DOCKETED

Docket Number:	97-AFC-01C
Project Title:	High Desert Power Plant (COMPLIANCE)
TN #:	210088
Document Title:	Opening Testimony
Description:	N/A
Filer:	Eric Janssen
Organization:	Ellison, Schneider & Harris L.L.P.
Submitter Role:	Applicant Representative
Submission Date:	1/29/2016 4:35:07 PM
Docketed Date:	1/29/2016

ELLISON, SCHNEIDER & HARRIS L.L.P.
ATTORNEYS AT LAW
2600 CAPITOL AVENUE, SUITE 400
SACRAMENTO, CALIFORNIA 95816
TELEPHONE: (916) 447-2166
http://www.eslawfirm.com

January 29, 2016

California Energy Commission
Docket Unit
Docket Number: 97-AFC-01C
1516 Ninth Street MS-4
Sacramento, CA 95814

RE: High Desert Power Project (97-AFC-1C):

Dear Docket Clerk,

In accordance with the California Energy Commission Committee's January 15, 2016 *Notice of Prehearing Conference and Evidentiary Hearing, Committee Schedule, and Further Orders*, attached is the Opening Testimony of High Desert Power Project, LLC for filing in docket number 97-AFC-1C.

Very truly yours,

Jeffery D. Harris
Attorney for High Desert Power Project, LLC

High Desert Power Project

(97-AFC-1C)

OPENING TESTIMONY

OF

HIGH DESERT POWER PROJECT, LLC

Petition for Modification to Drought-Proof the High Desert Power Project, Filed October 30, 2015

Executive Summary

Petition Description Testimony

Water Resources Testimony

Percolation and Groundwater Banking Testimony

January 29, 2016

TABLE OF CONTENTS

Page

EXECUTIVE SUMMARY

I. INTRODUCTION

A. Witnesses

Bryan Bondy, Randall S. Cullison, Bradley K. Heisey, Ryan T. Schroer, M. Fred Strauss, Tim Thompson

B. Qualifications

The qualifications for the witnesses for this panel on Executive Summary are set forth in Appendix A.

C. Prior Filings

In addition to the statements in this Opening Testimony, this panel's testimony includes and incorporates by reference the following documents:

- Exhibit 1002, Petition for Modification to Drought-Proof the High Desert Power Project (TN# 206468)
- Exhibit 1003, High Desert Power Project Recycled Water Feasibility Study Report (TN# 203306)
- Exhibit 1004, High Desert Power Project, LLC Reply to Staff Review of Feasibility Study (TN# 206909)
- Exhibit 1005, **Confidential:** Exhibits A, B, C, D, F, and G to the High Desert Power Project Recycled Water Feasibility Study Report (TN# 203307)
- Exhibit 1006**, Confidential**: Economic Information and Revised confidential Exhibit D to High Desert Power Project Recycled Water Feasibility Study Report (TN# 207311)
- Exhibit 1007, Presentation-Petition for Modification to Drought-Proof the High Desert Power Project (TN# 206866)
- Exhibit 1008, **Confidential:** Updated Exhibit F to the High Desert Power Project Recycled Water Feasibility Study Report (TN# 210081)

The facts contained in this testimony (including all referenced documents) are true and correct to the best of our knowledge and belief. To the extent this testimony contains opinions, such opinions are our own. We make these statements, and render these opinions freely and under oath for the purpose of constituting sworn testimony in this proceeding.

II. SUMMARY

On October 30, 2015, High Desert Power Project, LLC ("HDPP") filed a petition to drought-proof the High Desert Power Project ("Facility"), as directed by the Commission. In furtherance of the Commission's directive, the petition sets forth a water supply strategy that

both: (a) maximizes the Facility's use of recycled water ("Recycled Water"), and (b) provides HDPP with continued access to other water supply sources that must be blended with available Recycled Water to drought-proof the Facility as described below.

As described herein, under normal or even average circumstances, the Facility will need little to no groundwater from the Mojave River Basin ("MRB" or "Basin") administered by the Mojave Water Agency ("MWA") to efficiently and reliably operate. Moreover, to assure that the Facility will use as much Recycled Water and as little groundwater as feasible, the Petition proposes a "Loading Sequence" for use of various water supplies. Under the Loading Sequence, lower quality water supplies will be used first and preferentially such that Recycled Water is the Facility's primary supply and that State Water Project ("SWP") Water, Banked SWP Water and MRB Adjudicated Water[1] are the Facility's backup supplies for blending.

In reviewing this Testimony and the relief requested, it will be vitally important for the Commissioners to distinguish between two divergent concepts:

1. How the Facility will likely operate and use its various water supplies.

--Versus--

2. The "Reliability Envelope" or the permitting flexibility HDPP needs to operate this merchant Facility in California's competitive marketplace.

As explained in the Water Resources Testimony below, HDPP expects that in most years under most water conditions the Facility will not use MRB Adjudicated Water for operations. In fact, in three of the six scenarios studied, the Facility is projected to need no groundwater, relying instead on Recycled Water, SWP Water and Banked SWP Water injected into the well system built and paid for by the Facility. This is the first of these two divergent concepts; how the Facility will likely operate.

The Reliability Envelope required is another matter. HDPP is a merchant power plant that sells most of its energy in the California Independent System Operator ("CAISO") Day Ahead Market. As such, HDPP must be able to operate whenever called upon, 24 hours a day, seven days a week, excluding times when the Facility is down for maintenance. To survive and compete in California's energy marketplace, and to ensure the Facility can reliably serve the State of California, HDPP needs the permitting flexibility to respond to extreme events over which the Facility has no control. In the simplest terms, HDPP must have the flexibility gained through an appropriately sized Reliability Envelope to allow the Facility to compete and remain available as needed to ensure grid reliability. This Opening Testimony describes the required Reliability Envelope and the enforcement mechanisms that HDPP proposes to put into place to ensure that the Facility continues to maximize its use of Recycled Water.

As explained in detail in this Opening Testimony, the HDPP Recycled Water Feasibility Study concluded that it is not feasible for the Facility to operate using 100% Recycled Water for

[1] These water sources are defined and explained in more detail in Section II.B of the Petition Description Testimony.

cooling and other industrial purposes because HDPP's Recycled Water supplier is projected to not have the Recycled Water supplies required to meet the Facility's 4,000 acre-feet per year ("AFY") and 4,000 gallons per minute ("gpm") instantaneous water needs.

While HDPP and the Commission both shared the reasonable expectation that local water suppliers would improve their treatment and delivery systems to provide water of sufficient quality and quantity as needed for reliable operations, and while HDPP believes that improvements will continue, HDPP's Recycled Water supplier is unable to provide Recycled Water in the required quantities and qualities 24 hours per day, on all days of the year, as needed by the Facility for it to maintain high availability for generating power.

Furthermore, the Facility's water treatment system cannot operate reliably on a 100% Recycled Water as a sole supply. The HDPP water treatment system was not designed to treat and remove the higher amount of impurities associated with using 100% Recycled Water as required to maintain cooling tower PM_{10} emissions within the Facility's permitted limits and to protect the Facility's cooling systems and equipment from harmful deposits associated with high amounts of impurities in cooling tower water.

The capital costs to upgrade the water treatment system to operate on 100% Recycled Water are extremely high. The costs of further treating additional quantities of Recycled Water so that it is of adequate quality for use at the Facility are significantly higher than the cost of the other sources of water to the Facility. Unlike a regulated investor-owned utility, HDPP does not have a retail customer base from which it can charge rates based upon a "revenue requirement" that is based upon its costs including a rate of return on investor equity. Rather, HDPP's ability to earn revenues is subject to market forces and HDPP does not have guaranteed revenue to recover its costs and to earn a return on its invested capital. Using 100% Recycled Water will not provide HDPP with increased energy or capacity revenue opportunities. As explained in the Project Owner's November 2014 Recycled Water Feasibility Study Report (Exhibit 1003), it is simply not economically feasible for HDPP to incur these additional costs associated with the use of 100% Recycled Water.

The Reliability Envelope HDPP seeks is designed to maximize the Facility's use of Recycled Water and provide the flexibility necessary to deal with varying water supply conditions over the remaining life of the Facility. HDPP will continue to maximize use of Recycled Water as the Facility's primary water supply blended with other available water sources in ratios using a "Loading Sequence" to maintain the Cooling Tower Blowdown Rate *and* the Threshold Chloride Concentration, as defined herein, at levels necessary to reliably operate the Facility.

The Facility will preferentially seek to follow a defined sequence to blend water of higher quality with Recycled Water. Specifically, if monitoring indicates a change in water supplies is needed, HDPP will implement a "Loading Sequence" as follows. First, HDPP will continue to maximize use of Recycled Water as the Facility's primary water supply, to the extent it is available and its quality is sufficient to maintain cooling tower functions and reliable operation of the Facility, blended with SWP Water, if available and of suitable quality. Second, if monitoring indicates that higher quality backup water is needed, the Facility may next blend in

Banked SWP Water, if available. Third, if monitoring indicates that higher quality backup water is needed, the Facility may next blend in MRB Adjudicated Water.

More importantly, the water sources listed in the Loading Sequence are also in order of relative commodity and variable operating costs to HDPP. That is, Recycled Water, SWP Water and Banked SWP Water are all lower in relative costs compared to MRB Adjudicated Water. Consequently, as a merchant-based power plant, and to be competitive in the California energy market, the Facility must minimize variable operating expenses by using its lower-cost water supplies before turning to the most costly supply, MRB Adjudicated Water, only as the final selection.

HDPP also proposes in this Petition to allow for the possibility of percolating water into the Basin as an additional method to build the Facility's groundwater bank. Authorizing HDPP to increase its banked groundwater supply through the percolation of SWP Water by MWA using existing MWA facilities will provide an additional mechanism to help drought-proof the Facility. HDPP proposes to work with MWA to seek an agreement that allows HDPP to bank SWP water in the MRB via percolation using existing MWA facilities.

The Facility is a key resource in the diverse California generation mix. At 830 megawatts ("MWs"), the Facility represents important capacity for the State. By way of comparison, the Facility's capacity is approximately 37% of the capacity of the now retired San Onofre Nuclear Generating Station. With its high capacity factor, the Facility is a flexible, dynamic baseload generating that provides grid reliability and allows for the smooth integration of intermittent renewable resources. These benefits further California's greenhouse gas reduction goals, Renewable Portfolio Standard, and grid reliability requirements. The Facility also provides significant positive local economic impacts, creating jobs and tax revenues, and enjoys support from elected officials and opinion leaders at local, state, and federal levels.

The proposed modifications are required to drought-proof the Facility. No new infrastructure is required for the requested modifications. No new water supplies are required. All that is required is a sufficiently flexible Reliability Envelope, with appropriate checks and balances, that will drought-proof the Facility consistent with Energy Commission policy and with no adverse consequences to the environment.

PETITION DESCRIPTION TESTIMONY

I. INTRODUCTION

A. Witnesses

Bryan Bondy, Randall S. Cullison, Bradley K. Heisey, Ryan T. Schroer, M. Fred Strauss, Tim Thompson

B. Qualifications

The qualifications for the witnesses for this panel on Petition Description are set forth in Appendix A.

C. Prior Filings

In addition to the statements in this Opening Testimony, this panel's testimony includes and incorporates by reference the following documents:

- Exhibit 1002, Petition for Modification to Drought-Proof the High Desert Power Project (TN# 206468)
- Exhibit 1003, High Desert Power Project Recycled Water Feasibility Study Report (TN# 203306)
- Exhibit 1004, High Desert Power Project, LLC Reply to Staff Review of Feasibility Study (TN# 206909)
- Exhibit 1005, Confidential: Exhibits A, B, C, D, F, and G to the High Desert Power Project Recycled Water Feasibility Study Report (TN# 203307)
- Exhibit 1006, Confidential: Economic Information and Revised confidential Exhibit D to High Desert Power Project Recycled Water Feasibility Study Report (TN# 207311)
- Exhibit 1007, Presentation-Petition for Modification to Drought-Proof the High Desert Power Project (TN# 206866)
- Exhibit 1008, **Confidential:** Updated Exhibit F to the High Desert Power Project Recycled Water Feasibility Study Report (TN# pending)

The facts contained in this testimony (including all referenced documents) are true and correct to the best of our knowledge and belief. To the extent this testimony contains opinions, such opinions are our own. We make these statements, and render these opinions freely and under oath for the purpose of constituting sworn testimony in this proceeding.

II. HISTORY OF HDPP'S PURSUIT OF RECYCLED WATER

A. HDPP Has Worked Diligently Since 2008 to Drought-Proof the Facility By Diversifying Its Water Supply Sources.

HDPP has been working diligently since 2008 to secure a drought-proof water supply and to increase Recycled Water use by the Facility.

1. The Commission's Original Certification Expressly Prohibited the HDPP Facility from Using Recycled Water.

In what would most certainly be an anomaly today, the Facility, as certified by the Commission in the Final Decision in May of 2000, was expressly *prohibited* from using Recycled Water. Specifically, the Final Decision limited the Facility to a single water source:

> The Conditions of Certification below require that the High Desert Power Project *use only imported State Water Project water for its cooling needs*.[2]

Consequently, the Facility is not designed to operate on 100% Recycled Water.

At the time of the Commission's original approval, the California Department of Fish & Wildlife (then, the California Department of Fish & Game, "CDFG") opposed the use of Recycled Water by the Facility out of concern that reduced discharge of recycled water to the Mojave River would impact riparian vegetation in the Mojave River Narrows.[3]

Several major events have occurred since the original certification that made it possible for HDPP to voluntarily transition towards using Recycled Water. First, in August of 2000, three months after the Commission's certification of the Facility, the California Supreme Court substantially affirmed the Judgment of the Riverside County Superior Court adjudicating the water rights in the Basin and appointing MWA to act as the Watermaster to implement the adjudication. Through MWA's leadership, the Basin has been well-managed, serving as a model for the landmark Sustainable Groundwater Management Act of 2014.

Second, by Memorandum of Understanding ("MOU") dated June 27, 2003 (more than three years after the Commission's Certification of the Facility), CDFG and the Victor Valley Wastewater Reclamation Authority ("VVWRA") agreed that VVWRA would continue to discharge at least 9,000 acre feet per year of recycled water to the Mojave River to protect instream resources, thus freeing surplus Recycled Water for other uses in the region.

Third, starting in 2007, water deliveries from the SWP have been dramatically reduced as a result of court decisions regarding the biological opinion issued to protect the Delta smelt in the Sacramento-San Joaquin Delta ("Delta Smelt Biological Opinion"). The SWP Water reductions

---

[2] HDPP Final Decision, May 2, 2000, p. 230 (emphasis added).
[3] *Ibid*., p. 223.

have fundamentally altered the Facility's water supply plans. The reduction in pumping undermined the Commission's and HDPP's mutual understanding and belief that SWP Water would be available in sufficient quantities to allow the Facility to "bank" water many years in advance of need, thus assuring a dependable supply.

Fourth, HDPP and the Commission both shared the reasonable expectations that the local water suppliers would improve their treatment and delivery systems to provide water of sufficient quality and quantity as needed for reliable operations. With respect to Recycled Water, while the local purveyors have made great strides, the quantity and quality of water required has not materialized as anticipated. On average, there may very well be sufficient supplies; however, by definition, no single year is an "average" year. Flexible power plants such as the Facility — which California will depend on as it moves toward 50% renewable energy and while eliminating use of imported coal-fired energy and once-through cooling power plants — do not run on "average." Instead, they run in real time, meaning they must be capable of varying their output from minimum to maximum on an hourly, daily, monthly and annual basis as required by system reliability and market conditions. Rather than giving up on Recycled Water supplies materializing, the Petition seeks the flexibility needed to blend other sources of water and to operate the Facility, not on average, but under all energy demand and water supply conditions.

Fifth, the current drought has simply been more prolonged and more severe than any reasonable person would have anticipated in 2000 when the Facility was originally certified, or in 2007 when the Delta Smelt Biological Opinion reshaped the water landscape in California.

2. On its Own Initiative, HDPP Petitioned the Commission to Allow the Facility to Use Recycled Water.

Starting in 2007, court decisions under the federal Endangered Species Act have reduced SWP Water delivery from the SWP to protect the Delta smelt in the Sacramento-San Joaquin Delta. The reduction in pumping resulted in significantly reduced SWP Water allocations and unreliable SWP Water delivery throughout the State. As a result — and acting of its own volition — in 2008 HDPP petitioned the Commission to use Recycled Water at the Facility. In 2009 the Commission removed the prohibition, and allowed HDPP to use as much Recycled Water as feasible to operate the Facility given "current equipment capabilities and permit conditions."[4]

From its 2008 request to use Recycled Water to present, HDPP has consistently maintained — and the Facility's operational history demonstrates — that Recycled Water can be used as a source of cooling water, but only to the extent it is of sufficient quantity and quality to allow for the reliable operation of the Facility. The 2008 petition noted an important qualifier on the Facility's use of Recycled Water:

[4] See, SOIL&WATER-1(e).

