (Carter and Peseau).
[1244] Exhibit No. SNWA_103, p. 23; Transcript Vol.13 p. 3018-3019 (Carter and Peseau).

The Applicant has utilized the most relevant factors to determine that it is highly unlikely that there will be future agricultural growth and development in Delamar Valley. In addition to the factors discussed above, the conclusion advanced by the Applicant is based upon and supported by the premise that new investment in agricultural projects within Delamar Valley will not result in positive economic returns and therefore it is unlikely that new money will be invested in such a venture. Dr. Peseau and Mr. Carter base this opinion in large measure upon studies published by the University of Nevada, Reno.[1245] These documents were each based upon practices and materials considered typical of a well-managed farm and ranch in the region, as determined by a producer panel.[1246] Dr. Peseau and Mr. Carter explained that utilizing the establishment and maintenance costs of these studies compared to the USDA alfalfa market prices demonstrates unfavorable economic circumstances for establishing new alfalfa stands in White Pine County.[1247] Based upon the evidence submitted such an operation would face even greater challenges in Delamar Valley.[1248]

Dr. Peseau also provided testimony regarding his review of external factors that might be relevant to agricultural growth in Delamar Valley.[1249] He testified that the USDA prediction of contraction of the dairy market will likely negatively impact alfalfa demand and is not likely to drive growth in this basin.[1250] The State Engineer also received testimony that limitations on grazing allotments will negatively impact the demand for alfalfa as a supplemental winter

[1245] Exhibit No. SNWA_104; Exhibit No. SNWA_105; Transcript, Vol.13 pp. 2964-2965 (Carter and Peseau).
[1246] Exhibit No. SNWA_104; Exhibit No. SNWA_105.
[1247] Exhibit No. SNWA_103; Transcript, Vol.13 pp. 2987-2999 (Carter and Peseau).
[1248] Exhibit No. SNWA_103, p. 23; Transcript Vol.13 pp. 3018-3020 (Carter and Peseau).
[1249] Transcript, Vol.13 pp. 2983:10-2985:19 (Carter and Peseau).
[1250] Exhibit No. SNWA_103, pp.12-13; Transcript, Vol.13 pp. 299:8-3002:1 (Carter and Peseau).

feed.[1251] This opinion was consistent with the Protestant testimony that grazing allotments have been reduced in recent years.[1252]

No Protestant submitted any credible evidence indicating the likelihood of expansion of agriculture within Delamar Valley which would require additional water resources. Mr. Jim Garza did testify on behalf of White Pine County regarding his calculations of the amount of water available in Spring Valley and the amount of alfalfa that in his view could be grown using that water. However, neither he nor any other witness discussed development in Delamar Valley. The State Engineer notes that Mr. Garza, although a county official, was not designated as an expert, did not produce or provide an expert report, and was not qualified as an expert in any discipline by the State Engineer. The information upon which he based his calculations was not marked or submitted into the record, as it was not exchanged pursuant to the State Engineer's Pre-hearing Order. It is also of relevance to the State Engineer that Mr. Garza, although the Director of Community and Economic Development for White Pine County, admitted he was unfamiliar with any White Pine County planning document. The testimony of Mr. Garza has been given little weight by the State Engineer. Based upon the evidence submitted, the State Engineer concludes that no reservation of water is necessary for future agricultural development purposes in Delamar Valley.

Protestant witnesses testified that they believed the Proposed Action will harm and/or "dry up" the existing vegetation on their ranching operations.[1253] However, none of these Protestant witnesses provided testimony or evidence regarding future expansion of their existing operations or future economic or agriculture development plans which would require significant

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[1251] Transcript, Vol.13 pp. 2984:11-2985:11 (Carter and Peseau).
[1252] Transcript, Vol.24 p. 5507:12-15 (Gloeckner).
[1253] Transcript Vol. 24, pp. 5503:11-5516:7 (Gloeckner).

additional water resources.[1254] Accordingly, the State Engineer finds that the Protestant witnesses have not presented evidence that pumping pursuant to the Applications will unduly limit growth and development on their ranching operations or within the basin and that the Applicant has presented substantial evidence to show that the proposed action will not unduly limit growth and development with the basin. Based on the evidence submitted, the State Engineer finds that it is unlikely that significant amounts of additional water will be necessary for future growth of agriculture.

