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High Desert Power Project
(97-AFC-1C)
Petition
for
Modification
to
Drought-Proof the
High Desert Power Project

Submitted by

High Desert Power Project, LLC

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

High Desert Power Project, LLC ("HDPP" or "Project Owner") files this Petition for Modification ("Petition") as directed in the California Energy Commission's ("Commission") September 10, 2014 Order Approving Petition to Amend, and as necessary to bring the Commission's certification for the High Desert Power Plant (the "Facility") up to date with events and circumstances unforeseen by the Commission and the Project Owner's predecessor when the Facility was licensed in May of 2000. Circumstances that were unforeseen by the Project Owner and the Commission have reshaped the water supply landscape for the Facility.

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 Mojave Basin and appointing the Mojave Water Agency ("MWA") to act as the Watermaster to implement the adjudication. Through MWA's leadership, the Mojave 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), the California Department of Fish and Wildlife (then California Department of Fish and Game) and 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. This MOU settled, and fundamentally reshaped, how water is used and managed for the benefit of the environment and water users in the Mojave Basin.

Third, starting in 2007, water deliveries from the State Water Project ("SWP Water") 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 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. As a result — and acting of its own volition — in 2008 HDPP petitioned the Commission to lift the prohibition and allow for the use Recycled Water at the Facility.

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 and 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 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 when the Delta Smelt Biological Opinion reshaped the water landscape.

In response to these and other circumstances, HDPP has filed this Petition to drought proof the Facility. As described herein, under normal or even average circumstances, the Facility will need little to no MWA-administered groundwater 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 SWP Water, Banked SWP Water and MRB Adjudicated Water are the Facility's backup supplies for blending.

To objectively verify the Facility's commitment to implement the Loading Sequence, HDPP will monitor and report on two important water quality parameters: (1) cooling tower blowdown rate and (2) the levels of chloride in the cooling tower water. Specifically, HDPP will continue to maximize use of Recycled Water as the Facility's primary water supply blended with other available water sources in ratios needed to maintain the "CT Blowdown Rate" and the chloride concentration within acceptable levels.

With respect to CT Blowdown Rate, the Facility operators will monitor the actual CT Blowdown Rate and compare it to the CT Blowdown Rate required to maintain cooling water quality within the limits required to maintain permitted cooling tower PM_{10} emissions and to protect the Facility's cooling systems and equipment. With respect to chloride concentrations, when chloride concentration is greater than 980 mg/L, defined as the "Threshold Chloride Concentration," the circulating cooling water is not of acceptable quality. Whenever the actual CT Blowdown Rate is less than the required rate or whenever the cooling water chloride concentration is above the Threshold Chloride Concentration, then blending makeup water using supplies of higher quality is required to maintain compliance with air quality requirements and reliable operations. These two criteria, CT Blowdown Rate and Threshold Chloride Concentration, will ensure that the Facility uses its available water supplies consistent with the Loading Sequence, favoring Recycled Water as much as feasible for blending with other supplies.

Finally, in reviewing the Petition, it will be vitally important for the Commissioners to distinguish between (a) how HDPP expects the Facility to operate versus (b) the permitting flexibility needed to operate this merchant Facility in a competitive marketplace. As discussed in detail in this Petition, the expectation is that only under extreme circumstances will the Facility use MRB Adjudicated Water to operate reliability. Nevertheless, to compete in the marketplace and to ensure the Facility can reliably serve the State of California, HDPP needs the permitting flexibility to respond to the extreme events over which the Facility has no control. Accordingly, HDPP proposes to secure access to groundwater as may be needed under extreme circumstances, limited by using a five year rolling average to account for the annual variability in water quality, quantities, supplies and circumstances beyond its control.

As demonstrated in the Petition, permitting flexibility, tempered with the accountability proposed in revisions to Condition SOIL&WATER-1, is required to drought proof the Facility.

1.0 INTRODUCTION

1.1 Overview of Petition

High Desert Power Project, LLC ("HDPP") operates the High Desert Power Project (the "Facility" or "Project"), an 830 Megawatt ("MW") combined-cycle power plant located in the City of Victorville in San Bernardino County. The Facility was certified by the California Energy Commission ("CEC" or the "Commission") on May 3, 2000, and commenced commercial operations in April 2003.

The Commission's September 10, 2014 Order ("2014 Order") modifying the May 2000 final decision, as amended ("Final Decision"), adopted revisions to Condition of Certification SOIL&WATER-1 and required HDPP to file by no later than November 1, 2015 a petition for modification of SOIL&WATER-1 that will implement reliable primary and backup water supplies, or in the vernacular, "drought-proof" the Facility.[1] In furtherance of the Commission's directive, this 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. Having already spent millions of dollars on securing and maximizing Recycled Water use, implementing additional upgrades required to use 100% Recycled Water is not economically feasible.

Findings presented in HDPP's November 1, 2014 High Desert Power Project Recycled Water Feasibility Study Report (the "Feasibility Report")[2,3] demonstrate that without a more diverse and reliable water supply, the Facility will not be drought-proof in circumstances when currently permitted water sources are not of sufficient quality or quantity to reliably operate the Facility. As the Feasibility Report concludes, "HDPP's Recycled Water supplier is unable to provide Recycled Water in quantities and qualities on a 24 hours per day [basis] on all days of the year as required by the Facility for it to maintain high availability for generating power."[4] Given the potential for inadequate supply, HDPP requires continued access to more than one water supply to drought-proof the Facility.

HDPP has retrofitted the Facility and invested millions of dollars in on-site and off-site capital improvements to maximize the use of Recycled Water (see Section 2.1.3 below). It should also be noted that, as the least expensive source of water, it is in HDPP's financial interest to maximize use of Recycled Water. Why then must the Facility rely on blending water from more than one source to ensure the safe and reliable operation of the Facility? The answer lies in

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[1] TN # 203003. *Staff Analysis of the Proposed Petition to Allow High Desert Power Project to use Alternative Water Supplies.* August 28, 2014, pp. 4, 7, 12-15.
[2] TN # 203306. *High Desert Power Project Recycled Water Feasibility Study Report.* Docketed Date November 3, 2014.
[3] CEC's "*Staff Analysis of the High Desert Power Plant Recycled Water Feasibility Report*" was docketed on October 9, 2015. HDPP's comment and response have not been included in this Petition due to time constraints.
[4] TN # 203306. *High Desert Power Project Recycled Water Feasibility Study Report.* Docketed Date November 3, 2014, p. 5.

both the quantity and quality of Recycled Water required for safe and reliable operation of the Facility.

With respect to Recycled Water *quantity*, and despite HDPP having invested millions of dollars in on-site and off-site capital improvements, the Recycled Water suppliers' treatment and storage facilities do not supply Recycled Water at the sustained flow rates necessary to meet the Facility's maximum water demand.

With respect to Recycled Water *quality*, when constructed the Facility was explicitly prohibited from using Recycled Water and simply cannot operate reliably on a 100% Recycled Water supply. Despite HDPP's investment to use Recycled Water, the results in the Feasibility Report demonstrate that the Facility's water treatment system cannot effectively treat and remove the higher amount of impurities associated with using 100% Recycled Water as required to maintain permitted cooling tower PM_{10} emissions limits and to protect the Facility's cooling systems and equipment. Clogging or "fouling" of the Facility's water treatment filtration systems has occurred with use of Recycled Water requiring mitigation by blending in higher quality water sources.

Further, the Facility's water treatment system was designed to treat SWP Water, which historically has been of higher quality than Recycled Water. The Facility's water treatment system was not designed to remove the greater amounts of impurities found in Recycled Water and, as described in the Feasibility Report, it is not economically feasible to upgrade the water treatment system to reliably treat 100% Recycled Water. Consequently, Recycled Water must always be blended with other water sources.

In recognition of the Facility's need to blend multiple water sources, as well as drought-induced shortages of State Water Project water ("SWP Water"), the Commission in September 2014 approved HDPP's petition to add the use of adjudicated groundwater from the Mojave River basin ("MRB Adjudicated Water," also referred to as "MRB Water Rights" in Condition of Certification SOIL&WATER-1) to the already authorized use of Recycled Water, SWP Water, and SWP Water stored in HDPP's aquifer bank ("Banked SWP Water"). The Commission also ordered HDPP to submit this Petition to "implement reliable primary and backup HDPP water supplies that are consistent with state water policies or an alternate cooling system like dry cooling."

This Petition accomplishes the mandate to implement reliable primary and backup HDPP water supplies through three primary modifications to the Final Decision: (1) prioritizing the use of the different sources of water at 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; and (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.

Subsequent to the Commission's 2014 Order to drought-proof the Facility and as discussed herein, HDPP through various engineering and technical evaluations conducted during 2015 has identified the cooling tower blowdown rate ("CT Blowdown Rate", as defined below) and the chloride concentration in the circulating cooling tower water as key factors which can be monitored to provide a scientifically and *objectively verifiable* method to ensure that Recycled Water use is maximized while the Facility is drought-proofed through the blending of water supplies as necessary to maintain acceptable cooling tower performance. With respect to chloride concentrations, when chloride concentration is greater than 980 mg/L, defined as the "Threshold Chloride Concentration," the circulating cooling water is not of acceptable quality.

HDPP restates and affirms its commitment to use as much Recycled Water as feasible. As a merchant-based power plant, HDPP's commitment to use as much Recycled Water at the Facility as feasible is also aligned with its desire to minimize variable expense and use the least cost water supply while satisfying operating conditions in the Facility. In order to satisfy the requirements of the Commission's Order to drought-proof the Facility, HDPP requires access to more than one water supply for backup purposes and the ability to blend supplies with Recycled Water as reliability needs require.

To memorialize its commitment to use as much Recycled Water as feasible, HDPP proposes to use water for cooling and other industrial needs by implementing a "Loading Sequence" which is briefly introduced below and described in more detail in Section 2.4.