> The portion of reclaimed water used by the Facility *will depend on the quantity and quality of reclaimed water available* to the Facility and the *capacity for its Zero Liquid Discharge ("ZLD") system* to process reclaimed water.[5]

The 2008 petition discussed that the quality of the Recycled Water will have higher specific conductivity and silica content than SWP Water, which will require blending with SWP Water and an increase in cooling tower blowdown, and that greater utilization of Recycled Water could occur only "if additional treatment of the reclaimed water is implemented prior to delivery to the Facility."[6]

Since 2009, HDPP has invested approximately $6.7 million for: (i) multiple engineering and technical evaluations of the Facility's water treatment system investigating ways to maximize Recycled Water use for cooling and other industrial purposes at the Facility, and (ii) construction projects both inside and outside of the Facility fence line to obtain and utilize Recycled Water. (See, Ex. 1002, page 11, Table 1.)

B. HDPP Currently Has Access to Four Different Water Supplies That Can Be Blended to Drought-Proof the Facility, None of Which Alone is Sufficient for the Reliable Operation of the Facility.

To understand how HDPP intends to drought-proof the water supply for the Facility, given the approved equipment capabilities and permit conditions, it is important to focus on the four supplies available to accomplish this objective.

Recycled Water. HDPP has a contract to purchase Recycled Water from the Victorville Water District ("VWD") and receives Recycled Water from two sources: (i) VWD's Industrial Wastewater Treatment Plant ("IWWTP") and (ii) VVWRA's Shay Road Plant. Recycled Water is HDPP's preferred supply. However, as described in Exhibit 1003, VWD is also constrained by availability of water supply, effectiveness of treatment processes, and operational reliability of its equipment, all of which impact the ability to reliably supply Recycled Water in sufficient quantity and quality, and upgrades to the Facility's water treatment system that would be required to allow for the use of 100% Recycled Water are not feasible.

SWP Water. HDPP purchases SWP Water under a long term contract with the City of Victorville, which is supplied by MWA, the regional SWP contractor. When HDPP was originally certified, SWP Water was envisioned as the primary source of water for the Facility given the prohibition on use of Recycled Water imposed by the Commission. Historically,

---

[5] HDPP 2008 Petition for Modification, p. 1 (emphasis added).

[6] *Ibid*., p. 3: "The quantity of reclaimed water for initial usage in the cooling tower cannot be precisely determined at this time because it will be based on the specific conductivity (which is an indicator of Total Dissolved Solids) of the SWP water as well as the specific conductivity and silica content of the reclaimed water needed to achieve an acceptable blend. Without further treatment of the reclaimed water, HDPP anticipates that the specific conductivity of the reclaimed water will be approximately 25% to 40% higher than average SWP water; consequently, an increase in cooling tower blowdown will be required to meet the PM_{10} air emissions permit conditions. Cooling tower blowdown is ultimately limited by the capacity of the ZLD treatment system."

delivery of SWP Water has been interrupted from time-to-time. In particular, during the current exceptional drought conditions, HDPP received in 2014 just 565 acre-feet ("AF") of the 8,000 AF maximum SWP Water allocation allowed under HDPP's purchase agreement with the City of Victorville, and in 2015 HDPP was allocated only 2,171 AF.

Banked SWP Water. The Facility has an aquifer banking system ("ABS") that treats and injects SWP Water into the Basin (i.e., the aquifer bank) using a series of four wells located approximately five miles from the Facility. This supply, known as Banked SWP Water, can then be withdrawn for use subject to the limitations set forth in Conditions of Certification SOIL&WATER-5 and SOIL&WATER-6. The injected Banked SWP Water mixes with the native groundwater of the Basin. When withdrawn, the quality of Banked SWP Water is indistinguishable from that of the native groundwater, which makes Banked SWP Water a very high quality water to blend with Recycled Water.

The original Commission Decision imposed the condition that the Facility bank water via injection instead of percolation. Commission staff modeling estimated that the Facility would be able to use injection to bank multiple years of backup supply. It is important to note that *all* of the following conditions must be met in order for the Facility to treat and inject SWP Water: (a) SWP Water must be available and allocated to HDPP by MWA; (b) the allocated quantity must be in excess of the Facility's operating needs; (c) the SWP Water must meet certain concentration limits pertaining to total dissolved solids and trihalomethane content in order to be banked in the aquifer; and (d) the Facility must be operating and producing heat, or have sufficient residual heat after shut down, in order to provide the thermal energy needed to treat SWP Water for banking. The requirement to satisfy of *all* of these conditions substantially impairs the Facility's ability to bank surplus SWP Water when available and is likely more restrictive than the Commission envisioned in 2000.

MRB Adjudicated Water. On September 10, 2014, the Commission approved a petition allowing HDPP to obtain an alternate water supply from the Basin consistent with the "Judgment After Trial" dated January, 1996, in *City of Barstow, et al. v. City of Adelanto, et al*. (Riverside County Superior Court Case No. 208568) as administered by the MWA as the Watermaster. The Commission's approval to use MRB Adjudicated Water is limited to no more than 2,000 AF in water year 2014/2015 and no more than 2,000 AF in water year 2015/2016. MRB Adjudicated Water is made available to HDPP through an agreement with VWD (the "Agreement")[7]. The Agreement provides for VWD to supply HDPP with MRB Adjudicated Water under its own adjudicated right in a manner consistent with the CEC requirements. Per the Agreement, VWD may deliver MRB Adjudicated Water to the Facility using the existing ABS infrastructure that conveys Banked SWP Water to the Facility as well as through VWD's Recycled Water delivery system. The term of the Agreement currently extends until September 30, 2016, and may be extended consistent with Commission approval to use MRB Adjudicated Water beyond 2016. Potential impacts to the Basin from the Facility's use of MRB

[7] *Untreated Water Delivery Service Agreement By and Between Victorville Water District and High Desert Power Trust*. Effective August 18, 2015.

Adjudicated Water will be mitigated through compliance with the terms and conditions of the Judgment and the Rules and Regulations of the Mojave Basin Area Watermaster.

III. SUMMARY OF MODIFICATIONS PROPOSED IN THE PETITION

A. Overview of the Petition Before the Commission.

HDPP restates and affirms its commitment to use as much Recycled Water as feasible for the operation of the Facility. As a merchant power plant, HDPP's commitment to use as much Recycled Water at the Facility as feasible is also aligned with its desire to minimize operating expenses while satisfying acceptable operating conditions in the Facility. In order to satisfy the requirements of the Commission's Order to submit a petition that will implement reliable primary and backup water supplies that are consistent with State water policies at the Facility, HDPP submitted a petition on October 30, 2015.

The Petition accomplishes the mandate to implement reliable primary and backup HDPP water supplies at the Facility through four objectives:

> ***(1) Prioritizing the use of the different sources of water available to the Facility in accordance with State law and policy and other water quality factors (the "Loading Sequence"), such that Recycled Water is the Facility's primary supply and that SWP Water, Banked SWP Water and MRB Adjudicated Water are the Facility's backup supplies for blending;***
>
> ***(2) Comparing the required cooling tower blowdown rate to the actual rate, as well as monitoring chloride concentration in the circulating cooling water, to objectively determine when backup supplies for blending are required to maintain acceptable cooling tower performance and ensure the reliable operation of the Facility;***
>
> ***(3) Obtaining authorization to use MRB Adjudicated Water as a backup water supply with access up to 3,090 acre-feet per year ("AFY") as measured on a 5-year rolling average; and***
>
> ***(4) Working, as an additional method to build the project's groundwater bank, with MWA to seek an agreement to allow the Facility to bank SWP water in the Basin via percolation using existing MWA facilities.***

Objectives (1)-(3) are achieved by the Project Owner's proposed modifications to Condition of Certification SOIL&WATER-1. Objective (4) is achieved by the proposed modifications to Condition SOIL&WATER-4, 5, 6, 12 and 13, all as set forth herein.

B. HDPP Will Implement a "Loading Sequence" To Maximize Recycled Water Use by the Facility.

To effectuate HDPP's commitment to use as much recycled water as feasible, HDPP will commit to maximize Recycled Water use in a way that is objective and verifiable by operating the Facility under a priority-of-use system (i.e., the Loading Sequence) to select water for operational use on an as-needed basis. To minimize use of MRB Adjudicated Water, this water supply is listed as the fourth and final choice. The proposed Loading Sequence is consistent with the SOIL&WATER-1 conditions and is described as follows:

- *First*, HDPP will continue to maximize use of Recycled Water as the Facility's primary water supply, to the extent it is available and its quality is suitable to maintain cooling tower functions and reliable operation of the Facility, blended with SWP Water, if available and of suitable quality, in ratios that allow the required cooling tower blowdown rate (the "CT Blowdown Rate") to be achieved and the chloride concentration to remain below a set concentration (the "Threshold Chloride Concentration").

- *Second*, if monitoring indicates that higher quality backup water is needed to achieve the required CT Blowdown Rate or to reduce chloride concentration to below the Threshold Chloride Concentration, the Facility may next blend in Banked SWP Water, if available, in ratios that allow the required CT Blowdown Rate to be achieved and the chloride concentration to remain below the Threshold Chloride Concentration while maximizing Recycled Water use.

- *Third*, if monitoring indicates that higher quality backup water is needed to achieve the required CT Blowdown Rate or to reduce chloride concentration to below the Threshold Chloride Concentration, the Facility may next blend in MRB Adjudicated Water in ratios that allow the required CT Blowdown Rate to be achieved and the chloride concentration to remain below the Threshold Chloride Concentration while maximizing Recycled Water use. [8]

- *Finally*, while HDPP would endeavor to use the Loading Sequence hierarchy of supplies, the efficient and reliable operation of the Facility may require blending two or more supplies during startup, shutdown, upset conditions, disruptions in water supply, material changes in water supply quality, and other abnormal circumstances.

Once the required CT Blowdown Rate has been achieved and the chloride concentration has dropped below the Threshold Chloride Concentration, Recycled Water will continue to be used in ratios that maximize its use.

---

[8] There may be circumstances when it is advantageous to the long-term reliability of the Facility to increase storage in the aquifer bank by simultaneously treating and injecting SWP Water through the ABS system while using MRB Adjudicated Water conveyed through VWD's Recycled Water delivery system. Such a circumstance may include the opportunity to increase Banked SWP Water storage at year's end before that particular year's allocation expires.

C. The "Loading Sequence" Provides HDPP with the Economic Incentive to Minimize Use of Adjudicated Groundwater because Adjudicated Groundwater is the Most Expensive Water Supply Available to the Facility.

The water sources listed in the Loading Sequence are also in order of relative cost to HDPP. That is, Recycled Water, SWP Water and Banked SWP Water are all lower in relative commodity and variable operating costs compared to MRB Adjudicated Water. Consequently, as a merchant-based power plant, the Facility will minimize commodity costs and variable operating expenses by using its lower-cost water supplies, turning to MRB Adjudicated Water, the most costly supply, only as the final selection.

D. HDPP Should Be Authorized To Build Up Its Groundwater Bank Through Percolation Of SWP Using MWA's Existing Infrastructure.

HDPP also seeks the authority to increase its banked groundwater supply through the percolation of SWP Water by MWA using existing MWA facilities that will provide an additional mechanism to help drought-proof the Facility. This request is set forth in the attached Testimony on Percolation and Groundwater Banking.

WATER RESOURCES TESTIMONY

I. INTRODUCTION

A. Witnesses Bryan Bondy, Randall S. Cullison, Bradley K. Heisey, Ryan T. Schroer, M. Fred Strauss, Tim Thompson

B. Qualifications

The qualifications for the witnesses for this panel on Water Resources are set forth in Appendix A.

C. Prior Filings

In addition to the statements in this Opening Testimony, this panel's testimony includes and incorporates by reference the following documents:

- Exhibit 1002, Petition for Modification to Drought-Proof the High Desert Power Project (TN# 206468)
- Exhibit 1003, High Desert Power Project Recycled Water Feasibility Study Report (TN# 203306)
- Exhibit 1004, High Desert Power Project, LLC Reply to Staff Review of Feasibility Study (TN# 206909)
- Exhibit 1005, **Confidential:** Exhibits A, B, C, D, F, and G to the High Desert Power Project Recycled Water Feasibility Study Report (TN# 203307)
- Exhibit 1006**, Confidential**: Economic Information and Revised confidential Exhibit D to High Desert Power Project Recycled Water Feasibility Study Report (TN# 207311)
- Exhibit 1007, Presentation-Petition for Modification to Drought-Proof the High Desert Power Project (TN# 206866)
- Exhibit 1008, **Confidential:** Updated Exhibit F to the High Desert Power Project Recycled Water Feasibility Study Report (TN# pending)

The facts contained in this testimony (including all referenced documents) are true and correct to the best of our knowledge and belief. To the extent this testimony contains opinions, such opinions are our own. We make these statements, and render these opinions freely and under oath for the purpose of constituting sworn testimony in this proceeding.

II. SUMMARY OF WATER RESOURCES TESTIMONY

The proposed Loading Sequence, which emphasizes the use of Recycled Water, will not result in any significant environmental effects, and is consistent with California law and policy, particularly the laws and policies governing use of groundwater from the Basin.

A. The Quantity and Quality of Recycled Water Available to the Facility Is Insufficient to Be the Sole Source of Supply for the Facility

GSI Water Solutions, Inc. ("GSI")[9] evaluated the water supplies available to HDPP and the role each source may play in drought-proofing the Facility. GSI conducted investigations to determine the amount, availability, and reliability of each alternative water supply source set forth in the Loading Sequence. Using reasonably foreseeable assumptions over the next 10-year period, in conjunction with data gathered during the feasibility study period as ordered by the Commission, GSI analyzed the annual amount of MRB Adjudicated Water that the Facility could be expected to use based on the Loading Sequence.

Two base water supply scenarios were evaluated by GSI: (1) one scenario was modeled with the Victorville 2 Hybrid power plant ("VV2") built, operating, and using 3,150 AF of Recycled Water each year as approved by the Commission which provides a conservative analysis on the Facility's impact on water supply in the Basin,[10] and (2) the other scenario *without* VV2's hypothetical full demand of Recycled Water incorporated into the calculations.[11] Each base scenario was evaluated under Best case (wet climatic period), Average case (average climatic period), and Worst case (dry climatic period) conditions over the next 10 years with SWP Water available over a range of hydrologic conditions and without SWP Water available due to failure of Delta levees, California Aqueduct or other emergency. Table 3 provides a summary of the Facility's projected use of MRB Adjudicated Water based upon quantitative estimates of Best case, Average case, and Worst case conditions over the next 10 years with SWP Water available:[12]

GSI Report, TABLE 3
Summary of Modeled Annual Average Use of
MRB Adjudicated Water with SWP Water Available
2015 - 2024 (AFY)

Generation (MMWh)	Without VV2[13]			With VV2[14]		
	Water Supply Conditions					
	Best	Average	Worst	Best	Average	Worst
0.64	0	0	0	0	0	0
1.28	0	0	0	0	0	0
1.92	0	0	31	0	0	31
2.56	0	0	128	0	0	175
3.21	0	0	225	0	0	544
3.85	0	0	330	0	46	775
4.49	0	0	488	0	86	842
5.13	0	0	704	0	136	1,010

[9] GSI Water Solutions, Inc. is a consulting engineering firm specializing in water resource planning. www.*gsiwatersolutions.com/*

[10] To maximize conservatism of this scenario, the model assumes that VV2's full use of 3,150 AFY of available Recycled Water would be served first, otherwise there would be no modeled difference between the two scenarios.

[11] TN # 206321. *Staff Analysis of the High Desert Power Plant Recycled Water Feasibility Report.* Docketed Date October 9, 2015, pp. 6, 7.

[12] TN # 206468. *Availability and Use of Alternative Water Supplies at the High Desert Power Project.* GSI Water Solutions, Inc., Santa Barbara, California. October 2015.

