FILED
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Bernalillo County
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SECOND JUDICIAL DISTRICT COUT
STATE OF NEW MEXICO
COUNTY OF BERNALILLO

No. D-202-CV-2014-07209

AQUIFER SCIENCE, LLC,

Applicant-Appellant,

v.

SCOTT A. VERHINES, NEW MEXICO
STATE ENGINEER,

Appellee,

And

COUNTY OF BERNALILLO, NEW MEXICO, HERMOSILLA ESTATES NEIGHBORHOOD ASSOCIATION, INTERMOUNTAIN CONSERVATION TRUST, OLD SAND PARK SERVICE COOP., PONDEROSA RANCH ESTATES LANDOWNERS, INC., SAN PEDRO CREEK ESTATES HOMEOWNERS ASSOC., WILDFLOWER NEIGHBORHOOD ASSN., RUSSELL ABBINK, CHARLOTTE ABBINK, REBECCA ALZHEIMER, WILLIAM ALZHEIMBER, ROSEMARY AMSAUGH, ROD BAKER, CARYL BARON, STEVAN BARON, SCOTT BARRON, WENDY BARRON, DAVID A. BENSON, NANCY C. BENSON, PHYLLIS BERGMAN, RONALD P. BOHANNAN, THOMAS P. BOYCE, NATHANAEL BROWN, CAROLYN K BRYAN, PEGGY M. BRYAN, GEORGE T. BRYAN, DEE S. BUTLER, WILLIAM I BUTLER, JR., DON CAIN, MARIE CAIN, MIKE CAMP, JACK CAMPBELL, JOHN CAMPBELL, RODNEY CARNES, MARGARET M. CARROLL, DON CARNICOM, MINA CARNICOM, TOM CHRISTENSEN, MICHAEL COOK, JOSEPH A COOPER, KATHY G. COOPER, BETH CORWIN, MARIA V. CUMMINGHAM, JOEL DARNOLD, LISA DARNOLD, BARBARA DAVIS, RICHARD F. DAVIS, DARIELLE DEXHEIMER, RICHARD A. DUNN, HOWARD FARBER, SUSAN GIAMBATTISTA, DALE W. GUNN, MARK GUNTER, JAMES T HANLON, KATHLEEN A. HANLON, REBECCA S. HARTLEY, KAREN C. HAWORTH, MICHAEL D. HAWORTH, JOHN F. HAYES, LYNN HENRICKSON, BARBARA S. HERRINGTON, JOANNE HILTON, DAVID J. HOLCOMB, BRADLEY C. HOSMER, ZITA HOSMER, TRACEE HUDSON, LARRY IFELD, CURTIS JOHNSON, PATTI JONES, REESE JONES, DALE KENNEDY, CHARLES R. KING, ARNOLD G. KLEIN, THEODORE I. LAMBERT, MARY A. LARAIA, MARLYS LESLEY, PATRICK LESLEY, NANCY A. LOGAN, ROBERT M. LOPEZ, FRANCES M. LUSSO, JULIE LYNCH,

JAMES E. MALLINSON, MARILYN H MALLINSON,
MARK MANZUTTO, RONALD E. MASSIE, BARBARA
MCCARTY, RONALD MCCARTY, KATHY MCCOY, ARJAN
MELWANI, SHARMILA MELWANI, PAULA MICHEL,
TOM MICHEL, JAMES MILDREN, VENESEE MILDREN,
DOROTHY MITCHELL, KERRY MOLNAR, PETER MOLNAR,
ANDREW J. MOONEY, CLIFFORD D. MORRIS, GAYLE M.
MORRIS, LORNA MORROW, PAUL MORROW, MICHAEL
MOSLEY, JIM MULLANY, MARJORIE MULLANY, G. MARK
NAYLOR, TINA NENOFF, ERIN O'NEIL, JACK O'NEIL,
JACQUELINE ORR, JOHN ORR, JERRY PAGE, KAREN PAGE,
ANDREE PEEK, DOUG PEEK, HANS PETERSEN, MARK PICKERING,
SUSAN PICKERING, SYLVIA PIERCE, RICHARD RAGLE, DAN R. RITCHY,
JUDITH B. RICHEY, KATRINA RIVERS, DAVID J. ROESCH, DOUG
SALMI, KAREN SALMI, CAROL A. SANDERS-REED, JOHN N. SANDERS-
REED, REBECCA SCHNELKER, JILL SCHUMACHER, DONNA SCHUYLER,
RICHARD SCHUYLER, BARRY SILBAUGH, JANET WINCHESTER-SILBAUGH,
CAROLYN J. SIMMONS, JERRY A. SIMONS, SUE ANN SLATES,
ANNOINETTE SMITH, ROBERT SMITH, ROGER SOUTHWARD,
VERA SPRUNT, ELAINE M. STEPHENS, ANNE STRADER,
JO ELISE TABACCHI, MARGARET BURGES TAYLOR,
ROBERT K. TAYLOR, JOHNATHAN THOMAS, DAVID E. THOMPSON,
BRIAN TYREE, OVIDIU VIORICA, BIRUTE WATSON AND FAMILY, SAUL
BARRY WAX, DAVID S. WEAVER, ALBERT WEBB, DENISE WEBB,
ANGELA WELFORD, DAVID W. WENTWORTH, JEANNE S.
WENTWORTH, TIM WILLIS, JAN WISTE, CAROL J. WOOD,
JAMES A. WOOD, JAN WRIGHT AND MARY ANN ZANNER,

Protestants-Appellees.

FINDINGS OF FACT AND CONCLUSIONS OF LAW

The Court's decision, after a trial on the merits March 5-19, 2018, is set forth below. Any requested findings of fact or conclusions of law not included in this decision are deemed refused, immaterial to the Court's decision, or subsumed by these Findings of Fact and Conclusions of Law.

FINDINGS OF FACT

The Parties

1. Applicant is Aquifer Science is a Nevada limited liability company, the members of which are Vidler New Mexico, LLC (Vidler NM) and the Campbell Farming Corporation (CFC).

2. The Office of the State Engineer (OSE) was the administrative body in the hearing below and now stands in support of Aquifer Science's Application to appropriate groundwater in the East Mountains.

3. Protestants are:

A. the County of Bernalillo, as the Application effects groundwater in the County.

B. various individual landowners, neighborhood associations, trusts and co-ops in the subject area all of whom represented by New Mexico Environmental Law Center.

4. Dr. David Thompson, who lives in the subject area, represented himself in this matter throughout.

5. Additionally, David and Nancy Benson, Carolyn K. Bryan, William and Dee Butler, Michael Camp, Joseph and Kathy Cooper, Darielle Dexheimer, Curtis E. Johnson, Mark Moll, Lorna and Paul Morrow, Mark Naylor, Dale Gunn, Mark and Susan Pickering, Dan and Judith Richey, Janet Winchester Silbaugh, Rod D. Baker, Susan I Giambattista, Clifford and Gayle Morris, Tina M Nenoff, Jack and Erin O'Neil, Saul Barry Wax, Jo Elise Tabacchi, Russell and Charlotte Abbink and Theodore Lamber appeared pro se.

6. All parties appearing pro se and those represented by the Environmental Law Center will be referred to as "Protestants."

7. All Protestants and Bernalillo County oppose Aquifer Science's Application.

Proceedings Below

8. On November 14, 2014, the OSE adopted its designated Hearing Examiner's report denying Aquifer Science's Application S-2618 (Application). [AS Ex. 1, Application; 11-19-14 Notice of Appeal De Novo].

9. The OSE's denial of the Application was based on the determination that there was no unappropriated groundwater in the Sandia Basin to satisfy the Application.

10. The State Engineer premised this decision, in part, on the fact that the OSE had previously denied numerous permits in the Sandia Basin because of a lack of available water, impairment to existing water rights and that additional appropriations would not be consistent with conservation or the public welfare.

11. Pursuant to NMSA 1978, Section 72-7-1 (1971), Aquifer Science filed this de novo appeal on November 19, 2014. [11-19-14 Notice of Appeal De Novo].

12. The scope of the appeal encompassed the following subject areas:

A. Whether water is available in the Sandia Basin to satisfy the Application;

B. Whether the granting of the Application would impair existing water rights;

C. Whether the granting of the Application would be detrimental to the public welfare of the State; and

D. Whether the granting of the Application would be contrary to the conservation of water within the State. [2-24-26 Letter Decision].

13. The trial in this matter was held on March 5-19, 2018. [8-3-17 Third Amended Scheduling Order].

Applicant and Application

14. The purpose of Aquifer Science is to obtain water for the Campbell Ranch Master Plan Project. [3-05-18 Tr. 103:5-16 (Hartman Testimony)].

15. Aquifer Science's Application initially requested a new groundwater appropriation in the Sandia Basin of up to 1,500 acre feet per year (af/y) for use on 25,000 acres of land owned by CFC within the Sandia Basin, specifically, within the San Pedro Land Grant. [3-05-18 Tr. 104:9-21 (Hartman Testimony); AS Ex. 1]. In 2013, Aquifer Science amended the Application to change the place of use to 8,046 acres of land owned by CFC that comprise the CFC Project and to reduce the requested amount of water to 717af/y. In 2017, this Court permitted Aquifer Science to file an amended Application that reduced the requested appropriation to 350 af/y. [3-5-18 Tr.107:5-8, Tr.106:6-15, AS Ex.9; AS Ex.10]. The Application, as amended, requests approval of proposed beneficial uses of water for the Campbell Ranch Master Plan (Master Plan) Project. [3-05-18 Tr. 106:6-17 (Hartman Testimony); AS Ex. 4, Amendment to Application].

16. The four proposed points of diversion listed in the Application are within a 2,000 foot radius of the following specified locations in the Sandia Basin (on the U.S.G.S. Sandia Peak Quadrangle map, denoted UTM Zone 13 in meters/NAD 83):

A. Well 1: East 380500 (m), North 3894500 (m)

B. Well 2: East 379430 (m), North 3892969 (m)

C. Well 3: East 379980 (m), North 3893719 (m)

D. Well 4: East 380680 (m), North 3895000 (m)

17. The Application specified that the approximate depth of the wells was up to 4,000 feet. Stipulation at ¶ 4.

18. In accordance with the OSE directive, Aquifer Science published notice of the Application in newspapers that have general circulation where the Sandia Basin is located, including Bernalillo, Sandoval, and Santa Fe counties (the *Mountain View Telegraph*, the *Albuquerque Journal*, and the *Santa Fe New Mexican*). [3-05-18 Tr. 107:17-108:3 (Hartman Testimony); AS Ex. 2, Notices of Publication].

<u>Specific Information Regarding Application</u>

19. Vidler Water Company is a water developer that operates in the Southwest and is a wholly owned subsidiary of Pico Holdings, a NASDAQ listed company. [3-5-18, Tr. 98:23–99:10].

20. Aquifer Science is a limited liability company comprised of Vidler New Mexico, a wholly owned subsidiary of Vidler (both Vidler and Vidler New Mexico will be referred to interchangeably as "Vidler") and CFC. Vidler owns 95% of Aquifer Science and CFC owns 5%. [AS Ex. 7]. Vidler and CFC formed Aquifer Science in 2008 for the primary purpose "to own, explore, joint venture, develop, manage, maintain, lease and/or transfer water resources and related infrastructure. . . and to develop a deep aquifer water resource" capable of providing water for the Master Plan and for future development and to other users. [AS Ex.7].

21. The Master Plan area is located north of the Town of Edgewood (Edgewood) in the San Pedro Grant area. [3-05-18 Tr. 112:14-113:3 (Hartman Testimony); AS Ex. 9, Map of Master Plan Project Area].

22. The proposed purpose of use for the water requested in the Application is domestic, livestock, irrigation and commercial, to include subdivision, domestic, educational, recreational, commercial and related uses. Applicant's Ex. 1, p. 2, admitted into evidence at TR 3/5/2018, p. 108, lines 16 – 17, and testimony of Jeff Peterson, TR 3/15/2018, p. 158 lines 1 – 24.

23. The Master Plan is a multiple use development project consisting of four villages with residential, commercial, recreational/resort elements, such as open space and two golf courses. [*Id*.]. The overall acreage covered by the Master Plan is 8,046 acres, which includes almost three thousand acres of open space known as Monte Largo. [3-05-18 Tr. 112:14-20; 120:16-23 (Hartman Testimony); AS Ex. 9]. In addition to the Monte Largo open space area, significant open space throughout the Master Plan Project area is planned. [3-05-18 Tr. 120:23-121:10 (Hartman Testimony); AS Ex. 10, p. 1].

24. A total of 4,024 housing units are proposed throughout the Villages, with Villages 1 and 4, to the west and north, being less dense, and Villages 2 and 3 providing for the most concentrated development. [3-05-18 Tr. 114:17-115:21 (Hartman Testimony); AS Ex. 10]. These housing units will house approximately 10,000 people.

25. A wastewater treatment plant will be located in Village 3. [3-05-18 Tr. 115:22-25 (Hartman Testimony); AS Ex. 9].

26. The water rights sought would be withdrawn individually or combined from either of the two existing well locations, Points of Diversion for S-2618 (POD)-1 (Well ASE-1), or POD-3 (Well ASE-2). [3-05-18 Tr. 125:8-14 (Hartman Testimony); AS Ex. 9].

27. In the initial stages of development of the Master Plan, Aquifer Science proposes using potable water for irrigation. [3-05-18 Tr. 116:2-17 (Hartman Testimony); AS Ex. 10, p. 1].