HDPP will continue to maximize use of Recycled Water as the Facility's primary water supply blended with other available water sources in ratios needed to maintain the CT Blowdown Rate *and* chloride concentration at levels necessary to reliably operate the Facility, as further described herein. If either the CT Blowdown Rate or chloride concentration indicates that backup sources of water are needed for blending to maintain either at its acceptable level, then the Facility will preferentially seek to follow a defined sequence to blend water of higher quality with Recycled Water.

The Loading Sequence is as follows:

First, Recycled Water, if available, blended with SWP Water, if available and of suitable quality, in ratios needed to maintain the CT Blowdown Rate and keep chloride concentration below the Threshold Chloride Concentration.

Second, Recycled Water, if available, blended with SWP Water, if available and of suitable quality, and/or Banked SWP Water, if available, in ratios needed to maintain the CT Blowdown Rate and keep chloride concentration below the Threshold Chloride Concentration.

Third, Recycled Water, if available, blended with SWP Water, if available and of suitable quality, and/or Banked SWP Water, if available, and/or MRB Adjudicated Water in ratios needed to maintain the CT Blowdown Rate and keep chloride concentration below the Threshold Chloride Concentration.

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, and other abnormal circumstances.

Once the CT Blowdown Rate and chloride concentration have reached acceptable levels, the ratios will be adjusted to maximize Recycled Water use while keeping the CT Blowdown Rate and chloride concentration at acceptable levels.

It is important to note that the water sources listed in the Loading Sequence above are also in rank order of relative cost to HDPP. That is, Recycled Water is the least cost and MRB Adjudicated Water is the highest cost. Consequently, as a merchant-based power plant, the Facility will minimize variable operating expense and preferentially use the least-cost water supply, turning to MRB Adjudicated Water only as the final backup selection.

Continued access to MRB Adjudicated Water will be necessary due to the variability in quantity and quality of Recycled Water and SWP Water. 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. MRB Adjudicated Water will be purchased by the Facility from the Victorville Water District (“VWD”)[5] under VWD’s adjudicated water right (discussed below). As a condition to use this water source, the fee charged to the Project Owner by VWD (retailer) allows for payment to MWA (State Water Project contractor and wholesaler) to replace MRB Adjudicated Water sold to the Facility on a 2:1 basis, resulting in a net benefit to the Mojave groundwater basin (the “Basin”) through MWA’s replacement water program.

The Project Owner was ordered to file this Petition no later than November 1, 2015 “to ensure that the HDPP is drought proof for the long term.”[6] Approval of this Petition with the proposed language changes to SOIL&WATER-1, as presented in Section 4 of this Petition, will result in HDPP’s use of as much Recycled Water as feasible while also providing HDPP with access to other backup water supplies, appropriately limited, that can be blended to drought-

[5] The Victorville Water District is a County Water District and subsidiary district of the City of Victorville.

[6] TN # 203003. *Staff Analysis of the Proposed Petition to Allow High Desert Power Project to use Alternative Water Supplies*, p. 4. August 28, 2014.

proof the Facility. HDPP will continue to report all use of water from all sources to the Commission on a monthly basis pursuant to SOIL&WATER-1(b).

1.2 Summary of Environmental Impacts

Section 1769(a)(1)(E) of the Commission's Siting Regulations requires that an analysis be conducted to address any potential impacts the proposed revisions may have on the environment, and measures proposed to mitigate potentially significant adverse impacts. Section 1769(a)(1)(F) requires a discussion of the impact of the proposed revisions on HDPP's ability to comply with applicable laws, ordinances, regulations, and standards ("LORS"). Section 3.0 of this document discusses the potential impacts of the Petition on the environment, as well as a discussion of the consistency of the requested change with LORS. Section 3.0 concludes that the modification proposed in the Petition will be in compliance with all applicable LORS and will not affect the Facility's ability to comply with all applicable LORS, and that there will be no significant adverse environmental impacts associated with this Petition.

1.3 Consistency of Petition with License

Section 1769(a)(1)(D) of the Commission's Siting Regulations requires a discussion of the Petition's consistency with applicable LORS and whether the modification being sought is based on new information that changes or undermines the assumptions, rationale, findings, or other basis of the Final Decision. If the Facility is no longer consistent with the license, an explanation of why the modification should be permitted must be provided. The changes proposed herein are consistent with HDPP's CEC license and relevant LORS. As discussed in more detail in Sections 2.0 and 3.0 below, the proposed modifications do not undermine any basis for the CEC's licensing decision.

2.0 IMPORTANT HISTORY AND DESCRIPTION OF PETITION

2.1 History of HDPP's Voluntary Transition from Use of Surface Water to Maximum Use of Recycled Water.

The information supporting the proposed modification presented in this Petition was not known during the original certification proceeding. As explained below, HDPP has been working diligently since 2008 to secure a drought-proof water supply and to increase Recycled Water use by the Facility. Further, implementation of the Loading Sequence that provides for the blending of multiple water sources when needed is consistent with California law and CEC's preferred water policy to maximize the use of Recycled Water while ensuring grid reliability through a flexible and comprehensive water management strategy.

2.1.1 The Commission's Original Certification Expressly Prohibited the 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 was expressly ***prohibited*** from using Recycled Water and consequently was not designed to operate on 100% 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 <u>*use only imported State Water Project water for its cooling needs*</u>.[7]

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.[8]

Two 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, the California Supreme Court substantially affirmed the Judgment of the Riverside County Superior Court adjudicating the water rights in the Basin and appointing the Mojave Water Agency ("MWA") to act as the Watermaster to implement the adjudication, affirming the June 1, 1998 Judgment as to the stipulating parties. Since that time, MWA's leadership has resulted in significant increase in storage and sustainable water conditions in the Alto Subarea where the Facility is located as further described in Section 3.6 below. Moreover, as explained below, MWA manages the Basin as envisioned for all California groundwater basins by the 2014 Sustainable Groundwater Management Act ("SGMA").[9] The SGMA aims at providing the structure and the certainty already provided by the Judgment and MWA. Effective water basin management, similar to that of the Mojave Basin, is the direction the California Legislature envisions that all groundwater basins will move towards in the future under the SGMA.

Second, by Memorandum of Understanding (the "MOU") dated June 27, 2003 (more than 3 years after the Commission's certification of the Facility), the CDFG and Victor Valley Wastewater Reclamation Authority ("VVWRA") agreed that VVWRA would continue to discharge at least 9,000 AFY of Recycled Water to the Mojave River to protect instream resources. The MOU addressed the fish and wildlife resource concerns that caused the Commission to prohibit the Facility from using Recycled Water.

2.1.2 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 State Water Project 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

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[7] HDPP Final Decision, May 2, 2000, p. 230 (emphasis added).
[8] *Ibid*., p. 223.
[9] See Water Code § 10720.8(a)(2) exempting the Judgment and MWA from compliance with the SGMA.

Facility. In 2009 the Commission removed the prohibition allowing HDPP to use as much Recycled Water as feasible given the approved equipment capabilities and permit conditions.[10]

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 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:

> 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.[11]

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."[12]

As in 2008, HDPP desires to use as much Recycled Water as feasible. However, the Facility's existing water treatment system was not designed to remove the higher amounts of impurities found in Recycled Water and cannot reliably treat 100% Recycled Water. Moreover, upgrades to the water treatment system to use 100% Recycled Water are not feasible as described in the Feasibility Report. Consequently, water from more than one source must be blended with Recycled Water to allow for and to maximize Recycled Water use.

2.1.3 HDPP Has Been Proactive, Investing in Significant and Costly Capital Projects to Maximize the Facility's Use of Recycled Water.

When HDPP entered into its agreement for Recycled Water service with VWD in September 2010, it did so with the reasonable expectation that VWD would supply Recycled Water meeting the contractual water quantity and quality specifications and that no significant capital improvements beyond those required by the agreement would be needed by HDPP to use Recycled Water at the Facility. VWD has not always met the agreement specifications and HDPP has responded by accepting out-of-specification water. HDPP has invested significant

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

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

[12] *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."

capital into additional engineering analysis and water treatment facilities to improve Recycled Water use given the varying quality delivered.

Since 2009, HDPP has invested approximately $6.7 million for: (i) multiple engineering and technical evaluations of the Facility's existing 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. Table 1 below summarizes the costs to date.

TABLE 1
Costs Incurred to
Maximize Use of Recycled Water

No.	Project Name	Description	Date	Cost
1	Perform Reclaimed Water Study	Study the cost for the Facility water treatment system upgrades to allow plant to run on 100% Recycled Water.	2008-2014	$ 284,659
2	Fund Construction of Recycled Water Delivery Facilities	VWD design, procure and install "outside the Facility fence" Recycled Water delivery piping and facilities.	2009-2011	$ 1,657,375
3	Construct Recycled Water Receiving Facilities	HDPP design, procure and install "inside the Facility fence" Recycled Water piping and facilities.	2009-2011	$ 589,038
4	Conduct Water Treatment Project	Perform various engineering studies, pilot studies, procure and temporarily install test water treatment equipment, to study ways to increase use of Recycled Water at the Facility.	2013	$ 2,469,049
5	Construct Third-Stage Cold Lime Softening System	Add an additional stage of softening to the cooling tower blowdown system to allow for more softening retention time.	2014-2015	$ 1,316,519
6	Construct UV System	Add UV system to cooling tower blowdown system to control organics that contribute to fouling of the micro-filters.	2014-2015	$ 133,184
7	Perform Engineering & Technical Evaluations	Retain engineering and technical consultants to evaluate the Facility water treatment system and recommend options for "drought proofing" the Facility.	2015	$ 244,401
			Total	$ 6,694,225

The capital projects and technical studies presented in Table 1 are complete. They have increased the Facility's ability to use more Recycled Water but they are not sufficient for the Facility to use 100% Recycled Water. With respect to upgrading the Facility's water treatment system such that it could use 100% Recycled Water, the Feasibility Report filed in November 2014 concludes:

> The capital costs to upgrade the water treatment system are extremely high and 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 utilities in California who have a retail customer base upon which it can recover the incremental capital and operating and maintenance costs associated with using Recycled Water, HDPP is a merchant generating facility and the amount of revenue it earns to pay for its costs is subject to market forces. Using 100% Recycled Water will not provide HDPP with increased energy or increased capacity revenue opportunities therefore it is not economically feasible for HDPP to incur these additional costs associated with the use of 100% Recycled Water. Accordingly, additional Recycled Water may not be furnished for a reasonable cost and the use of additional Recycled Water at the Facility is not mandated by California Water Code section 13550.[13]

Given these economic realities, efficient and reliable operation of the Facility may require the blending of two or more water supplies to maintain the CT Blowdown Rate and keep chloride concentration below the Threshold Chloride Concentration.