If the SWP Water supply is completely curtailed due to critical drought on the SWP system, or a catastrophic event occurs that critically disables the SWP, and if such an emergency occurs at a time when little to no Banked SWP Water reserves exist and the Facility is operating at design capacity, the Facility would require 2,976 to 3,654 AFY of MRB Adjudicated Water if the VV2 is built, and 2,400 to 3,344 AFY if VV2 is not built. If Recycled Water and SWP Water are both not available during an emergency situation, the Facility would be forced to rely exclusively on MRB Adjudicated Water and under these conditions and while operating at design capacity the Facility would require 4,000 AFY of MRB Adjudicated Water.

B. To Date, HDPP's Water Suppliers Have Not been Able to Assure the Instantaneous Flow Requirement of 4,000 gpm.

The Facility requires up to 4,000 gpm of supply water 24 hours per day whenever the Facility is available to operate. The existence of an average annual water supply in acre-feet per year is insufficient for the Facility if the water cannot be delivered reliably and at the instantaneous rate required for Facility operation.

During the Feasibility Study Report period, it was demonstrated that the VWD's delivery system cannot deliver up to 4,000 gpm on a continuous, reliable basis when Recycled Water is delivered through VWD's existing distribution system. The deficiencies in reliable delivery, in addition to the known occurrences of Recycled Water production outages, force the Facility to ensure that other water supplies in its portfolio of options are maintained in an always-ready state and can be activated at any time.

Facility operations are dependent on the instantaneous availability of a usable water source and the continued ability to have immediate access to alternative supply sources (SWP Water, Banked SWP Water, and MRB Adjudicated Water) to ensure operability of the Facility. Because the amount of VWD's existing Recycled Water storage only allows for a few hours of the Facility's operating water demand, when an outage at the VVWRA Shay Road Plant or at the IWWTP occurs, the Facility is forced to switch from Recycled Water to SWP Water, Banked SWP Water, or MRB Adjudicated Water within a few hours to sustain power-generation operations. Because the Facility has no on-site storage or pre-treatment capability for incoming Recycled Water before it is delivered into the Facility's cooling tower, when Recycled Water is delivered "out-of-spec", the Facility is forced to immediately switch to SWP Water, Banked SWP Water or MRB Adjudicated Water to sustain power-generation operations.

To date, HDPP's suppliers have not been able to deliver the instantaneous flow rate of 4,000 gpm for more than a few hours, making the diversity of water supply sought by the Project Owner all the more critical.

C. Because the Facility's Water Treatment Systems Were Certified and Designed to Use SWP Only, Given the Ban On Recycled Water Use In the Original Approval, Recycled Water Can Be Used Only When Blended with Other Waters.

Since the Commission issued its 2009 Order granting HDPP the ability to use Recycled Water, the supply of Recycled Water available to HDPP has been intermittent on a day-to-day

basis, has been unavailable for long periods of time, and has been out of specification, not meeting the quality requirements of the Recycled Water service agreement with VWD. In the 2009 Order, HDPP was required to conduct a feasibility study to evaluate the use of 100% Recycled Water for evaporative cooling purposes and other industrial uses.

As presented in Exhibit 1003, it was determined that it is not feasible for the Facility to operate using 100% Recycled Water for cooling and other industrial purposes because:

(i) The design basis for the Facility's instantaneous water requirement is up to 4,000 gpm, 24 hours per day on all days of the year. A reliable water supply for the Facility must be able to meet both the annual and instantaneous requirements in order for the Facility to maintain a high availability for every hour of every day each year excluding planned maintenance.[13]

(ii) The Recycled Water supply is projected to fall short of the Facility's 4,000 AFY design basis requirement in future years.

(iii) The Recycled Water is not available 24 hours per day on all days of the year in quantities and qualities as required by the Facility to maintain high availability for generating power.[14]

(iv) The Facility's water treatment system cannot operate reliably on a 100% Recycled Water supply because its water treatment system was not designed to treat and remove the higher amount of impurities associated with using 100% Recycled Water as required to maintain cooling tower PM_{10} emissions within the Facility's permitted limits and to protect the Facility's cooling systems and equipment from harmful deposits associated with high amounts of impurities in cooling tower water.[15]

(v) Upgrades to the Recycled Water treatment and storage facilities area required to increase the reliability of the quantity and quality of the Recycled Water are not feasible for HDPP to undertake.

These conditions prevent HDPP from relying on Recycled Water as the sole source of water for the Facility. Furthermore, it is unknown how the drought will affect the availability of Recycled Water to HDPP. It is also unknown whether 2016 will mark the end of the current drought or whether it will be another year in this current multi-year drought cycle. In either event, a reasonable expectation is that reduced water usage though conservation and efficiency measures will result in lower inflows to wastewater treatment plants, likely reducing the available supply of water to be recycled.

---

[13] TN # 203306. *High Desert Power Project Recycled Water Feasibility Study Report*. Docketed Date November 3, 2014, p. 4.
[14] *Ibid.*, p. 20.
[15] *Ibid.*, p. 5.

The Facility's water treatment system was designed to treat SWP Water, which historically has been of higher quality than Recycled Water. The Facility was not designed to remove the greater amounts of impurities found in Recycled Water, nor is it feasible to upgrade the treatment system to reliably treat 100% Recycled Water as described in Exhibit 1003. Consequently, Recycled Water must always be blended with other waters when used.

D. HDPP's Use of Groundwater Will Have No Significant Effects on the MRB Basin

The Facility began commercial operations in April 2003. From 2004 to 2014 the Facility's average annual energy production was 3.91 million megawatt-hours ("MMWh") and ranged from a low of 1.87 MMWh in 2011 to a high of 4.89 MMWh in 2012. The Facility's generation profile with corresponding estimated water demand is provided below in Table 2 below.

TABLE 2
Generalized Water Demand Profile

MMWh[(a)]	AFY
0.64	500
1.28	1,000
1.92	1,500
2.56	2,000
3.21	2,500
3.85	3,000
4.49	3,500
5.13	4,000[(b)]

[(a)] Million Megawatt Hours
[(b)] Design basis requirement

The Facility has demonstrated the ability to use Recycled Water for certain durations by blending various percentages with SWP Water or groundwater or both, depending on operating conditions, water qualities, current equipment capabilities, and permit conditions.[16] Due to the uncertainty in quantity and quality of SWP Water to allow for either direct use or aquifer banking, the use of MRB Adjudicated Water called upon under the Loading Sequence could occur. If it did, such use would have a *de minimis* effect on the water supplies of the Basin under any foreseeable condition.

[16] Percentages have varied based on the changing quality of both Recycled Water and SWP Water since Recycled Water use began in July 2011. Assumptions in the water use model set the lower limit of Recycled Water at 20% when *either* SWP Water or groundwater is used as diluent, which has generally but not always been possible when the high specific conductance of SWP Water interferes with the operability of the Facility's water treatment equipment.

Production safe yield of the Alto Subarea of the Basin is 69,862 AFY.[17] Accordingly, under worst case water conditions *with* VV2 built and operating, the projected use of MRB Adjudicated Water (1,010 AFY) would have a *de minimis* effect on the Basin resulting in:

a) Less than 0.2% of the Alto Subarea safe yield groundwater during average climatic conditions when operating at high capacity and with SWP Water available,

b) Less than 2% of the Alto Subarea safe yield in extreme dry periods when operating at high capacity and with SWP Water available,

c) Less than 6% of the Alto Subarea safe yield during the highly unlikely combination of a complete State Water Project outage with zero availability of Recycled Water (i.e., emergency conditions), providing the full design basis demand of 4,000 AFY, and

d) Less than significant (negligible) hydraulic stress on the aquifer due to infrequent pumping.

E. The "Loading Sequence" Provides HDPP with the Economic Incentive to Minimize Use of Higher Cost MRB Adjudicated Water.

The water sources listed in the Loading Sequence are also in order of relative cost to HDPP. That is, Recycled Water, SWP Water and Banked SWP Water are all lower in relative cost compared to MRB Adjudicated Water. Consequently, as a merchant-based power plant, the Facility will minimize variable operating expenses by using its lower-cost water supplies, and turning to MRB Adjudicated Water only as the final selection.

The water sources listed in the Loading Sequence above are also in order of relative cost to HDPP. Exhibit F of Exhibit 1003, *Impact of 100% Recycled Water Use on Facility Operations and Maintenance Costs (Confidential)*, provides confidential business information showing HDPP's delivered water cost in October 2014. The MRB Water cost presented in Exhibit F was HDPP's estimated MRB Water cost based on the MRB Water Watermaster's projected replacement and makeup water assessment rates for 2014-15. In August 2015, HDPP entered into an Untreated Water Delivery Service Agreement with the Victorville Water District ("VWD") where VWD delivers MRB Adjudicated Water to HDPP at a cost that is significantly higher than the estimate provided in Exhibit F. Confidential Exhibit 1008 sets forth the updated costs for all water sources, confirming that MRB Adjudicated Water is substantially more expensive and is indeed the highest cost water for the Facility.

As a merchant-based power plant, the Facility will minimize variable operating expenses and use the least-cost water supply, turning to MRB Adjudicated Water only as the final, most costly backup selection.

---

[17] *Twenty-First Annual Report of the Mojave Basin Area Watermaster – Water Year 2013-2014. May 1, 2015.* pg. 34.

F. The 3,090 AFY Figure Represents a Worst Case, Yet Plausible Scenario, That Must Be Considered to Allow HDPP to Participate in California's Electricity Markets

HDPP seeks approval to use MRB Adjudicated Water, limited to an amount not exceeding 3,090 AFY, measured on a five-year rolling average basis. This volume will provide Facility operators with the flexibility to both maintain reliability and drought-proof water supplies in reasonably foreseeable climatic and operating conditions.

As set forth in the Executive Summary Testimony, the HDPP needs a "Reliability Envelope" that will allow it to operate under all reasonably foreseeable conditions. The most extreme set of conditions would assume the following for each water supply:

1. Recycled Water: Minimal Recycled Water Delivers, in the calculated scenarios, a twenty-percent annual supply.
2. SWP Water: No SWP Water caused by an extended critical drought on affecting the SWP system or a catastrophic event that critically disables the SWP, such as a large earthquake near the Bay Delta that causes numerous levee failures, as examined in the October 30, 2015 Petition.
3. Banked SWP Water: No Banked SWP Water available to the Project (previously banked SWP Water depleted).

These extreme events represent the outside edge of the Reliability Envelope and thus the need for the 3,090 AFY availability of MRB Adjudicated Water. Attachment 1 demonstrates how the 3,090 acre-feet per year limit is calculated, and utilizes the following assumptions and calculation methodology.

Assumptions.

- In Row 6 of Attachment 1, the estimated annual energy production assuming the Facility runs in the 3x1 (three combustion turbines plus one steam turbine operating) configuration at full capability 16 hours each day and in the 2x1 (two combustion turbines plus one steam turbine operating) configuration at minimum load 8 hours each day is 5,000,000 megawatt-hours ("MWh"). While the 5,000,000 MWh is not the Facility's maximum annual energy capability, it represents a reasonable maximum generation amount.
- In Column C of Attachment 1, the volume of SWP Water allocated to HDPP is 0 AF assuming a drought scenario.
- Assumption 1. The 0.775 AF/gigawatt-hour ("GWh") water consumption rate is based on the Facility's recent historical annual water consumption rates.
- Assumption 2. The 0 AF aquifer bank balance assumes a multi-year drought scenario where HDPP has exhausted its Banked SWP Water aquifer bank and must use MRB Adjudicated Groundwater as its backup water supply.
- Assumption 3. The 0% Recycled Water to SWP Water blend ratio assumes the quality of SWP Water is poor and Recycled Water cannot be blended with

SWP Water. A poor quality scenario existed in early December 2015 and is believed to be related to drought conditions and low water flow through the SWP Water aqueduct.

- Assumption 4. The 20% Recycled Water to groundwater blend ratio is the estimated annual average ratio of Recycled Water that can be blended with groundwater while maintaining the cooling tower water quality within acceptable limits while operating in the 3x1 configuration 16 hours each day and the 2x1 configuration 8 hours each day.

Calculation Methodology.

1) Multiplying the 5,000,000 MWh (5,000 GWh) energy production in Row 6 of Attachment 1 by the 0.775 AF/GWh water consumption (Assumption 1) results in a total water required for power production equal to 3,873 AF.
2) Because the Column C assumption is 0 AF of an SWP Water allocation and HDPP's aquifer bank balance is 0 (Assumption 2), the entire 3,873 AF of water required for power production in Step 1 above must come from MRB Adjudicated Water and Recycled Water.
3) Multiplying the 3,873 AF total water requirement from Step 3 above x 20% (Assumption 4) results in the Facility using 775 AF of Recycled Water.
4) If the Facility uses 775 AF of Recycled Water from Step 3 above, the balance of water required for power production must come from MRB Adjudicated Water which then would be equal to 3,873 AF (Step 2) less 775 AF (Step 3) equaling 3098 AF. (Note, the difference between the 3,090 AF in the Petition and the 3,098 AF in this example calculation is due to rounding.)

A cross check for this Attachment 1 calculation is set forth in Exhibit B to Exhibit 1002. In brief, the 3,090 AF in the Petition is based on the following calculations:

- Generation of 4,999,592 MWh/yr
- Facility Generation per day: 14,480 MWh
- No SWP Water available to HDPP
- Recycled Water availability of twenty percent (20%) for the year
- No Banked SWP Water available
- Total Water Requirement Based on Generation: 3,870 AFY
- Recycled Water Used for Power Generation (20%): 780 AFY
- Groundwater Used for Power Generation: 3,090 AF

In summary, HDPP is requesting access of up to 3,090 AFY of MRB Adjudicated Water in order for it and power purchasers to have reasonable certainty the Facility will be able to operate under reasonable maximum generation dispatch conditions during a multi-year drought period. As demonstrated in Attachment 1 and Exhibit B to Exhibit 1002, depending on the availability and quality of SWP Water available to the Facility, the volume of Banked SWP

Water the Facility has in its aquifer bank and actual Facility dispatch levels, the Facility is expected to use less than 3,090 AF of MRB Adjudicated Water during most years.

G. HDPP's Petition Provides Objective "Checks And Balances" To Verify That The Facility Will Continue To Maximize Its Use Of Recycled Water

Through extensive study, HDPP has identified certain parameters of the Facility's water treatment system which, when not within certain operating ranges, affect how much Recycled Water the Facility can use. The quality of available Recycled Water also determines how much water from other backup water supplies must be blended with Recycled Water for efficient and reliable operations of the Facility and to meet existing permit conditions. As discussed below, the need to blend Recycled Water with other sources of water will be objectively determined and verified.

1. Monitoring CT Blowdown Rate Will Objectively Determine Blending Requirements and Maximize the Use of Recycled Water.

Maintaining cooling water quality that is compatible with the Facility's equipment tolerances and permit limits is a necessity that requires monitoring of the quality of the source waters and adjusting the quality of the circulating water in the cooling tower when needed. There are many dissolved constituents in the cooling water, and the Facility's operators must maintain certain constituents within acceptable ranges to ensure efficient and reliable operations of the water treatment system. The concentrations of these certain constituents are dependent upon the water treatment system performance and changes in source water quality, and are balanced by blending different source waters of differing quality depending on operational considerations.

The purpose of a cooling tower is to reject heat to the atmosphere. The Facility's cooling tower rejects heat produced during the power generating process that is not otherwise used in the Facility. This heat rejection is accomplished by evaporating a portion of the water that circulates through the cooling tower.

Similar to a tea kettle boiling on a stove that leaves deposits behind, impurities dissolved in the circulating cooling water increase in concentration as water evaporates from the cooling tower, degrading the water quality which is reflected in rising specific conductance (a.k.a., electrical conductivity) of the water. The concentrated dissolved impurities are removed by discharging water from the cooling tower — known as "blowdown" — to the Facility's water treatment system while additional "makeup" water is added to the cooling tower to replenish that which is lost to evaporation and blowdown.

The Facility's water treatment system is zero liquid discharge (i.e., ZLD) and is designed to extract and reuse the maximum amount of water of blowdown discharged from the cooling tower. The water treatment system is a complex process that includes ultraviolet treatment, filtration, softening, microfiltration, reverse osmosis filtration, and crystallization. Failure to remove a sufficient amount of impurities through the water treatment system and failure to add sufficient makeup water of adequate quality can lead to PM_{10} emissions from the Facility's cooling tower exceeding the permitted limit, as well as exceeding the processing capabilities and

the design tolerances of the Facility's equipment. Treated water is returned to the cooling tower for reuse.