However, the Master Plan provides for the use of treated effluent to irrigate the golf course and common areas once effluent is available. [*Id.*; 3-05-18 Tr. 123:16-124:15 (Hartman Testimony); AS Ex. 10, p. 1].

28. Aquifer Science's proposed plan includes replacing San Pedro Creek flow that may be affected with treated effluent which is described in the Phased Pumping Schedule and Development Plan. [3-05-18 Tr. 139:18-140:8 (Hartman Testimony); AS Ex. 12, Phased Pumping Schedule].

29. On December 3, 2001 Edgewood approved the Annexation of the Master Plan area, Villages 2, 3, and 4, and also approved the associated Master Plan. [3-05-18 Tr. 120:3-11 (Hartman Testimony); AS Ex. 11, Town of Edgewood 2001 Annexation and Development Agreement]. The total area annexed by Edgewood was 6,826 acres. [3-05-18 Tr. 127:14-128:16 (Hartman Testimony); AS Ex. 11].

30. Village 1, located on the west side of State Highway 14, was not annexed by Edgewood and is under the jurisdiction, from a planning perspective, of Bernalillo County, but Village 1 is still part of the Master Plan. [3-05-18 Tr. 159:7-160:4; 128:17-129:2 (Hartman Testimony)]. Bernalillo County has not annexed Village 1 and Bernalillo County has not approved the Master Plan.

31. Village 1 is comprised of 1,220 acres and 807 dwelling units.

32. Village 1 requires 120.8 af/y of the 717 (716.9) af/y required for the Master Plan and would generate 70.7 af/y of the effluent on which the total water demand depends. [AS Ex. 18].

33. Aquifer Science proposes that central water and wastewater facilities will serve all Villages within the Master Plan area and would agree to a permit condition that there would

be no septic systems or domestic wells as a part of the development of the Villages within the Master Plan area. [3-12-18 Tr. 171:19-172:10; 172:19-173:9 (Timian-Palmer Testimony)].

34. Aquifer Science intends to develop the Master Plan starting with Villages 2, 3 and 4, ending with 1. [3-12-18 Tr. 171:19-172:13 (Timian-Palmer Testimony)]. If Village 1 is not annexed into the Master Plan, Aquifer Science will not need and will not be able to use 350 acre-feet/year. Aquifer Science has not presented a plan for the water it will not need if Village 1 is not annexed into the Master Plan. Further, Aquifer Science has not presented an alternate plan for the generation of effluent if Village 1 is not annexed into the Master Plan.

35. Aquifer Science proposes to use a permitted water right in the Estancia Basin (Permit E-4854(D)) as an independent supply source for the proposed 17 af/y total water demand for the Master Plan Project. [3-05-18 Tr. 129:3-130:21 (Hartman Testimony); AS Ex. 8, Letter of Intent]. This water right is permitted by the OSE for both irrigation use in the Estancia Basin and the proposed beneficial uses at the Master Plan. [*Id.*].

36. The Master Plan area has been incorporated into the Entranosa Water and Wastewater Association's (Entranosa) service area, and Entranosa has committed to provide water service for the Master Plan as reflected in a Letter of Intent between the parties. [*Id.*] The arrangement with Entranosa contemplates combined use of 367 af/y under Permit E-4854(D), which is currently in a permit held by Campbell, and the permitted appropriation under the Application of 350 af/y from the Sandia Basin to serve the Master Plan. [3-05-18 Tr. 130:22-131:11 (Hartman Testimony); AS Ex. 8].

37. Initially, Aquifer Science plans to use groundwater from the Application permitted for all of the construction needs and stream flow replacement. [3-05-18 Tr. 131:12-21; 132:23-134:7

38. A Phased Water Use Schedule was developed by Daniel B. Stephens & Associates (DBSA) for water use at the Master Plan area based on the pumping schedule using 350 af/y over a 40-year period. [3-05-18 Tr. 132:23-134:7 (Hartman Testimony); AS Ex. 12].

39. It is necessary to construct the infrastructure for the Project in the initial phases of development. [3-05-18 Tr. 135:8-13 (Hartman Testimony)]. This would include roads, electric, gas and other utilities, including initial construction of the water distribution system and the wastewater treatment plant. [3-05-18 Tr. 134:8-135:13 (Hartman Testimony)]. The golf course will be developed in this phase because it is a site for storing and applying treated effluent as the Project progresses. [3-05-18 Tr. 135:14-136:7 (Hartman Testimony].

40. The schedule shows that by year 11 (if Village 1 is annexed into the Master Plan) the Project will use 100% of the proposed appropriation of 350 af/y under this Application. [AS Ex. 12]. This schedule also demonstrates the need for San Pedro Creek stream flow replacement, identifies the years in which different parts of the Master Plan will be constructed, quantifies the total Master Plan demands, including the number of housing units that will be completed, sets forth the incremental pumping schedules, shows the residential and non-residential water demand, the outdoor water uses, the amount of treated effluent, and the total use of water used on the golf courses including both potable and non-potable uses. [*Id.*].

41. Based on the impact evaluation prepared by DBSA, Aquifer Science proposes conditions of approval as a basis for mitigating any excessive impacts of the Application on existing water rights. [3-05-18 Tr. 137:21-138:11 (Hartman Testimony); AS Ex. 13a, Proposed Conditions of Approval]. These conditions include:

A. Replace impacted wells. [3-05-18 Tr. 138:12-139:17 (Hartman Testimony); AS Ex. 13a].

B. Replenish water to San Pedro Creek, in an amount determined to be required to mitigate/offset the impact on San Pedro Creek flows. [3-05-18 Tr. 139:18-140:6 (Hartman Testimony); AS Ex. 13a].

C. Retire pre-1907 Middle Rio Grande Basin water rights in an amount required to mitigate/offset impact on Rio Grande flows. [3-05-18 Tr. 140:9-21 (Hartman Testimony); AS Ex. 13a].

D. Limit the amount of pumping in accordance with the 40-year pumping schedule. [3-05-18 Tr. 140:22-141:4 (Hartman Testimony); AS Ex. 13a]. This will restrict the maximum water use during the proposed phased pumping. [*Id.*]. Aquifer Science would be limited in the first 5 years to use, at most, an average of 192 af/y. [AS Ex. 13a].

Water Demand Analysis

42. Gregory Hurst, P.E., Robert Peccia and Associates, prepared a water demand and use study for the proposed appropriation in the Application to supply the Master Plan. [3-05-18 Tr. 109:23-110:3 (Hartman Testimony)].

43. The Court qualified Mr. Hurst as a water resource management expert with a particular focus on water demand and supply analyses without objection. [3-05-18 Tr. 210:2-211:2 (Hurst Testimony)].

44. Mr. Hurst's water demand and use analysis for the Application includes components of water use, reuse and conservation for the Master Plan. [3-05-18 Tr. 203:24-204:10 (Hurst Testimony)]. Aquifer Science's water demand analysis attempts to achieve water conservation targets by employing best practices for conservation, including: (1) high efficiency building fixtures; (2) state of the art appliances; (3) low water landscape palettes and reduced

irrigated landscaped areas; and (4) low flow landscape irrigation systems. [3-05-18 Tr. 204:11-25; 205:17-206:2 (Hurst Testimony)].

45. The water demand study includes the following components: (1) indoor potable water use; (2) outdoor landscape use; (3) golf course irrigation; and (4) streamflow replenishment. [3-05-18 Tr. 211:5-14 (Hurst Testimony)]. The water demand study includes water conservation strategies used to estimate the demand for overall water use and consumption. [3-05-18 Tr. 204:4-21 (Hurst Testimony)].

46. Enforcement and verification of conservation targets, including high efficiency fixtures, appliances, reduced landscaping and the like is difficult.

47. Mr. Hurst's calculation is based on two components – interior demand and exterior demand. [3-05-18 Tr. 211:5-14 (Hurst Testimony)]. An estimated 80% of the total interior water use will generate treated sewage affluent (TSE). [3-05-18 Tr. 219:16-220:18 (Hurst Testimony)]. The calculated TSE, in turn, is reused to satisfy exterior demand, which is primarily irrigation of the golf course, common areas, and streamflow replenishment. [3-05-18 Tr. 221:24-222:5 (Hurst Testimony)].

48. The water conservation analysis model is based on the land use framework for the Master Plan, dated February 2002, and predicts water demand at full build-out and full occupancy. [3-05-18 Tr. 213:11-24 (Hurst Testimony); AS Ex. 10]. Wastewater is collected from all interior uses and treated for reuse. [3-06-18 Tr. 34:5-13 (Hurst Testimony); 03-12-18 Tr. 171:19-172:10; 172:19-173:9 (Timian-Palmer Testimony)].

49. The indoor water demand analysis begins with a "Baseline Demand." [3-05-18 Tr. 217:24-218:1 (Hurst Testimony)]. The second component of the water demand analysis is the "Best Case." [3-05-18 Tr. 218:2-5] (Hurst Testimony)].

50. The formula for calculating the Baseline Demand is: "Users" multiplied by "flow rates" multiplied by "user practices." [3-06-18 Tr. 18:4-22 (Hurst Testimony)]. The Baseline fixture flow rates are based on the 1992 EPA Guidelines. [3-05-18 Tr. 216:17-217:11 (Hurst Testimony); AS Ex. 21, EPA Guidelines]. The local interior usage rates were calculated in accordance with the standard user patterns as presented in Wilson and others' *Water Conservation and Quantification of Water Demands in Subdivision; Guidance Manual for Public Officials and Developers* report. [3-05-18 Tr. 214:13-215:20 (Hurst Testimony); AS Ex. 20]. The users were calculated using the Full Time Equivalent Methodology (FTE), which accounts for water uses at the Master Plan Project attributable to all residents, visitors, and employees. [3-05-18 Tr. 213:11-24 (Hurst Testimony); 3-06-18 Tr. 19:7-20:5 (Hurst Testimony)].

51. Residential and non-residential interior water demand for the Baseline Case is 52.1 gallons per capita per day (GPCD), and 26.0 GPCD, respectively. [3-05-18 Tr. 222:12-223:6 (Hurst Testimony); AS Ex. 14, Interior Water Demand].

52. To calculate the best case for water conservation, more efficient water use strategies were applied by simply substituting more efficient water fixtures and appliances. [3-05-18 Tr. 217:14-218:13 (Hurst Testimony); AS Ex. 14]. Residential and non-residential interior water demand for the Best Case is 36.0 GPCD, and 17.3 GPCD, respectively. [3-05-18 Tr. 223:18-25 (Hurst Testimony); AS Ex. 14].

53. The total interior water demand was calculated using the best result GPCD values multiplied by the FTE population for each building type. [3-05-18 Tr. 218:6-219:15; 224:12-18 (Hurst Testimony); AS Ex. 15, Total Interior Water Demand for Each Village]. This gives a

total annual water use value for each village in gallons that is part of the overall project water demand. [3-05-18 Tr. 224:19-225:22 (Hurst Testimony); AS Ex. 15].

54. The recycled water calculation was based on the interior demand for the project. [3-05-18 Tr. 219:23-220:3 (Hurst Testimony)]. This calculation provides the total treated effluent available for reuse in gallons and is then incorporated into the overall project water demand analysis to reduce the exterior water demand. [3-05-18 Tr. 225:11-25 (Hurst Testimony); AS Ex. 16, Recycled Water Calculations].

55. Exterior Water Demand is calculated by taking the landscape area multiplied by the plant evapotranspiration per plant group, per month, per facilities or land use type. [3-05-18 Tr. 220:19-221:7 (Hurst Testimony)]. There are four categories of exterior water use that include: (1) residential exterior demand, mainly landscape use, exclusively supplied by a potable source; (2) common area landscape, supplied by recycled water, if sufficient, and augmented by a potable water source; (3) golf course irrigation, which will initially rely on potable water and then rely on recycled water as it becomes available; and (4) streamflow replenishment initially sourced from potable water and then sourced from recycled water as it becomes available. [3-05-18 Tr. 221:24-222:11 (Hurst Testimony)].

56. The Best Option for exterior water usage employs achievable conservation measures, including native landscapes drip irrigated for residential exterior use and minimal turf for common areas mixed with mostly native vegetation. [3-05-18 Tr. 221:8-23 (Hurst Testimony)]. Total exterior use for residential and nonresidential use was 513.6 af/y. [3-05-18 Tr. 226:1-6 (Hurst Testimony); AS Ex. 17, Exterior Water Demand Table].

57. The total consumptive use for the Master Plan is 716.9 af/y based on the proposed development types outlined in the current Master Plan and the total of the demand calculations

described above. [3-05-18 Tr. 213:6-10; 226:7-227:1 (Hurst Testimony); AS Ex. 18, Overall Annual Water Demand Area Table].

Well Testing and Geologic Framework

58. Mr. Christopher Wolf is a geochemist [3-06-18 Tr. 43:6-13 (Wolf Testimony)].

59. The Court qualified Mr. Wolf, without objection, as a geologist with specializations in hydrogeology and geochemistry. [3-06-18 Tr. 45:10-22].

60. Mr. Wolf developed the geologic model that was used as a component of the numerical groundwater flow model prepared by DBSA. [3-06-18 Tr. 48:3-8 (Wolf Testimony); 3-07-18 Tr. 82:5-83:3 (Blandford Testimony)]. He collected data on the local hydrogeology from the literature, including geologic maps, incorporated the data developed through Aquifer Science's well drilling program, and reviewed surface geophysical data. [3-06-18 Tr. 48:23-49:20 (Wolf Testimony)]. He also collected water chemistry data, monitor well data, stream flow data, and reviewed Bernalillo County well data when it became available. [3-06-18 Tr. 59:25-60:3; 65:1-8; 77:5-6; 100:8-23 (Wolf Testimony)]. These data were incorporated into the development of geologic cross-sections and a geologic block model. [3-06-18 Tr. 49:19-50:1 (Wolf Testimony)].