2.2 HDPP 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 instructive to focus on the four supplies available to accomplish this objective.

Recycled Water. HDPP has a contract to purchase Recycled Water from the 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 the Feasibility Report, VWD does not reliably supply Recycled Water in sufficient quantity and quality, and upgrades to the Facility's existing 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 State Water Project contractor. When HDPP was originally certified, SWP Water was envisioned as the primary source of water for the

[13] TN # 203306. *High Desert Power Project Recycled Water Feasibility Study Report.* Docketed Date November 3, 2014, pp 6, 21.

Facility given the prohibition on use of Recycled Water imposed by the Commission. Historically, 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 has been 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 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 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 from the State Water Project and allocated to HDPP for its use 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. These conditions substantially impair the Facility's ability to bank surplus SWP Water when available and are 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 the VWD (the "Agreement")[14]. 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. Impacts to the Basin from the Facility's use of MRB Adjudicated Water

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

will be mitigated through compliance with the terms and conditions of the Judgment and the Rules and Regulations of the Mojave Basin Area Watermaster. Moreover, as a condition to use this water source, the fee charged to the Project Owner by VWD under the Agreement allows for payment to MWA to replace MRB Adjudicated Water sold to the Facility on a 2:1 basis, resulting in a net benefit to the Basin through MWA's replacement water program.[15]

2.3 HDPP Will Use Objective Criteria to Blend Water Supplies to Maximize the 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 in Section 2.3.1 below, the need to blend Recycled Water with other sources of water will be objectively determined and verified.

2.3.1 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 fundamental tenet which 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 may be brought back into balance 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.

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

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 out of every gallon 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 through makeup water addition can lead to PM_{10} emissions from the Facility's cooling tower exceeding HDPP's 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 monitor the cooling water quality and determine if it is acceptable is to use engineering principles to calculate the CT Blowdown Rate required to maintain cooling water quality, measured as 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 24-hr rolling average basis

BDF_A= Blowdown Flow Actual; measured on a 24-hr rolling average basis

The complete description and derivation of the CT Blowdown Formula is found in Exhibit A to this Petition.

2.3.2 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.

2.4 To Effectuate HDPP's Commitment to Use as Much Recycled Water as Feasible, the Facility's Makeup Water Will Be Selected from Available Supplies and Blended Consistent with SOIL&WATER–1 Using the Loading Sequence.

As a condition of approval of this Petition, 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 waters on an as-needed basis, in order to minimize use of MRB Adjudicated Water 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 CT Blowdown Rate to be achieved and the chloride concentration to remain below 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. [16]

- *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.

It is important to note that the water sources preferentially listed in the Loading Sequence above are also in rank order of relative cost to HDPP. That is, Recycled Water is the least cost and MRB Adjudicated Water is the highest cost. Consequently, 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 backup selection.

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[16] 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.

Continued access to MRB Adjudicated Water will be necessary due to the seasonal and annual variability of Recycled Water and SWP Water quality and quantity. Water use modeling (see Section 3.7 below) examined scenarios with SWP Water available and scenarios with major SWP Water outages. Modeling assuming that SWP Water is both available and of suitable quality, as measured by specific conductance less than 670 µS/cm[17], suggests that an expected range of MRB Adjudicated Water use over the next 10-year period could vary from zero to 1,010 AFY in any year if the City of Victorville's Victorville 2 power plant is built; or zero to 704 AFY if the Victorville 2 power plant is *not* built, which the Commission Staff suggested would be the case.[18]

The use of SWP Water alone in the Loading Sequence cannot be relied upon because the specific conductance of SWP Water delivered to the Facility often exceeds 670 µS/cm for extended durations and in any year the quantity of SWP Water available to the Facility is highly variable and is susceptible to complete curtailment in emergency conditions.[19] The most probable emergency conditions that could affect the Facility's SWP Water supply is an extended critical drought affecting the State Water Project system or a catastrophic event that critically disables the State Water Project, such as a large earthquake near the Delta that causes numerous levee failures or an earthquake or landslide damaging the California Aqueduct[20]. Under such emergency conditions, little to no SWP Water may be available for several years. 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 Victorville 2 is built, and 2,400 to 3,344 AFY if Victorville 2 is *not* built.[21]

To account for the uncertainty in quantity and the variability in quality of SWP Water, HDPP proposes access to MRB Adjudicated Water up to but not exceeding 3,090 AFY, measured on a five-year rolling average basis. This maximum rolling average volume of 3,090 AFY will provide the Facility operators with the flexibility to maintain reliability in reasonably foreseeable climatic and dispatch conditions. This volume was derived using an assumed annual generation amount equivalent to the Facility running 16 hours per day at full load and 8 hours per day at a minimum load and *no* use of SWP Water factored into the Loading Sequence. Exhibit B to this Petition provides additional support and explanation regarding the calculation of this maximum required volume.

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[17] Derived value based on equipment tolerance/design and operational history that supports an acceptable CT Blowdown Rate.

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

[19] See Exhibit C, *Availability and Use of Alternative Water Supplies at the High Desert Power Project.* GSI Water Solutions, Inc., Santa Barbara, California. October 2015.

[20] At the time of submission of this Petition SWP Water was not available to the Facility due to the October 15, 2015 thunderstorm that caused flooding and mudslides that have inundated a portion of the California Aqueduct.

[21] TN # 206321. *Staff Analysis of the High Desert Power Plant Recycled Water Feasibility Report.* Docketed Date October 9, 2015, pp. 6, 7. In the Staff Analysis, Staff suggests that the Victorville 2 project will not be built.

Additionally, the water use modeling included assumptions on future availability of Recycled Water and SWP Water, but future outages of either supply are not predictable. Both supplies are subject to significant interruptions and, accordingly, the Facility requires access to greater quantities of MRB Adjudicated Water as a final backup selection for the purpose of surety of supply.[22] The proposed maximum of 3,090 AFY on a five-year rolling average would provide access to greater than 3,090 AF in a single year should catastrophic outages affect SWP Water availability. The fee charged to the Project Owner by VWD allows for payment to MWA to replace MRB Adjudicated Water sold to the Facility on a 2:1 basis under the Agreement,[23] resulting in a net benefit to the Basin as administered by the Watermaster through MWA's Replacement Water program.

2.5 Necessity of the Proposed Petition

Sections 1769(a)(1)(B) and (C) of the CEC Siting Regulations require a discussion of the necessity for the proposed modifications and whether the modifications are based on information known by the petitioner during the certification proceeding. The proposed modifications are necessary to prevent the Facility from being curtailed and perhaps completely shut down due to drought-related water shortages.

These modifications are necessary due to the significant changed circumstances affecting the water supply available to the Facility during its operational history, none of which were foreseen by the Commission when it originally certified the Facility in May 2000, including:

1. August 2000, three months after Certification of the Facility, the California Supreme Court substantially affirmed the Judgment adjudicating the groundwater rights of the Mojave Basin. The Supreme Court affirmation of the Judgment provided assurances that the Basin will be managed sustainably, assurances that were not confirmed at the time the Commission authorized the Facility to use only SWP Water. Through MWA's leadership, the Mojave Basin has been well-managed, serving as a model for the landmark SGMA of 2014.

2. June 2003, CDFG and VVWRA entered into a Memorandum of Understanding requiring VVWRA to discharge at least 9,000 AFY of Recycled Water to the Mojave River to protect instream resources. The MOU addressed the fish and wildlife resource concerns that caused the Commission to initially prohibit the Facility from using Recycled Water.

3. May 2007, Federal District Court invalidates Biological Opinions authorizing the Central Valley Project ("CVP") and SWP to take Delta smelt and Central Valley runs of chinook salmon, species listed under the

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[22] Such a significant interruption aside from the drought recently occurred in October 2015. MWA notified HDPP on October 22nd that extensive flooding near Hwy 58 caused a mud flow into the aqueduct and the extent of damage would not be assessed for weeks. MWA reported that there would be no/limited pumping for at least two weeks and probably longer, and that MWA would be curtailing deliveries to keep as much water in the pools for customers.

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

Federal Endangered Species Act. An interim remedy imposes minimum Old and Middle River ("OMR") flows in the Delta to protect Delta smelt, the effect of which is to limit CVP and SWP exports.

4. For 2008, the California Department of Water Resources issues a 35% SWP allocation due to dry conditions and Delta smelt protections.

5. August 2008, the Facility petitions for authorization to use Recycled Water supplied by VWD and obtains Commission approval in 2009.

6. December 2008, U.S. Fish and Wildlife Service issues a new Biological Opinion ("BO") finding that the Long-Term Operational Criteria and Plan for coordination of the Central Valley Project and State Water Project is likely to jeopardize the existence of Delta smelt. The Biological Opinion includes measures that affect the timing and reduce the magnitude of CVP and SWP water diversions. Multi-year litigation over the BO commences.

7. February 2011, settlement reached among U.S. Fish and Wildlife Service and operators of the CVP and SWP imposing revised minimum OMR flows to protect Delta smelt.