As described above, specific conductance of the cooling water is a measure of *all* dissolved constituents which includes, but is not limited to: chloride, silica, calcium, phosphate, sulfate, and magnesium. The specific conductance of the cooling water is controlled by the volume of blowdown (i.e., the CT Blowdown Rate) and the addition of makeup water to the cooling tower. Specific conductance and CT Blowdown Rate are directly related. That is, increasing specific conductance reflects worsening water quality as the concentration of dissolved constituents increases. If the cooling water quality degrades beyond an acceptable level, then a higher CT Blowdown Rate and/or addition of makeup water of higher quality are required. However, the CT Blowdown Rate is limited by the throughput capability of the water treatment system which is based on the circulating water quality, and the suitability of a water source for use as makeup is based on its quality. CT Blowdown Rate and makeup water quality are therefore related to one another.

One method to manage the cooling water quality is to use engineering principles to calculate the CT Blowdown Rate required to prevent the specific conductance from degrading to unacceptable levels. This mathematical approach (the "CT Blowdown Formula") determines the CT Blowdown Rate required to maintain circulating cooling water quality within acceptable limits and is based on empirical flow and specific conductance data continuously monitored at the Facility.

The required blowdown flow from the cooling tower ("BDF_R") is determined by keeping three operational components of the cooling tower in balance: (i) CT Blowdown Rate, (ii) makeup water addition rate, and (iii) evaporation. This balance is necessary to maintain acceptable quality of the circulating cooling water, measured as specific conductance, by preventing the concentration of dissolved constituents from reaching levels that adversely affect the water treatment system and other equipment. Simply put, if the actual blowdown flow ("BDF_A") leaving the cooling tower is less than the required blowdown flow, then higher quality circulating water in the cooling tower is required for the Facility to meet environmental permit limits and maintain acceptable conditions for the Facility equipment.

All of these principles are condensed into the CT Blowdown Formula which is expressed as follows:

If: $BDF_R > BDF_A$

Then: addition of higher quality makeup water is required to maintain the cooling tower water quality.

Where: BDF_R = Blowdown Flow Required; measured on a 48-hr rolling average basis

BDF_A= Blowdown Flow Actual; measured on a 48-hr rolling average basis

The complete description and derivation of the CT Blowdown Formula is found in Exhibit A to Exhibit 1002, with the exception of one modification presented above. HDPP's experience using the formula to date has found that a 48-hr rolling average more accurately determines when a change in water supplies is required.

2. *Monitoring the Chloride Concentration Will Objectively Determine Blending Requirements and Maximize the Use of Recycled Water.*

Although the Facility continuously monitors specific conductance in the cooling water as a measurement of overall water quality, the concentrations of specific constituents are periodically measured and monitored to ensure the water treatment system will function optimally and the Facility's equipment will not be harmed. For example, chloride above a certain concentration contributes significantly to corrosion of the steam turbine condenser tubing.

For this reason, HDPP proposes to use chloride concentration as a second measurement to ensure the quality of the cooling water is at an acceptable level. When chloride concentration is greater than 980 mg/L, the "Threshold Chloride Concentration," the circulating cooling water is not of acceptable quality and blending makeup water using supplies of higher quality is required. Because the cooling tower's design criteria for chloride is 1,000 mg/L or less, the 980 mg/L Threshold Chloride Concentration provides a prudent safety measure to allow for operational adjustments before concentrations reach levels where corrosion or other damage could occur to the cooling system.

By monitoring and maintaining the CT Blowdown Rate above the rate established by the CT Blowdown Formula and by monitoring and maintaining chloride concentrations below the Threshold Chloride Concentration at acceptable levels by blending suitable makeup water supplies, HDPP operators will be able to maintain cooling water at acceptable qualities and maximize the use of Recycled Water. The water supply or water supplies selected for blending will be based on available quality and quantity of source waters accessible to the Facility, implemented pursuant to the Loading Sequence as described in detail in Section 2.4 below.

H. There is No Groundwater Overdraft in the Alto Subarea Where the Facility Is Located.

The Facility is located in the Alto Subarea of the Basin. Each of the five MWA subareas is managed separately due to their unique hydraulic characteristics and water demands. MRB Adjudicated Water used by the Facility would be pumped from, and put to beneficial use in, the Alto Subarea of the Basin.

Since at least 1996, overdraft in the Alto Subarea has been eliminated because this portion of the Basin has been successfully operated within its desired Operating Range.[18] Per the Watermaster: "Conservation, importation of State Water Project water, MWA's 'R-cubed'

[18] *Twenty-First Annual Report of the Mojave Basin Area Watermaster – Water Year 2013-2014. May 1, 2015.* Figure 3-17.

program, and implementation of the Judgment have resulted in hydrologic balance in Alto. The water supply conditions in Alto Subarea are sustainable."[19]

As discussed above, the Judgment was substantially affirmed by the California Supreme Court in August 2000, shortly *after* the Facility was licensed by the Commission. The physical solution employed by MWA as Watermaster has resulted in increased storage in the Alto Subarea over time. In fact, since HDPP operations began in 2003, Alto Subarea groundwater storage has increased approximately 140,000 AF and groundwater levels have remained in the Operating Range (above levels considered to be of concern) since at least 1996.[20] Free production allowance ("FPA") rampdown in the Alto Subarea is 60% of Base Annual Product ("BAP") where it has remained since 2005. The FPA reduction has resulted in the purchase of Replacement Water as part of the physical solution which, in part, maintains the long-term sustainability of the Alto Subarea.

I. Implementing the Loading Sequence Will Result in No Net Change In Basin Supply.

Because the Basin is a closed system, the different sources of water used within the Basin are fungible and all contribute to the Basin supply. SWP Water surplus not needed to supply the demand of MWA's contractors including the Facility is percolated by MWA to recharge the Basin. Likewise, if the Facility is not operating and cannot inject SWP Water into the Basin, the SWP Water not injected by the Facility could be recharged or otherwise beneficially used by MWA through alternate means. Similarly, Recycled Water from the IWWTP not immediately used by the Facility is percolated into the Basin at a percolation pond.[21] Recycled Water surplus to the recharge capacity of the percolation pond is applied to the Westwinds Golf Course for irrigation, and a considerable portion after evapotranspiration will percolate into the Basin.

J. Extending the Existing Authorization to Use MRB Adjudicated Water Requires No New Infrastructure and Can Be Implemented Consistent with Applicable Laws, Ordinances, Regulations, and Standards ("LORS").

Implementing the Loading Sequence will not require new infrastructure or construction of any kind, and will not result in any physical change in the environment. The various water supplies to be obtained will use existing water supply infrastructure to serve the Facility. Moreover, the use of the various water supplies through the 2015/2016 water year for blending has been reviewed and approved by the Commission and found to be in compliance with applicable LORS.

---

[19] *Ibid*., p. 35 (emphasis added).
[20] *Ibid*., Figure 3-17.
[21] *New Waste Discharge Requirements and Revised Water Recycling Requirements for the City of Victorville Water District Industrial Wastewater Treatment Plant and Victor Valley Wastewater Reclamation Authority, City of Victorville.* No. R6V-2014-0002 / WDID No. 6B360911001. Lahontan Regional Water Quality Control Board. January 9, 2014.

K. VWD has Existing Legal Authorization to Serve MRB Adjudicated Water to the Facility.

VWD has existing legal authorization to pump MRB Adjudicated Water for the Facility. VWD will pump groundwater to meet future demands of the Facility under VWD's existing adjudicated water right and in compliance with the Judgment and Rules and Regulations of the Watermaster.

L. The Judgment Mitigates All Use of MRB Adjudicated Water to Below the Level of Significance.

HDPP's use of MRB Adjudicated Water consistent with the Loading Sequence will not adversely affect groundwater resources because the Judgment, as implemented by MWA as Watermaster, mitigates adverse effect of *all* groundwater use to a level that is less than significant as described herein.

MWA serves as Watermaster of the Mojave River stream system and the Basin on the appointment of the Court.[22] MWA's responsibilities include, among other things, annual monitoring and reporting on Basin conditions, management of Basin safe yield through enforcement of pumping limits, and importation of surface water from the State Water Project to replace pumped groundwater.[23] The Judgment was substantially affirmed by the California Supreme Court in August 2000, shortly *after* HDPP was licensed by the Commission.[24] The Superior Court of Riverside County maintains continuing jurisdiction over the Judgment. The Judgment adjudicated the water rights to the Basin and affirmed a physical solution to appoint a Watermaster to balance withdrawals (pumping) and recharge to maintain the safe yield of the Basin.

The Judgment has significantly reduced historic groundwater pumping and has established a mechanism to ensure that future groundwater production is maintained within the safe yield. The Judgment mitigates the effects of groundwater withdrawal by the following primary methods:

- Assigning each adjudicated water right a "Base Annual Production," or "BAP," in AF per water year (October 1 through September 30);25
- Establishing a "Free Production Allowance" ("FPA"), which is the percentage of the BAP that can be pumped within the water year without payment of a pumping charge;26
- Allowing a right holder to delay, or carry over, a FPA to a subsequent water year ("Carry Over");27

---

[22] Judgment, ¶¶ 4(nn); 23(c).
[23] *See generally* Judgment, ¶¶ 24-29.
[24] *City of Barstow v. Mojave Water Agency* (2000) 23 Cal.4th 1224.
[25] Judgment, ¶ 4(g).
[26] *Ibid.*, ¶ 4(k)).

- Imposing an obligation to pay for "replacement water" for any water pumped in excess of the FPA ("Replacement Water Assessments"), which is used by MWA to acquire SWP Water and other supplies to recharge the Basin;28
- Directing MWA to maintain the Basin in safe yield by recommending annual adjustments to the FPA and by importing SWP Water and other supplies to replace pumped water in excess of the native safe yield;29
- Authorizing MWA to recommend adjustments to the Replacement Water Assessments for each subarea each year.[30]

MWA has recommended, and the court has approved, FPAs tailored to the specific water uses and hydrologic conditions of each subarea. In the Alto Subarea where the Facility is located, MWA has reviewed hydrological conditions and set the FPA at 60% for industrial water use and 80% for agricultural use in recognition of differences in return flows from different types of water uses.

The Replacement Water Assessment provision of the Judgment and MWA's State Water Project contract allows MWA to successfully maintain groundwater levels within the operational range established for the Alto Subarea and build water supply surplus in the Basin. MWA uses the Replacement Water Assessments to acquire surplus SWP Water available in above normal years and other water supplies for percolation into the Basin.[31]

The Judgment encourages efficient use of water by allowing for the transfer of groundwater production rights from one user to another. Water rights can be transferred on an annual basis or permanently within each subarea at any location within the subarea upon notice to MWA and compliance with applicable terms and conditions.[32] The transfer of groundwater production rights will also be subject to a BAP adjustment (reduction) by MWA to not cause an increased consumptive use of water.[33] The consumptive use adjustment for industrial use is determined by MWA on a case-by-case basis. The effect of the consumptive use adjustment is to permanently retire some portion of the BAP, thus reducing the total amount of groundwater production that is not subject to Replacement Water Assessments.

The Judgment allows any person or entity within the Basin, including HDPP, to intervene to become a Party to the Judgment by executing a stipulation with MWA.[34] Once a Party, HDPP can acquire existing BAP and FPA groundwater production rights adjudicated under the

---

[27] *Ibid.*, ¶ 4(i).
[28] *Ibid.*, ¶¶ 4(dd), 24(g) 4(ee), 25(b), 27, 28.
[29] *Ibid.*, ¶¶ 9(a), 24(g), 24(o), 27.
[30] *Ibid.*, ¶¶ 9(b), 27(b).
[31] Note that MWA recharges raw SWP Water by percolation, and does *not* believe that treatment and injection required by the Commission for the Facility is necessary.
[32] *Ibid.*, ¶ 24(n), 24(r), 34; Ex. F, ¶ 2.
[33] *Ibid.*, ¶ 24(q), Ex. F, ¶ 2.
[34] Judgment, ¶ 40.

Judgment or HDPP can pay applicable Replacement Water Assessments without acquiring existing groundwater production rights.

MWA may also adjust the FPA of an existing right to account for changes in consumptive use. As discussed, HDPP has contracted to purchase MRB Adjudicated Water from VWD under its water right and has not sought to become a party and acquire its own rights under the Judgment at this time. The MWA has evaluated the Facility's use of water under VWD's water right and has assigned Replacement Water Assessments on a 2:1 replacement ratio.[35]

III. PROPOSED MODIFICATIONS TO CONDITION OF CERTIFICATION SOIL&WATER-1

Approval of this Petition with modest language changes to SOIL&WATER-1 will result in HDPP's use of as much Recycled Water as feasible, while also providing HDPP with access to other water supplies, appropriately limited, that can be blended to drought-proof the Facility. HDPP has developed a monitoring program to provide an objectively verifiable method to ensure that Recycled Water use is maximized while the Project is drought-proofed through the blending of water supplies as necessary to maintain reliable function of the water treatment system.

In summary, the Facility's water usage when implementing the Loading Sequence:

(1) Has no adverse environmental or hydrologic effect on the Basin.

(2) Benefits the Basin by providing for net gain in storage.

(3) Ensures electric generation reliability in the region under all operating conditions.

(4) Is consistent with California energy and water use policy.

For the reasons stated herein, HDPP proposes the following revisions to SOIL&WATER-1:

Proposed additions are shown in **bold underline** and deletions in ~~strikethrough~~.

SOIL&WATER-1

Water used for project operation (except for domestic purposes) shall be State Water Project (SWP) water obtained by the project owner consistent with the provisions of the Mojave Water Agency's (MWA) Ordinance 9 and/or appropriately treated recycled waste water, and/or an alternative water supply obtained from the Mojave River Basin ("MRB") consistent with the "Judgment After Trial" dated January, 1996, in City of Barstow, et al. v. City of Adelanto, et al. (Riverside County Superior Court Case No. 208568) (collectively, "MRB Water Rights") as administered by the MWA Watermaster (the "Judgment").

---

[35] Teleconference with Kirby Brill, MWA General Manager, on June 4, 2015.

a. Whenever recycled waste water of quality sufficient for project operations is available to be purchased from the City of Victorville, the project owner shall use direct delivery of maximum quantities of such water for project operations. Whenever the quantity or quality of recycled waste water is not sufficient to support project operations, the project may supplement recycled water supplies with SWP water, banked SWP water from the four HDPP wells as long as the amount of water used does not exceed the amount of water determined to be available to the project pursuant to SOIL&WATER-5, and/or MRB Water Rights. The Project Owner shall consume no more than **3,090** AF **per calendar year (January 1 to December 31), calculated on a five-year rolling average.** ~~in water year 2014/2015 (October 1 2014 September 30, 2015) and no more than 2,000 AF in water year 2015/2016 (October 1, 2015 September 30, 2016).~~ **Use** of MRB Water Rights and the acquisition, use ~~and~~ **or** transfer of MRB Water Rights shall be in compliance with the Judgment and Rules and Regulations of the MWA Watermaster. At the project owner's discretion, dry cooling may be used instead, if an amendment to the Commission's decision allowing dry cooling is approved.
b. **Total annual water used for cooling purposes from all water sources shall not exceed 5,000 AFY.** The project owner shall report all use of water from all sources to the Energy Commission CPM on a monthly basis in acre-feet.

~~c. The project owner shall submit a Petition to Amend (PTA) no later than November 1, 2015 that will implement reliable primary and backup HDPP water supplies that are consistent with state water policies or an alternate cooling system like dry cooling.~~

~~d. (Item Deleted)~~

~~e.~~ c. The project's water supply facilities shall be appropriately sized and utilized to meet project needs. The project shall make maximum use of recycled waste water for power plant cooling given current equipment capabilities and permit conditions.

~~f. The project owner shall continue with the feasibility study evaluating the use of 100 percent recycled water for evaporative cooling purposes and other industrial uses. The feasibility study shall be completed by the project owner and submitted to the CPM.~~

Verification:
* * *
Total annual water used for cooling purposes from all water sources shall not exceed 5,000 AFY. The Project Owner shall consume no more than 3,090 AF of MRB Water Rights per calendar year (January 1 to December 31), calculated on a five-year rolling average.

If the use of MRB Water Rights reaches 1,500 AF in any one calendar year, the Project Owner shall both (i) provide the CPM with notice that 1,500 AF of MRB Water Rights has been consumed thus far in the calendar year, within ten calendar days of reaching the 1,500 AF level and (ii) provide on a monthly basis thereafter until the end of the calendar year a report on AF of MRB Water Rights consumed during each month following the notice.