61. Mr. Wolf also oversaw the drilling and testing/monitoring of two supply wells. [3-06-18 Tr. 48:10-11 (Wolf Testimony)]. Through this drilling effort, an accurate and detailed description of the geologic units was obtained, including the types of geologic formations encountered and their thicknesses. [3-06-18 Tr. 55:10-19 (Wolf Testimony)].

62. The Master Plan is located in an area of the Sandia Basin called the San Pedro Synclinorium. [3-06-18 Tr. 51:7-17 (Wolf Testimony)]. This is an area that has been folded such that the rock units are dipping inward toward each other like an oblong bowl that is tilted to the

south. [3-06-18 Tr. 81:1-21 (Wolf Testimony)]. In addition to the Synclinorium, there are two significant structural features, the Tijeras and San Antonito Faults, which bound the Synclinorium. [3-06-18 Tr. 79:13-23 (Wolf Testimony); AS Ex. 50, Geologic Map by Ferguson and others; AS Ex. 52, Geologic Map by Kelley and Northrop].

63. Mr. Wolf developed a Geologic Model that identified the geologic features as well as provided a description of the geologic formation relationships below the ground surface. [3-06-18 Tr. 87:25-88:15 (Wolf Testimony); AS Ex. 49, Block Model]. For the Sandia Basin each geologic formation, where saturated with water, is synonymous with an aquifer system, e.g., the San Andres and Glorieta Formations is also a reference to the San Andres Glorieta Aquifer. [3-06-18 Tr. 78:22-79:12; 52:18-53:2; 65:9-21 (Wolf Testimony)]. Some of the important geologic formations for the hydrologic analyses, from shallowest at ground surface to deepest, include the Chinle Group, the San Andres Glorieta Formation, and the Madera Limestone. [3-06-18 Tr. 52:4-17 (Wolf Testimony); AS Ex. 50].

64. Mr. Wolf also evaluated faults in the San Pedro Synclinorium that included the San Antonito, Tijeras Fault Zone, and other faults, such as en-echelon faults that occur between the prominent faults, the geometry of geologic formations and how they occur at the surface and in the subsurface, rock types, and thickness of the rock layers. [3-06-18 Tr. 51:7-22 (Wolf Testimony); AS Ex. 41, Geologic Cross-section A-A'].

65. The well drilling and testing were integral to the initial analyses and provided a significant amount of subsurface data for the two exploratory wells (ASE-1 (S-2618 POD-1) and ASE-2 (S-2618-POD-3), permitted and approved by the OSE. [3-06-18 Tr. 46:13-19; 47:11-15; 53:18-54:21 (Wolf Testimony); AS Ex. 27, Exploratory Wells and Monitoring Locations]. The exploratory well construction and testing was conducted to evaluate aquifer conditions and

productivity to determine the aquifer production capability of water and subsurface geologic characteristics in the vicinity of the Master Plan Project. [3-06-18 Tr. 48:12-14; 55:2-19 (Wolf Testimony)]. Wells ASE-1 and ASE-2 were constructed as production wells capable of supplying water for the project. [3-06-18 Tr. 53:18-54:21; 54:25-55:1 (Wolf Testimony)].

66. Lithologic samples were collected every 10 feet during the drilling of both supply wells and borehole geophysical testing was conducted to help refine the lithologic information collected at the 10-foot intervals. [3-06-18 Tr. 55:10-19; 57:9-19 (Wolf Testimony)]. This information was used to determine geologic formation contacts, where each geologic unit begins and ends below the ground surface; this analysis provides geologic formation thicknesses at depth. [3-06-18 Tr. 55:10-19; 56:16-24 (Wolf Testimony)]. Additional data collected from the drilling and testing of ASE-1 included discrete zonal testing used to identify the productive capacity of specific geologic units and zonal sampling to analyze the water chemistry. [3-06-18 Tr. 57:25-58:4 (Wolf Testimony); AS Ex. 25, ASE-1 Well Completion].

67. ASE-1 was drilled to depth 3,694 feet below ground surface (bgs) and targeted the Madera Limestone Formation. [3-06-18 Tr. 55:20-56:15; 57:20-24 (Wolf Testimony); AS Ex. 25]. This well encountered the entire stratigraphic rock column found below ground surface in the area of the Master Plan Project. [3-06-18 Tr. 56:16-57:8 (Wolf Testimony); AS Ex. 25]. The geologic data collected at ASE-1 was used in the development of the hydrogeologic cross-sections depicting the subsurface geology for the project area and for developing a geologic block model. [3-06-18 Tr. 48:23-50:1 (Wolf Testimony); AS Ex. 49].

68. The zonal testing and sampling process for ASE-1 isolated the potential yield and water quality of water bearing zones. [3-06-18 Tr. 57:25-58:15 (Wolf Testimony); AS Ex. 24, Summary of Groundwater Quality Data from ASE-1 Zone Tests; AS Ex. 51, AES-1 Zone Test

Sampling Results]. The results of the zonal testing found that the Madera Formation was not a productive zone. [3-06-18 Tr. 59:7-9 (Wolf Testimony)]. The most productive zone tested was the Glorieta Formation, which yielded an average flow rate of 109 gallons per minute (gpm), demonstrating that the Glorieta Formation would be a highly productive aquifer. [3-06-18 Tr. 58:16-59:12; 127:21-25 (Wolf Testimony); AS Ex. 23, Zone Test Summary ASE-1]. The San Andres Limestone Formation and the Glorieta Sandstone Formation are interbedded or interleaved, and act as a single hydro-stratigraphic unit or aquifer system. [3-06-18 Tr. 125:11-18 (Wolf Testimony)].

69. Aquifer Science and DBSA decided to complete ASE-1 in the Abo Formation to a depth of approximately 2,140 feet below ground surface to evaluate the aquifer characteristics. [3-06-18 Tr. 65:9-18; 64:5-25 (Wolf Testimony); AS Ex. 25]. Pump testing of the well showed that the Abo Formation can produce approximately 30 gallons per minute, indicating it is only moderately productive. [3-06-18 Tr. 64:21-25; 59:7-12 (Wolf Testimony); AS Ex. 26, Observed Drawdown and Recovery ASE-1 Constant Rate Aquifer Test].

70. Because the ASE-1 zonal testing revealed that the San Andres-Glorieta is the most productive zone, it became the target aquifer for the completion of ASE-2. [3-06-18 Tr. 66:20-67:3 (Wolf Testimony)]. ASE-2 was drilled to a depth of 710 feet below ground surface and is screened over the full thickness of the San Andres Glorieta Formations to ensure the productive capability of the well and also provide the required scientific information to understand the aquifer. [3-06-18 Tr. 67:4-68:11 (Wolf Testimony); AS Ex. 28, ASE-2 Well Completion Diagram].

71. Both a step-test and a constant rate test were performed on Well ASE-2 to determine well efficiency and aquifer properties. [3-06-18 Tr. 61:10-17 (Wolf Testimony)]. For

the step test, pumping rates began at 400 gallons per minute and were incrementally increased to 1,600 gallons per minute. [3-06-18 Tr. 69:8-21 (Wolf Testimony); AS Ex. 29, Observed Drawdown and Recovery ASE-2 Step Test]. The constant rate test was completed over a period of seven days at a pumping rate of 850 gallons per minute. [3-06-18 Tr. 70:2-20 (Wolf Testimony); AS Ex. 30, Observed Drawdown and Recovery ASE-2 Constant Rate Aquifer Test].

72. During the constant rate testing of ASE-2, the Wheatfield deep and shallow wells, the Ameriwest well, and well ASE-1 were monitored for changes in water levels. [3-06-18 Tr. 53:18-54:10; 72:22-73:8; 73:12-20; 74:5-13; 75:4-16 (Wolf Testimony); AS Ex. 27]. The Ameriwest well (S-1065 Expl-1) is approximately a half mile southwest of ASE-1 and is completed in the San Andres-Glorieta aquifer, as is the Wheatfield deep well (S-2073 POD-2) located about a mile south of ASE-1 and 2 on the Master Plan Property. [3-06-18 Tr. 53:18-54:5 (Wolf Testimony; AS Ex. 27]. These two monitor wells are completed in the same aquifer as is ASE-2. [3-06-18 Tr. 72:3-10; 73:12-16 (Wolf Testimony)]. The Wheatfield shallow well (S-2073) is proximal to the Wheatfield deep well and is completed in the Chinle Group overlying the San Andres-Glorieta aquifer. [3-06-18 Tr. 75:2-8 (Wolf Testimony)]. The Ameriwest and Wheatfield Deep wells showed an immediate decline from pumping and failed to recover to pre-test levels within thirty-five days. Ex. AS 120. Well ASE-1 is completed in the Abo Formation aquifer that is deeper than the San Andres-Glorieta aquifer. [3-06-18 Tr. 74:5-75:1 (Wolf Testimony)]. The San Pedro Spring was also monitored during the aquifer test. [3-06-18 Tr. 77:3-6 (Wolf Testimony)].

73. Aquifer tests conducted for test well ASE-2 in the San Andres/Glorietta ("SAG") aquifer concluded San Pedro Spring had a reduction in flow of 14 gallons per minute by the end

of the test, while the model simulated only a 3-4 gallon per minute decline. Neil Blanford, March 7, 208 TR 123:2-8.

74. Proposed wells ASE-3 and ASE-4 are located a mile to a mile and a half south of ASE-1 and ASE-2. Eric Keyes, March 15, 2018 TR 64:9-20. These wells were not test pumped, and Applicant cannot be sure what the impact of pumping at these well locations might be. Id. at 64:24-65:9.

75. Water chemistry data that was analyzed after it was collected from the aquifer testing of wells ASE-1 and ASE-2, and the zonal sampling during the drilling of ASE-1 demonstrate that geologic units such as the San Andres-Glorieta, Yeso, Abo, and Madera Formations act as discrete groundwater flow units with limited connectivity. [3-06-18 Tr. 59:25-61:9 (Wolf Testimony); AS Ex. 23; AS Ex. 24; AS Ex. 51].

76. Mr. Wolf developed hydrogeologic cross-sections as the foundation for the three-dimensional block model. [3-06-18 Tr. 83:12-23; 87:23-88:9 (Wolf Testimony); AS Ex. 49]. These cross-sections reflect the subsurface geology within the San Pedro Synclinorium and adjacent areas based on existing and newly collected data; including the surface geophysical survey conducted for the Master Plan area, lithologic and geophysical logs for well ASE-1, geologic logs for other wells such as the Ameriwest well and the Wheatfield wells, and field observations of surficial geology. [3-06-18 Tr. 83:24-84:8; 86:12-21; 86:22-87:17 (Wolf Testimony)].

77. Five hydro-geologic cross-sections were constructed for this project. [3-06-18 Tr. 87:18-20 (Wolf Testimony) AS Ex. 40, Geologic Cross-Section Locations]. These cross-sections were developed to illustrate the significant features within the San Pedro Synclinorium, including the Tijeras and San Antonito Faults. [3-06-18 Tr. 87:25-88:9 (Wolf Testimony)].

These geologic structures affect the occurrence and movement of groundwater within the geologic formations. [3-06-18 Tr. 83:10-15 (Wolf Testimony)].

78. The San Pedro Synclinorium consists of a broad syncline and anticline, or folding of the rocks (i.e., the rocks are not lying in nice horizontal bands). [3-06-18 Tr. 89:17-90:12 (Wolf Testimony); AS Ex. 41]. The folds are disrupted by faults; specifically, the Tijeras Fault, which is actually a fault zone consisting of multiple faults and rotated blocks of rocks caught up within the faults. [3-06-18 Tr. 89:1-90:12 (Wolf Testimony)]. The San Antonito Fault, which naturally bounds the project area breaks up but does not fully offset geologic formations at the cross-section location. [3-06-18 Tr. 91:22-92:2 (Wolf Testimony); AS Ex. 41]. One of the important structural features in the Tijeras Fault zone is the juxtaposition of rock formations on different sides of the fault. [3-06-18 Tr. 89:17-23; 90:25-91:8 (Wolf Testimony)]. For example, the San Andres Glorieta Formations are truncated at the fault zone and occur adjacent to the Madera Formation across the fault. [3-06-18 Tr. 89:17-23; 90:25-91:8 (Wolf Testimony)]. The San Andres Glorieta Formations are cut off (fully offset) by this fault, thereby bounding the aquifer. [AS Ex. 41].

79. The faults that are oblique to the Tijeras and San Antonito faults cut across the San Pedro Synclinorium and are referred to as en-echelon faults for this project. [3-06-18 Tr. 94:15-95:16[1]; 97:1-99:11 (Wolf Testimony); AS Ex. 43, Geologic Cross Section C-C']. There are en-echelon faults identified by Kelley and Northrop (1975) and Ferguson and Others (1999) which occur on the east side of the San Antonito Fault and extend across the Synclinorium. [3-06-18 Tr. 110:6-19 (Wolf Testimony); AS Ex. 44, Bedrock Geology Map].

[1] The transcript on 3-06-18 page 95, line 6 identifies "international line faults" which should read "en-echelon line faults."