As with crop-based agriculture, the uncontroverted evidence demonstrates that the cow/calf market in Delamar Valley is unlikely to grow in the foreseeable future. Mr. Carter provided testimony and USDA trends for cow/calf grazing.[1255] These trends are downward and do not support likely growth. The Applicant again relies in part on information published by University of Nevada, Reno for establishment and maintenance costs of a cattle operation in White Pine County.[1256] Dr. Peseau and Mr. Carter then contrasted this information with USDA cow/calf market prices and the resulting conclusion, like the alfalfa operation, demonstrates the generally unfavorable economic circumstances for establishing new cattle operations in Delamar Valley. Although on cross-examination counsel for GBWN asked Dr. Peseau about grazing allotments and Dr. Peseau's knowledge of proposals to expand grazing operations, Dr. Peseau indicated he had no information and at no point did GBWN or any Protestant, including the representative of the Nevada Cattlemen's Association, submit evidence of intent to expand cattle operations which would result in a need for additional water resources within the basin.[1257]

[1254] Transcript Vol. 24, pp. 5503:11-5516:7 (Gloeckner).
[1255] Transcript, Vol.13 pp. 3002:15- 3009:5 (Carter and Peseau).
[1256] Exhibit No. SNWA_104; Transcript, Vol.13 pp. 3004-3005 (Carter and Peseau).
[1257] Transcript, Vol.13 pp. 3037-3038 (Carter and Peseau).

Lastly, Dr. Peseau and Mr. Carter submitted their analysis of the economics of a new joint alfalfa and cow/calf operation.[1258] Similar to each type of operation singularly, this analysis demonstrates to a reasonable certainty that a joint alfalfa and cow/calf operation is still not economic, even though certain expenses and overhead can be shared, and therefore it is unlikely that there will be future development of such operations.[1259]

The evidence and conclusions of Dr. Peseau and Mr. Carter was uncontroverted by any opposing expert. Dr. Kilkenny testified on behalf of GBWN. Although she testified to her opinion that the pendency of these Applications has affected growth and development in the basins as an abstract concept, she did not quantify that growth nor could she indicate what had been the effect.[1260] On cross examination Dr. Peseau and Mr. Carter testified to the contrary that the pendency of these applications has not been a factor in depressing investment in agriculture in the basins of origin.[1261] Dr. Kilkenny criticized the method employed by Dr. Peseau and Mr. Carter, suggesting that they had only considered 10 to 12 years of a typical cattle cycle, but she did not offer a contrary opinion regarding the conclusions they reached.[1262] In fact, Dr. Kilkenny provided testimony consistent with the conclusion advanced by the Applicant suggesting that such operations are marginally profitable at best and often in the red.[1263] Similarly, she offered no contrary opinion or rebuttal report regarding the economics of new crop-based agriculture in the basins. The absence of any contrary opinion is notable given her considerable experience and education in Agricultural and Applied Economics.[1264] Rather, the evidence submitted both

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[1258] Exhibit No. SNWA 103, Transcript, Vol.13 pp. 3013:13-3016:24 (Carter and Peseau).
[1259] Exhibit No. SNWA 103, Transcript, Vol.13 pp. 3013:13-3016:24 (Carter and Peseau).
[1260] Transcript, Vol.22 pp. 4988-4989 (Kilkenny).
[1261] Transcript Vol.13 pp. 3047-3048 (Carter and Peseau).
[1262] Transcript, Vol.22 pp. 4991-4992 (Kilkenny)
[1263] Transcript, Vol.22 p. 4991:21-22 (Kilkenny).
[1264] Exhibit No. GBWN_067.

through the testimony of Dr. Kilkenny and all of the Protestants focused on the currently existing economic activity and not on future activity which might be negatively impacted by the granting of these Applications.[1265]

The State Engineer finds that the Applicant has presented substantial uncontroverted evidence supported by expert testimony that it is highly improbable that there will be any additional investment in new agricultural endeavors in Delamar Valley and that numerous factors including the unfavorable economics of such operations, and not the availability of water, is and will continue to be the factor limiting additional agricultural development in the basin.[1266] The State Engineer and concludes that based upon the evidence in the record, including but not limited to that cited above, it is unlikely there will be any new agricultural development in Delamar Valley and therefore the granting of these Applications will not unduly limit such development.

D. Change of Use for Existing Water Rights

In reaching the conclusion that granting the Applications will not unduly limit future growth and development, the State Engineer has considered not just the prospects and trends for future growth, but also the water rights already established within Delamar Valley that will remain within the basin for current and future uses. The Protestants focused upon the existing water rights and the effects should those rights be lost; however existing water rights are protected under the law and approving the Applications does not undermine any of those rights or their priority. The existing water rights in Delamar Valley will remain available not only for their current use, but also for different permanent and temporary uses through a change of use

[1265] Exhibit Nos. GBWN_066, GBWN_068, GBWN_114; Transcript, Vol.22 pp.4971-5080 (Kilkenny); Vol.28 pp. 6226-6260 (Cooper and Sanders)
[1266] Transcript, Vol.13 pp.3021-3022 (Carter and Peseau).

application. Many basins in Nevada have grown and developed in this fashion, with agricultural water rights being changed to a different purpose when a demand arises. As indicated elsewhere in this ruling, 8.95 afa of existing water rights are available within Delamar Valley and will remain in the basin even after these Applications are granted. Although it is not required by statute that any amount of water be reserved for the basin of origin, the existing water rights as well as the water described in the following section, will be available to support any unforeseen future use that was not known or contemplated at the time these Applications were considered.