The Project Owner shall operate the project consistent with the cooling tower blowdown rate (CT Blowdown Rate) based on the CT Blowdown Formula and the 980 mg/L (Threshold Chloride Concentration). When a change in operation is indicated, the Project Owner shall implement a "Loading Sequence" as follows:

First, HDPP will continue to maximize use of Recycled Water as the Facility's primary water supply, to the extent it is available and its quality is sufficient to maintain cooling tower functions and reliable operation of the Facility, blended with SWP Water, if available and of suitable quality.

Second, if monitoring indicates that higher quality backup water is needed to achieve the required CT Blowdown Rate or to reduce chloride concentration to below the Threshold Chloride Concentration, the Facility may next blend in Banked SWP Water, if available.

Third, if monitoring indicates that higher quality backup water is needed, the Facility may next blend in MRB Water Rights.

Finally, while HDPP would endeavor to use the Loading Sequence hierarchy of supplies, the efficient and reliable operation of the Facility is left to the professional judgment of the operators and may (or may not) require blending two or more supplies during startup, shutdown, upset conditions, disruptions in water supply, material changes in water supply quality, and other abnormal circumstances.

Recycled Water will continue to be used in ratios that maximize its use. The Project Owner shall report both on a calendar year quarterly basis and on an annual basis in the Annual Compliance Report the following:

- **Recycled Water used (acre-feet),**
- **SWP Water used (acre-feet),**
- **Banked SWP Water used (acre-feet), and**
- **MRB Water Rights used (acre-feet).**

PERCOLATION AND GROUNDWATER BANKING TESTIMONY

I. INTRODUCTION

A. Witnesses Bryan Bondy, Randall S. Cullison, Bradley K. Heisey, Ryan T. Schroer, M. Fred Strauss, Tim Thompson

B. Qualifications

The qualifications for the witnesses for this panel on Percolation and Water Banking Testimony are set forth in Appendix A.

C. Prior Filings

In addition to the statements in this Opening Testimony, this panel's testimony includes and incorporates by reference the following documents:

- Exhibit 1002, Petition for Modification to Drought-Proof the High Desert Power Project (TN# 206468)
- Exhibit 1003, High Desert Power Project Recycled Water Feasibility Study Report (TN# 203306)
- Exhibit 1004, High Desert Power Project, LLC Reply to Staff Review of Feasibility Study (TN# 206909)

The facts contained in this testimony (including all referenced documents) are true and correct to the best of our knowledge and belief. To the extent this testimony contains opinions, such opinions are our own. We make these statements, and render these opinions freely and under oath for the purpose of constituting sworn testimony in this proceeding.

II. SUMMARY OF PERCOLATION AND GROUNDWATER BANKING TESTIMONY

Authorizing HDPP to increase its banked groundwater supply through the percolation of SWP Water by MWA using existing MWA facilities will provide a potential additional mechanism to help drought-proof the Facility. Because this method would not require the construction of new facilities, and will be conducted pursuant to an agreement with MWA in accordance with all applicable LORS, this modification will not result in any adverse environmental impacts, and will not affect the ability of the Facility to be in compliance with all applicable LORS.

A. HDPP Should Be Authorized To Build Up Its Groundwater Bank Through Percolation Of SWP Using MWA's Existing Infrastructure

Staff and Applicant are in apparent agreement that HDPP should be allowed to increase its banked groundwater supply by having MWA percolate SWP Water using MWA's existing facilities. As set forth below, HDPP proposes changes to existing Conditions of Certification SOILS&WATER-4, 5, 6, 12 and 13.

As an additional method to build the project's groundwater bank, the project owner will work with the Mojave Water Agency (MWA) to seek an agreement to allow HDPP to bank SWP water in the Basin via percolation using existing MWA facilities.

SOIL&WATER-4 Injection Schedule

a. The project owner shall inject one thousand (1000) acre-feet of SWP water within twelve (12) months of the commencement of the projects commercial operation.

b. By the end of the four years and two months from the start of commercial operation, the project owner shall install and begin operation of a pre-injection ultraviolet (UV) disinfection system.

c. By the end of the fifth year of commercial operation, the project shall submit a report to the CPM demonstrating that HDPP has maintained an average THM concentration level consistent with the WDR permit requirements.

d. After the end of the fifth year of commercial operation, the project owner shall inject SWP water when it is available in excess of volumes needed to operate the project, up to a cumulative quantity of 13,000 acre-feet, subject to equipment capabilities and permit requirements. The amount of **injected SWP** water available to HDPP for extraction is equal to Injection minus Extraction minus Dissipation minus 1000 acre-feet, as defined in **SOIL&WATER-6**.

e. As an additional method to build the project's groundwater bank, the project owner will work with the Mojave Water Agency (MWA) to seek a feasible agreement or modify existing agreements to allow the project to bank SWP water in the Mojave River Basin through percolation using existing MWA facilities.

Verification: The project owner shall submit an installation and operation report describing the pre-injection ultraviolet disinfection system (UV) by the end of the fourth year of commercial operation. Forecasted estimates of SWP water to be injected shall be included in the quarterly Aquifer and Storage Recovery Well Report. The project owner shall submit a UV performance report by the fifth year of commercial operation. For other related items, see the verification to **Condition 5**. See also the verification to **Condition 12**. **If the project owner and MWA are able to reach an agreement or modify existing agreements regarding use of existing MWA facilities for the percolation and banking of SWP water that is feasible for the facility, the project owner shall provide a copy of such agreement or modified agreements to the CPM.**

SOIL&WATER-5 Calculation of Balance

a. The amount of banked groundwater **as injected SWP water** available to the project shall be calculated by the CEC staff using the HDPP model, FEMFLOW3D. **The amount of banked groundwater as percolated SWP water by MWA available to the project shall be calculated by MWA or the Mojave Basin Area Watermaster.** The amount of banked groundwater available shall be updated on a calendar year basis by the CEC staff, taking into account the amount of groundwater pumped by the project during the preceding year and the amount of water banked by the project during the preceding year.

SOIL&WATER-6 Banked Water Available for Project Use

a. The amount of banked groundwater available to the project during the first twelve (12) months of commercial operation is the amount of SWP water injected by the project owner into the High Desert Power Project (project) wells, minus the amount of groundwater pumped by the project owner, minus the amount of dissipated groundwater, and minus any amount described in SOIL&WATER-5(b).

b. The amount of banked groundwater available to the project after the first twelve (12) months of commercial operation is: **(1)** the amount of SWP water injected by the project owner into the project wells**,** minus the amount of groundwater pumped by the project owner, minus the amount of dissipated groundwater, minus one thousand (1,000) acre feet, and minus any amount described in SOIL&WATER-5(b) **and (2) the amount of SWP water percolated by MWA**.

SOIL&WATER-12

The project owner shall prepare and submit to the CEC CPM and, if applicable, to the Lahontan RWQCB for review and approval, a water treatment and monitoring plan that specifies the type and characteristics of the treatment processes and identify any waste streams and their disposal methods. The plan shall provide water quality values for all constituents monitored under requirements specified under California Code of Regulations, Title 22 Drinking Water Requirements, from all production wells within two (2) miles of the injection wellfield for the last five (5) years.

The plan shall also provide SWP water quality sampling results from Rock Springs, Silverwood Lake, or other portions of the East Branch of the California Aqueduct in this area for the last five (5) years. Also identified in the plan will be the proposed treatment level for each constituent based

upon a statistical analysis of the collected water information. The statistical approach used for water quality analysis shall be approved prior to report submittal by the CEC CPM and, if applicable, the RWQCB. Treatment of SWP water prior to injection shall be to levels approaching background water quality levels of the receiving aquifer or shall meet drinking water standards, whichever is more protective. The plan will also identify contingency measures to be implemented in case of treatment plant upset.

The plan submitted for approval shall include the proposed monitoring and reporting requirements identified in the Report of Waste Discharge (Bookman-Edmonston 1998d) with any modifications required by the RWQCB.

Verification: Ninety (90) days prior to ~~banking~~ **injection** of SWP water within the Regional Aquifer, the project owner shall submit to the Lahontan RWQCB and the CEC CPM a proposed statistical approach to analyzing water quality monitoring data and determining water treatment levels. The project owner shall submit the SWP water treatment and monitoring plan to the CEC CPM and, if appropriate, to the Lahontan RWQCB for review and approval. The CEC CPM s review shall be conducted in consultation with the MWA, the VVWD, and the City of Victorville. The plan submitted for review and approval shall reflect any requirements imposed by the RWQCB through a Waste Discharge Requirement.

SOIL&WATER-13

The project owner shall implement the approved water treatment and monitoring plan. All ~~banked~~ **injected** SWP water shall be treated to meet local groundwater conditions as identified in Condition SOIL&WATER-12. Treatment levels may be revised by the CEC and, if applicable, by the RWQCB, based upon changes in local groundwater quality identified in the monitoring program not attributable to the groundwater banking program. Monitoring results shall be submitted annually to the CEC CPM and, if applicable, to the RWQCB.

ATTACHMENT 1

HIGH DESERT POWER PROJECT ESTIMATED GROUNDWATER VOLUME REQUIRED FOR POWER PRODUCTION

ATTACHMENT 1. HIGH DESERT POWER PROJECT ESTIMATED GROUNDWATER VOLUME REQUIRED FOR POWER PRODUCTION

Generation (MWh/yr)	Water Required for Power Production (AFY)	SWP Water Available to the Project (AFY) 0	500	1,000	1,500	2,000	2,500	3,000	3,500
5,000,000	3,873	3,098	2,698	2,298	1,898	1,498	1,098	698	298
4,500,000	3,485	2,788	2,388	1,988	1,588	1,188	788	388	0
4,000,000	3,098	2,478	2,078	1,678	1,278	878	478	78	0
3,500,000	2,711	2,169	1,769	1,369	969	569	169	0	0
3,000,000	2,324	1,859	1,459	1,059	659	259	0	0	0
2,500,000	1,936	1,549	1,149	749	349	0	0	0	0
2,000,000	1,549	1,239	839	439	39	0	0	0	0
1,500,000	1,162	929	529	129	0	0	0	0	0
1,000,000	775	620	220	0	0	0	0	0	0

Groundwater Volume Required for Power Production (AFY)

Assumptions

1. Water Consumption Rate for Power Production = 0.775 AF/GWh
2. Aquifer Bank Balance = 0 Acre-ft
3. Recycled Water to SWP Water Blend Ratio = 0.0%
4. Recycled Water to Ground Water Blend Ratio = 20.0%

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

DECLARATION OF
Bryan Bondy, PG, CHG

I, Bryan Bondy, declare as follows:

1. I am presently employed by GSI Water Solutions, Inc. as Senior Hydrogeologist.

2. A copy of my professional qualifications and experience are attached hereto and incorporated herein by reference.

3. The testimony on Executive Summary, Petition Description, Water Resources, and Percolation and Groundwater Banking for the High Desert Power Project (97-AFC-1C) in support of the *Petition for Modification to Drought-Proof the High Desert Power Project* was prepared either by me or under my supervision, and is based on my independent analysis, data from reliable sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue(s) addressed herein.

5. I am personally familiar with the facts and conclusions presented in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 1/28/16

Signed: 

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

Bryan Bondy, PG, CHG
Senior Hydrogeologist

EDUCATION

MS, Geological Sciences, San Diego State University
BS, Geological Sciences, San Diego State University

Certification, GIS, Mt. San Jacinto Junior College

PROFESSIONAL REGISTRATIONS

Professional Geologist: California

Certified Hydrogeologist: California

DISTINGUISHING QUALIFICATIONS

- ✓ Experienced in Sustainable Groundwater Management Act Implementation
- ✓ Experience facilitating stakeholder groups
- ✓ Experience groundwater supply and management studies
- ✓ Experience with well design and installation
- ✓ Experienced groundwater flow and contaminant transport

Bryan has 19 years of experience in managing and conducting a wide range of and water resources and environmental projects in California and other western states. His expertise includes groundwater supply and management, field investigations, geophysical surveys, subsurface characterization, numerical modeling, contaminant hydrogeology, well design and installation, and data management and analysis. He has a strong analytical background and is experienced in geochemical and groundwater numerical modeling applications.

REPRESENTATIVE PROJECTS

Groundwater Model and Basin Management Plan Updates, Goleta Water District, California. Bryan serving as hydrogeologist and modeler to help the District with this groundwater model and Basin Management Plan update projects. Recharge and pumping terms in the model were updated through 2013 and the model calibration was be re-tested. The model is being used to (a) determine the amount of pumping that can be supporting without exceeding safe yield, and (b) assist in siting new wells to optimize and increase District pumping and injection capacity as part of the 2016 Groundwater Management Plan Update.

Groundwater Pumping Redistribution Evaluation, Valencia Water Company (VWC), Santa Clarita Valley, California. GSI is conducting numerical model simulations to examine how an existing operating plan for the Santa Clarita Valley's shallow and deep aquifer systems could be modified to meet target yields despite drought conditions in the local watershed and a pending curtailment of imported State Water Project supplies. Bryan is providing senior review of this work that includes conducting simulations to evaluate a variety of concepts for how to sustainably implement temporary increases in annual groundwater production at certain wells located in the lower reaches of the watershed, to make up for drought-induced pumping reductions in the upper portions of the watershed. The results of the current study will be used VWC to make decisions about the degree to which water supplies that are banked outside of the watershed should be used to augment groundwater supplies in 2014.

Shandon Area Groundwater Assessment and Monitoring Program, Paso Robles Basin, California. Bryan is working with a group of wine grape growers in the Shandon sub-area of the Paso Robles groundwater basin to develop a better understanding of the aquifer system underlying the area and assess sustainable pumping rates and volumes. His work has involved analysis of structural geology in the deeper units and its effect on groundwater movement.

(Bryan worked on the following projects before recently joining GSI.)

Technical Advisor and Facilitator - Las Posas Valley Groundwater Basin Users Group, Ventura County, California. Since 2009, Bryan has served as the Las Posas Valley Groundwater Basin Users (stakeholder) Group's technical advisor and facilitator. During this time Bryan has educated the stakeholders on the basin groundwater hydrology, groundwater management issues, and has led the group through a groundwater management planning process (prior to SGMA). Bryan is currently leading the stakeholder group though a Sustainable Groundwater Management Act planning process. Recently, Bryan successfully facilitated group consensus on a groundwater pumping allocation methodology that includes pumping reductions necessary to achieve sustainable yield.

Sustainable Groundwater Management Act Technical Advisory Committee – Fox Canyon Groundwater Management Agency (FCGMA), Ventura County, California. Bryan was appointed by the FCGMA Board of Directors to the Agency's Technical Advisory Committee. The Committee is tasked with advising the Board of Directors on Groundwater Sustainability Plan development issues.

Ventura Water Commission, City of San Buenaventura, California. In 2015, Bryan was appointed to the Water Commission by the City Council and serves as the Vice Chairperson. The Commission is tasked with advising the City Council on water rates and long-term water supply planning policy issues. (This is a volunteer position.)

Proposition 84, USBR, and Fox Canyon GMA Grants, Ventura County, California. Bryan has served in various capacities on several grant applications, including grant application project manager and senior application reviewer for Calleguas MWD. Bryan has also managed several

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

GSI Water Solutions, Inc.

Bryan Bondy, PG, CHG

Senior Hydrogeologist

planning grants for the District.

Aquifer Storage and Recovery Groundwater Monitoring Program, Calleguas MWD, Ventura County, California. Since 2012, Bryan has worked with well owners in the Las Posas Groundwater Basin to develop a voluntary groundwater monitoring program in the vicinity of the Calleguas Aquifer Storage and Recovery facilities. Bryan successfully negotiated access and monitoring agreements with water agencies and landowners. To date, Bryan has secured permission to monitor groundwater levels and quality in over two dozen wells in the basin.

Ventura Regional Groundwater Model Review, United Water Conservation District, Santa Paula, California. As a senior hydrogeologist at, Bryan performed an independent, comprehensive review of the Ventura Regional Groundwater Model that was originally completed by the United States Geological Survey. The model area includes the groundwater basins of the Santa Clara River Valley and Coastal Plain of Ventura County, which provide almost half of the water supply for Ventura County. Bryan used Groundwater Vistas to import hydrographs from wells that were not used in the original model calibration to assess the validity of the model. The review showed that the model was not accurately predicting groundwater levels in key areas of the basins. Based on the review results, a decision was made to reconstruct and re-calibrate the model.