80. Additional data south of Campbell Ranch became available in December 2015 when Bernalillo County drilled new monitor wells under Permit S-2775. [3-06-18 Tr. 100:6-9 (Wolf Testimony)]. This included new elevation data for the San Andres Glorieta Formations. [3-06-18 Tr. 100:24-101:16 (Wolf Testimony); AS Ex. 45, Hydrogeology at Bernalillo County Monitor Wells (S-2775)]. The water levels from the ASE-2, Wheatfield Deep, and Ameriwest wells are consistent across the project area, as compared to the County well completed in the San Andres Glorieta formations where the water level is about 300 feet higher than that of the other wells. [3-06-18 Tr. 104:2-105:5 (Wolf Testimony); AS Ex. 46, Hydrogeologic Cross Section].

Bernalillo County and USGS Groundwater Monitoring

81. Bernalillo County developed a well monitoring program in approximately 2010. Sara Chudnoff, March 9, 2018 TR 7:6-7.

82. During the course of monitoring wells, Bernalillo County observed the water column reported depth is often different between well drilling logs and actual measurements taken in the Bernalillo County monitoring program. *See, e.g.*, Sara Chudnoff, March 9, 2018 28:20-34:10 (Wildflower 2 well example showing over 70 foot difference).

83. The OSE and USGS groundwater monitoring program takes measurements every five years. Sara Chudnoff, March 9, 2018 TR 6:20-7:2. Bernalillo County's groundwater monitoring program takes measurements every quarter. *Id.* at 8:8-11.

84. Bernalillo County well monitoring program data provided to Aquifer Science shows a general decline in the water column in 75% of the wells located in the model domain, with the majority of wells declining over one foot per year. Sara Chudnoff, March 9, 2018 TR 55:17-21.

85. Bernalillo County well monitoring data was provided to Aquifer Science through approximately December 2015. Sara Chudnoff, March 9, 2018 TR 49:11-15.

86. Since providing monitoring program data to Aquifer Science, there has continued to be a decline in water levels shown in the Bernalillo County monitoring program wells located within the model domain with an average drop of 1.78 feet per year. Phillip Rust, March 9, 2018 TR 124: 3-6, 125:2-11.

87. Protestants' expert witness, Reid Bandeen concluded the average water level change for nine United States Geological Survey (USGS) monitoring wells in the Sandia Basin since the 2011 Aquifer Science report was released was a decline of 2.06 feet per year. Reid Bandeen, March 13, 2018 TR 91:20-25; Ex. NMELC 35.

88. The OSE acknowledged drawdown rates in the Estancia Basin were near 1.5 feet per year. Eric Keyes, March 15, 2018, TR 94:7-10.

89. Further, the OSE acknowledges some wells next to each other have different drawdowns and declines in the Sandia Basin. Eric Keyes, March 15, 2018, TR 95:1-4.

90. The geologic formations at the Bernalillo County well are substantially off-set compared to the other three wells. Coupled with the water level elevation differences, this indicates a fault between the County well and the other wells, which Aquifer Science experts termed an en-echelon fault. [3-06-18 Tr. 104:25-106:14 (Wolf Testimony); AS Ex. 46].

91. The en-echelon fault is consistent with the numerous faults pervasive throughout the area south of Campbell Ranch's southern boundary, as shown on the cross-section C-C', which is consistent with the fault patterns shown in existing literature (Kelley and Northrop, 1975, and Ferguson and Others, 1999) and the results of the electromagnetic geophysical study. [3-06-18 Tr. 98:22-23 (Wolf Testimony); AS Ex. 43; AS Ex. 50; AS Ex. 52]. Based on the

Bernalillo County well data, these faults limit groundwater flow. [3-06-18 Tr. 104:14-106:23 (Wolf Testimony)].

92. The cross-sections were used to create a geologic block model and then were incorporated into Leapfrog software to develop a fully three-dimensional view of the geology of the Synclinorium. [3-06-18 Tr. 49:13-50:17 (Wolf Testimony)]. The geologic model, as illustrated by the cross-sections and block model, represent a predictable stratigraphic sequence within the Sandia Basin area. [3-06-18 Tr. 116:11-117:13; 117:9-119:4 (Wolf Testimony)]. The Leapfrog model is based on the hydrogeologic cross-sections where they include the area in between the San Antonito Fault and the Tijeras Fault Zones. [3-06-18 Tr. 114:9-18 (Wolf Testimony)]. The bedrock geology map is not a component of the three-dimensional geologic model. [3-06-18 Tr. 110:20-22 (Wolf Testimony)].

93. Mr. Norman Carlson is a professional geophysicist and is the Chief Geophysicist at Zonge International, Inc. [3-06-18 Tr. 186:21-187:5 (Carlson Testimony)].

94. The Court qualified Mr. Carlson as an expert in the field of geophysics, specializing in electromagnetic geophysical methods and studies without objection. [3-06-18 Tr. 192:13-25 (Carlson Testimony)].

95. Aquifer Science engaged Zonge to conduct an electromagnetic geophysical study to identify and characterize lithology and subsurface structures. This geophysical study provided data for identifying well locations on the Campbell Ranch property. [3-06-18 Tr. 188:20-189:11 (Carlson Testimony)].

96. Mr. Carlson began his geophysical electromagnetic survey by examining the geology using the Geology of Sandia Park Quadrangle by Ferguson to identify and familiarize himself with the surface geology. [3-06-18 Tr. 193:2-6 (Carlson Testimony)]. The surface

geology map reveals that much of the Master Plan area is covered by younger quaternary units which obscure geologic structures in the area. [3-06-18 Tr. 193:7-194:1 (Carlson Testimony)]. However, the geologic map also reveals multiple faults and the syncline and anticline (folding) features. [3-06-18 Tr. 194:7-25 (Carlson Testimony)]. A geophysical survey can extend to fairly substantial depths to look under the covering of soils to identify the lithology or geologic features that occur at depth in the subsurface. [3-06-18 Tr. 189:4-7; 194:2-6; 196:21-197:2 (Carlson Testimony)].

97. To conduct the geophysical investigation, Zonge used a diagnostic geophysical survey tool developed in the mid to late 1970s at the University of Toronto called a Controlled Source Audio-Frequency Magnetotellurics (CSAMT). [3-06-18 Tr. 197:3-11 (Carlson Testimony)]. Because different geologic formations exhibit different electrical resistivities which a geophysicist can correspond to known formations and structures, subsurface geologic formations and structures can be identified from these electric and magnetic field measurements. [3-06-18 Tr. 198:9-199:5 (Carlson Testimony)]. The measurements of the electric and magnetic fields over a range of frequencies identify structural changes in the subsurface using computer modeling to produce a cross-section of resistivity at different depths. [3-06-18 Tr. 199:19-25; 204:18-205:9 (Carlson Testimony)].

98. Use of CSAMT as a Diagnostic Tool. The CSAMT survey has been used by multiple governmental agencies and facilities, including Sandia National Laboratory and US Geological Survey. [3-06-18 Tr. 200:1-22 (Carlson Testimony)]. In addition, the CSAMT method has been presented in publications and peer-reviewed and accepted by various geophysical societies and associations. [3-06-18 Tr. 200:23-201:5 (Carlson Testimony)].

99. For the surface geological survey on the Campbell Ranch property, six transects or lines (where the dipoles were located and the field measurements are made) were located across the Master Plan Project area. [3-06-18 Tr. 202:13-203:13 (Carlson Testimony); AS Ex. 148, Geophysical Survey Map/Results]. Four of the transects were run in a northwest-southeast direction across the synclinorium area, starting with and including the north to south Line A, Line G, Line H, and Line E. [*Id*.]. Two transects were run perpendicular to the east-west transects in a southwest-northeast direction along the axis and parallel to the synclinorium and include Line F and I. [*Id*.]. These transects include or are very near to the existing Wheatfield and Ameriwest wells where lithologic data is available at depth in order to corroborate the results of the geophysical survey and to help inform the modeling and interpretation of the survey. [3-06-18 Tr. 203:3-13 (Carlson Testimony)].

100. The results of this study demonstrate that the data were clean enough to be valid because they were repeatable. [3-06-18 Tr. 203:20-204:17 (Carlson Testimony)]. The CSAMT electromagnetic survey that was conducted on the Master Plan Project provides realistic results, given the area. [3-06-18 Tr. 205:24-206:7 (Carlson Testimony)]. Using the computer model, the resistivity data that were measured at certain frequencies was converted to resistivity at certain depths. [3-06-18 Tr. 204:18-205:9 (Carlson Testimony)].

101. The results of CSAMT Line F show several geologic features that are confirmed by well data, including the stratigraphic layering and dipping of the geologic units to the south that is confirmed by the lithologic data collected from both the Wheatfield and Ameriwest wells, but also revealed a much more complicated reality than the simple interpretation using only the well data. [3-06-18 Tr. 206:8-208:11 (Carlson Testimony); AS Ex. 151, Map/Cross Section of Line F]. The geophysical survey results were also imposed on the geologic cross-section

constructed by DBSA geologic consultants which identifies and takes into account these structural features identified by the survey. [3-06-18 Tr. 208:12-209:7 (Carlson Testimony); AS Ex. 152, Map/Cross Section of Line F]. The Cross-section and the survey illustrate the layering of the geologic units, the extensive faulting of the area (these would be faults that extend across the synclinorium) consistent with what Ferguson shows on his surficial geologic map, and the general dip to the south of the beds in the synclinorium. [3-06-18 Tr. 209:8-210:6 (Carlson Testimony); AS Ex. 152].

102. CSAMT Survey Lines G, H, and E. CSAMT Lines G, H, and E are roughly southeast-northwest transects across the axis of the synclinorium and extend from the Tijeras Fault zone west across the Campbell Ranch property. [3-06-18 Tr. 210:7-18 (Carlson Testimony); AS Ex. 153, CSAMT Line Cross Sections E, H and G]. The survey accurately identified the Tijeras Fault zone. [3-06-18 Tr. 210:19-211:6 (Carlson Testimony); AS Ex. 153]. The Tijeras Fault zone is clearly identifiable on the right-hand side of the survey Lines G, and H by the purple shading and high resistivity values. [*Id*.]. Another fault zone is identified as the linear feature similar to the Tijeras Fault Zone occurring on the left-hand side of the survey Lines A, G, H, and E. [3-06-18 Tr. 211:7-212:14 (Carlson Testimony); AS Ex. 153]. This fault zone has been termed the "geophysical fault" and occurs approximately parallel and near the center-line, or axis of the synclinorium. [*Id*.]. The geophysical fault zone is represented by variable resistivity values that change from adjacent resistivity values. [*Id*.]. In survey Line G there are similar linear features on each end that represent faulting. [AS Ex. 153]. Because of these changes in resistivity values, and because these occur near the axis of the synclinorium, the only realistic interpretation when all of the data is considered is a fault. [3-06-18 Tr. 212:2-5 (Carlson Testimony); 3-07-18 Tr. 51:13-23 (Carlson Testimony)].

103. The CSAMT electromagnetic survey is a well-accepted method to study subsurface geology and structure where it is hidden by alluvial cover. [3-06-18 Tr. 213:20-214:5 (Carlson Testimony)]. The survey results identified structural features known from existing well data and surface maps, and the survey data was repeatable, resulting in a reliable data set. [3-06-18 Tr. 214:6-8 (Carlson Testimony)]. The survey also identified numerous faults crossing the study area; in particular, the survey identified the "geophysics fault" as depicted in Mr. Wolf's cross-sections. [3-06-18 Tr. 213:20-214:15 (Carlson Testimony)].

<u>Hydrologic Analyses</u>

104. Aquifer Science witness Neil Blandford is the lead scientist engaged by Aquifer Science, LLC for the *de novo* appeal of Application S-2618. He is responsible for evaluating the availability of water for appropriation and developing and applying a groundwater flow model to evaluate the effects of the Application pumping on Existing wells and surface water sources. [3-07-18 Tr. 53:6-10 (Blandford Testimony)].

105. Mr. Blandford is an expert in the areas of hydrology, geology and groundwater modeling. [3-07-18 Tr. 55:2-16 (Blandford Testimony)].

106. Mr. Umstot is an expert in the areas of hydrogeology, recharge and modeling analyses. [3-08-18 Tr. 114:19-115:9 (Umstot Testimony)].

107. Aquifer Science witness Todd Umstot prepared a recharge study and model that quantifies the amount of recharge that is available to supply wells and springs in the East Mountain area where Aquifer Science Proposed to appropriate water under Application S-2618. [3-08-18 Tr. 114:5-18 (Umstot Testimony)].

108. Aquifer Science witness Dennis Cooper prepared the estimated average annual per capita water use for each domestic well in the DBSA groundwater flow model area. He also

provided an overview of the requirements of the NMOSE's Morrison Guidelines, which are used by the Engineer to evaluate groundwater impacts of proposed new appropriations in the Sandia Basin (including Application S-2618), and discussed the Engineer's evaluation of the Application's impacts on surface water rights and sources. Finally, Mr. Cooper reviewed and analyzed the proposed water uses in the Application in relation to conservation and public welfare matters. [3-08-18 Tr. 14:21-15:24 (Cooper Testimony)].

109. Mr. Cooper is an expert in New Mexico State Engineer water rights administration and procedures. [3-08-18 Tr. 20:7-11 (Cooper Testimony)].

Historic Condition of San-Andres Glorieta Aquifer

110. Aquifer Science proposes to appropriate 350 af/y of groundwater from the San Andres-Glorieta aquifer. [3-07-18 Tr. 74:20-75:6 (Blandford Testimony); 3-15-18 Tr. 24:8-11 (Keyes Testimony); AS Ex. 9].