E. Reserving Water for Future Uses

GBWN offered the testimony of Dr. Kilkenny regarding basin of origin issues. By her own admission, Dr. Kilkenny completed no original work.[1267] Rather, as she concedes, her effort was an attempt to update information which had been previously compiled by others.[1268] Notably, Dr. Kilkenny did not provide any opinion regarding the likelihood of future growth and development within Delamar Valley, nor did she provide any evidence of specific future growth and development which was planned, being considered, or which might even occur. Rather, she speculated that the pendency of these Applications has had an effect upon the growth and development of the basins.[1269] Dr. Kilkenny explained that she did not attempt to quantify the economic activity within Delamar Valley; instead, she presented county-wide information for White Pine and Lincoln counties.[1270] Dr. Kilkenny conceded that when she authored her report she did not understand the geographic extent of Delamar Valley.[1271] Dr. Kilkenny's testimony

[1267] Transcript, Vol.22 pp. 5020:18- 5021:7 (Kilkenny).
[1268] Transcript, Vol.22 pp. 5020:18- 5021:7 (Kilkenny).
[1269] Transcript, Vol.22 pp. 4988-4989, 5022-5023 (Kilkenny).
[1270] Transcript, Vol.22 pp. 5033-5035, 5038 (Kilkenny).
[1271] Transcript, Vol.22 pp. 5024-5026 (Kilkenny).

revealed numerous errors and misstatements in her report and her report and testimony has been given little weight by the State Engineer.

Little evidence of even speculative future growth was submitted by any Protestant. Instead, the Protestants focused upon the current and past uses of water in Delamar Valley, rather than arguing the need for water to support future growth. The Protestants' evidence of the need to protect established water rights in Delamar Valley is understood, appreciated and acknowledged by the State Engineer. However, the protection of those senior rights is provided for under Nevada law and the issue of impacts to existing rights is addressed fully in this ruling.

No Protestant identified a specific quantity of water that should be reserved for protection of future growth and development in Delamar Valley. Although NRS 533.370(6)(d) (2010) does not expressly authorize the State Engineer to reserve water in the basin of origin for future growth and development, the State Engineer has determined it is appropriate to reserve a quantity of water within Delamar Valley. This quantity of water is established to ensure that future growth and development which is not currently foreseeable or anticipated is not unduly limited as a consequence of the approval of the Applications. The amount of water hereby reserved should more than adequately support even unexpected growth and development within Delamar Valley. It is also noted by the State Engineer that should he receive applications for future mining and/or milling uses, which are by their nature temporary, the approval of the Applications will not affect the availability of water for such temporary mining and milling uses.

As the evidence submitted does not support any reasonable expectation for growth and development in Delamar Valley in the foreseeable future and, therefore, there are no foreseeable additional water needs in the basin, the State Engineer finds that the reservation of 50 afa is appropriate. Because no Protestant submitted evidence in support of a specific quantity of water

that should be reserved in Delamar Valley, the only evidence in the record was supplied by the Applicant. A reservation of 50 afa is consistent with the testimony of the Applicant witness Mr. Richard Holmes. Mr. Holmes presented at Table 4-1 of his expert report the non-agricultural water rights granted in Delamar Valley for the past 50 years, demonstrating that only 7 afa of water rights, all for stockwater, have been approved during that time frame.[1272] While Mr. Holmes concluded no water is required to be reserved, based on the historic use of water in the basin he also demonstrated that 50 afa would be more than enough water for any unforeseen future uses in Delamar Valley. [1273] Accordingly, the State Engineer has elected to reserve 50 afa of water for unforeseeable future growth in Delamar Valley. The State Engineer finds that based upon the evidence presented, the currently existing rights and the trend of the last 50 years, this reserve of water should more than adequately meet any unexpected demand. As accurately described in the evidence submitted, this amount of water in Delamar Valley is enough to support 80 new, individual residences. The State Engineer finds this is a sufficient amount of water to reserve as the evidence has demonstrated that currently no one resides in the basin.[1274] Alternatively, this amount of water could support 2 to 3 new commercial uses within the basin.[1275] The State Engineer find this is a sufficient amount of water to reserve as the evidence demonstrated that no such uses currently exist in Delamar Valley.[1276] This amount of water would also support an increase of 2,000 additional head of cattle or 11,000 sheep.[1277] It is recognized this particular future use is very unlikely unless there was a significant increase in the