Groundwater Management Study, San Diego County Water Authority, Padre Dam Municipal Water District, Riverview Water District, Lakeside Water District, Helix Water District, and City of San Diego, San Diego County, California. Bryan was staff hydrogeologist and graduate researcher for this study to develop information and planning tools necessary to manage the groundwater resources of the Santee-El Monte Basin. The study consisted of a hydrogeologic evaluation of the basin, water budget development, groundwater monitoring well installation, establishment of a groundwater monitoring network, groundwater monitoring and water quality testing, and development of a groundwater flow model of the basin. Groundwater modeling was performed to evaluate the impact of a number of conceptual groundwater management alternatives on groundwater levels in the basin and to address key groundwater management questions.

Geophysical Investigation and Well Installation, McCanna Ranch Water Company, near Perris, California. As project manager and hydrogeologist, Bryan provided management and field services for the installation of four community water supply wells for a 1,000+ home development. He reviewed regional geologic and hydrogeologic data and coordinated a geophysical investigation to determine optimal well locations within an alluvial basin; and oversaw the drilling, design, and installation of the community water supply wells.

Aquifer Storage and Recovery (ASR) Project, San Diego County Water Authority, San Diego, California. Bryan was staff hydrogeologist for an ASR study in the San Diego Formation. Phase I of the study, a gravity survey, was performed to identify sections of the San Diego Formation sufficiently thick for potable water storage and recovery. Gravity data were collected, reduced, modeled, and interpreted to identify zones within the San Diego Formation suitable for follow-up exploration. Phase II planning included the conceptualization of ASR projects, exploration scope development, and costing.

Water Supply Evaluation, Santa Clarita, California. As senior hydrogeologist, Bryan reviewed groundwater production data and performed a monthly water budget analysis at the Robinson Ranch Golf Course. Results of the analysis suggested potential water shortages during summer months. He prepared recommendations for tasks to increase the groundwater production capacity of the golf course.

Hazardous Waste Site Perchlorate Remedial Investigation (RI), Glen Avon, California. Bryan was senior hydrogeologist and project manager for an RI to assess the geology and distribution of perchlorate-impacted groundwater beneath Zone 4 of the Stringfellow Hazardous Waste Site (CERCLA). He reviewed previous consultants' work products, developed a conceptual hydrogeologic model of the site, prepared the RI work plan, and oversaw and managed all remedial investigation activities.

Groundwater Flow Modeling, Shell Service Station, Morro Bay, California. As project hydrogeologist, Bryan constructed a groundwater flow model to assess regional groundwater flow

©2016 GSI Water Solutions, Inc. www.gsiws.com BBondy@gsiws.com 805.895.3956

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

GSI Water Solutions, Inc.

Bryan Bondy, PG, CHG

Senior Hydrogeologist

and contaminant transport conditions in a coastal alluvial basin near the City of Morro Bay. Modeling was conducted to evaluate the potential for dissolved-phase impacts to the City's Well #3 from a fuel release at an upgradient service station. Bryan performed aquifer testing and data analysis in support of model construction.

Groundwater Flow Modeling, Confidential Client, Riverside, California. As project hydrogeologist, Bryan constructed a groundwater flow model to evaluate the capture zone and groundwater flow paths in the vicinity of a Santa Ana Watershed Project Authority desalter well in the Arlington Basin. Modeling was performed to evaluate the likelihood for migration of dissolved-phase hydrocarbons released from a local service station to the well.

Underground Storage Tank Management, ExxonMobil Oil Corporation, Various Locations, Los Angeles County, California. Bryan was client service manager/project manager for a portfolio of ExxonMobil Oil Corporation underground storage tank cases, with a total annual budget of several million dollars. He was responsible for client interface, budgeting, contract management, fiscal tracking, and case management. He developed case closure strategies and managed life-cycle scopes and budgets.

Geologic Logging and Groundwater Flow Evaluation, Chatham Brothers Barrel Yard, Escondido, California. As staff hydrogeologist, Bryan performed geologic logging and supervised the installation of soil vapor extraction, groundwater extraction, and groundwater monitoring wells in a decomposed granite/fractured bedrock aquifer system at a former solvent recycling facility. He evaluated groundwater flow conditions and fate and transport of PCE, TCE, and breakdown products in the multi-aquifer system; performed periodic groundwater monitoring; prepared groundwater monitoring reports; and performed operations and maintenance of the site groundwater pump-and-treat and soil vapor extraction systems.

Groundwater Monitoring and Site Investigation, GEC Marconi/BAE Systems Facility, San Marcos, California. Bryan performed geologic logging and supervised the installation of groundwater monitoring wells in a multi-aquifer system at a former electronics manufacturing facility. He prepared a conceptual model of groundwater flow conditions for the multi-aquifer system; performed periodic groundwater monitoring to track copper, chromium, PCE, and halogenated volatile organic compound breakdown products; and prepared site investigation and groundwater monitoring reports. He also performed operations and maintenance of a groundwater pump-and-treat system, including system optimization and NPDES discharge permit reporting.

Groundwater Monitoring and Modeling, Delco Facility, Goleta, California. Bryan performed geologic logging and supervised the installation groundwater monitoring wells in a shallow unconfined aquifer and performed periodic groundwater monitoring to track PCE and TCE migration and attenuation. He participated in the development and calibration of a groundwater flow model of a shallow unconfined aquifer. The model was developed to evaluate groundwater flow conditions in the shallow aquifer and to assess groundwater surface water interactions with the Goleta Slough wetlands area. Transport modeling was performed to evaluate the potential for dissolved-phase contaminant migration to environmental receptors at the slough.

Groundwater Monitoring and Soil Sampling, Maxwell Technologies Facility, San Diego, California. Bryan performed soil sampling to assess the extent of PCB-impacted soil. Other responsibilities included performing geologic logging, supervising installation of a groundwater monitoring well using air percussion drilling techniques, and performing periodic groundwater monitoring to assess the distribution of PCE, TCE, and breakdown products.

Site Investigations, Port of San Diego, Various Locations, California. Bryan reviewed previous consultant work products and developed site investigation plans for two Port of San Diego project sites. He conducted tidal influence monitoring and evaluated tidal effects on groundwater flow patterns, conducted a CPT-LIF investigation to assess lithology and release conditions in the underground storage tank release area, and performed groundwater monitoring and report preparation.

©2016 GSI Water Solutions, Inc. www.gsiws.com BBondy@gsiws.com 805.895.3956

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

Bryan Bondy, PG, CHG

Senior Hydrogeologist

PUBLICATIONS AND PRESENTATIONS

Beckett, G. D. and B. Bondy. 2006. *API-LNAST Users Guide Version 1.5, 2006.*

Bondy, B. and Boehm, G. 2005. *Use of CPT-LIF Investigation Techniques and Advanced Data Visualization for Rapid and Effective Site Investigation.* Los Angeles Regional Water Quality Control Board Technical Speaker Series. March 2005.

Bondy, B. 2011. *The Las Posas Basin Groundwater Puzzle: Piecing Together the Big Picture.* Association of Water Agencies of Ventura County Waterwise Breakfast Speaker Series. May 2011.

Bondy, B. 2011. *Choosing the Appropriate Scale for Groundwater Management - Basin -Specific Planning within a Groundwater Management Agency.* 28th Biennial Groundwater Conference & 20th Groundwater Resources Association Annual Meeting. October 2011.

Bondy, B. 2012. *Ventura County Brackish Groundwater Desalination: Salt Management and New Water Supply.* Association of Water Agencies of Ventura County Waterwise Breakfast Speaker Series. February 2012.

Bondy, B. 2012, 2013, and 2014. *Ventura County Groundwater.* Association of Water Agencies of Ventura County Annual Fall Bus Tour.

Bondy, B. 2013. *Development of Brackish Groundwater Resources in Ventura County.* American Groundwater Trust Alternative Water Resources for Southern California Conference. Ontario, California. February 2013.

Bondy, B. 2013. *Calleguas MWD ASR Project.* Groundwater Resources Association of California Central Coast Quarterly Branch Meeting. Fall 2013.

Bondy, B. 2014. *Yes, Geology is Important! – How Faults, Folds and a Creek Created Challenges for the Las Posas Basin Aquifer Storage and Recovery Project.* Groundwater Resources Association Conference on Groundwater Issues and Water Management – Strategies Addressing Challenges of Sustainability and Drought in California. March 2014.

Bondy, B. 2014. *Understanding Groundwater (Groundwater 101).* Association of Water Agencies of Ventura County Annual Symposium. April 2014.

Bondy, B. 2015. *Salinity Management Options for Agricultural Pumpers in the Las Posas Basin.* Association of Water Agencies of Ventura County Waterwise Breakfast Speaker Series. February 2015.

Bondy, B. 2015. *Water: The Resource, New Realities and Solutions.* Panelist, Water Session of the Ventura County Agricultural Summit. September 2015.

Wittman, G. and B. Bondy, 2004. *The Use of Computerized Groundwater Modeling to Design Capture Zone Well Array for the Perchlorate Remediation System in Zone 4 at the Stringfellow Superfund Site.* Groundwater Resources Association of California Perchlorate Symposium, Glendale, California. August 2004.

©2016 GSI Water Solutions, Inc. www.gsiws.com BBondy@gsiws.com 805.895.3956

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

DECLARATION OF
Randall S. Cullison

I, Randall S. Cullison, declare as follows:

1. I am presently employed by Tenaska Capital Management, LLC as Vice President.

2. A copy of my professional qualifications and experience are attached hereto and incorporated herein by reference.

3. The testimony on Executive Summary, Petition Description, Water Resources, and Percolation and Groundwater Banking for the High Desert Power Project (97-AFC-1C) in support of the *Petition for Modification to Drought-Proof the High Desert Power Project* was prepared either by me or under my supervision, and is based on my independent analysis, data from reliable sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue(s) addressed herein.

5. I am personally familiar with the facts and conclusions presented in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct to the best of my knowledge and belief.

Dated: Jan 28, 2016 Signed: Randall S Cullison

{00347952;1}

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

Randall S. Cullison
Vice President
Tenaska Capital Management, LLC
Omaha, Nebraska

Summary of Experience

Mr. Cullison joined Tenaska in 1995 and Tenaska Capital Management, LLC (TCM) in 2009. TCM is a Tenaska affiliate that serves as manager to private equity limited partnerships. TCM's managed funds are standalone entities that focus on the energy industry and acquisition of generation, natural gas midstream and energy-related service sector companies or assets. Mr. Cullison has 34 years of energy industry experience in project management, engineering, technical and commercial aspects of power asset development, construction, acquisition, operations, maintenance, and asset management. Mr. Cullison's primary responsibility at TCM is to optimize TCM's portfolio of generation assets.

Mr. Cullison previously served as Director of Asset Management for Tenaska responsible for improving the profitability of power assets, overseeing the bidding and marketing of merchant power assets in the PJM, CAISO, ERCOT, and MISO energy markets, managing customer relationships for contracted assets, and managing the ownership transition for newly acquired assets. Mr. Cullison also served as a project manager for Tenaska responsible for the development and construction of greenfield power generation assets. Prior to joining Tenaska, Mr. Cullison served as a Senior Engineer at MidAmerican Energy, where he was responsible for the evaluation and implementation of capital improvement projects for power generation assets. Mr. Cullison began his energy industry career with Northern Liquid Fuels Company, where he was responsible for pipeline capital improvement projects.

Education

Kansas State University
1981 B.S., Mechanical Engineering

Licenses

Professional Engineer (Inactive) – State of Nebraska

Work History

2007 – Present	**Tenaska Capital Management, LLC** – Omaha, Nebraska Power Generation Investments and Asset Management
1995 – 2007	**Tenaska, Inc.** – Omaha, Nebraska Power Generation Development, Construction and Asset Management
1986 – 1995	**MidAmerican Energy** – Council Bluffs, Iowa

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

Power Generation Asset Engineering and Capital Construction

1981 – 1986 **Northern Liquid Fuels Company** – Omaha, Nebraska
Liquid Fuels Storage and Transportation Engineering

Power Generation Projects under Management at Tenaska Capital Management

Project	MW	State
Armstrong Energy	625	Pennsylvania
Big Sandy Peaker Plant	300	West Virginia
Calumet Energy	325	Illinois
Commonwealth Chesapeake	315	Virginia
Crete Energy Venture	328	Illinois
High Desert Power Project	830	California
Holland Energy	665	Illinois
Lincoln Generating Facility	656	Illinois
New Covert Generating	1100	Michigan
Pleasants Energy	313	West Virginia
Rio Nogales Power Project	800	Texas
Rolling Hills Generating	850	Ohio
Troy Energy	600	Ohio
University Park Energy	300	Illinois
Wolf Hills Energy	245	Virginia

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

DECLARATION OF
Bradley K. Heisey, P.E.

I, Bradley K. Heisey, declare as follows:

1. I am presently employed by Tenaska Capital Management, LLC as Senior Vice President of Portfolio Management.

2. A copy of my professional qualifications and experience are attached hereto and incorporated herein by reference.

3. The testimony on Executive Summary, Petition Description, Water Resources, and Percolation and Groundwater Banking Testimony for the High Desert Power Project (97-AFC-1C) in support of the *Petition for Modification to Drought-Proof the High Desert Power Project* was prepared either by me or under my supervision, and is based on my independent analysis, data from reliable sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue(s) addressed herein.

5. I am personally familiar with the facts and conclusions presented in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 1-29-2016 Signed: Bradley K Heisey

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

Bradley K Heisey, P.E.
Sr. Vice President
Tenaska Capital Management, LLC
Omaha, Nebraska

Summary of Experience

Mr. Heisey is Senior Vice President of Portfolio Management for Tenaska Capital Management, LLC (TCM), a Tenaska affiliate that serves as manager to private equity limited partnerships. TCM's managed funds are standalone entities that focus on the energy industry and acquisition of generation, natural gas midstream and energy-related service sector companies or assets. Mr. Heisey has 34 years of experience in the energy industry with an emphasis on power generation, natural gas transportation and natural gas storage. While at TCM, Mr. Heisey has been responsible for the management of over 8,250-megawatt (MW) of power generating assets. Prior to joining TCM in 2007, Mr. Heisey served as managing director of Tyr Energy, Inc. where he was responsible for commercial activities and optimization of a 1,700-megawatt (MW) portfolio of power generating assets. In that role he served as the asset owner's representative seeking improvements in the financial and physical performance of the facilities.

Education

Oklahoma State University
1987 M.B.A.
Oklahoma State University
1981 B.S., Mechanical Engineering

Licenses

Oklahoma Professional Engineer, PE 15572

Work History

2007 – Present	**Tenaska Capital Management, LLC** – Omaha, Nebraska Power Generation Investments and Asset Management
2003 – 2007	**Tyr Energy, Inc.** – Overland Park, Kansas Power Generation Investments and Asset Management
1998 – 2003	**Utilicorp United (fka: Aquila Energy Marketing) –** Kansas City, Missouri Natural Gas Marketing and Power Generation Asset Management
1995 – 1998	**Resource Energy Services Company** – Houston, Texas Natural Gas Marketing and Transportation

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

1991 – 1995 **Aquila Energy Marketing** – Omaha, Nebraska
Natural Gas Marketing and Transportation

1981 – 1991 **Occidental Petroleum (fka: Cities Service Oil Company)** – Tulsa, Oklahoma
Various Engineering, Technical, and Marketing Roles

Power Generation Projects under Management at Tenaska Capital Management

Project	MW	State
Armstrong Energy	625	Pennsylvania
Big Sandy Peaker Plant	300	West Virginia
Calumet Energy	325	Illinois
Commonwealth Chesapeake	315	Virginia
Crete Energy Venture	328	Illinois
High Desert Power Project	830	California
Holland Energy	665	Illinois
Lincoln Generating Facility	656	Illinois
New Covert Generating	1100	Michigan
Pleasants Energy	313	West Virginia
Rio Nogales Power Project	800	Texas
Rolling Hills Generating	850	Ohio
Troy Energy	600	Ohio
University Park Energy	300	Illinois
Wolf Hills Energy	245	Virginia

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

DECLARATION OF
Ryan T. Schroer

I, Ryan T. Schroer, declare as follows:

1. I am presently employed by Tenaska Capital Management, LLC as Managing Director and Chief Financial Officer.

2. A copy of my professional qualifications and experience are attached hereto and incorporated herein by reference.

3. The testimony on Executive Summary, Petition Description, and Water Resources for the High Desert Power Project (97-AFC-1C) in support of the *Petition for Modification to Drought-Proof the High Desert Power Project* was prepared either by me or under my supervision, and is based on my independent analysis, data from reliable sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue(s) addressed herein.