111. Water levels in the San Andres-Glorieta aquifer within the San Pedro Synclinorium have remained unchanged through time despite the fact that groundwater pumping adjacent to Campbell Ranch has increased through time to the current amount of nearly 500 af/y [3-07-18 Tr. 75:2-6 (Blandford Testimony)].

Availability of Water

112. The well ASE-2 aquifer step-testing indicates that the well can pump at a rate of at least 1,600 gallons per minute, which is equivalent to 2,500 af/y. [3-06-18 Tr. 69:18-21 (Wolf Testimony)]. The well ASE-2 constant rate aquifer test was conducted at a pumping rate of 850 gallons per minute, which is equivalent to about 1,600 af/y., nearly four times the requested appropriation of 350 af/y. [3-07-18 Tr. 58:9-14 (Blandford Testimony); 3-06-18 Tr. 70:2-20 (Wolf Testimony)].

Determination of Aquifer Hydraulic Properties and Boundary Conditions Using Aquifer Test Data

Overview of Aquifer Test Results

113. Aquifer testing of wells ASE-1 and ASE-2 was used to determine aquifer hydraulic properties (hydraulic conductivity and storage coefficient) and the presence of physical barriers and boundary conditions within the San Pedro Synclinorium. [3-07-18 Tr. 58:18-59:4 (Blandford Testimony)].

114. The aquifer testing for well ASE-2 found that the San Andres-Glorieta aquifer is productive. The maximum observed drawdown during the constant rate pumping test at the Ameriwest and Wheatfield deep monitor wells was about 1.6 and 1.4 feet, respectively. The observed decline in water levels in the Ameriwest and Wheatfield deep monitor wells (*i.e.*, wells monitoring the San Andres-Glorieta aquifer) was similar, even though the Wheatfield deep well is about 2.4 times as far from ASE-2 as is the Ameriwest well. [3-07-18 Tr. 62:14-22 (Blandford Testimony); 3-06-18 Tr. 72:22-73:8; 73:12-20; 73:25-74:4 (Wolf Testimony); AS Ex. 34, Ameriwest Well Levels; AS Ex. 35, Wheatfield Deepwell Water Levels; AS Ex. 93, Theis Drawdown Analysis for the Ameriwest Observation Well; AS Ex. 94, Theis Drawdown Analysis for the Wheatfield Deep Observation Well].

115. Both observation wells, however, failed to recover to pre-test levels within thirty-five days.

116. The San Andres-Glorieta aquifer is bounded and does not extend uninterrupted in all directions. [3-07-18 Tr. 62:23-63:10 (Blandford Testimony); 3-08-18 Tr. 6:24-8:22 (Blandford Testimony); AS Ex. 89, Site Overview and Well Locations; AS Ex. 93; AS Ex. 94].

117. No drawdown attributable to the test was observed in the Wheatfield shallow well, which monitors the Chinle Group aquifer, indicating there is limited connection between the San Andres-Glorieta aquifer and the overlying Chinle Group aquifer. This observation is also consistent with long-term water level trends at the Wheatfield well pair. [3-07-18 Tr. 70:17-71:10 (Blandford Testimony); 3-06-18 Tr. 75:9-13 (Wolf Testimony); AS Ex. 36, Wheatfield Shallow Well Water Levels; AS Ex. 90, Depth to Water Wheatfield Well (Shallow); AS Ex. 91].

118. There was no decline in water level in the Abo Formation well ASE-1 during the ASE-2 aquifer test, indicating limited hydraulic connection between the San Andres-Glorieta aquifer and the underlying Abo Formation aquifer. [3-07-18 Tr. 70:17-71:10; 72:10-19 (Blandford Testimony); 3-06-18 Tr. 74:5-75:1 (Wolf Testimony); AS Ex. 32, Well ASE-1 Water Levels].

119. San Pedro Spring flow declined by about 14 gpm over the course of the ASE-2 constant rate aquifer test. This result indicates that well ASE-2 is in good hydraulic connection with the spring, and well ASE-2 pumping will affect spring flow. [3-07-18 Tr. 70:1-16 (Blandford Testimony); 3-06-18 Tr. 77:19-78:7 (Wolf Testimony); AS Ex. 39, Observed Spring Discharge; AS Ex. 92, Flow at San Pedro Spring Gaging Station, October 1, 2010 through January 3, 2011].

Use of Theis Solution to Interpret Aquifer Test Data

120. The Theis solution (used in numerical groundwater models) was used to evaluate San Andres-Glorieta aquifer properties in the vicinity of the ASE-2, Ameriwest, and Wheatfield deep wells.

121. In analyzing the ASE-2 aquifer test results using the Theis solution, it was determined that two no-flow boundaries had to be present because the observed plotted

drawdown matches the two-boundary plotted curve from the Theis solution. [3-07-18 Tr. 62:23-64:12 (Blandford Testimony); AS Ex. 93; AS Ex. 94].

<u>Development of Groundwater Flow Model to Predict Effects of Application S-2618 on Existing Water Rights and Wells</u>

122. Numerical modeling is required to predict drawdown in the multiple aquifers that exist in the area of the Application. [3-07-18 Tr. 75:22-77:6 (Blandford Testimony)].

123. DBSA developed a groundwater flow model to determine the impacts of the S-2618 appropriation on existing ground and surface water users. [3-07-18 Tr. 76:25-77:9 (Blandford Testimony)].

124. The standard practice for developing a groundwater flow model is as follows: (a) the purpose of the model is defined; (b) a conceptual model of groundwater flow is developed. The conceptual model includes the determination of the distribution of geologic units and their hydraulic properties, sources, and depletions (losses) of water; (c) the conceptual model is implemented into a numerical model. This step includes specification of a model grid and the assignment of key features of the aquifer system to the model grid; (d) the numerical model is calibrated to the observed data and hydrologic conditions, also called history matching. Calibration is an iterative process where model inputs, such as hydraulic conductivity, are adjusted to obtain a reasonable correspondence between simulated and observed conditions, such as water levels through time; (e) a model sensitivity analysis is conducted, which is a process where model inputs are adjusted and the effects on model outputs are documented; (f) the calibrated model is applied for its intended purpose; in this case predictive simulations were made to assess the effects of S-2618 pumping on groundwater and surface water sources; and (g) the modeling effort and simulation results are documented. [3-07-18, Tr. 77:12-79:5 (Blandford

Testimony); AS Ex. 99, Reilly, T.E., and Harbaugh, A.W., 2004, *Guidelines for Evaluating Groundwater Flow Models*: U.S. Geological Survey Scientific Investigations Report 2004-5038, p.17].

125. The DBSA model uses the computer code MODFLOW-SURFACT. The MODFLOW-SURFACT code, and related versions of the MODFLOW computer code developed by the U. S. Geological Survey, has been extensively applied world-wide by groundwater hydrologists. [3-07-18 Tr. 79:6-14 (Blandford Testimony)].

126. The groundwater flow model was developed, documented and applied by DBSA through application of standard professional practice. [3-07-18 Tr. 77:12-24 (Blandford Testimony); AS Ex. 99].

Features of the Groundwater Flow Model

127. The DBSA model domain encompasses an area of about 72 square miles which includes the Campbell Ranch Project and adjacent areas. [3-07-18 Tr. 81:15-18 (Blandford Testimony); 3-15-18 Tr. 28:3-8 (Keyes Testimony); AS Ex. 111, Groundwater Model Boundaries].

128. The model domain is subdivided into a three-dimensional grid to obtain a mathematical solution, to distribute the hydraulic properties according to geologic formation, and to add other features at their appropriate location and depth such as pumping wells. [3-07-18 Tr. 79:15-80:5; 81:19-82:4 (Blandford Testimony)].

129. The area of the model is divided into model cells that are 300 feet by 300 feet, and in the vertical dimension the grid is comprised of 56 horizontal layers ranging in thickness from 100 to 300 feet. [3-07-18 Tr. 80:25-81:18 (Blandford Testimony)].

Overview of Inputs to the Groundwater Flow Model

130. The geology input to the model represents the geologic structures that include the locations of aquifers and faults in the model domain. The geology input determines the distribution of hydraulic properties in the model domain. [3-07-18 Tr. 82:5-12; 97:13-20 (Blandford Testimony)].

131. The geologic inputs in the model account for conditions such as dipping (non-level) geologic formations and offset of geologic units at significant fault zones. The result is a three-dimensional geologic configuration that incorporates information from the geologic maps and cross-sections [3-07-18 Tr. 85:3-11 (Blandford Testimony)].

Compilation of Wells and Water Rights/Domestic Wells Water Use Inputs

132. Current and historical water uses are required inputs to the model. Water use is divided into (a) permitted water right uses; and (b) domestic well pumping. [3-07-18 Tr. 85:12-25; 88:3-11 (Blandford Testimony)].

133. Wells of other ownership are completed in the Chinle Group aquifer south of the Application area, the Yeso, Abo or Madera Formations north of the Application area and in multiple geologic formations across the Tijeras and San Antonito faults that bound the San Pedro Synclinorium. There are no domestic wells or permitted water right wells in the portion of the San Andres-Glorieta aquifer where well ASE-2 will pump water. [3-07-18 Tr. 90:1-12 (Blandford Testimony); AS Ex. 107, Cross Section with Aquifer Units and Approximate Location of Domestic Wells].

134. Using the OSE New Mexico Water Rights Reporting System (NMWRRS) database, DBSA identified 12 existing permitted groundwater rights in the Sandia Basin in the vicinity of the Campbell Ranch Project area. Historical meter readings were also obtained from

the database for the wells that had reported values. [3-07-18 Tr. 85:12-86:24 (Blandford Testimony); AS Ex. 108, Existing Water Rights].

135. The amount of domestic well pumping input is based on DBSA's estimate of households served by domestic wells in the model domain area of the Sandia Basin. Aerial photographs for the years 2006 and 2009 were used to identify households that could have a domestic well. [3-07-18 Tr. 86:25-88:8 (Blandford Testimony); AS Ex. 109, Domestic Water Use in the Model Domain].

136. The model was assigned a water use of 0.25 af/y for each house served by a domestic well. The estimate of water use from a domestic well is consistent with the State Engineer Publication *Water Use by Categories 2010*, Technical Report 54 (Report 54) and its estimates of the per capita use for the "rural, self-supplied" homes (i.e. for Bernalillo County of 100 GPCD, and for Santa Fe, Sandoval, and Torrance Counties of 80 GPCD. These counties were used because the existing homes are located where the three counties meet. 2010 U.S. Census data for these counties that show the average household size is 2.55 persons per household. Using Report 54 and Census data, his calculation of per capita domestic water use for 100 GPCD is 0.286 af/y, and for 80 GPCD is 0.228 af/y. The average of the three counties' annual use rate is 0.25 af/y, which was used to quantify the existing water use for each home. The total existing domestic water use is quantified by multiplying the total number of households by 0.25 acre-feet per year for a total of about 390 af/y from domestic wells. [3-08-18 Tr. 53:1-54:5 (Cooper Testimony); 3-08-18 Tr. 86:25-87:9; 88:3-11; 89:13-25 (Blandford Testimony); AS Ex. 81, *New Mexico Water Use by Categories 2010*; NMOSE Technical Report 54 pp. 69, 88, 92, 97; AS Ex. 86, U.S. Census Bureau, DP-1 Profile of General Population and Housing

Characteristics: 2010 Demographic Profile Data, pp. 1-6 and 4-6; AS Ex. 110, Total Domestic Well Pumping Used in the Groundwater Model].

137. The amount of pumping from domestic wells through time was estimated using well completion dates in the NMWRRS database. The number of wells in the OSE database was scaled by the total number of households in the model area through 2015. Pumping from domestic wells in the model has increased through time to slightly less than 400 af/y in 2015. [3-07-18 Tr. 89:3-25 (Blandford Testimony); AS Ex. 110].

Groundwater Recharge Inputs

138. Groundwater recharge is an input to the top of the groundwater flow model. [3-08-18 Tr. 116:1-9 (Umstot Testimony); 3-07-18 Tr. 96:6-9 (Blandford Testimony)].

139. For Application S-2618, Applicant prepared a recharge study and model to determine the quantity of water that travels vertically and enters the groundwater flow model domain at the land surface. Groundwater recharge is a source of water supply to wells and springs in the area of the Application. Applicant also evaluated the direct recharge in the areas adjacent to the groundwater model to estimate the maximum potential quantities of water available to flow through the subsurface and into the sides of the groundwater flow model. This quantity of water is termed subsurface recharge and is ultimately determined by the groundwater flow model. [3-08-18 Tr. 114:5-18 (Umstot Testimony)].

Recharge Simulation Approach

140. Applicant used the watershed model method to estimate groundwater recharge. Watershed models provide comprehensive and detailed estimates of recharge over a region by considering all primary factors that can affect recharge, including climate, topography, soil,

vegetation, and bedrock parameters. The watershed model method estimates when and where recharge occurs. (3-8-18 Tr. 119:6-120:6 (Umstot Testimony)].

141. The watershed model selected for evaluating the amount of recharge in the area of Application S-2618 is the Distributed Parameter Watershed Model (DPWM). Applicant developed the DPWM from the Sandia National Laboratory (SNL) watershed model by creating a generalized version of the SNL model to accept physical characteristics and inputs, such as soil types, climatic factors (e.g. precipitation, temperature), and plant types, for any given watershed. [3-08-18 Tr. 119:6-121:8 (Umstot Testimony)].