[1272] Exhibit No. SNWA_241, pp. 4-1 to 4-2.
[1273] Exhibit No. SNWA_241, pp. 4-1 to 4-2.
[1274] Exhibit No. SNWA_241, pp. 2-11, 4-1 and 4-2.
[1275] Exhibit No. SNWA_241, pp. 4-1 and 4-2.
[1276] Exhibit No. SNWA_241, pp. 4-1 and 4-2.
[1277] Exhibit No. SNWA_241, pp. 4-1 and 4-2.

amount of forage that could be utilized for grazing. This reserved water is in addition to the water rights which already exist within Delamar Valley and could be repurposed to a different manner of use if future development required it.

The State Engineer finds that based on the quantity of existing water rights in the basin, and the additional reservation of 50 afa for future growth and development, sufficient water exists to meet virtually any unforeseen demand that might occur in the future. Therefore, based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that approving the Applications will not unduly limit future growth and development in Delamar Valley.

XII. PLACE OF USE (LINCOLN COUNTY)

The Applications were filed for municipal and domestic uses in Clark, Lincoln, Nye, and White Pine Counties. During the administrative hearing on these Applications, evidence was provided to support a place of use in both Clark and Lincoln counties.

Mr. Dylan Frehner, General Counsel for the Lincoln County Water District, provided testimony on behalf of Lincoln County and the Lincoln County Water District (collectively, "Lincoln County"). That testimony described Lincoln County's agreement with the Applicant that would assign a portion of the Applications to Lincoln County.[1278] Mr. Frehner also described Lincoln County's intentions to put any water it received from the Applications to beneficial use within Lincoln County. Mr. Frehner testified regarding two resolutions: one from the Lincoln County Board of County Commissioners, and one from the Lincoln County Water District. [1279] Both resolutions identified and confirmed Lincoln County's lack of current plans

[1278] Exhibit No. SNWA_352; Transcript, Vol.14 pp. 3149:18-3152:9 (Frehner).
[1279] Exhibit No. SNWA_346; Exhibit No. SNWA_347; Transcript, Vol. 14 pp. 3153:4-3157:7 (Frehner).

for growth and development in Delamar Valley, which is located entirely within Lincoln County.[1280] In that regard, evidence indicated that Lincoln County does not anticipate development for municipal use of water within Delamar Valley.[1281] Rather, this evidence supported Lincoln County's intention to put the water to beneficial use elsewhere within Lincoln County, specifically within Coyote Spring Valley.[1282]

The agreement between SNWA and Lincoln County was admitted into evidence as Exhibit No. SNWA_352. In accordance with this agreement, the use of the water by Lincoln County is limited to Lincoln County in general or the applicable basin of origin.[1283] Through the testimony of Mr. Frehner and the evidence submitted, Lincoln County has indicated that it does not anticipate projects or development in Delamar Valley, and further has indicated its intent to use any water obtained pursuant to these Applications within the Lincoln County/Coyote Springs Consolidated General Improvement District.[1284] The evidence submitted confirmed that Lincoln County still expects the Coyote Springs development to proceed.[1285]

With regard to the Coyote Springs development, the testimony and evidence submitted was consistent with State Engineer Ruling No. 5918 and the determination made therein that the Coyote Springs development has a need to import water into Coyote Spring Valley where it will be placed to beneficial use in Lincoln County.[1286] The evidence also supported the resolution of the Coyote Springs General Improvement District Board of Trustees that when developed,

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[1280] Exhibit No. SNWA_346; Exhibit No. SNWA_347; Transcript, Vol.14 pp. 3153:4-3157:7 (Frehner).
[1281] Transcript, Vol.14 pp. 3153:4-3157:7 (Frehner).
[1282] Transcript, Vol.14 pp. 3153:4-3157:7 (Frehner).
[1283] Exhibit No. SNWA_352; Transcript, Vol.14 p. 3152:15-25 (Frehner).
[1284] Exhibit No. SNWA_346; Exhibit No. SNWA_347; Transcript, Vol.14 pp. 3152-3157 (Frehner).
[1285] Exhibit No. SNWA_354; Exhibit No. SNWA_355; Transcript, Vol.14 pp. 3158-3159 (Frehner).
[1286] Exhibit No. SNWA_358; Transcript, Vol.14 pp. 3159-3160 (Frehner).