5. I am personally familiar with the facts and conclusions presented in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 1/28/16 Signed: Ryan T. Schroer

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

Ryan T. Schroer
Managing Director & Chief Financial Officer
Tenaska Capital Management, LLC
Omaha, Nebraska

Summary of Experience

Mr. Schroer is Managing Director & Chief Financial Officer for Tenaska Capital Management, LLC (TCM), a Tenaska affiliate that manages private partnerships focused on the energy industry and the acquisition and management of power generation, natural gas midstream and energy-related service sector companies and assets. Mr. Schroer has 18 years of experience in accounting and reporting, the last 12 of which have been focused on the energy industry. On behalf of the partnerships, companies and assets managed by TCM, Mr. Schroer leads the accounting, financial reporting, and administration, and is involved in strategic planning, compliance, and partner relations.

Education

Creighton University
1997 B.S.B.A. – Accounting

Licenses

Certified Public Accountant (Inactive) – State of Nebraska, Certificate No. 6366

Work History

2005 – Present **Tenaska Capital Management, LLC** – Omaha, Nebraska
Managing Director & Chief Financial Officer (December 2013 – Present)
Senior Vice President & Chief Financial Officer (January 2011 – November 2013)
Vice President & Controller (July 2007 – December 2010)
Controller (May 2005 – June 2007)

1997 – 2005 **KPMG LLP** – Omaha, Nebraska
Senior Audit Manager (August 2004 – May 2005)
Audit Manager (August 2002 – July 2004)
Senior Audit Associate (August 1999 – July 2002)
Audit Associate (September 1997 – July 1999)

Power Generation Projects under Management at Tenaska Capital Management, LLC

Project	MW	State
Armstrong Energy	625	Pennsylvania
Big Sandy Peaker Plant	300	West Virginia
Calumet Energy	325	Illinois
Commonwealth Chesapeake	315	Virginia
Crete Energy Venture	328	Illinois
High Desert Power Project	830	California

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

Holland Energy	665	Illinois
Lincoln Generating Facility	656	Illinois
New Covert Generating	1100	Michigan
Pleasants Energy	313	West Virginia
Rio Nogales Power Project	800	Texas
Rolling Hills Generating	850	Ohio
Troy Energy	600	Ohio
University Park Energy	300	Illinois
Wolf Hills Energy	245	Virginia

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

DECLARATION OF
M. Fred Strauss, P.G.

I, M. Fred Strauss, declare as follows:

1. I am presently employed by Tenaska, Inc. as Director of Environmental Programs.

2. A copy of my professional qualifications and experience are attached hereto and incorporated herein by reference.

3. The testimony on Executive Summary, Petition Description, Water Resources, and Percolation and Groundwater Banking for the High Desert Power Project (97-AFC-1C) in support of the *Petition for Modification to Drought-Proof the High Desert Power Project* was prepared either by me or under my supervision, and is based on my independent analysis, data from reliable sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue(s) addressed herein.

5. I am personally familiar with the facts and conclusions presented in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 1-28-16 Signed: M. Fred Strauss

{00347951;1}

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

M. Fred Strauss, P.G.
Director, Environmental Programs
Tenaska, Inc.
Omaha, Nebraska

Summary of Experience

Mr. Strauss has 32 years of experience in water supply, hydrogeology, and environmental geology. Mr. Strauss leads Tenaska's efforts in evaluating and securing water supplies for domestic power generation. His responsibilities include identifying water resources, determining reliability of supply through analysis and modeling, securing permits and contracts, and interacting with the public. Since joining Tenaska in 1998, he has led water supply projects across the United States pertaining to the development and acquisition of electric generating stations.

Education

Fort Hays State University
1985 M.S., Geology
University of Kansas
1983 B.S., Geology
1980 B.S., Cell Biology (w/honors)

Licenses

California Professional Geologist, No. 4726

Work History

1998 – Present	**Tenaska, Inc.** – Omaha, Nebraska Director, Environmental Programs
1996 – 1998	**Montgomery Watson** – Pasadena, California Vice President
1991 – 1996	**Brown and Caldwell** – Pasadena, California Environmental Services Department Manager
1988 – 1991	**Hart Environmental Mgmt Group** – Irvine, California Manager of Geosciences / Senior Project Manager
1985 – 1988	**Layne-Western Company, Inc.** – Bakersfield, California Hydrogeologist
1983 – 1985	**Independent Consulting Hydrogeologist** – Hays, Kansas

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

Representative Water Supply Projects

Project	MW	State
Tenaska Virginia Generating Station	885	Virginia
Tenaska Kiamichi Generating Station	1,220	Oklahoma
Tenaska Central Alabama Generating Station	885	Alabama
Tenaska Lindsay Hill Generating Station	845	Alabama
Tenaska Georgia Generating Station	944	Georgia
Tenaska Gateway Generating Station	845	Texas
Tenaska Frontier Generating Station	830	Texas
Lakefield Junction	534	Minnesota
High Desert Power Project	830	California
Rio Nogales Power Project	800	Texas
Holland Energy	665	Illinois
Rolling Hills Generating	850	Ohio

Selected Bibliography

Pritchard, D.E., S. Sirovica and M.F. Strauss. 2002. Innovative River Intake: Infiltration Gallery Meets Virginia Guidelines in Shallow Water Application. Presentation at Power-Gen International Conference, Orlando, Florida

Sokolsky, Esq., A. and M.F. Strauss. 1995. How the Attorney, Environmental Consultant, and Client Can All Get Along. The Practical Lawyer, vol. 41, no. 1, pp 73-84

Sokolsky, Esq., A. and M.F. Strauss. 1994. The Attorney-Consultant Relationship: The Ultimate Power to Enforce Nationwide Cleanup. Trial Lawyer's Guide, vol. 38, no. 1, pp 18-31.

Strauss, M.F., S.L. Story and N.E. Mehlhorn. 1989. Applications of Dual Wall Reverse Circulation Drilling in Ground Water Exploration and Monitoring. Ground Water Monitoring Review, vol. 9, no. 2, pp. 63-71.

Strauss, M.F. 1988. Proposed Standard Guide for the Use of Dual Wall Reverse Circulation Drilling for Geoenvironmental Site Characterizations and the Installation of Subsurface Water Quality Monitoring Devices. American Society for Testing Materials, Philadelphia, 16 p.

Strauss, M.F. 1985. An Optimal Shallow Disposal Site and Facility for Hazardous Waste in Kansas. Masters Thesis, Open File Report, Kansas Geological Survey, 63 p.

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

DECLARATION OF
Tim Thompson, PG, CHG

I, Tim Thompson, declare as follows:

1. I am presently employed by GSI Water Solutions, Inc. as Principal Consultant.

2. A copy of my professional qualifications and experience are attached hereto and incorporated herein by reference.

3. The testimony on Executive Summary, Petition Description, Water Resources, and Percolation and Groundwater Banking for the High Desert Power Project (97-AFC-1C) in support of the *Petition for Modification to Drought-Proof the High Desert Power Project* was prepared either by me or under my supervision, and is based on my independent analysis, data from reliable sources, and my professional experience and knowledge.

4. It is my professional opinion that the prepared testimony is valid and accurate with respect to the issue(s) addressed herein.

5. I am personally familiar with the facts and conclusions presented in the testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct to the best of my knowledge and belief.

Dated: 1-28-16 Signed: Timothy Thompson

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

GSI Water Solutions, Inc.

Tim Thompson, PG, CHG

Principal Consultant

EDUCATION

MS, Geology, University of California, Santa Barbara

BS, Geology, University of California, Los Angeles

PROFESSIONAL REGISTRATIONS

Professional Geologist: California

Certified Hydrogeologist: California

Registered Geologist: Arizona

SAFETY TRAINING

First Aid/CPR/AED

DISTINGUISHING QUALIFICATIONS

- ✓ Expertise in western U.S. water resource issues: supply, quality, and management
- ✓ Expertise in assessment of groundwater basin yield, water quality, natural recharge, and sustainability
- ✓ Experience in well design, construction, and maintenance
- ✓ Expertise in stormwater treatment, water quality compliance, and TMDLs
- ✓ Experience in groundwater exploration, development, and management

Tim has 30 years of experience in water resource and environmental sciences, regulatory issues, litigation support, and project management for both public-sector and private-sector clients, primarily in California, Nevada and Arizona. His technical knowledge along with awareness of local, state, and federal regulations and policies benefit his project assignments that include the following: groundwater basin characterization, groundwater management, production and monitoring well design and installation, development and implementation of long-term monitoring programs, water quality degradation, water rights disputes, water resource planning, water quantity/quality analysis and modeling, reclaimed water use, conjunctive use and artificial recharge, stormwater and surface water quality modeling and monitoring, stormwater treatment, and regulatory compliance.

REPRESENTATIVE PROJECTS

Injection Well Design and Testing, Water Replenishment District of Southern California Los Angeles County), California. Tim is part of a team providing technical design, permitting and implementation support for the future installation of several dedicated wells that will allow for of aquifer storage of highly treated wastewater from a planned advanced water purification facility.

Groundwater and Potable Water Monitoring, NRG Energy (San Bernardino County), California. At the NRG/BrightSource Ivanpah Solar Electric Generating Station, Tim manages the long-term groundwater and potable water system monitoring program required for permit compliance. Work involves regular data collection and preparation of annual reports that meet requirements established in California Energy Commission site permit (2013 to present).

ASR Well Design/Installation, City of Woodland (Yolo County), California. Tim directs the overall development of well design and specifications package, driller selection, well construction, permitting and well testing effort. His extensive experience in these duties represents a key factor in GSI being chosen for this project work. Water quality and well yield are significant considerations in this effort (2014 – present).

Alternative Water Supply Evaluations, Tenaska Energy, Victorville (San Bernardino County), California. Tim provides services to High Desert Power Project to evaluate reliability and water quality aspects of various water supplies, including recycled water and banked groundwater to ensure compliance with California Energy Commission permit requirements and adjudicated Mojave Basin considerations. (2/2014 – present)

Antelope Valley Groundwater Adjudication, Los Angeles and Kern Counties, California. Tim is a Court-appointed expert witness retained to calculate and report typical water use of the 3,500+ Small Pumper Class (2009 - present). He provided testimony at trial in August 2015.

Subsurface Ocean Intake/Indirect Potable ReUse Evaluations, City of Santa Barbara (Santa Barbara County), California. In coordination with the City's Engineering consultant (Carollo Engineers), Tim provides technical leadership to the team analyzing alternative subsurface intake methods for the proposed re-construction of the City's desalination facility. An additional component of the evaluation is feasibility analysis of Indirect Potable ReUse water storage, including the potential of using the groundwater basins for storage of highly treated wastewater (ongoing).

Groundwater Management, City of Fillmore (Ventura County), California. Tim directs groundwater basin analysis; safe yield evaluations; municipal well site selection; basin-wide water quality and water supply modeling; analysis of depth-related groundwater water quality changes; water quality considerations regarding recycled water use; and well design, installation oversight, and permitting evaluation of a new water supply wellfield. Project work is ongoing. (2002 to present).

Stormwater Quality Analysis, East Area One Project, Santa Paula (Ventura County), California. Tim managed a team effort to evaluate potential of effects on fishery habitat conditions in the Santa Clara River that could result from the proposed development of the East Area One residential development. Tim was retained by Meridian Consultants to provide technical analyses in support of several detailed comment letters submitted on the Draft EIR for this project.

©2016 GSI Water Solutions, Inc. www.gsiws.com TThompson@gsiws.com 805.895.3956

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

Tim Thompson, PG, CHG
Principal Consultant

- ✓ Litigation support and expert testimony

PUBLICATIONS

Listed separately.

Aquifer Investigation and Groundwater/Surface Water Interaction, PG&E/Diablo Canyon, San Luis Obispo County, California. Tim provided comprehensive aquifer investigation, groundwater/surface water interaction assessment, well testing and rehabilitation, and regulatory consulting services. Projects included (1) bedrock aquifer evaluation, installation of deep bedrock wells, aquifer and water quality testing, and groundwater-surface water interaction evaluation. and (2) groundwater analysis and monitoring well installation at the reactor site to characterize groundwater flow orientation and water quality in compliance with the nationwide Groundwater Protection Initiative

Stormwater and Groundwater Support, Shea Homes, Oxnard (Ventura County), California. Tim provides stormwater and groundwater support for the RiverPark Development. Work includes groundwater modeling, stormwater quality modeling, California Environmental Quality Act (CEQA) documentation, water rights assessments, groundwater/surface water interaction, evaluation of nitrate and future water quality issues, re-abandonment of numerous oil wells, TMDL issues, large-scale groundwater dewatering plan/Regional Board permitting, monitoring well installation, water quality analysis of groundwater/surface water interactions, and assessment of potential opportunities for Indirect Potable ReUse, including GRRP permitting considerations. (2000 to present).

Groundwater Provenance Evaluation, City of Arcadia (Los Angeles County), California. Tim was retained as an expert witness to evaluate and testify on groundwater provenance considerations associated with a sub-basin boundary in the adjudicated Raymond Basin (2013 – 2014).

Groundwater Supply Evaluation, Best, Best & Krieger (BBK), Thousand Oaks (Ventura County), California. In support of pre-acquisition due diligence being conducted by BBK, Tim conducted expert support services related to sustainability of groundwater supply, well reliability and long-term drought issues at Hidden Valley Ranch.

Groundwater Evaluation, University of California (UCSB), Santa Barbara (Santa Barbara County), California. Tim evaluated groundwater safe yield projections and recycled water demand forecasts as prepared by a local water purveyor (Goleta Water District) in support of UCSB's preparation of its Long-Range Development Plan Environmental Impact Report (EIR). Work was based on modeling scenarios and was associated with evaluation of drought period minimum supplies.

Groundwater Evaluation, Western Water Company, Moorpark (Ventura County), California. In support of the client's interest in developing water rights investment opportunities, Tim conducted extensive analyses of groundwater recharge options in the western and eastern portions of the Las Posas groundwater basin for determination of groundwater recharge volumetric potential and water rights investment opportunities. Evaluation involved review and analysis of existing and planned wells, water quality, water rights and groundwater modeling conducted by USGS and Ventura Co.

Sierra Club v. California American Water Company, Carmel (Monterey County), California. Retained by California American to evaluate groundwater usage issues associated with Endangered Species Act considerations and flow in Carmel River (2009 – 2010).

Aquifer Recharge Study, Chino Basin (San Bernardino County), California. Tim provided technical analysis, permitting evaluation, and agency coordination for investor-funded projects focused on opportunities for recharge of imported or local water supplies into the adjudicated Chino Basin. Work included execution of a purchase agreement for a 200-acre parcel in Fontana for potential groundwater recharge of treated effluent from a nearby municipal facility, site recharge performance testing, 4-mile-ling pipeline routing, water quality considerations, regulatory considerations, Chino Basin adjudication aspects, acquisition of viable recharge credits, and financial and economic projections.

Groundwater/Surface Water Interaction, Planning Department, Santa Barbara County, California. Tim provided groundwater/surface water interaction evaluations of riverbank well production regarding the potential impact to endangered southern California steelhead habitat from increased groundwater pumping from the banks of the Santa Ynez River.

©2016 GSI Water Solutions, Inc. www.gsiws.com TThompson@gsiws.com 805.895.3956

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

GSI Water Solutions, Inc.

Tim Thompson, PG, CHG

Principal Consultant

Water Quality Impact Evaluation, Turlock Irrigation District (Stanislaus County), California. Tim managed the evaluation of water quality impacts to groundwater associated with a request to increase pumping for supply to the TID Walnut Energy Center power generation facility. Work involves development of predictive effects of increased pumping and reporting and negotiations with California Energy Commission staff to achieve amended operating conditions.

Groundwater Analyses and Expert Testimony, BrightSource, Inyo County, CA. At the Hidden Hills Solar Electric Generating Station (near Pahrump, NV), Tim managed the analyses and provided expert testimony to the California Energy Commission (CEC) related to comprehensive aquifer investigations, groundwater modeling of local and regional effects, sustainable yield, well yield testing, energy facility permitting assistance, and evaluation of water right offsetting alternatives.

Aquifer and Water Supply Assessment, Gillibrand Aggregate Mine, City of Simi Valley, California. Tim provided preliminary aquifer investigation, safe yield investigations, water supply assessment development, groundwater/surface water interaction assessment, water quality, and regulatory consulting services in association with planned permit application to allow expansion of the mine in the Simi Valley area.

Gorman Post Ranch, Los Angeles County, California. Tim provided comprehensive aquifer and sustainable yield investigations, preparation of a Water Supply Assessment, groundwater recharge calculation, water quality, and regulatory consulting in association with this proposed development.