DPWM Model Domain and Timeframe for Recharge Analysis

142. The DPWM domain extends over 350 square miles and encompasses the groundwater model domain. The DPWM domain is divided into a uniform grid of cells that represent a portion of the land surface 300 feet by 300 feet in size. The DPWM calculates the vertical infiltration of water through the soils; the DPWM and groundwater models are directly connected only where the DPWM and groundwater model domains overlie each other to include any potential areas that may contribute surface water flow as run-on within the groundwater flow model domain. The DPWM domain extends beyond the DBSA groundwater model domain to include areas that may contribute surface water flow (run-on) to the groundwater model domain. [3-08-18 Tr. 124:18-125:14 (Umstot Testimony); AS Ex. 56, Map of DPWM Model Domain with Physiography of the East Mountains].

143. The DPWM simulation period is from October 1970 through September 2015, which is water years 1971 through 2015. The time frame was selected to start in the 1970s when there was minimal pumping of groundwater from domestic wells in the East Mountains and ended on the last complete water year before the DPWM modeling analysis in the Spring of

2016. The period simulated includes both wet and drought periods. [3-08-18 Tr. 127:4-16 (Umstot Testimony)].

Overview of Data Input to DPWM

144. The DPWM calculates the water balance by assimilating data on weather, soils, bedrock, vegetation, and topography. The input parameter data are distributed over the model domain so that each grid cell has the input data mapped at the cell location. Weather data include precipitation, air temperature and wind speed. Soils data include soil hydraulic conductivity, water retention characteristics and depth. Bedrock data include the hydraulic conductivity of the bedrock. Vegetation data include root zone depth, plant height, and vegetation density. Topography data include the elevation, slope and orientation of the land surface. [3-08-18 Tr. 130:5-132:25 (Umstot Testimony); AS Ex. 56; AS Ex. 62, Time Series of Total Annual Precipitation Within DPWM Model Domain; AS Ex. 63, Map of Mean Annual Precipitation Simulated by DPWM].

145. The mean annual total precipitation for the DPWM domain is about 316,000 af/y. After subtracting evapotranspiration (231,000 af/y), sublimation (67,000 af/y), and runoff out of the DPWM domain (6,000 af/y) the remaining water that is recharge is 12,000 af/y. About 4 percent of the precipitation that falls on the DPWM domain becomes groundwater recharge. [3-08-18 Tr. 149:2-151:21 (Umstot Testimony); AS Ex. 72, Table of DPWM Total Annual Water Balance Results; AS Ex. 73, Map of Mean Annual Recharge; AS Ex. 74, Time Series Plot of Total Annual Recharge in the MODFLOW Model Domain; AS Ex. 60, *Groundwater Quality and Susceptibility of Groundwater to Effects from Domestic Wastewater Disposal in Eastern Bernalillo County, Central New Mexico, 1990-91*, by Blanchard and Kues, dated 1999 (portions)].

146. The mean annual total of precipitation for the groundwater flow model domain is about 60,800 af/y. After subtracting evapotranspiration (45,800 af/y), sublimation (12,700 af/y), and runoff out of the groundwater model domain (800 af/y) the remaining water that is recharge is 1,500 af/y. The percentage of precipitation that becomes recharge in the groundwater model domain is about 2 percent. The recharge from DPWM was provided as input to the groundwater model. Decadal averages for recharge were used for the 1960s, 1970s and 1980s in the groundwater model; and annual values were used for 1991 through 2015 when more detailed groundwater level data were available. Assignment of recharge on an annual basis to the groundwater flow model is appropriate since the time lags between precipitation events and water reaching the aquifers is less than six months as documented for the East Mountain area by the USGS. [3-08-18 Tr. 152:17-156:14 (Umstot Testimony); AS Ex. 57; AS Ex. 60; AS Ex. 73; AS Ex. 74].

147. Recharge in DPWM Areas Adjacent to the DBSA Groundwater Model Domain. Recharge in the DPWM areas adjacent to the groundwater flow model domain may contribute horizontal groundwater flow into the sides of the groundwater model domain in what is termed subsurface recharge. The DPWM does not calculate horizontal subsurface recharge, but DPWM can estimate the maximum recharge potentially available on the sides of the groundwater flow model. The quantity of subsurface recharge is ultimately calculated by the groundwater model with the limitation that the subsurface recharge cannot exceed the potential calculated by DPWM. [3-08-18 Tr. 156:18-158:15 (Umstot Testimony); AS Ex. 73]

148. The DPWM results for areas adjacent to the DBSA groundwater flow model are:

A. In the areas to the east of the groundwater model domain, recharge is present in DPWM, but the subsurface recharge is negligible due to the inhibition of groundwater flow by the Tijeras and Gutierrez faults. [3-08-18 Tr. 157:18-158:5 (Umstot Testimony); AS Ex. 73].

B. In the area to the northeast of the groundwater model domain, the recharge is negligible and therefore there is minimal potential for subsurface recharge. [3-08-18 Tr. 157:18-158:5 (Umstot Testimony); AS Ex. 73].

C. In the area to the northwest, there is a potential for groundwater inflow, but the USGS (Bartolino, *et al*. 2010) found that the groundwater flow direction in this area is generally northward and away from the groundwater model domain. [3-08-18 Tr. 156:21-157:7 (Umstot Testimony); AS Ex.73].

D. In the area to the south of the groundwater model domain, there is a small potential for groundwater inflow, but the USGS (Bartolino et al 2010) found that the direction of groundwater flow in this area is southward and away from the groundwater model domain. [3-08-18 Tr. 158:5-8 (Umstot Testimony); AS Ex. 73].

E. In the area west and upslope of the groundwater model domain, between the crest of the Sandia Mountains and the western boundary of the groundwater model, there is of recharge. The DPWM estimates the maximum potential subsurface recharge to be 2,800 af/y. Because the USGS found that flow from this recharge area to the east towards the groundwater model domain is inhibited by the presence of north-south trending faults and much of the recharge is discharged to springs and vegetation, only a fraction of the potential subsurface recharge is available to the groundwater model domain. [3-08-18 Tr. 158:9-161:1 (Umstot Testimony); AS Ex. 75, Map of Mean Annual Recharge with Potential Contributing Area on the West Area Outlined].

<u>Groundwater Flow Model Calibration and History Matching Process</u>

149. The groundwater model was calibrated to the following observed data sets:

A. A set of 148 measured water levels for various times provided in Bartolino et al. (2010). [3-07-18 Tr. 111:7-13 (Blandford Testimony); AS Ex. 117, Simulated and Observed Water Levels for 2010].

B. Observed water levels through time measured at 11 monitor wells by the USGS and at 5 other wells (ASE-1, ASE-2, Ameriwest, Wheatfield Shallow, Wheatfield Deep) in the Application area monitored by DBSA. [3-07-18 Tr. 117:22-118:13 (Blandford Testimony); AS Ex. 116, Wells with Hydrographs Within Model Domain].

C. Observed water levels at 90 monitor wells for the period 2010 through 2015 (the period monitored varies by well) measured by Bernalillo County. [3-07-18 Tr. 113:4-14 (Blandford Testimony); AS Ex. 115, Bernalillo County Monitor Well Hydrographs].

D. San Pedro Spring flow measured before, during, and after the well ASE-2 aquifer test. [3-07-18 Tr. 122:18-123:24 (Blandford Testimony)].

E. The difference in observed water levels between deep and shallow well pairs ASE-1/ASE-2 and Wheatfield deep/Wheatfield shallow. [3-07-18 Tr. 120:21-121:6 (Blandford Testimony)].

F. The difference in observed water level at Bernalillo County San Andres-Glorieta aquifer well S- 2775 POD-1 and the Wheatfield deep San Andres-Glorieta aquifer well. [3-07-18 Tr. 119:24-120:20 (Blandford Testimony); AS Ex. 46].

G. Observed changes in water levels at wells ASE-1, ASE-2, Ameriwest, Wheatfield shallow and Wheatfield deep during and after the well ASE-2 aquifer test. [3-07-18 Tr. 121:7-122:17 (Blandford Testimony); AS Ex. 120, Simulated Versus Observed Drawdown at Ameriwest Observation Well for ASE-2 Constant Rate Test; AS Ex. 121, Simulated Versus

Observed Drawdown at Wheatfield-Deep Observation Well for ASE-2 Constant rate Test; AS Ex. 122, Simulated Versus Observed Drawdown at Pumping Well for ASE-2 Constant Rate Test].

Adjustments to Model Properties During Calibration Process

150. Initial model calibration efforts showed that water levels and spring flows could not be reasonably simulated without additional adjustments at certain fault zones. In these cases, low-permeability features along the fault zone, representative of fault gouge or smearing and disruption of geologic units within the fault zone were added to the model. [3-07-18 Tr. 105:9-25 (Blandford Testimony)].

151. These low-permeability fault zone features were implemented as low-permeability model cells with hydraulic conductivity of 0.0001 feet per day along the Tijeras Fault Zone, which can be several hundred feet wide, and as low permeability zones assumed to be 1 foot wide along the San Antonito, geophysics and echelon faults. [3-07-18 Tr. 106:1-25 (Blandford Testimony); AS Ex. 112].

152. OSE hydrologist Mr. Keyes evaluated the need for the low permeability fault zones in the DBSA groundwater model and determined that the low-permeability fault zones are necessary in the model to simulate observed hydrologic conditions. [3-15-18 Tr. 75:20-76:4, 88:5-16 (Keyes Testimony)].

153. Multiple sources of information and observation indicate that the Tijeras Fault Zone is a zone of low hydraulic conductivity relative to that of the immediately adjacent rocks. [3-07-18 Tr. 107:1-108:17 (Blandford Testimony)].

Model Calibration Results

154. Applicant conducted model calibrations which evaluated statistical measures of the correspondence between simulated and observed water levels include the mean error (ME), the mean absolute error (MAE) and the root mean squared error (RMSE). [3-07-18 Tr. 110:6-111:3 (Blandford Testimony)].

155. The model was compared to the site water levels (wells ASE-1, ASE-2, Ameriwest, Wheatfield deep and Wheatfield shallow), Bernalillo County San Andres-Glorieta monitor well S-2775 POD-1 and the 148 water levels in Bartolino, *et al*. (2010). [3-07-18 Tr. 111:4-112:8 (Blandford Testimony); AS Ex. 117].

156. Model simulation results were also compared to the measured water levels through time at the approximately 90 Bernalillo County monitor wells [3-07-18 Tr. 113:4-14 (Blandford Testimony); AS Ex. 115].

157. A comparison of DBSA simulated water levels to those observed at a network of approximately 90 wells monitored by Bernalillo County also shows a good correspondence between simulated and observed water levels. 3-07-18 Tr. 113:4-14 (Blandford Testimony); AS Ex. 119, Simulated and Observed Water Level for 2015].

158. The DBSA simulated decline in water levels at the approximately 90 Bernalillo County well monitoring locations is similar to or greater than the observed decline at most locations [3-07-18 Tr. 176:16-179:18 (Blandford Testimony); AS Ex. 115].

159. Simulated water levels through time at eleven USGS monitor wells and five wells in the area of the Application (ASE-1, ASE-2, Ameriwest, Wheatfield deep, Wheatfield shallow) were compared as part of the model calibration process. The simulated trends at the majority of the well locations are similar to or greater than observed trends, indicating that DBSA predicted

water level declines will be similar to or greater than actual declines. [3-07-18 Tr. 117:22-119:18 (Blandford Testimony); AS Ex. 114, Model Calibration Hydrographs].

160. The simulated difference in water levels between the shallow Wheatfield well (Chinle Group aquifer) and the deep Wheatfield well (San Andres-Glorieta aquifer) was several feet, significantly less than the observed difference. [3-07-18 Tr. 120:21-121:6 (Blandford Testimony)].

161. The seven-day ASE-2 aquifer test was also simulated in the groundwater flow model. The model is able to reasonably simulate observed drawdown during the test and water level recovery after the test, at the ASE-2, Ameriwest, and Wheatfield wells. [3-07-18 Tr. 121:7-122:17 (Blandford Testimony); AS Ex. 120; AS Ex. 121; AS Ex. 122].

162. The DBSA simulated San Pedro Spring flow for 2015 of 96 af/y closely replicates the average spring flow of about 100 af/y. [3-07-18 Tr. 122:18-123:1 (Blandford Testimony)].

163. The results of the groundwater model calibration are reasonable as indicated by the fit between: (a) observed and simulated water levels across the model domain; (b) observed and simulated changes in water levels through time; and (c) observed and simulated spring flows. State Engineer hydrologist Keyes was satisfied with the calibration of the model. [3-07-18 Tr. 123:16-19 (Blandford Testimony); 3-15-18 Tr. 39:3-40:9 (Keyes Testimony].

164. The calibrated DBSA groundwater model is a reliable tool for predicting the future effects of Application 2618. [3-07-18 Tr. 123:25-124:4 (Blandford Testimony); 3-15-18 Tr. 40:1-4; 47:2-9; 48:20-49:16; 54:17-55:6 (Keyes Testimony)].

<u>Model Sensitivity Analysis</u>

165. A model sensitivity analysis was conducted on the final calibrated groundwater flow model to illustrate which input parameters have the largest effect on model outputs. [3-07-18 Tr. 124:5-11 (Blandford Testimony)].

Model Documentation

166. The groundwater model was documented in accordance with the standards provided in the Reilly and Harbaugh USGS report. [3-07-18 Tr. 124:12-16 (Blandford Testimony); AS Ex. 99].

Use of Calibrated DBSA Model for Predictive Simulations of Impacts of Application on Existing Wells and Surface Water Sources

167. Because the calibrated groundwater flow model can reasonably replicate past hydrologic conditions, it is an appropriate tool that is suitable for estimating future hydrologic conditions and the effects of S-2618 pumping on wells and surface water. [3-07-18 Tr. 123:9-24 (Blandford Testimony)]. [3-15-18 Tr. 44:23-45:19; 54:17-55:6 (Keyes Testimony)].