Coyote Springs would adopt a plan of conservation.[1287] The evidence confirms that the water from these Applications to be assigned to Lincoln County pursuant to the agreement between the Applicant and Lincoln County is currently contemplated to be put to beneficial use in the Lincoln County/Coyote Springs General Improvement District.[1288] Accordingly, the State Engineer finds that the Applicant has presented sufficient evidence that the Place of Use of the Applications will include Lincoln County.

XIII. OTHER PROTEST GROUNDS

A. The Applications are in Proper Form

The Protestants allege that the Applications should be denied because they fail to adequately describe the place of use, 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. The application form used by the Office of the State Engineer only requires a brief explanation of the description of the proposed works of diversion and delivery of water. On its Applications, the Applicant described that the water was to be diverted via a cased well, pump, pipelines, pumping stations, reservoirs and distribution system. The Applicant estimated the cost of each well and indicated it believed it would be a minimum of 20 years to construct the works of diversion and place the water to beneficial use.[1289]

Applicants who request an appropriation for municipal water use are required by NRS 533.340(3) to provide information approximating the number of persons to be served and the future requirement. While the Applicant did not have this information physically on its

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[1287] Exhibit No. SNWA_357; Transcript, Vol.14 pp. 3160-3162 (Frehner).
[1288] The State Engineer, however, notes the obligation of Lincoln County under the cooperative agreement between Lincoln County and the Southern Nevada Water Authority and the Las Vegas Valley Water District towards the Basin of Origin. Exhibit No. SNWA_352, p. 1; Sec. 4.3.1.4.
[1289] Exhibit No. SE_046.

application, by letter dated March 22, 1990, the Applicant supplemented its Applications and indicated the approximate number of persons to be served was 800,000 in addition to the 618,000 persons it was currently serving. The population of southern Nevada already exceeds this projection as it now is nearing 2 million citizens.

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.

B. Access to Federal Land

Some of the Protestants alleged that the Applicant has not demonstrated the ability to access land containing the points of diversion or a right-of-way from the BLM for the Project. Testimony was provided that the Lincoln County Lands Act identified a utility corridor for this and other utilities and that the Act required issuance of a right-of-way for the Project within the area designated by the Act.[1290] The Applicant submitted evidence that it is complying with NEPA and a DEIS has been prepared as part of the process to obtain from the BLM the rights-of-way to gain access to federal land for the Project.[1291] The State Engineer finds the evidence indicates the Applicant is pursuing the right-of-way in good faith and with reasonable diligence.

C. Need for Further Study/More Information

Protestants allege that the Applicant has not completed sufficient analysis of its need for this water, and sufficient information about the aquifers at issue does not presently exist to allow the State Engineer to make an intelligent judgment as to the effects of granting the Applications.

[1290] Exhibit No. SNWA_351.
[1291] Transcript, Vol.1 p. 217:16-25 (Holmes).

Protestants argue that granting the Applications in absence of further comprehensive study and planning and an independent, formal and publicly-reviewable assessment would prove detrimental to the public interest. The State Engineer finds there is no evidence that the State Engineer or the public has been denied relevant information. The State Engineer finds there is no provision in Nevada water law that requires comprehensive water-resource development planning prior to the granting of a water right application. Furthermore, the evidence shows that the Applicant has engaged in comprehensive long-range planning.[1292] The State Engineer finds there is nothing in Nevada water law that requires water resource evaluation by an independent entity, but rather that is the responsibility of the State Engineer; therefore, this protest claim is dismissed. The State Engineer finds that additional study is not needed to grant the Applications. The Applicant has already conducted valuable study of the hydrology and environment of the area. The State Engineer finds that additional study will be required going forward in the form of the monitoring and management program. Therefore, this protest ground is overruled.

D. <u>Las Vegas is Big Enough</u>

Protestants argue that Las Vegas is large enough and further growth is not in the best interest of Las Vegas Valley, that Clark County should only grow within the limits of its local resources, and the state should encourage growth control, use of local resources, and sustainability rather than give Las Vegas more water. The State Engineer finds no evidence was provided in support of the protest claim that the population of Las Vegas is big enough and future growth is not in the interest of the Las Vegas community, the state or the nation. In addition, the State Engineer finds he has not been delegated the responsibility to control growth and has not been delegated the responsibility for land use planning in Nevada. The decisions as

[1292] Exhibit No. SNWA_209; Transcript, Vol.2 pp. 248:20-250:2 (Entsminger).

to growth control are the responsibility of other branches of government. Therefore, these protest claims are overruled.