8. July 2011, Facility receives first deliveries of Recycled Water. Recycled Water was not available April 2012 through June 2013 and September 2013 through January 2014, among other outages.

9. For 2009 through 2012, the California Department of Water Resources issues SWP allocations of 40%, 50%, 80% and 65% respectively.

10. Multi-year drought commencing in 2013 and continuing today, coupled with measures to protect Delta smelt, limits SWP allocations to 35% in 2013, 5% in 2014, and 20% in 2015.

The current exceptional drought, its impacts on the availability of SWP Water, along with other regulatory restrictions that have reduced SWP Water pumping and delivery, and the intermittent nature of Recycled Water service to date were not known at the time of the original certification. Because the quantity and quality of both SWP Water and Recycled Water available to HDPP vary significantly, this Petition is necessary to provide HDPP with the flexibility to utilize different water sources as available, whether individually or combined, as needed to ensure reliable and efficient operation of the Facility.

2.5.1 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 the 2014 Feasibility Report, 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 gallons per minute ("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.[24]

(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.[25]

(iv) The Facility's water treatment system cannot operate reliably on a 100% Recycled Water supply because its existing 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.[26]

(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 2015 will mark the end of the current drought cycle 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.

The Facility's existing water treatment system was designed to treat SWP Water which most often historically has been of higher quality than Recycled Water. The Facility was not

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

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 the Feasibility Report. Consequently, Recycled Water must always be blended with other waters when used.

2.5.2 SWP Water is Insufficient in Quantity and Quality to Drought-Proof the Facility.

Due to the pumping restrictions to protect the Delta smelt, coupled with the exceptional drought conditions in northern California, delivery of SWP Water to the Facility has proven to be unreliable. Historically, delivery of SWP Water has been interrupted from time-to-time. However, in 2014, the Facility received just 565 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. If the drought continues into 2016 and beyond, it is expected the amount of SWP Water delivered to the Facility will continue to be severely diminished.

SWP Water quality varies seasonally, with the SWP Water having higher specific conductance (reflecting worse water quality) during certain runoff events and periodically during the irrigation season. HDPP is limited on its ability to inject SWP Water into its aquifer storage bank based on the total dissolved solids ("TDS") content in the SWP Water. HDPP is prohibited by permit from injecting SWP Water into the aquifer bank when the TDS content is greater than 400 mg/L, and cannot exceed an annual average of 322 mg/L TDS in the injected SWP Water.[27] Generally, for at least several months of each year, SWP Water quality will exceed allowable TDS concentration which prohibits banking, even if SWP Water is available in amounts greater than needed to operate the Facility. This inability to bank SWP Water due to cyclical or seasonal natural water composition changes reduces the amount of storage that HDPP can secure which, in turn, affects reliability of the Facility. The inability of the Facility to bank SWP Water when the Facility is not operating also limits the use of SWP Water as the sole source to drought-proof the Facility.

Additionally, during the times when SWP Water is of lower quality, its effectiveness as a diluent for Recycled Water is diminished which correspondingly reduces the percentage of Recycled Water that the Facility may use.

2.5.3 Access to MRB Adjudicated Water Ensures the Facility's Water Supply Reliability Under All Operating Conditions, Allowing Maximum Use of Recycled Water.

The 2014 Feasibility Report concluded that it is not feasible for the Facility to operate using 100% Recycled Water for cooling and other industrial purposes. Under all sustainable conditions, HDPP has learned through its operating experience that Recycled Water must be blended with SWP Water, Banked SWP Water and/or MRB Adjudicated Water in order to

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[27] *See Conditional Waiver of Waste Discharge Requirements issued to Victorville Water District and High Desert Power Project, LLC.* No. R6V-2012-0012 / WDID No. 6B360105004. Lahontan Regional Water Quality Control Board. March 14, 2012.

operate the Facility. Groundwater is the least variable source in terms of quantity and quality and, when used as a diluent with Recycled Water or SWP Water, provides the greatest assurance of maintaining acceptable cooling tower water quality allowing the Facility's water treatment system to operate most efficiently.

In the event that SWP Water is unavailable or its quality is unsuitable for use in the Facility, and Banked SWP water is unavailable, access to MRB Adjudicated Water is the final source of water that the Facility would draw upon to operate reliably and enable HDPP to maximize use of Recycled Water.

3.0 ENVIRONMENTAL ANALYSIS OF THE PETITION

3.1 Implementing the Loading Sequence is Not a CEQA Project and Can Be Implemented Consistent with Applicable 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. Implementation of the Loading Sequence is therefore not a "Project" as defined by CEQA because it is neither "an activity [with] the potential to cause direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment."[28]

3.2 Use of MRB Adjudicated Water is Consistent with California Water Law and Policy.

This Petition proposes use of water that is consistent with State energy and water law and policy. A foundational principle of California water law and policy is contained in Water Code section 13550, which states that the use of potable domestic water for nonpotable uses, including industrial uses, is a waste or an unreasonable use of the water if the State Water Board finds that recycled water is available which is "of adequate quality for these uses and is available for these uses" and "may be furnished for these uses at a reasonable cost to the user." When considering whether recycled water is of "adequate quality for these uses and is available for these uses," the State Water Board shall consider all relevant factors, including the level and types of specific constituents in the recycled water affecting these uses, on a user-by-user basis.[29]

Recycled water is of "reasonable cost" when the "cost of supplying the treated recycled water is comparable to, or less than, the cost of supplying potable domestic water," after having considered all relevant factors, including, but not limited to, the "present and projected costs of supplying, delivering, and treating potable domestic water for these uses and the present and projected costs of supplying and delivering recycled water for these uses."[30] The State Water Board will not mandate the use of recycled water if such use will adversely affect downstream water rights, degrade water quality, or be injurious to plantlife, fish, and wildlife.[31] In making

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[28] California Public Resources Code § 21065.
[29] Water Code § 13550, subd. (a)(1).
[30] *Ibid.*, § 13550, subd. (a)(2).
[31] *Ibid.*, § 13550, subd. (a)(3).

the determination of whether the use of recycled water shall be mandated, the State Water Board will consider the impact of the cost and quality of the recycled water on the specific individual user.[32]

The Feasibility Report demonstrates that the Facility's use of Recycled Water and other water sources is consistent with Water Code section 13550.[33] The Facility currently uses all Recycled Water that is made available by VWD and VVWRA and that is capable of being used at the Facility with existing infrastructure. The current supply of Recycled Water is not of adequate quality for use at the Facility without blending with higher quality water. The cost of treatment to use a higher percentage of Recycled Water is economically infeasible for the Facility and is therefore not of reasonable cost under section 13550 because the costs of treating and delivering additional quantities of Recycled Water to the Facility greatly exceed the cost of blending SWP Water, Banked SWP Water and MRB Adjudicated Water. The availability of the other sources of water make it possible for the Facility to use any Recycled Water.

The Loading Sequence implemented by monitoring the CT Blowdown Rate and chloride concentration will ensure that the mandate of section 13550 is met. The Loading Sequence will ensure that Recycled Water is the Facility's primary water supply and that SWP Water, Banked SWP Water and MRB Adjudicated Water are the Facility's backup water supplies that will be used to blend with and increase the utilization of Recycled Water. Monitoring the CT Blowdown Rate and chloride concentration will allow the Facility to objectively determine when sources of water other than Recycled Water are required to maintain cooling tower function and ensure the reliable operation of the Facility.

In addition to consistency with California Law, the blending of water sources using the Loading Sequence is consistent with the Commission's water policies. The most concise and often cited statement of Commission's Water policy is set forth in the 2003 Integrated Energy Policy Report ("IEPR")"

> Consistent with the [State Water] Board policy [Resolution 75-58] and the Warren-Alquist Act, the Energy Commission will approve the use of fresh water for cooling purposes by power plants which it licenses only where alternative water supply sources and alternative cooling technologies are shown to be "environmentally undesirable" or "economically unsound." Additionally, as a way to reduce the use of fresh water and to avoid discharges in keeping with the Board's policy, the Energy Commission will require zero-liquid discharge technologies unless such technologies are shown to be "environmentally undesirable" or "economically unsound." The Energy Commission interprets "environmentally undesirable" to mean the same as having a "significant adverse environmental

[32] *Ibid.*, § 13550, subd. (b).
[33] See Feasibility Report, Exhibit E.

> impact" and "economically unsound" to mean the same as "economically or otherwise infeasible."[34]

The 2003 IEPR further states, "'Feasible' is defined under the CEQA as meaning 'capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social and technological factors.' (Cal. Code Regs., tit. 14, § 15365.) The same definition exists in the Energy Commission's siting regulations. (See Cal. Code Regs., tit. 20, § 1702(e).)"[35]

The Feasibility Report demonstrates that it is "economically or otherwise infeasible" to construct additional capital facilities to allow the Facility to run on 100% Recycled Water — even assuming that the problems with water supply quantity could be resolved at all times. This is because the Facility's 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. Moreover, there are no "significant adverse environmental impacts" associated with the Loading Sequence implemented by monitoring the CT Blowdown Rate and chloride concentration. Finally, the Facility is a ZLD facility, consistent with the 2003 IEPR's mandate that requires "zero-liquid discharge technologies unless such technologies are shown to be 'environmentally undesirable' or 'economically unsound.'"

3.3 Extending the Existing Authorization to Use MRB Adjudicated Water Requires No New Infrastructure, Is Not a CEQA Project, and Can Be Implemented Consistent with Applicable LORS.

Use of MRB Adjudicated Water is not a "Project" as defined by CEQA because it is neither "an activity [with] the potential to cause direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment."[36] 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.

3.4 Implementing the Loading Sequence Will Result in No Net Change In Mojave River 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.[37] Recycled Water surplus

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[34] 2003 IEPR, p. 41.
[35] *Ibid.*, p. 41, fn. 64.
[37] *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*

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.