168. The OSE is the only other party in this case that used a groundwater flow model to simulate the effects of S-2618 pumping on groundwater and surface water sources. [3-07-18 Tr. 125:23-126:1 (Blandford Testimony)].

169. The other parties to the case, including the clients represented by the New Mexico Environmental Law Center and Bernalillo County, did not: (a) develop a calibrated groundwater flow model that could be used to evaluate the impacts of the Application; (b) modify and calibrate the DBSA model to evaluate their own assumptions regarding impacts of the Application; (c) prepare an independent analysis of the DBSA model components, such as (i) a recharge model or study that evaluated the amount of recharge in the Sandia Basin region of the DBSA groundwater flow model domain; (ii) any separate evaluation of the aquifer testing

conducted by DBSA; or (iii) site-specific analyses or any specific calculations regarding climate change made by their expert; and (d) provide anything to support their claims in this case regarding impairment, availability of water, water conservation, and public welfare. [3-14-18 Tr. 142:18-148:5 (Davis Testimony); 3-13-18 Tr. 97:25; 98:1-11; 101:19-25; 102:1-5; 109:7-12; 111:23-25; 112:1-8 (Bandeen Testimony); 3-15-18 Tr. 12:10-13:2 (Gutzler Testimony)].

170. OSE hydrologist Mr. Keyes reviewed the DBSA groundwater model in detail and conducted an independent evaluation of the model boundaries, aquifer properties, geology, fault zones, stresses (groundwater pumping and recharge) and calibration to the observed data. [3-15-18 Tr. Tr. 54:17-55:6, 87:18-24 (Keyes Testimony)].

Overview of Predictive Simulations

171. The predictive simulations analyzed the impacts of Application S-2618 based on pumping of 350 af/y in accordance with the pumping schedule. [3-07-18 Tr. 129:7-12 (Blandford Testimony); AS Ex. 125, Pumping Schedule for S-2618 Pumping of 350 acre-feet per year].

172. The Applicant assessed the pumping effects on groundwater using a 40-year period in accordance with the Morrison Guidelines. S-2618 pumping effects on the Rio Grande are assessed over a 100-year period. [3-07-18 Tr. 127:10-13; 127:14-18 (Blandford Testimony)].

173. All pumping in the predictive simulations is from the San Andres-Glorieta aquifer at well ASE-2. [3-07-18 Tr. 182:5-10 (Blandford Testimony)].

174. Long-term average estimated recharge of 1,489 af/y was applied as a constant in the predictive simulations. Groundwater inflow along the western boundary and return flow from Paa-Ko were applied at the same rates as used in the model calibration. [3-07-18 Tr. 93:19-25; 126:8-10 (Blandford Testimony); 3-15-18 Tr. 82:18-83:12 (Keyes Testimony)].

175. Domestic use for each household in the groundwater model domain not served by a public system is 0.25 af/y [3-08-18 Tr. 53:11-54:5 (Cooper Testimony); 3-07-18 Tr. 88:3-11 (Blandford Testimony)]. Total pumping from domestic wells in the predictive simulation is approximately 390 af/y. [3-07-18 Tr. 126:10-12 (Blandford Testimony); AS Ex. 110].

176. Water columns were available for most of the wells with permitted rights and 1,186 domestic wells. [3-07-18 Tr. 129:25-130:5 (Blandford Testimony)].

177. Where multiple water levels were available for a given well, the most recent available water level was used to compute the well's water column [3-07-18 Tr. 131:10-15 (Blandford Testimony)].

178. None of the permitted water right or domestic wells are in the portion of the San Andres-Glorieta aquifer where well ASE-2 will pump water; they are in the Chinle Group aquifer south of the project area, the Yeso, Abo, or Madera Formations north of the project area, and in various formations across the Tijeras and San Antonito faults that bound the San Pedro Synclinorium. [Blandford Testimony; 3-07-18 Tr. 91:11-92:13 (Blandford Testimony); AS Ex. 107].

Morrison Guidelines

179. Applicant's impairment analysis is based solely on pumping from ASE2 (only 1 of 4 testing wells).

180. The OSE uses the Morrison 2006 Guidelines and its draw down allowance to analyze impacts on existing water rights, because preventing any impact would results with the denial of all applications.

181. The Morrison 2006 Guidelines are used to evaluate the magnitude of impairment.

182. The OSE has not established specific basin criteria for the Sandia Basin. Stipulation at ¶11. The State Engineer has applied Morrison 2006 Guidelines to assess impacts on existing wells associated with a proposed groundwater appropriation in the Sandia Basin. *See* Stipulation at ¶ 11. The Morrison 2006 Guidelines provide criteria for evaluating, typically over a 40-year period, the physical and economic impacts of a groundwater application on existing wells. Stipulation at ¶ 12. For thick alluvial aquifers, the Morrison 2006 Guidelines allow a 10 foot drawdown allowance; for thin alluvial aquifers only a 2-4 foot drawdown allowance is allowed. Ex. AS 79 (Morrison 2006 Guidelines).

183. The Sandia Basin is not a basin with a thick alluvial aquifer. Dennis Cooper, March 8, 2018 59:21-23; Eric Keyes, March 15, 2018 TR 52:18-20.

184. The Morrison 2006 Guidelines indicate that "maintaining a 40-year water supply for nearby wells from the date of evaluation" is a criterion for the initial pass at examining local well impact. *Id.*

185. The Morrison 2006 Guidelines call for evaluating potential impairment based first on allowable economic drawdown (70% of the water column) and then allowable physical drawdown (20 feet above the bottom of the well). Consideration of physical drawdown differs for non-domestic wells and domestic wells (where it is assumed to be 20 feet). *Id.*

186. The Morrison 2006 Guidelines as applied to domestic wells provide that no more than 70 percent of the water column can be depleted or a minimum water column of 20 feet must be maintained at the end of 40 years, whichever allows for the least amount of drawdown attributable to S-2618 pumping. For permitted water right wells, no more than 70 percent of the water column can be depleted. If either of these conditions is exceeded, the well may be considered impacted under the Morrison drawdown guidelines. [3-07-18 Tr. 130:23-131:9

(Blandford Testimony); 3-08-18 Tr. 34:14-23 (Cooper Testimony); AS Ex. 79, p. 3 and Figures 5 and 6].

187. The Morrison 2006 Guidelines include administrative drawdown allowances that the State Engineer or decision-maker applies to evaluate drawdown impacts on existing wells. These drawdown allowances range from 2 feet to 10 feet over 40 years (0.05 to 0.25 feet per year) and are based on the thickness of the aquifer or formation. [3-08-18 Tr. 38:22-41:5 (Cooper Testimony); 3-15-18 Tr. 52:9-53:23; 90:15-91:21; 92:1-93:24 (Keyes Testimony); AS Ex. 79, pp. 4-5].

188. Despite the fact that the Sandia Basin is not a thick alluvial aquifer, Aquifer Science's experts applied the Morrison 2006 Guidelines for thick alluvial aquifers to its application.

189. OSE hydrologist Mr. Keyes also applied the ten-foot administrative drawdown allowance in his evaluation of the 40-year simulation of groundwater impacts. [3-15-18 Tr. 92:12-93:12 (Keyes Testimony)].

190. Aquifer Science's application of the 10 foot in 40 years administrative drawdown analysis indicated 11 wells will be impacted by AS's proposed pumping.

191. OSE, using the same drawdown analysis, concluded 12 wells would be impacted by Aquifer Science's proposed pumping.

192. Additionally, Mr. Keyes also identified an additional six wells with "accelerated drawdown" due to the proposed pumping. Eric Keyes, March 15, 2018, TR 78:19-22.

193. Paul Davis, however, testified that as many as 100 wells would be identified as impaired due to pumping under the Morrison 2006 Guidelines by eliminating use of the 10 foot

drawdown which is not recommended for evaluation of drawdown in aquifers not characterized as "thick alluvial" aquifers. Paul Davis, March 14, 2018 TR 124:13-17.

San Pedro Spring and Creek

194. DBSA's predictive analysis shows that impacts to perennial reaches along San Pedro Creek will occur due to the diminishment of spring flow attributable to S-2618 pumping. There are no water rights on San Pedro Creek. [3-07-18 Tr. 149:1-4 (Blandford Testimony)].

195. DBSA simulations of S-2618 pumping indicate that San Pedro Creek flow will be diminished by 102 af/yr over time. [3-07-18 Tr. 146:22-147:4 (Blandford Testimony)].

196. Aquifer Science proposes replenishing the creek during the initial phases of the Master Plan, with pumped groundwater. Thereafter, the water returned to San Pedro Creek would consist primarily of treated effluent. [3-05-18 Tr. 139:18-140:8 (Hartman Testimony); 3-07-18 Tr. 146:15-21 (Blandford Testimony)].

197. Both the drawdown to the creek and the ability to replenish the flow are premised on the full implementation of the Master Plan, which includes Village 1. Village 1 has not been annexed and has not been approved by Bernalillo County.

198. Aquifer Science proposes replenishing San Pedro Creek stream flow by releasing water to the Creek in the vicinity of San Pedro Spring in an amount up to 102 af/y in accordance with the replenishment schedule. [3-05-18 Tr. 139:18-140:6 (Hartman Testimony); 3-07-18 Tr. 146:9-14 (Blandford Testimony); 3-15-18 Tr. 162:15-20; 163:20 (Peterson Testimony); AS Ex. 13a].

199. In order for Aquifer Science to offset the stream depletion in this manner Aquifer Science would be required to obtain a permit from the New Mexico Environment Department to put treated effluent into the creek.

Rio Grande

200. The State Engineer requires groundwater permit applicants to evaluate the impacts of the proposed appropriation on existing surface water rights and associated river flows. [3-08-18 Tr. 46:12-47:18 (Cooper Testimony)].

201. The *State Engineer Middle Rio Grande Administrative Area Guidelines for Review of Water Rights Applications* (MRGAA Guidelines) state that the surface waters of the Rio Grande are considered fully appropriated. Thus, the State Engineer only allows new groundwater appropriations that will deplete the Rio Grande flow to be approved with conditions that require the applicant to retire existing, valid Rio Grande water rights to offset the additional depletion. [3-08-18 Tr. 46:12-25 (Cooper Testimony); AS Ex. 85, *Middle Rio Grande Administrative Area Guidelines for Review of Water Right Applications* (pp. 1-2) Thomas C. Turney State Engineer, dated September 13, 2000].

202. DBSA computed the potential effects of S-2618 pumping on the on the Rio Grande by calculating the reduction in groundwater outflow from the Sandia Basin to the Middle Rio Grande Basin attributable to S-2618 pumping at the northern boundary. The computed impact of S-2618 pumping on the Rio Grande at 100 years is less than 1 af/y for both predictive simulation scenarios. [3-07-18 Tr. 147:9-148:5 (Blandford Testimony); AS Ex. 143, Analysis of Rio Grande Depletion].

203. Aquifer Science proposed offsetting the predicted effects of S-2618 pumping on the Rio Grande through retirement of 1 af/y of valid Rio Grande pre-1907 surface rights as a condition of approval. [3-05-18 Tr. 140:9-21 (Hartman Testimony); 3-07-18 Tr. 148:3-5 (Blandford Testimony); AS Ex. 13a].

204. Offsetting the impacts of pumping S-2618 on Rio Grande flow through retirement of pre-1907 Rio Grande surface water rights would mitigate any potential impairment of Rio Grande water rights that could result from pumping under S-2618. [3-05-18 Tr. 140:9-21 (Hartman Testimony); 3-15-18 Tr. 162:10-24 (Peterson Testimony)].

Water Conservation and Public Welfare Matters

Conservation

205. There are no regulatory guidelines that establish the requirements for the OSE to evaluate conservation of water in New Mexico for water rights permit applications. However, the OSE has long considered water use efficiency as a principal component of conservation of water in the State. [3-08-18 Tr. 49:2-50:4 (Cooper Testimony)].

206. The OSE now includes a condition of approval in water rights permits that requires the permittee to apply the highest and best technology standards for efficient use of water under the permit. [3-08-18 Tr. 49:2-11 (Cooper Testimony)].

207. Aquifer Science proposes to use the most efficient fixtures and appliances currently marketed and used in the United States as the basis for establishing residential water use under Application S-2618. [3-05-18 Tr. 217:14-218:13 (Hurst Testimony)].

208. The Applicant's building permits, however, are reviewed and enforced by local jurisdictions not OSE.

209. Aquifer Science proposes to limit exterior residential landscaping to native vegetation and to reuse treated effluent for watering of the golf course and common areas. [3-05-18 Tr. 221:8-23 (Hurst Testimony)].

210. The proposed average per capita water use under the Application as amended is 48 GPCD. [3-05-18 Tr. 227:4-228:9 (Hurst Testimony); 3-15-18 Tr. 183:7-15 (Peterson Testimony); AS Ex. 19].

211. The OSE has published and placed on its web site "A Water Conservation Guide for Public Utilities (2001) which addresses topics for a water conservation plan that includes: (a) use of efficient plumbing fixtures; (b) xeriscaping and landscape design; (c) reuse of water; and (d) irrigation with reclaimed wastewater. [3-08-18 Tr. 49:11-50:4 (Cooper Testimony); AS Ex. 80, *A Water Conservation Guide for Public Utilities*, March 2001 (portions)].