E. Denial of Prior Applications

Protestants argue that the Applications should be denied because the Division of Water Resources has already denied water appropriations in this basin. No evidence was presented, however, that prior applications were denied in the basin for reasons that are applicable to the Applications at issue. The State Engineer has denied several applications in the basin based on the Desert Land Entry Act and the Carey Act for failure to establish a reasonable expectation to put the water to beneficial use based on lack of control of the point of diversion. In this case, the Applicant is actively pursuing right-of-ways to the points of diversion. Therefore this protest ground is overruled.

F. Duplicate Applications

Protestants argue that the Applications should be denied because the Applicant filed duplicate applications in 2010. The Applicant likely did this because of uncertainty as to the status of the Applications at issue during the appeals process after the last hearing. Regardless, the State Engineer is not required to reject Applications because later-filed duplicate applications were filed. Therefore, the State Engineer overrules this protest ground.

G. Subdivision Maps

The State Engineer finds no evidence was provided in support of the protest claim that the Applications should not be approved if said approval is influenced by the State Engineer's "desire or need" to ensure there is sufficient water for new lots and condominium units created in the Las Vegas Valley by subdivision maps. The State Engineer finds it is his responsibility and obligation to follow the law, not his "desire or need"; therefore, the protest claim is dismissed.

H. Impacts to Indian Springs, Nellis Air Force Base and Lake Mead

A Protestant has argued that the Applications should be denied because of potential impacts to the Indian Springs Valley Basin which may harm rights owned by the U.S. Air Force in the basin. No evidence was presented of impacts to Indian Springs Valley Basin. Therefore, the State Engineer finds that this protest ground is overruled. Protestants argued that the Applications should be denied because of impacts to Lake Mead National Recreation Area and Moapa Wildlife Refuge. No evidence was presented showing any specific impacts to these areas. Therefore, the State Engineer finds that this protest ground is overruled.

I. Climate Change

Protestants allege, as a protest ground, that cyclical drought and long term climatic change are causing a diminishment of water resources in this basin and all connecting basins. No evidence was submitted that the groundwater resources in Delamar Valley are diminishing due to climate change or drought. Therefore, this protest ground is overruled.

XIV. SUMMARY OF PUBLIC COMMENT

Pursuant to the Hearing Notice dated April 1, 2011, the State Engineer indicated that he would receive both verbal and written public comment regarding the hearing of the Applications.[1293] Thereafter, the State Engineer announced on his website that it would be holding a public hearing on Friday, October 7, 2011. On the first day of the hearing, September 26, 2011, the hearing officer, Susan Joseph-Taylor announced that the hearing would offer the time for the public to comment on the Applications and related protests.[1294]

[1293] Exhibit No. SE_001.
[1294] Transcript, Vol.1 p. 7:6-17 (Joseph-Taylor).

On October 7, 2011 at 8:00 a.m., the public comment proceeded as scheduled.[1295] The public comment was simulcast over the internet as well as from the hearing room in Carson City, a remote site in Ely, a remote site in Las Vegas, and a remote site in Caliente.[1296] The public comment was attended by the State Engineer Jason King, Chief Hydrologist Rick Felling, Deputy State Engineer Kelvin Hickenbottom, as well as the chief hearing officer Susan Joseph-Taylor. Also in attendance were representatives and counsel for the Applicant and counsel for Protestant Great Basin Water Network.

On October 7, 2011, the State Engineer heard public comment from the different sites from 8:00 a.m. until 3:06 p.m. The State Engineer heard public comment from 96 persons. Public comment was closed when there was no additional person who wished to offer public comment. At that point, the hearing officer reminded the public that written public comment would be accepted until December 2, 2011, and could be filed at the Elko office, the Las Vegas office or the Carson City office.[1297]

The State Engineer received written public comment until December 2, 2011, receiving over 25,000 pieces of correspondence. The State Engineer has reviewed and considered all written comments and the oral comments received on October 7, 2011 prior to issuing this ruling.

In determining whether to approve or reject an application for an interbasin transfer of groundwater, the State Engineer must make rulings based upon fact and science. While the State Engineer will acknowledge and consider public comment, the State Engineer cannot make decisions based upon speculative beliefs rather than the evidence submitted. The State Engineer

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[1295] Transcript, Vol.10 p. 2098 *et. seq.*
[1296] Transcript, Vol.10 p. 2098 *et. seq.*
[1297] Transcript, Vol.10 p. 2322 (Joseph-Taylor).

will not make a decision based solely on how many letters are received for or against the Project. The public input process is designed to allow a person to express their general support or opposition to the Project; it is not designed to provide for an opportunity to "vote" on whether or not the Project should be built.[1298]

The State Engineer took comment from tribal leaders and members who spoke against the Project as well as from public officials and individuals from White Pine and Lincoln Counties, and from other persons from around the state, including Las Vegas. These persons raised various concerns including the protection of water rights, environmental concerns, and concerns centering upon traditional Native American culture and concerns that the Applications may interfere with their ability to observe and participate in those activities and, in the case of the protection of water rights, the ability to earn a living. These concerns are acknowledged and are addressed elsewhere in this ruling.