3.5 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.[38] 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.[39] The Judgment was substantially affirmed by the California Supreme Court in August 2000, shortly *after* HDPP was licensed by the Commission.[40] 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);[41]
- 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;[42]
- Allowing a right holder to delay, or carry over, a FPA to a subsequent water year ("Carry Over");[43]

Victorville. No. R6V-2014-0002 / WDID No. 6B360911001. Lahontan Regional Water Quality Control Board. January 9, 2014.

[38] Judgment, ¶¶ 4(nn); 23(c).

[39] *See generally* Judgment, ¶¶ 24-29.

[40] *City of Barstow v. Mojave Water Agency* (2000) 23 Cal.4th 1224.

[41] Judgment, ¶ 4(g).

[42] *Ibid.*, ¶ 4(k)).

[43] *Ibid.*, ¶ 4(i).

- 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;[44]

- 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;[45]

- Authorizing MWA to recommend adjustments to the Replacement Water Assessments for each subarea each year.[46]

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.[47]

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.[48] 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.[49] 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.[50] Once a Party, HDPP can acquire existing BAP and FPA groundwater production rights adjudicated under the

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[44] *Ibid.*, ¶¶ 4(dd), 24(g) 4(ee), 25(b), 27, 28.
[45] *Ibid.*, ¶¶ 9(a), 24(g), 24(o), 27.
[46] *Ibid.*, ¶¶ 9(b), 27(b).
[47] 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.
[48] *Ibid.*, ¶ 24(n), 24(r), 34; Ex. F, ¶ 2.
[49] *Ibid.*, ¶ 24(q), Ex. F, ¶ 2.
[50] 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.[51]

3.6 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 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.

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.[52] Per the Watermaster: "Conservation, importation of State Water Project water, MWA's 'R-cubed' program, and implementation of the Judgment have resulted in hydrologic balance in Alto. The water supply conditions in Alto Subarea are sustainable."[53]

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.[54] FPA rampdown in the Alto Subarea is 60% of 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.

3.7 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.

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[51] Teleconference with Kirby Brill, MWA General Manager, on June 4, 2015.
[52] *Twenty-First Annual Report of the Mojave Basin Area Watermaster – Water Year 2013-2014. May 1, 2015.* Figure 3-17.
[53] *Ibid*., p. 35 (emphasis added).
[54] *Ibid*., Figure 3-17.

3.8 The Facility's Use of MRB Adjudicated Water Will Have a *De Minimis* Effect on Water Supplies in the Basin.

The Facility began commercial operations in April 2003. From 2004 to 2014 the Facility's average annual energy production was 3.91 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.

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.[55] 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.

GSI Water Solutions, Inc. ("GSI")[56] evaluated the water supplies available to HDPP and the role each 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

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55 Percentages based on the changing quality of both Recycled Water and SWP Water since Recycled Water use began in July 2011. However, 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 because, in some instances, SWP Water cannot effectively be used as a diluent because its poor quality, as reflected in its specific conductance, interferes with the operability of the Facility's water treatment equipment.
56 GSI Water Solutions, Inc. is a consulting engineering firm specializing in water resource planning. www.gsiwatersolutions.com/

Commission, GSI analyzed the annual amount of MRB Adjudicated Water that the Facility could be expected to use based on the Loading Sequence described in Section 2.3.2 above.

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 its full 3,150 AF each year as approved by the Commission which provides a conservative analysis on the Facility's impact on water supply in the Basin,[57] and (2) the other scenario *without* VV2's hypothetical full demand incorporated into the calculations providing a more realistic evaluation, which the Commission Staff suggested would be the case.[58] 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:[59]

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

	Without VV2[(60)]			With VV2[(61)]		
	Water Supply Conditions					
Generation (MMWh)	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

[57] 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.
[58] TN # 206321. *Staff Analysis of the High Desert Power Plant Recycled Water Feasibility Report.* Docketed Date October 9, 2015, pp. 6, 7.
[59] *Availability and Use of Alternative Water Supplies at the High Desert Power Project.* GSI Water Solutions, Inc., Santa Barbara, California. October 2015.
[60] The model assumes that Banked SWP Water would be depleted of usable storage (i.e., 1,000 AF remaining) before using MRB Adjudicated Water under this scenario *without* VV2.
[61] The model assumes that Banked SWP Water would be depleted of usable storage (i.e., 1,000 AF remaining) before using MRB Adjudicated Water under this scenario *with* VV2.

If the SWP Water supply is completely curtailed due to critical drought on the State Water Project system or a catastrophic event that critically disables the State Water Project 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 Victorville 2 is built, and 2,400 to 3,344 AFY if Victorville 2 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.

Production safe yield of the Alto Subarea is 69,862 AFY.[62] 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 0.5% 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.

3.9 The Facility's Use of MRB Adjudicated Water Has Less Than Significant Adverse Effect Due to 2:1 Replacement Water Requirement.

As discussed above, the Judgment and Watermaster adjustment of FPA and imposition of Replacement Water Assessments mitigates *all* groundwater use in the Basin to a level that has less than significant adverse effect, including VWD pumping under its existing water right on behalf of the Facility. Moreover, in all operating conditions the fee charged to the Project Owner by VWD under the Agreement requires payment to MWA to replace MRB Adjudicated Water sold to the Facility on a 2:1 basis,[63] resulting in a net benefit to the Basin through MWA's replacement water program.

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

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

4.0 REVISIONS TO CONDITIONS OF CERTIFICATION

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 Commission energy and water use policy.

For the reasons stated herein, HDPP requests that the Commission revise SOIL&WATER-1 as follows:

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").

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. 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:

* * *

The Project Owner shall operate the project to maintain the required cooling tower blowdown rate (CT Blowdown Rate) based on the CT Blowdown Formula and to maintain chloride concentration at or below 980 mg/L (Threshold Chloride Concentration) in the circulating cooling tower water. When the required CT Blowdown Rate is less than the actual blowdown rate as determined by the CT Blowdown Formula, or when the chloride concentration cannot be maintained at or below the Threshold Chloride Concentration, the Project Owner shall implement a "Loading Sequence" (described in more detail below):

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, in ratios that allow the required CT Blowdown Rate to be achieved and the chloride concentration to remain below 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 Water Rights 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.

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.

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. 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).

In addition, 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.

5.0 POTENTIAL EFFECTS ON THE PUBLIC

Consistent with CEC Siting Regulations Section 1769(a)(1)(G), this section discusses the potential effects on the public of the modifications proposed in the Petition. The modifications proposed in the Petition will have no significant impacts on the environment, and will be in compliance with all applicable LORS and Conditions of Certification. Accordingly, there will be no adverse impacts on the public associated with this Petition.

6.0 LIST OF PROPERTY OWNERS

CEC Siting Regulations Section 1769(a)(1)(H), requires a list of the property owners potentially affected by the proposed modifications. All property within a mile of the Facility is part of the Southern California Logistics Airport ("SCLA") property, the former George Air Force Base.

7.0 POTENTIAL EFFECTS ON PROPERTY OWNERS

Consistent with CEC Siting Regulations Section 1769(a)(1)(I), this section addresses potential effects of the Petition on nearby property owners, the public, and parties in the application proceeding. There will not be any significant impacts to nearby property owners and the public. Nearby businesses will not be impacted.

EXHIBIT A

Derivation of Cooling Tower Blowdown Formula

DEFINITIONS

BDF_A	Blowdown Flow Actual, measured as an hourly average (gpm)
BDF_R	Blowdown Flow Required, (gpm)
BD_C	Blowdown Conductivity, measured as an hourly average (µS)
RW_F	Recycled Water Flow, measured as an hourly average (gpm)
RW_C	Recycled Water Conductivity, measured as an hourly average (µS)
CW_F	Clarified Water Flow, measured as an hourly average (gpm)
CW_C	Clarified Water Conductivity, measured as an hourly average (µS)
$EVAP_F$	Evaporation Rate (gpm)
$EVAP_C$	Evaporation Conductivity (µS)
CT_{L1}	Cooling Tower Basin Level, measured at the top of the hour (%)
CT_{L2}	Cooling Tower Basin Level, measured at the bottom of the hour (%)
DCT_L	Differential Cooling Tower Basin Level (%)
DCT_F	Differential Cooling Tower Basin Flow, calculated as an hourly average (gpm)
MU_F	Total flow of all cooling tower makeup water sources (gpm)
MU_C	Weighted average conductivity of all cooling tower makeup water sources (µS)
COC	Cycles of Concentration defined as BD_c / MU_c.

DERIVATION OF BLOWDOWN FLOW REQUIRED (BDF_R)

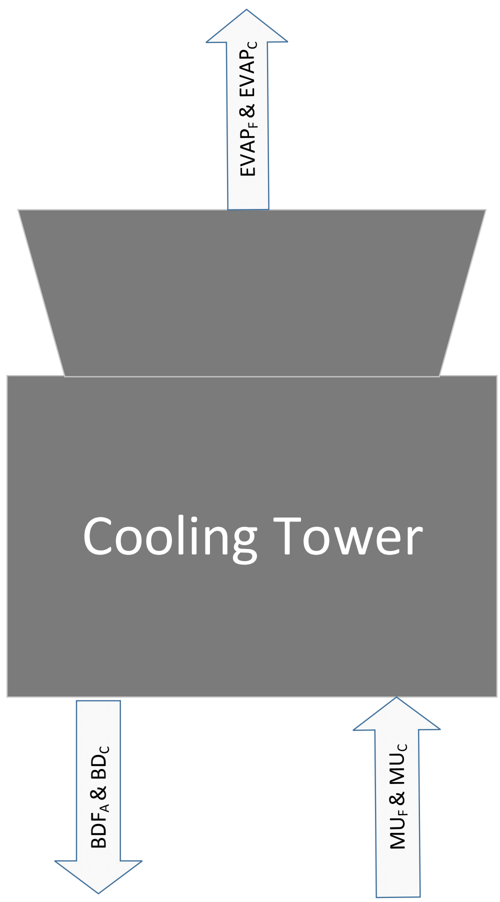
<u>HDPP Blowdown Flow Criteria:</u>

The purpose of any cooling tower is to reject heat from an industrial process to the surrounding environment; this is accomplished through evaporation of the cooling tower water. As water in the cooling tower evaporates into the atmosphere, dissolved impurities are left behind. Over time, as makeup water is used to replenish the evaporated water, the concentration of dissolved impurities in the cooling tower water increases, degrading the water quality of the cooling tower water. If the impurities in the cooling tower water reach high enough concentrations, the Facility's cooling tower water systems can be damaged and the Facility's PM_{10} emissions may exceed their permitted limit.