Groundwater Exploration, Lake Arrowhead Community Services District (San Bernardino County), California. Tim conducted this regional groundwater exploration and development project, including well site selection, structural geologic mapping and analysis, well design, permitting (county and CEQA), and installation of five bedrock wells (600-800 feet deep), geophysical logging, and water quality testing. Follow-on work included identification of optimal of future well sites.

Wetlands and Groundwater Recharge, City of Avondale (Maricopa County), Arizona. Tim oversaw the design, permitting, and construction of a 15,000-acre-feet per year constructed wetlands and groundwater recharge project. The 75-acre constructed wetlands facility includes more than 20 lakes that collectively treat nitrate-rich surface water from agricultural runoff and recycled water collected by the SRP canal system to standards acceptable for groundwater recharge and subsequent potable reuse. This project included project management, groundwater modeling, facility design, technical work for permit acquisition, installation (including design, logging, sampling and testing of monitoring wells), system start-up and preparation of comprehensive operations and maintenance manual, and ongoing technical support services.

Groundwater Exploration, Apex Industrial Park, Las Vegas (Clark County), Nevada. At the Apex Industrial Park, Tim was project manager for a regional groundwater exploration and permitting effort resulting in installation of deep (more than 2,000 feet) bedrock wells, regional hydrogeologic evaluations, water rights filing, and water supply planning. Duties included regional geologic research and well site selection, driller selection and contracting, well logging, water quality sampling and analysis, drilling oversight, contract administration, well testing (design, operation, monitoring, and evaluation), well completion design and supervision, and preparation of final technical report. Well site selections and regional hydrogeologic analyses were conducted in four separate groundwater basins throughout the area north of Las Vegas, along with extensive water rights and federal agency coordination and planning.

Aquifer Recharge, Goleta Water District (Santa Barbara County), California. Tim managed the feasibility study, design, and grant funding application for well injection of potable water into six existing District wells for this aquifer recharge project. The grant was fully funded and was one of the two highest scoring applications submitted statewide for the early 2002 round of Proposition 13 water bond funding.

Drought Mitigation Well Project, City of Santa Barbara (Santa Barbara County), California. Tim managed the City's drought mitigation well drilling program, including extensive groundwater exploration and development in multiple locations:

©2016 GSI Water Solutions, Inc. www.gsiws.com TThompson@gsiws.com 805.895.3956

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

GSI Water Solutions, Inc.

Tim Thompson, PG, CHG

Principal Consultant

- Mission Creek – Site selection, well logging, water quality testing, and well performance testing of three bedrock production wells (900 to 1,300 feet deep). Included installation of pipeline and power lines and all associated permitting and agency coordination.
- North Portal of Mission Tunnel – Site selection, driller contracting, well logging, water quality testing, well performance testing and well completion of deep bedrock well.
- Gibraltar Reservoir – Groundwater exploration under emergency drought-related demands including regional hydrogeologic investigations, well site selection, water quality testing, and performance testing. Project resulted in completion of five shallow alluvial production wells tapping water supplies present beneath reservoir bottom silts and muds during period when reservoir was completely dry. Time-domain electromagnetic geophysical techniques were used in well site selection.

ASR Well Design/Testing, City of Santa Barbara (Santa Barbara County), California. Tim directed implementation of a well injection recharge project, including testing of City well performance for conversion to injection wells, and evaluation of geochemical issues of remixing of surface water and groundwater.

Groundwater Management, Bear Valley Community Services District, Tehachapi (Kern County), California. Tim provided services including extensive analysis of this groundwater-dependent District's needs and requirements, bedrock aquifer analyses, quantification of natural recharge, geophysical evaluations (seismic reflection/ refraction), remote sensing investigations, site selection and installation of deep bedrock, alluvial, and monitoring wells, and groundwater management advisory support.

Groundwater/Surface Water Interaction, City of Mesquite (Clark County), Nevada. Tim oversaw the groundwater/surface water interaction component of the lower Virgin River Habitat Conservation Plan, as required for regulatory compliance with Section 7 of the federal Endangered Species Act. His role included preparation of the Hydrological Monitoring and Mitigation Plan, which constitutes a long-term monitoring program developed to determine if groundwater pumping effects flows in the adjacent Virgin River.

Groundwater Exploration and Development, Green Valley County Water District (Los Angeles County), California. Tim managed the groundwater exploration and development program for the community of Green Valley in northern Los Angeles County. Work involved regional exploration and well site selection, design/oversight of seismic surveys, installation of a 900-foot bedrock well, including contractor oversight, permitting (including U.S. Forest Service coordination), well logging, water quality testing, and wellhead treatment recommendations.

Hydrogeologic Evaluation, City of Santa Clarita (Los Angeles County), California. Tim managed the analysis and mitigation of flooding in a residential area caused by high surficial recharge rates that generated occasional high groundwater conditions. Work included hydrogeologic evaluation and well siting work leading to the installation of two monitoring wells, one new production well, and retrofit of an existing production well to allow dewatering and associated water level monitoring of groundwater conditions. Tasks included aquifer flow analysis, well permitting, contractor selection, well logging, water quality testing, performance testing, well design and completion, and overall project management.

Hydrogeologic Evaluations, Keystone Fruit Co., Riverside, Washington. Tim was responsible for hydrogeologic oversight and technical report preparation for the Tunk Creek aquifer test and hydrogeologic evaluation, which analyzed the groundwater/surface water interactions between the aquifer and creek.

Groundwater Resources Support, Young-Nak Property, Lake Hughes (Los Angeles County), California. Tim provided groundwater supply assessment, groundwater quality modeling, stormwater modeling, and regulatory liaison services associated with California Environmental Quality Act documentation requirements for site expansion impacts analysis.

©2016 GSI Water Solutions, Inc. www.gsiws.com TThompson@gsiws.com 805.895.3956

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

Tim Thompson, PG, CHG
Principal Consultant

STORMWATER MANAGEMENT/PERMITTING PROJECTS

Stormwater Runoff Evaluation, Department of Food and Agriculture, California. As part of a team preparing a programmatic EIR for the eradication of the light brown apple moth (*Epiphyas postvittana*) from affected counties in California, Tim analyzed potential stormwater runoff issues related to water quality and watershed effects associated with the various methods contemplated for eradication.

Stormwater Water Quality Modeling, TriMark, Ventura County, California. Tim managed this project to develop a stormwater water quality model and best management practices designs to establish compliance with City of Oxnard and State regulatory limits for the NorthShore Mandalay Development. He also provided long-term groundwater monitoring services for an adjacent wetland mitigation parcel at McGrath State Beach, as required for project approvals.

Hydrogeologic Support, Los Angeles County, California. Tim was a project scientist on a team that prepared the Los Angeles County Department of Public Works North Santa Monica Bay Watersheds (NSMBW) Regional Watershed Implementation Plan and the Malibu Creek Bacteria TMDL. He provided technical support regarding overview of the hydrogeology of the NSMBW and Malibu Creek watersheds, and water quality model-based support for the development of structural and non-structural solutions, and municipal codes associated with stormwater quality.

Stormwater Pollutant Load Evaluations, City of Los Angeles (Los Angeles County), California. As project scientist, Tim worked with the City's Watershed Division in coordination with CREST (Cleaner Rivers through Effective Stakeholder TMDLs) to (1) prepare stormwater pollutant load estimates in this highly urbanized Los Angeles area watershed and (2) predict the impacts of various watershed management scenarios on in-stream water quality TMDLs. Work included preparing Ballona Creek bacteria TMDL: devising various implementation options for achieving bacteria limits for the three reaches of the creek, understanding effects of potential implementation options, and evaluating the range of suggested options in relation to a series of goals and objectives.

Water Quality Management Plan, M. Timm Development, Inc., Carpinteria (Santa Barbara County), California. Tim developed a water quality management plan for stormwater treatment and regulatory compliance at the Mission Terrace Development.

PERMITTING SUPPORT PROJECTS

Water Resources Support for Programmatic Environmental Impact Report (PEIR), Mosquito Vector Control Association of California Coastal Region, California. Tim provided technical report preparation and impact analyses for the groundwater and water resources sections of the PEIR for this regional evaluation of the effects of continued implementation of a suite of pesticide application and other vector control strategies. The work was prescribed in the Integrated Vector Management Programs for Alameda, Contra Costa, Marin, Sonoma, Napa, Solano, Santa Clara, and San Mateo Counties.

Permitting Support, NW Natural, Fresno and Madera Counties, California. Tim provided comprehensive permitting support to Northwest Natural and its partner PG&E for the Gill Ranch Gas Storage Project. He provided water resources, discharge permitting, groundwater analyses, and regulatory support. Key aspects of this work included preparation and submittal of "Notice of Intent" forms to the Central Valley Regional Board for anticipated water discharges associated with different aspects of the 27-mile-long pipeline installation and hydrostatic testing. Discharges were permitted under a Board order associated with discharges considered "Low Threat to Water Quality." The primary hydrostatic testing involved 1 million gallons of water that was discharged across a fallow field.

Water Resources Support, Permit/Resource Management Department, Sonoma County, California. Tim prepared water resources and water quality sections of the Preservation Ranch Environmental Impact Report (EIR) for a proposed 19,000-acre vineyard and restoration project in northwest Sonoma County. Work involved (1) determining project impacts on water resources including groundwater, water quality, stormwater, total maximum daily loads (TMDL), and other water resources considerations; and (2) evaluating potential groundwater/surface water interactions

©2016 GSI Water Solutions, Inc. www.gsiws.com TThompson@gsiws.com 805.895.3956

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

Tim Thompson, PG, CHG

Principal Consultant

by conducting a diagnostic pumping test to evaluate effects of pumping on flow in nearby springs.

Water Resources Analysis, Metropolitan Water District of Southern California. Tim provided water resources analysis and comprehensive GIS mapping products to evaluate water supply benefits in the Imperial Valley area potentially derived from fallowing and crop water use reductions.

Permitting Support, Department of Water and Power, Los Angeles County, California As project scientist for the Owens Valley Dust Mitigation program, Tim provided permitting support for wetlands certification and dewatering discharge water quality compliance issues.

SELECTED LITIGATION SUPPORT PROJECTS

- BrightSource Energy – Retained as expert witness to testify before California Energy Commission on proposed project in eastern California, near Pahrump, Nevada.
- Southern California Edison (SCE) v. Sunrise Growers – Retained by SCE for evaluation of groundwater usage.
- Sleepy Valley Water Company (SVWC) v. Rainmaker Water – Retained by SVWC for water rights evaluations in a small groundwater basin.
- Ladd Construction v. Ventura County Public Works – Retained by Ventura County for litigation support regarding timing and execution of Los Angeles Regional Water Quality Board permitting.
- Santa Barbara Channel Keeper v. Venoco – Provided litigation support related to potential water quality issues associated with a proposed Paredon well drilling program.
- Keller et al. v. D.R. Horton Homes – Deposed as a fact witness for land ownership lawsuit related to water resources and permitting-related technical matters associated with timing of entitlements associated with RiverPark Development in Oxnard, California.
- IWR v. South Tahoe Public Utilities District (Arizona) – Provided expert witness technical support and mock-trial participation for land and water rights value determination in federal court condemnation case.
- Spiekerman v. City of Avondale – Deposed as a fact witness for construction timing and delays lawsuit related to timing of design document, permitting completion, and public agency review turn-around-time issues on a $15 million construction project involving constructed wetlands, artificial recharge basins, and residential development.

DUE DILIGENCE SUPPORT PROJECTS

Water Supply Alternatives, The Riverside Company, Oceanside (San Diego County), California. In support of pre-acquisition due diligence being conducted by The Riverside Company, Tim conducted an expert review and support services related to water supply alternatives, water rights, groundwater/surface water interaction, and reverse-osmosis treatment system design alternatives and costs at HerbThyme Farms on the San Luis Rey River.

Groundwater Evaluation, Teasdale Quality Foods, Atwater (Merced County), California. In support of pre-acquisition due diligence, Tim evaluated the cannery's groundwater production. Work included evaluating the reliability of yield, integrity of well and pumping facilities, vulnerability to groundwater contamination issues impacting clients' wells, Regional Water Quality Control Board's National Pollutant Discharge Elimination System (NPDES) permitting considerations for facility effluent, considerations related to partial conversion to City water supplies, and cost analysis of various physical and institutional water supply alternatives.

Groundwater and Surface Water Supply Evaluations, Calpine Company, Redlands (San Bernardino County), California. Tim provided due diligence support for Calpine's efforts to consider bidding on a partially permitted power plant site in Redlands. He conducted analyses of groundwater production potential, available surface water supplies, permitting issues, and water quality aspects that were critical to evaluating costs and timelines for installation and operation of a proposed 500-megawatt (MW) power plant. His expertise and familiarity with general water issues, groundwater conditions, regulatory/permitting requirements, and local agencies provided a valuable resource to Calpine.

APPENDIX A

WITNESS QUALIFICATIONS AND DECLARATIONS

GSI Water Solutions, Inc.

Tim Thompson, PG, CHG

Principal Consultant

Water Supply Evaluation, Calpine Company, Hudson, Colorado. Tim provided technical services for due diligence of a water supply option to cool a proposed 500-MW power generating station to be built near Hudson. Work included development and evaluation of conceptual design, feasibility studies, permitting, and engineering cost schedules.

Groundwater Recharge Evaluations, Summit Engineering, Reno, Nevada. Tim conducted detailed groundwater recharge calculations for investor-based Eco-Vision project encompassing entire northern half of State of Nevada. Developed robust GIS-based methodology to calculate natural recharge to the numerous vast groundwater basins from natural precipitation, including considerations of 30+ years of rainfall, snowpack, runoff, and evapotranspiration data. He developed a modified approach to the soil-moisture balance technique to determine long-term recharge amounts in support of demonstrating to the Nevada Division of Water Resources State Engineers Office the presence of surplus, unallocated groundwater. The project concept included intention to wheel water down the Humboldt River for sale to potential buyers in the Reno and Carson City areas.

Groundwater Basin Evaluations, Burlington Northern-Santa Fe (BNSF) Railroad, San Bernardino (San Bernardino County), California. At the BNSF InterModal Railroad Yard, Tim conducted detailed evaluations of groundwater basin characteristics, groundwater development options, water quality, wellfield design and water rights for an investor-supported groundwater development program in the Bunker Hill basin area of San Bernardino. Work included determination of potential groundwater production rates and valuation for potential resale of water to other entities.

Groundwater Analysis, Western Water Company, San Diego (San Diego County), California. Tim provided technical expertise in hydrogeology and groundwater resource analysis to a water investment company on a range of diverse projects. He conducted evaluations of groundwater basin capacity, groundwater banking, and water transfers for projects throughout California and the southwestern United States. Work included conducting basin analysis, investigating groundwater resource issues, and coordinating information from a variety of sources (such as U.S. Geological Survey, other consultants, and public agencies that were program partners). Projects included evaluations of water supply privatization, wastewater reuse, and alternative uses for existing groundwater resources.

REPRESENTATIVE WATER QUALITY/REMEDIATION/NRDA PROJECTS

Water Quality Evaluation, Turlock Irrigation District, Stanislaus County, California. Tim managed the evaluation of potential water quality impacts to groundwater associated with a request to increase pumping for supply to the Walnut Energy Center power generation facility. Work involved development of predictive effects of increased pumping and reporting and negotiations with the California Energy Commission's staff to achieve amended operating conditions.

Hydrologic Support, California Department of Water Resources, Brawley (Imperial County), California. For this complicated restoration project at the Salton Sea, related to species conservation habitat development, Tim provided water resources expertise and field-based technical support to evaluate infiltration characteristics of the areas proposed for flooding and groundwater recharge.

NRDA Studies, BP Americas, Houston, Texas. From 2010 through 2014, Tim managed the Water Column NRDA Technical Working Group of a consultant team that responded to the Deepwater Horizon oil accident in the Gulf of Mexico on behalf of BP. He provided support to the Water Column and Deep Water Benthic Communities technical working groups, and participated in the design, implementation, and reporting associated with Natural Resource Damage Assessment (NRDA) studies.

Aquifer Analysis, U.S. Department of Energy, Scioto County, Ohio. At the Portsmouth Gaseous Diffusion Facility, Tim provided comprehensive aquifer analysis, multi-well pumping test analysis and hydrogeologic evaluation for input to stream remediation program targeted on historical nonaqueous-phase liquid (DNAPL) contamination.

©2016 GSI Water Solutions, Inc. www.gsiws.com TThompson@gsiws.com 805.895.3956