The State Engineer additionally took comment and received letters from various unions and organizations, state municipalities, and large employers within the state—all of which expressed support of the Project. These entities and organizations represent not only the respective interests of each organization and entity, but also hundreds of thousands of constituents who are members and/or employees of each.[1299] For example, the State Engineer heard testimony and received letters from large employers that employ more than 50,000 employees. These are employers within the state, including the Bank of America of Southern Nevada, Bank of Nevada, Boyd Gaming, Caesars Entertainment, KB Homes, Las Vegas

[1298] *See* NAC 533.060; NRS 532.120; NRS 533.365 (2010).
[1299] Transcript, Vol.10 pp. 2226-2232 (Valentine and Foley).

Convention and Visitors Authority, and Wynn Resorts.[1300] The representatives from these entities are in support of the Project because they believe a water shortage within the Las Vegas area would have a devastating impact on the gaming, resort and construction industries, and therefore on the entire state's economy.[1301] The State Engineer heard testimony and received letters from labor unions, including the Culinary Workers Union, AFL-CIO and IBEW Local 357, which represent over 250,000 Nevadans. The State Engineer heard testimony and received letters from organizations including the Associated General Contractors, Las Vegas Chamber of Commerce, Latin Chamber of Commerce, North Las Vegas Chamber of Commerce, Southern Nevada Building and Construction Trades Company, and Southern Nevada Home Builders Association.[1302] The Nevada Resort Association also submitted a letter in support of the Project, and the Resort Association represents all the major casino and resort properties in Nevada. The State Engineer also received letters from all the municipalities in southern Nevada, representing a majority of the state's population, including Clark County, the City of Las Vegas, the City of Henderson, the City of North Las Vegas and Boulder City.[1303] These organizations echoed the opinion that a water shortage in Las Vegas would have severe economic impacts within the state.[1304]

XV. UNAPPROPRIATED WATER

The State Engineer finds the perennial yield of Delamar Valley is 6,600 afa, based on the Applicant's estimated annual recharge for the basin. The State Engineer finds that while there are interbasin flows between Delamar Valley and Pahranagat Valley, these flows enter

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[1300] Transcript, Vol.10 pp. 2143-2145; 2226-2232 (Wyatt, Valentine and Foley).
[1301] Transcript, Vol.10 pp. 2143-2145; 2226-2232 (Wyatt, Valentine and Foley).
[1302] Transcript, Vol.10 pp. 2143-2145; 2226-2232 (Wyatt, Valentine and Foley).
[1303] Transcript, Vol.10 pp. 2143-2145, 2226-2232 (Wyatt, Valentine and Foley).
[1304] Transcript, Vol.10 pp. 2143-2145; 2226-2232 (Wyatt, Valentine and Foley).

Paharanagat Valley downgradient from existing water rights at Hiko, Crystal and Ash Springs, and, therefore, water from Delamar Valley is not source water for those existing water rights. Therefore, it is not necessary to limit the water available for appropriation to one half of the perennial yield in Delamar Valley. The amount of committed groundwater associated with existing rights with priority dates before October 17, 1989 is 8.95 afa and the water to be reserved for unforeseen future growth and development is 50 afa. Accordingly, the State Engineer finds that there is 6,541 afa available for appropriation in Delamar Valley pursuant to the Applications.

CONCLUSIONS OF LAW

I.

The State Engineer has jurisdiction over the parties and the subject matter of this action and determination.[1305]

II.

The State Engineer is prohibited by law from granting an application to appropriate the public waters where:[1306]

A. there is no unappropriated water at the proposed source;
B. the proposed use or change conflicts with existing rights;
C. the proposed use or change conflicts with protectable interests in existing domestic wells as set forth in NRS 533.024; or
D. the proposed use or change threatens to prove detrimental to the public interest.

The State Engineer concludes there is unappropriated water for export from Delamar Valley, there is no substantial evidence the proposed use will conflict with existing rights, that existing rights are sufficiently protected by the Applicant's monitoring, management, and

[1305] NRS Chapters 533 and 534.
[1306] NRS 533.370(5) (2010).

mitigation plan, there is no substantial evidence that the proposed use will conflict with protectable interests in existing domestic wells, or that the use will threaten to prove detrimental to the public interest. Therefore, there is no reason to reject the Applications under NRS 533.370(5) (2010).