Industry standard cooling tower water management principals provide that in order to maintain acceptable cooling tower water chemistry, sufficient cooling tower water must be withdrawn from the cooling tower ("blowdown flow") to remove the required amount of dissolved impurities from the cooling tower water. The amount of cooling tower blowdown flow required is dependent upon the quality of water in the cooling tower, the amount of impurities found in the cooling tower makeup water (i.e., the "makeup water quality"), and the amount of evaporation taking place in the cooling tower.

Because the Facility is a zero-liquid-discharge ("ZLD") facility, the Facility's existing water treatment system removes the impurities from the cooling tower blowdown water and returns the treated water back to the cooling tower. Because the Facility was originally prohibited from using Recycled Water as makeup water for the cooling tower, the Facility's existing cooling tower blowdown water treatment system was not designed to remove the higher amount of impurities typically found in Recycled Water when compared to SWP Water. This design limitation reduces the volume of cooling tower blowdown flow that can be treated. As described above, when the actual cooling tower blowdown flow is less than the required blowdown flow, unacceptable levels of impurities in the cooling tower water result in potential damage to the Facility's water systems and the Facility is at risk for exceeding its permitted PM_{10} emission limits.

A criterion triggering the use of or increasing the use of higher quality cooling tower makeup water sources is if the cooling tower blowdown flow required to maintain acceptable cooling tower water quality (BDF_R) is greater than the actual blowdown flow (BDF_A) as determined on a rolling 24-hour average. This criterion has been proposed to allow HDPP to proactively respond to changes in the incoming makeup water quality and upsets within HDPP's water treatment system while maintaining acceptable cooling tower water chemistry. The concept used to derive the expression for BDF_R is comprised of a mass balance around the cooling tower as shown in the simplified example in the figure below.



Performing a mass balance on the cooling tower for water yields:

$$MU_F = EVAP_F + BDF_A. \tag{1}$$

The mass of dissolved solids into and out of the cooling tower is estimated using the conductivity of the respective flows. Performing a mass balance on the cooling tower for dissolved solids yields:

$$MU_F \times MU_C = EVAP_F \times EVAP_C + BDF_A \times BD_C \,. \tag{2}$$

Since evaporation is pure water and contains zero dissolved solids, the term $EVAP_C = 0$. Substituting and solving equation (2) for MU_F yields:

$$MU_F = BDF_A \times \frac{BD_C}{MU_C} = BDF_A \times COC \,. \tag{3}$$

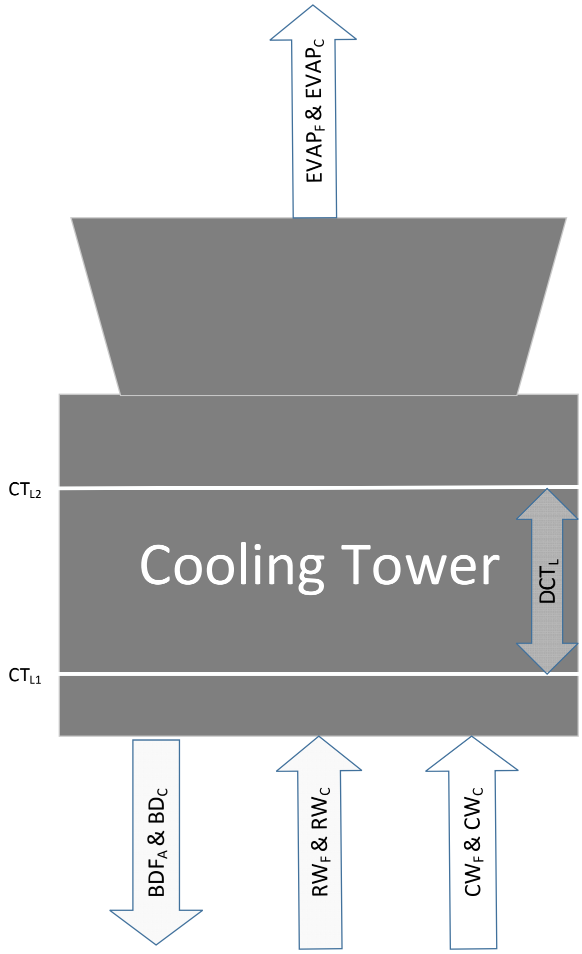
Substituting equation (1) into equation (3) results in equation (4) below expressing blowdown flow in terms of the cooling tower water evaporation rate and cooling tower water cycles of concentration:

$$BDF_A = \frac{EVAP_F}{COC - 1} \,. \tag{4}$$

Equation (5) below provides the cooling tower blowdown flow required to maintain proper cooling tower water quality at a known evaporation rate and at a known cooling tower water cycles of concentration – i.e., sufficient amount of impurities are being removed from the cooling tower water. Therefore, if BDF_A is greater than BDF_R, cooling tower water quality will be improving; alternatively if BDF_A is less than BDF_R, cooling tower water quality will be degrading.

$$BDF_R = \frac{EVAP_F}{COC - 1} \,. \tag{5}$$

The development of BDF_R for the Facility is the exact same as presented above. However, the mass balance around the Facility's cooling tower is much more complex due to storage, multiple cooling tower makeup water sources and varying makeup water source qualities. The mass balance diagram for the Facility is given below.



The introduction of storage into the mass balance analysis is important since the storage volume of the cooling tower basin is significant. Furthermore, accumulation or reduction of the volume of water stored in the cooling tower basin will impact the mass balance equations very differently. The resulting final expression derived for BDF_A will be different as a result. The following set of derivations are proved to highlight the differences in the mass balance equations resulting from storage as well as present the final form of BDF_R in each operating scenario. The operating scenarios are as follows:

1. Operating Scenario 1: Cooling tower basin level *increasing*

2. Operating Scenario 2: Cooling tower basin level *decreasing*

<u>Operating Scenario 1: Cooling tower basin level *increasing*</u>

Using the same methodology as presented above, a mass balance for water is applied. Here, the makeup water flow is comprised of several sources. Therefore, the makeup flow is given by:

$$MU_F = RW_F + CW_F . \tag{6}$$

Completing the mass balance for water around the cooling tower yields:

$$MU_F = EVAP_F + BDF_A + DCT_F . \tag{7}$$

Where DCT_F is given by:

$$DCT_F = \left[CT_{L2} - CT_{L1}\right] \times \frac{439322}{60} . \tag{8}$$

Note that the term [DCT_{L2}-DCT_{L1}] is the Differential Cooling Tower Basin Level (DCT_L), which is the total percent change of the cooling tower basin water level over an hour (%/hr). The term 439,322 is the total volume of the cooling tower basin in gallons, while the term 1/60 is used to convert flow from gallons per hour to gallons per minute.

Performing a mass balance for the dissolved solids yields:

$$MU_F \times MU_C = EVAP_F \times EVAP_C + BDF_A \times BD_C + DCT_F \times MU_C . \tag{9}$$

Where MU_C is given as the weighted conductivity of the makeup water sources. MU_C is estimated as:

$$MU_C = \frac{\left[RW_F \times RW_C + CW_F \times CW_C\right]}{\left[RW_F + CW_F\right]} . \tag{10}$$

Note the following with regards to equation (9):

1) $EVAP_C = 0$; evaporation is pure water and has near zero impurities.

2) The change in solids associated with a change in DCT_L may not be readily apparent. However, the change in solids can be rationalized when considering the simplified example previously presented. In the previous simplified example, in which the level of the cooling tower basin did not change, $MU_F = EVAP_F + BDF_A$. Since MU_F and BDF_A are directly measured, $EVAP_F$ can be easily calculated.

   Now, with the inclusion of storage as shown in equation (7), $EVAP_F$ can still be directly calculated from the measured flows of MU_F, BDF_A and DTC_F. However, if cooling tower basin levels are increasing, then $EVAP_F < MU_F – BDF_A$. Therefore, an increase in cooling tower basin level is a direct result of excess makeup water being supplied. Therefore, MU_C is applied to DCT_F.

   Alternatively, if cooling tower basin levels are decreasing, then $EVAP_F > MU_F – BDF_A$. Again, since MU_F and BDF_A are directly measured, the decrease in cooling tower basin level is due to evaporation. Therefore $EVAP_C$ is applied to DCT_F as shown in equation (14).