212. Aquifer Science's proposed water uses for residential, commercial and irrigation purposes are at the lower level of per capita water uses that are described in the OSE's Conservation Guide for Public Utilities 2001 for rural self-supplied homes in Bernalillo, Santa Fe, and Torrance Counties and for certain public water systems in the Sandia Basin and the Engineer's New Mexico Water Use by Categories (2010). [3-05-18 Tr. 204:4-206:2; 227:4-228:9 (Hurst Testimony); 3-08-18 Tr. 49:2-53:19 (Cooper Testimony); 3-15-18 Tr 183:6-184:3 (Peterson Testimony); AS Ex. 9; AS Ex. 19; AS 80; AS 81].

213. The proposed per capita water use under the Application is consistent with efficient water use standards in the Conservation Guide for Public Utilities (2001). [3-05-18 Tr. 215:2-8 (Hurst Testimony); AS Ex. 20].

214. Applicant does not, however, offer a per capita cap on water use and does not offer to condition its permit accordingly.

215. Further, the Application, Master Plan, and Appendix E allow the use of independent wells and septic systems which is contrary to its representations at trial.

216. Professor David Gutzler, an expert witness in climate science and modeling with a regional focus on the impacts of climate change testified. There is a clear and unambiguous tendency for very severe droughts to occur in New Mexico on average twice per century, as observed in reconstructions of stream flow based on tree ring records that go back for more than 1,000 years [3-14-18, Tr. 209:1-25– 210:13]. The temperature trends, both modeled and in the data, are steady and rising. During the periods of episodic drought, the effect of increasing temperatures is to greatly increase the evaporation rate which exacerbates the kinds of drought that have been occurring for millennia in this region [3-14-18, Tr. 208:22–209:20]. New Mexico and the East Mountain area are currently in a major drought. [3-14-18, Tr. 210:14–16]. The last major drought in New Mexico was in the 1950s and set record low stream flows and destroyed dry land farming in much of the state including the Estancia Basin. [3-14-18, Tr. 210:17–211:14]. The effect of the severity of drought New Mexico is currently experiencing is to cause a negative surface water balance. [3-14-18, Tr. 214:10–17]. A negative surface water balance inhibits the supply of surface water to percolate into aquifers. [3-14-18, Tr. 214:10–17]. It is highly likely that sometime within the next half century, there will be another severe drought like the current drought and the 1950s drought. [3-14-18, Tr. 214:18–25]. Because of warmer temperatures, the current drought is expected to be followed by a drought in the next 50 years that is likely to be more severe with drier surface than seen in the past. [3-14-18, Tr. 215:1–5]. These droughts will extend to the Sandia Basin and the area of Application S-2618 [3-14-18, Tr. 215:6–16]. Large scale climate change associated with increasing greenhouse gases increases temperature, which increases evaporation rates, and to a lesser extent, pushes precipitation northward, resulting in a state of less precipitation and higher temperatures. [3-14-18, Tr. 205:11–25]. This has the effect of drying the land surface. The surface water balance trends

negative and indicates less water available for groundwater recharge through the surface. [3-14-18, Tr. 205:11–25]. Snowpack and runoff in the Sandia Mountains will decrease, and both evaporation and evapotranspiration will increase as temperatures rise. [3-14-18, Tr.217:16–218:2]. The availability of surface water will decline in this region and including the area of the Application over the next half century. [3-14-18, Tr. 219:10–19].

217. The impact of climate change was not considered by Applicant in its Water Demand or Hydrologic Analysis.

Public Welfare

218. There are no regulatory guidelines that establish the requirements for State Engineer evaluation of New Mexico public welfare matters for water rights permit applications. [3-08-18 Tr. 48:5-49:1 (Cooper Testimony)].

219. The State Engineer has consistently determined that the beneficial use of water proposed in an application is not detrimental to the public welfare of the state. [3-08-18 Tr. 48:5-23 (Cooper Testimony); 3-15-18 Tr. 174:4-13; 177:21-24 (Peterson Testimony); OSE Ex. 28, ¶¶ 51 and 52 (admitted Peterson)].

220. The proposed water uses in the Application as amended are recognized beneficial uses in New Mexico. [3-15-18 Tr. 157:15-158:24 (Peterson Testimony)]. [3-07-18 146:15-21 (Blandford Testimony); 3-05-18 Tr. 114:14-116:18; 114:6-13 (Hartman Testimony); AS Ex. 13a].

OSE'S Position

221. In a complete reversal of its position in the hearing below, OSE now takes the position that there is available water for the Application, that there is no impairment to existing

water rights and that the Application is not contrary to conservation or detrimental to the public welfare.

PROPOSED CONCLUSIONS OF LAW

1. Aquifer Science appeals this matter pursuant to NMSA 1978, §72-7-1(A) (1971). This Court has jurisdiction over the parties and the subject matter hereof.

2. The Court's review is *de novo*. N.M. Const. art. XVI, §5; NMSA 1978, §72-7-1(E).

3. The Application as amended requests to appropriate 350 af/y of groundwater from the Sandia Basin for uses at the Master Plan Project and proposes to beneficially use the proposed appropriation. [7-17-17 Order Granting Motion to Amend].

4. Published notice of the Application has been completed in compliance with NMSA 1978, §72-12-3(D).

5. New Mexico district courts have jurisdiction to authorize amendments to applications in *de novo* appeals.

6. This de novo appeal requires this Court to independently decide this case based on the evidence presented to it. *See Farmers' Dev. Co. v. Rayado Land & Irr. Co.*, 1913-NMSC-035, ¶14, 18 N.M. 1.

7. The Applicant has the burden of establishing that there is available groundwater to appropriate and that the appropriation (a) will not impair the existing rights of others, (b) is not contrary to the conservation of water within the state, (c) is not detrimental to the public welfare of the state. *In re City of Roswell*, 1974-NMSC-044, 86 N.M. 249, 522 P.2d 796; *Hanson v. Turney*, 2004-NMCA-069, 136 N.M. 1, 94 P.3d 1.

8. The application must be rejected if water is not available for appropriation. NMSA 1978, §72-5-7; *Lion's Gate Water v. D'Antonio*, 2009-NMSC-057, ¶25, 147 N.M. 523.

9. Even if water is available for appropriation, a permit can be denied if it is contrary to the conservation of water within the state or detrimental to the public welfare of the State. NMSA 1978, §72-12-3(E) (2001).

10. Further, unappropriated water belongs to the public and is subject to appropriation for "beneficial use". N.M. Const. Art. XVI Sec. 2.

11. "Beneficial use shall be the basis, the measure and the limit of the right to the use of water." N.M. Const. art. XVI, § 3; NMSA § 72-12-2. Beneficial use is "the use of such water as may be necessary for some useful and beneficial purpose in connection with the land from which it is taken." *State ex rel. Erickson v. McLean*, 1957-NMSC-012, ¶ 29, 308 P.2d 983. Accordingly, the quantity of an appropriation must be measured by the amount applied to beneficial use. *Id*.

12. There is sufficient unappropriated water available in the Sandia Basin to supply the 350 af/y requested in the Application as amended.

13. Because there is water available in the Sandia Basin, as demonstrated by Applicant's expert testimony, the Court must examine whether Applicant's application (1) will impair the existing rights of others, (2) is not contrary to the conservation of water within the state, and (3) is not detrimental to the public welfare. Section 72-12-3 (E).

Impairment

14. Whether an application impairs existing water rights is a fact driven inquiry. *Montgomery v. Lomos Altos, Inc.*, 2007-NMSC-002, ¶ 21, 141 N.M. 21.

15. In New Mexico there is no "bright-line rule regarding what constitutes impairment." *Id.* ¶ 21.

16. A lowering of the water table is not necessarily an impairment; a de minimums depletion may give rise to impairment. *Id.* ¶ 22.

17. The trial court must assess the magnitude of the impairment and whether the impairment can be offset. *Id.* ¶ 22 and ¶ 34.

18. In this case, all parties agree the Application will impair existing water rights. Aquifer Science's expert witnesses testified that based on the application of the Morrison 2006 Guidelines, that a minimum 11 existing wells will be impaired. The OSE testified that it believes the application will impair 12 existing wells. The Protestants' experts testified that because the Applicant and OSE did not properly apply the Morrison 2006 Guidelines, the impairment is much greater-approximately 100 wells will be impaired by the Application.

19. The Court agrees with Protestants' analysis. The Morrison 2006 Guidelines require application of the geophysical properties of the San Andreas-Glorietta. The San Andreas-Glorietta is not a thick alluvial basin.

20. Applicant and OSE improperly applied the Morrison 2006 Guidelines for thick alluvial aquifers. Applying the Guidelines to a thick alluvial aquifer allowed Applicant and OSE to utilize a ten foot drawdown allowance over a 40-year period. This analysis resulted in a calculation that only 11 to 12 wells could be impaired by the Application.

21. The correct application of the Morrison 2006 Guidelines requires an allowable 40-year drawdown of two feet. With the application of a two foot drawdown, the Application will impair as many as 100 wells.

22. Section 72-12-3(E) states that an application should not be granted if the proposed appropriation would impair existing water rights.

23. Here, the impairment to existing water rights is not de minimums, it is substantial. The evidence established that offset of the impairment is not feasible.

24. In fact, the Applicant provided no testimony regarding the feasibility of replacing 100 wells (if such remediation is even contemplated by Section 72-12-3(E)).

25. Aquifer Science's Application is denied because the magnitude of the impairment to existing water rights is significant.

26. Further, Bernalillo County's approval of the Master Plan and annexation of Village 1 into the Master Plan is uncertain.

27. For purposes of approving the subdivision and platting of land, the jurisdiction of a county includes all territory not within the boundary of a municipality. NMSA 1978, § 3-20-5(A)(1) (1998).

28. When property is annexed to another jurisdiction, ordinances, such as subdivision ordinances, from the original jurisdiction are not applicable to land owners in the new jurisdiction unless extraterritorial zoning rights are reserved. *See Sandoval Cty. Bd. Of Comm'rs v. Ruiz*, 1995-NMCA-023, ¶ 19, 119 N.M. 586, 893 P.2d 482.

29. Accordingly, covenants and restrictions which may be put in place by any developer of the Master Plan are insufficient to enforce actual implementation of the water use assumptions presented by Aquifer Science in this matter.

30. Town of Edgewood ordinances are insufficient to enforce actual implementations of the water use assumptions presented by Aquifer Science in this matter. See, e.g., Town of Edgewood Ordinance No. 2000-25 (Landscape Ordinance).

31. Also, Absent inclusion of Village 1 in the Master Plan, the Applicant's calculation of groundwater usage is not accurate and the generation of effluent to mitigate/offset the impact the Master Plan will have on San Pedro Creek is flawed.

32. These issues likewise demonstrate the unresolved impairment that will be caused by the Master Plan.

Conservation

33. The water demand calculations for 350 af/y are premised on a large reuse of treated wastewater for golf course irrigation and stream replenishment.

34. Full buildout of Village 1 is speculative and does not persuade the Court that there will be sufficient wastewater to achieve Aquifer Science's conservation goals.

35. Under existing practice, the OSE places conditions on groundwater appropriation permits requiring the use of the "highest and best technology available to ensure water conservation to the maximum extent practical." This is a standard condition of groundwater appropriation permits.

36. There is no written OSE guideline or written policy on "highest and best technology available to ensure water conservation to the maximum extent practical."

37. The term "contrary to water conservation" is evaluated by OSE on a case-by-case basis, but there is no written policy or written guideline used by the OSE for that determination.

38. Applicant also proposes use of efficient fixtures and appliances and to limit landscaping to achieve conservation. Whether these proposals can be enforced by local government is speculative.

39. Aquifer Science argues that using reclaimed water on the golf course shows conservation, meanwhile its own plan uses 100 out of the 350 af/y of potable, not reclaimed, water on the golf course for the first 2 years. [3-5-18, Tr. 116:13–17, 176:13–23].

40. The plan installs two 9-hole golf courses that will need to be maintained using potable water until there is effluent generated to replace some, but not all, of that with reclaimed water. [3-5-18, Tr.176:13–23].

41. Aquifer Science argues that building golf courses solely as a place to put effluent generated by potential future residential use is conservation, even though the courses themselves will require 37% (131 af/y) of potable water, even after 11 years. [AS Ex. 12]. Using potable water on the golf courses as Aquifer Science waits for full residential buildout is not consistent with conservation. [3-5-18, Tr. 190].

42. Finally, Applicant did not consider climate change in preparing its water demand or hydrologic analyses.

43. The data surrounding climate change indicates that the availability of surface water will decline during the life of this proposed development.

44. Applicant's failure to include this in its analysis, suggests a lack of long-term planning regarding conservation.

45. Aquifer Science's Application is denied as it is not consistent with conservation.

Speculation

46. Protestant and Bernalillo County ask this Court to adopt Colorado's anti-speculation doctrine. *See* Protestants Notice of Supplemental Authority. While the Court agrees that evolution in this area of the law would be helpful in analyzing water appropriations, it is either left to the Legislature or the Supreme Court to adopt this doctrine.

Public Welfare

47. Because the Court has determined that Aquifer Science's Application impairs existing water rights and that the Application contravenes conservation, there is no need to reach the issue of public welfare.

IT IS SO ORDERED.

C. SHANNON BACON
DISTRICT COURT JUDGE

CERTIFICATE OF SERVICE

Efiled and served to counsel of record on date of filing.

Parties Served via CM/ECF System:

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Counsel shall provide a copy of the forgoing to the Pro Se Parties.

Heather Garcia
TCAA to Judge C. Shannon Bacon