III.

The State Engineer concludes that the Applicant provided proof satisfactory of its intention in good faith to construct any work necessary to apply the water to the intended beneficial use with reasonable diligence, and its financial ability and reasonable expectation actually to construct the work and apply the water to the intended beneficial use with reasonable diligence. Therefore, if all other statutory requirements are fulfilled, NRS 533.370(1) requires the Applications to be approved.

IV.

The State Engineer concludes that the Applicant has justified the need to import water from Delamar Valley, that an acceptable conservation plan is being effectively carried out, that the use of the water is environmentally sound as it relates to the basin of origin, and that by reserving 50 afa in the basin of origin, that the export of water will not unduly limit the future growth and development of Delamar Valley. Therefore, there is no reason to reject the Applications under NRS 533.370(6) (2010).

RULING

The protests to Applications 53391 and 53392 are hereby overruled in part and the Applications are hereby granted in the following amounts and subject to the following conditions:

1. The Applications are granted subject to existing rights.

2. The Applicant shall pay the statutory fees.

3. The State Engineer has reviewed and approves the Hydrologic Monitoring and Mitigation Plan for Delamar, Dry Lake and Cave Valley[1307] that was prepared by the Applicant. The Applications are granted conditioned upon the Applicant's compliance with that Plan, and any amendments to that Plan that the State Engineer requires at a later date pursuant to his authority under Nevada law.

4. The State Engineer has reviewed and approves the Biological Monitoring Plan for Delamar, Dry Lake and Cave Valley[1308] that was prepared by the Applicant. The Applications are granted conditioned upon the Applicant's compliance with that Plan, and any amendments to that Plan that the State Engineer requires at a later date pursuant to his authority under Nevada law.

5. The Applicant shall file an annual report with the State Engineer by March 31st of each year detailing the findings of the approved Hydrologic and Biological Monitoring Plans.

6. Prior to the Applicant exporting any groundwater resources from Delamar Valley, biological and hydrologic baseline studies shall be completed and approved by the State Engineer. A minimum of two years of biological and hydrologic baseline data shall be collected by the Applicant in accordance with the approved monitoring plans and will be submitted to the State Engineer and approved by the State Engineer prior to the Applicant exporting any groundwater resources from Delamar Valley. Data collected prior to the approval of the monitoring plans by the State Engineer qualifies as baseline data, provided the data was collected in accordance with the subsequently approved plans.

[1307] Exhibit No. SNWA_148.
[1308] Exhibit No. SNWA_366.

7. The Applicant shall update a computer groundwater flow model approved by the State Engineer once before groundwater development begins and every five years thereafter, and provide predictive results for 10-year, 25-year and 100-year periods.

8. The perennial yield of Delamar Valley is 6,600 afa, based on the Applicant's recharge estimate for the basin.

9. There is 8.95 afa of committed groundwater associated with existing rights. An additional 50 afa must be reserved for unforeseen future uses in Delamar Valley. Therefore, the amount of groundwater available for appropriation under the Applications is 6,541 afa. Applications 53391 and 53392 are permitted for a total combined duty not to exceed 6,541 afa.

10. The State Engineer shall consider any alleged conflict from the Applications with an existing water right or domestic well, and any allegation that pumping pursuant to the Applications is environmentally unsound. The Applicant shall provide information regarding monitoring, model runs, management and mitigation measures, and other information that is needed to evaluate the allegations. The State Engineer will evaluate such concerns on a case-by-case basis with site-specific evidence. Part of that analysis will be a determination of what a reasonable lowering of the static water table would be in each case,[1309] and what level of impact to an environmental area of interest is reasonable and environmentally sound. If necessary, the State Engineer will then determine on a case-by-case basis whether a management plan is required to protect against a specific allegation, and that plan may include thresholds and triggers to manage groundwater development under the Applications.

[1309] *See* NRS 534.110.

11. If pumping conflicts with existing rights, conflicts with the protectable interests in domestic wells as set forth in NRS 533.024, threatens to prove detrimental to the public interest or is found to be environmentally unsound, the Applicant will be required to curtail pumping and/or mitigate the impacts to the satisfaction of the State Engineer.

Respectfully submitted this 26th day of January, 2012

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CERTIFICATE OF SERVICE

I hereby certify that on this 26 day of January, 2012, a true and correct copy of SOUTHERN NEVADA WATER AUTHORITY'S PROPOSED DELAMAR VALLEY RULING was served on the following by Fed Ex overnight delivery as follows:

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DATED this 26 day of January, 2012.

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