Substituting equation (7) into equation (9) and letting $EVAP_C = 0$ yields:

$$MU_C\left[EVAP_F + BDF_A + DCT_F\right] = BDF_A \times BD_C + DCT_F \times MU_C . \tag{11}$$

Solving for $EVAP_F$ yields:

$$EVAP_F = BDF_A \times \frac{BD_C}{MU_C} - BDF_A = BDF_A\left[COC - 1\right]. \tag{12}$$

Rearranging equation (12) for BD_F yields the blowdown flow required to maintain cooling tower chemistry, which is the same as equation (5) reproduced below:

$$BDF_R = \frac{EVAP_F}{COC - 1}. \tag{5}$$

Since $EVAP_F$ is not a directly measured parameter, equation (7) can be solved for $EVAP_F$ and substituted into equation (5) to yield:

$$BDF_R = \frac{MU_F - BDF_A - DCT_F}{COC - 1}. \tag{13}$$

<u>Operating Scenario 2: Cooling tower basin level *decreasing*</u>

Under Operating Scenario 2, equations (6), (7) and (10) are still valid under the stated operating conditions. These equations are reproduced below:

$$MU_F = RW_F + CW_F \tag{6}$$

$$MU_F = EVAP_F + BDF_A + DCT_F \tag{7}$$

$$MU_C = \frac{\left[RW_F \times RW_C + CW_F \times CW_C\right]}{\left[RW_F + CW_F\right]}. \tag{10}$$

The solids mass balance given in equation (9) is now given by:

$$MU_F \times MU_C = EVAP_F \times EVAP_C + BDF_A \times BD_C + DCT_F \times EVAP_C. \tag{14}$$

Substituting EVAPC = 0 and equation (7) into equation (14) yields the required blowdown flow:

$$BDF_R = \frac{EVAP_F + DCT_F}{COC - 1}. \tag{15}$$

Again, since $EVAP_F$ is not directly measured, solving equation (7) for $EVAP_F$ and substituting into equation (15) yields:

$$BDF_R = \frac{MU_F - BDF_A}{COC - 1}. \tag{16}$$

SUMMARY OF BDF_R EQUATIONS

CT Basin Level	Blowdown Flow Required
Increasing	$BDF_R = \frac{MU_F - BDF_A - DCT_F}{COC - 1}$
Decreasing	$BDF_R = \frac{MU_F - BDF_A}{COC - 1}$

EXHIBIT B

Derivation of Maximum MRB Adjudicated Water Demand

Plant Operating Basis	Facility Energy Generated per Year (MWh)	Facility Energy Generated per Day (MWh)	Total Water Requirement for Power Generation (AFY)	Reycled Water Use for Power Generation [(1)] (AFY)	Groundwater Use for Power Generation [(2)] (AFY)
3x1 Full Load 16 hrs/day + 2x1 Min Load 8 hrs/day	4,996,592	14,480	3,870	780	3,090

[(1)] HDPP's model found silica to be the constituent that limits the maximum amount of Recycled Water that can be used by the Facility when the incoming Recycled Water silica concentration is at 40 mg/L. Above this concentration, silica contributes significantly to scale formation throughout the cooling water system. The 40 mg/L concentration is the maximum allowable concentration specified in HDPP's Reclaimed Water Service Agreement with the Victorville Water District. The amount of silica and other constituents in the cooling tower water will be monitored and controlled to within acceptable limits by applying the CT Blowdown Formula and the Loading Sequence described in this Petition.

[(2)] This value represents the upper limit of MRB Adjudicated Water use in any year, assuming no SWP Water available in the Loading Sequence.

DERIVATION

1. Estimate Facility annual energy production
    a. Estimate monthly Facility capability based on historical ambient temperatures.
    b. Assume Facility runs at 3x1 configuration full capability 16 hours each calendar day and 2x1 minimum load configuration 8 hours each calendar day.
    c. Calculate monthly generation by multiplying Facility capability from Item 1b above by the applicable hours of each month.

2. Estimate cooling tower evaporation rates at 3x1 full load and 2x1 minimum load
    a. Evaluate hourly 2014-15 generation and determine monthly average evaporation rates when the Facility load is greater than 700 MW (a proxy for full load evaporation) and at 320 MW (a proxy for 2x1 configuration minimum load).

3. Calculate maximum Recycled Water blend ratio
    a. Define water quality of incoming groundwater and Recycled Water.
        i. Use values identified in Feasibility Report.
    b. Use evaporation rate from Item 2 above
    c. Assume cooling tower blowdown rate = 250 gpm (current Facility hydraulic limit)
    d. Define proposed cooling tower water constituent limits
        i. Start with Facility design limits

ii. Increase silica limit from 150 mg/L to 180 mg/L based on Facility current practice to use specialty dispersant chemicals to mitigate silica deposits on Facility equipment

iii. Based on operating experience, evaluate silica and chloride which are the constituents most likely to limit Facility's use of Recycled Water.

e. Calculate the cooling tower cycles of concentration.

f. For each month of the year, calculate the maximum percentage of Recycled Water that can be blended with groundwater while not exceeding the constituent limits established in Section 3d above.

4. Determine the annual volume of water required for power production

a. From historical data, determine the 2014-15 historical monthly water use for power on an acre-ft/GWh ("AF/GWh") basis.

b. Multiply the ratios from Section 4a above by the energy volumes from Section 1c above to determine the monthly volume of total water needed for power production.

c. Multiply the total water volumes from Section 4b above by the percentages from Section 3f above to determine the volume of groundwater required for each month.

EXHIBIT C

REPORT: *AVAILABILITY AND USE OF ALTERNATIVE WATER SUPPLIES AT THE HIGH DESERT POWER PROJECT*

PREPARED BY GSI WATER SOLUTIONS, INC.

OCTOBER 2015

Report

Availability and Use of Alternative Water Supplies at the High Desert Power Project

Prepared for

High Desert Power Project, LLC

14302 FNB Parkway, Omaha, NE 68154

October 2015

Prepared by

GSI Water Solutions, Inc.

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Contents

Tables

Figures

Appendices

Acronyms and Abbreviations

ABS	Aquifer Banking System
ADWF	Average Dry Weather Flows
AF	acre-feet
AFY	acre-feet per year
CEC	California Energy Commission
DFG	California Department of Fish and Game
DWR	California Department of Water Resources (DWR)
EC	Electrical Conductivity (specific conductance)
EDU	Equivalent Dwelling Unit
Facility	High Desert Power Project
gpd	gallons per day
gpm	gallons per minute
HDPP	High Desert Power Project, LLC
IWWTP	City of Victorville Water District's Industrial Wastewater Treatment Plant
mgd	million gallons per day
MOU	Memorandum of Understanding
MRB	Mojave River Basin
MW	megawatt
MWA	Mojave Water Agency
SCLA	Southern California Logistics Airport
SWP	State Water Project
TDS	total dissolved solids
VVWRA	Victor Valley Wastewater Reclamation Authority
VWD	Victorville Water District
Water Board	California Regional Water Quality Control Board, Lahontan Region
UV	ultraviolet light

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1. Introduction

High Desert Power Project, LLC (HDPP or Project Owner) operates the High Desert Power Project (the Facility), an 830 megawatt (MW) combined-cycle power plant located in the City of Victorville in San Bernardino County. The Facility was certified by the California Energy Commission (CEC or the Commission) on May 3, 2000, and commenced commercial operations in April 2003.

GSI Water Solutions, Inc. was retained by HDPP to prepare this report regarding the availability and use of alternative water supplies at the Facility in support of HDPP's November 1, 2015 Petition for Modification to "drought-proof" the Facility (the Petition) by "implementing reliable primary and backup HDPP water supplies that are consistent with State of California water policies." Specifically, the Petition includes a request for approval of the implementation of a systematic priority-of-use (referred to in this document as the "Loading Sequence") for primary and backup water supplies that is consistent with the conditions currently set forth in SOIL&WATER-1 and removal of the two-year restriction on Mojave River Basin Adjudicated Groundwater use. The proposed Loading Sequence is described as follows:

(1) Recycled Water, if available, blended with SWP Water, if available and of suitable quality, in ratios needed to maintain acceptable operating conditions.

(2) Recycled Water, if available, blended with SWP Water, if available and of suitable quality, and/or Banked SWP Water, if available, in ratios needed to maintain acceptable operating conditions.

(3) Recycled Water, if available, blended with SWP Water, if available and of suitable quality, and/or Banked SWP Water, if available, and/or MRB Adjudicated Water in ratios needed to maintain acceptable operating conditions.

The Facility's design basis annual water requirement is 4,000 acre-feet per year (AFY) (excluding water stored in the aquifer bank for future use) (R. Cullison, pers. comm., 2015). From 2004 through 2014, the average annual energy production from the Facility has been 3.91 million MWh per year. The annual average water consumption for energy production (excluding water required for aquifer banking) has been 2,741 AFY. (R. Cullison, pers. comm., 2015). On an instantaneous basis, the Facility's design basis water requirement for producing power (excluding water for aquifer banking) is up to 4,000 gallons per minute (gpm) 24 hours per day. Excluding periods of planned maintenance outages, the Facility is expected to maintain 98% availability or higher and, therefore, requires water supply that is 100% reliable every hour of every day.

A significant factor in the Facility's water supply planning is this understanding that the Facility requires adequate water on demand 24 hours per day to operate. Throughout this document, the "acre-feet per year" terminology is consistently applied to characterize the overall amounts of water associated with different supply options. However, the existence of an average annual supply is insufficient to the Facility if it cannot be delivered consistently and reliably every hour of every day when the Facility is available to operate. Thus, while the average number of acre-feet per year available to the Facility is important, it is equally important that water supply is available continuously throughout every day at the required instantaneous delivery rate (in gpm) to allow the Facility to operate. Consequently, the annualized quantification of water supplies in acre-feet per year terms is only useful at the coarsest of planning perspectives.

Although HDPP will prioritize the use of Recycled Water pursuant to the Loading Sequence and will strive to maximize Recycled Water use, known and common occurrences of Recycled Water outages and Recycled Water that does not meet the Facility's quality requirements force HDPP to ensure that SWP Water, Banked SWP Water, or MRB Adjudicated Water are maintained in an always-ready state, can be activated at any time, and can be utilized as needed until Recycled Water supplies are again available. Furthermore, operational experience to date shows that even when Recycled Water is available, dilution using one or more of the above-listed water supplies is required to achieve a blended water quality that can be used by the Facility's water treatment system.

This report focuses on two sets of "Water Supply Scenarios" that represent the expected range of non-emergency water supply conditions[1]. The scenarios evaluate the volume and reliability of the primary and backup water supplies listed in the Loading Sequence in priority order by applying a set of variables that affect the availability of each source. Details of the Water Supply Scenarios are set forth in Section 3.1. Water Supply Scenarios 1A-1C calculate the amounts of water needed from each source under proposed operations described in the Petition for Alternative Water Supplies to "drought-proof" the Facility (i.e., permanent use of MRB Adjudicated Water as a 4th priority, backup supply) with the assumption that the Victorville 2 Hybrid Power Project is not built. Water Supply Scenarios 2A-2C differ only in the assumption that the Victorville 2 Hybrid Power Project is built and uses 3,150 AFY of Recycled Water. Both Water Supply Scenarios calculate water use in priority order. Each Water Supply Scenario is calculated three times using a range of "Water Supply Conditions", to explore the effect of "best case," "average," and "worst case" factors controlling the required availability of the various water supplies in priority order under non-emergency conditions.

[1] Non-emergency water supply conditions means the normal range of deliveries for a given supply. Non-emergency conditions do not include outages that could occur as a result of infrastructure failure, natural disaster, record-breaking drought conditions, or other event that unexpectedly severely limits or completely cuts off a given alternative water supply.

2. Water Supply

In an effort to assess the potential for achieving the goal of "drought-proofing" the Facility by "implementing reliable primary and backup water supplies that are consistent with state water policies", investigations were conducted to determine the amount, availability, and reliability of each water supply set forth in the Loading Sequence. The water supplies are listed below in priority order:

1. Recycled Water - Treated effluent currently produced by the Victorville Water District's (VWD)[2] Industrial Wastewater Treatment Plant (IWWTP) located at the Southern California Logistics Airport (SCLA) and by the Victor Valley Water Reclamation Authority (VVWRA) at the Shay Road wastewater reclamation plant (the VVWRA Shay Road Plant).
2. SWP Water consistent with the provisions of the Mojave Water Agency's (MWA) Ordinance 9, which may be used as directly delivered to the Facility.
3. Banked SWP Water - SWP Water that is treated by the Facility's aquifer banking system (ABS) and then stored in an underground aquifer (i.e., the Aquifer Bank) via well injection for later use.
4. MRB Adjudicated Water, as approved on September 10, 2014 by the CEC in response to the drought-induced curtailment of SWP water may be used on a temporary basis, subject to certain limitations, through September 30, 2016. The Petition proposes usage of MRB Adjudicated Water as a backup supply on a permanent basis.

The availability of each water supply is described in the following sections in priority order. Discussions of specific quantitative factors and projections utilized in the Water Supply Scenarios are <u>underlined</u> where they appear in the following sections.

Table 1 summarizes historical water use at the Facility.

[2] The Victorville Water District is a County Water District and subsidiary district of the City of Victorville.

Table 1. Historical Water Use at the Facility.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
SWP Water Allocation Requested by HDPP (AF)	8,000	8,000	8,000	8,000	8,000	8,000	8,000	6,500	6,500	6,500	6,500
SWP Water Allocation Received (AF)	8,000	8,000	8,000	8,000	3,280	2,706	3,486	6,500	6,500	6,500	565
SWP Water Use for Power Production + Aquifer Banking (AF)	3,433	3,191	3,915	3,154	3,229	2,532	2,813	1,518	3,833	2,312	564
SWP Water Injected into Aquifer Bank (AF)	502	773	1,431	537	377	507	553	342	820	402	93
Banked SWP Water Extracted from Aquifer Bank for Power (AF)	4	11	25	214	526	723	98	33	288	1,308	1,381
Banked SWP Water Cumulative Net Injection (AF)	498	762	1,407	323	4,284	4,065	4,520	4,823	5,355	4,449	3,161
Banked SWP Water Available for Power[1] (AF)	N/A	N/A	N/A	N/A	3,135	2,919	3,364	3,600	4,122	3,360	1,942
MRB Adjudicated Water Use for Power Production[2] (AF)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0
Recyled Water Use for Power (AF)	0	0	0	0	0	0	0	71	112	65	1,140
Total Water Use for Power Only (AF)	2,935	2,429	2,508	2,831	3,378	2,748	2,359	1,280	3,412	3,283	2,992
Total Water Use for Power + Aquifer Banking (AF)	3,437	3,203	3,939	3,368	3,755	3,255	2,911	1,622	4,233	3,685	3,085

1. Excludes first 1000 acre feet banked by project and losses incurred due to groundwater dissipation, which is calculated by the CEC
2. MRB Adjudicated Water was temporarily made available to HDPP beginning in September 2014 for a two year period.

2.1 Recycled Water

The following sections describe the history of Recycled Water use at the Facility and factors controlling projected future Recycled Water availability.

2.1.1 History of Recycled Water Availability and Use at the Facility

The Facility was originally permitted by the CEC to use SWP Water and Banked SWP Water only. The use of any Recycled Water was specifically prohibited. Through a petition process, HDPP successfully attained a CEC permit modification on November 18, 2009 to allow for use of Recycled Water at the Facility in addition to SWP Water and Banked SWP Water. Recycled Water use was also approved by the California Regional Water Quality Control Board, Lahontan Region (Water Board) in Order R6V-2009-0138 (Water Board, 2009).

Following these approvals, the Facility began receiving Recycled Water though the *Reclaimed Water Service Agreement* (the Agreement) with VWD dated September 7, 2010, which specified that VWD would deliver to the Facility Recycled Water that meets Title 22 reuse standards as well as other water quality specifications (e.g., total dissolved solids [TDS] and silica) as presented in the Agreement (i.e., "in-spec" Recycled Water). Under the terms of the Agreement, VWD was to initially provide up to 1,000 AFY (and at flow rates of up to 1,000 gpm) of Recycled Water to the Facility from two sources: (1) the IWWTP, and (2) the VVWRA Shay Road Plant. Figure 1 provides an overview of the location of the Facility, the wastewater treatment plants, and conveyance pipelines. VWD prioritizes delivery of Recycled Water from the IWWTP over VVWRA Shay Road Plant (S. Ashton, pers. comm., July 1, 2015); therefore, IWWTP Recycled Water is projected to be the first water used by the Facility in the Water Supply Scenarios presented in this report.

The IWWTP operated by VWD currently collects and treats wastewater from: (1) the Dr. Pepper/Snapple bottling facility, (2) the nearby Victorville Federal Correctional Complex (approximately one-third of its wastewater), (3) domestic flows from the City of Victorville, and (4) other municipal and industrial sources at SCLA. Historically, IWWTP has been available to deliver Recycled Water, although it has not typically met supply contract quality specifications, so use has been limited. VVWRA, who operates the VVWRA Shay Road Plant, is a Joint Powers Authority with a service area of 216 square miles, including the communities of Victorville, Hesperia, Apple Valley, and the San Bernardino County service areas of Spring Valley Lake and Oro Grande.

Delivery of Recycled Water to the Facility commenced in July 2011. On March 21, 2014, the Facility exercised its right under the Agreement and notified VWD to increase: (1) annual delivery of Recycled Water to 4,000 AFY, and (2) instantaneous delivery rate to 4,000 gpm. As discussed below, this requested increase in deliveries to 4,000 gpm and 4,000 AFY to the Facility only partially occurred. Table 2 summarizes historical deliveries of Recycled Water to the Facility.

As is evident in Table 2, Recycled Water use by the Facility has been limited. The primary reasons for the limited usage have been Recycled Water supply outages and Recycled Water supplies that did not meet the Facility's water quality requirements. Several factors have resulted in interruptions in the delivery of Recycled Water to the Facility since July 2011. During two separate periods (see Table 2) Recycled Water was not delivered to the Facility because: (1) capital improvement plant modifications at the VVWRA Shay Road Plant curtailed the production of Recycled Water from mid-April 2012 through June 2013, and (2) problems with the ultraviolet light (UV) disinfection system at the VVWRA Shay Road Plant similarly prevented the production of Recycled Water during portions of 2013 and 2014 (HDPP, 2014). UV system downtime was approximately 31% overall during 2014 due to UV lamp issues (L. Olds, pers. comm., July 2015). The UV lamp issues were ultimately addressed by the manufacturer, resulting in a decrease in downtime to approximately 15% (pers. comm., Cullison 2015). Based upon recent information from VVWRA, operational performance is expected to improve moving forward; therefore, 15% downtime (85% uptime) is the projected worst case condition for both wastewater treatment plants in Water Supply Scenarios presented in this report under normal, non-emergency conditions.

The outages at the VVWRA Shay Road Plant resulting in the inability to produce and deliver "in-spec" Recycled Water are of key importance with respect to planning for Recycled Water use because these historical incidents indicate that future outages will occur. Additionally, since Recycled Water delivery began in July 2011, the IWWTP has failed to meet the specification requirements (primarily because of higher than allowable concentrations of TDS due to changes in the Dr. Pepper/Snapple process as described below) and has only been able to produce "out-of-spec" Recycled Water, which required more dilution with SWP Water or Banked SWP Water to achieve a blended supply that the Facility's water treatment system can treat.

It is important to note that the Facility's water treatment system cannot operate reliably on a 100% Recycled Water. This is because the 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. Thus, Recycled Water from the VVWRA Shay Road Plant and/or the IWWTP can be used at the Facility only when blended with other water supplies acting as a diluent to create a product that the Facility's water treatment system can reliably treat. Groundwater, whether it be Banked SWP Water or MRB Adjudicated Water, is consistently the highest quality diluent supply available to the Facility enabling the maximum use of Recycled Water on a volumetric basis. SWP Water, when available, is also used as a diluent but is of worse quality than groundwater (particularly during droughts) and varies in quality throughout the year, resulting in the Facility being able to use less Recycled Water on a volumetric basis. The Facility has demonstrated the ability to use varying percentages of Recycled Water for certain durations by blending with SWP Water and groundwater, depending on operating conditions, water qualities, and given current equipment capabilities and permit conditions (R. Cullison, pers. comm., 2015).

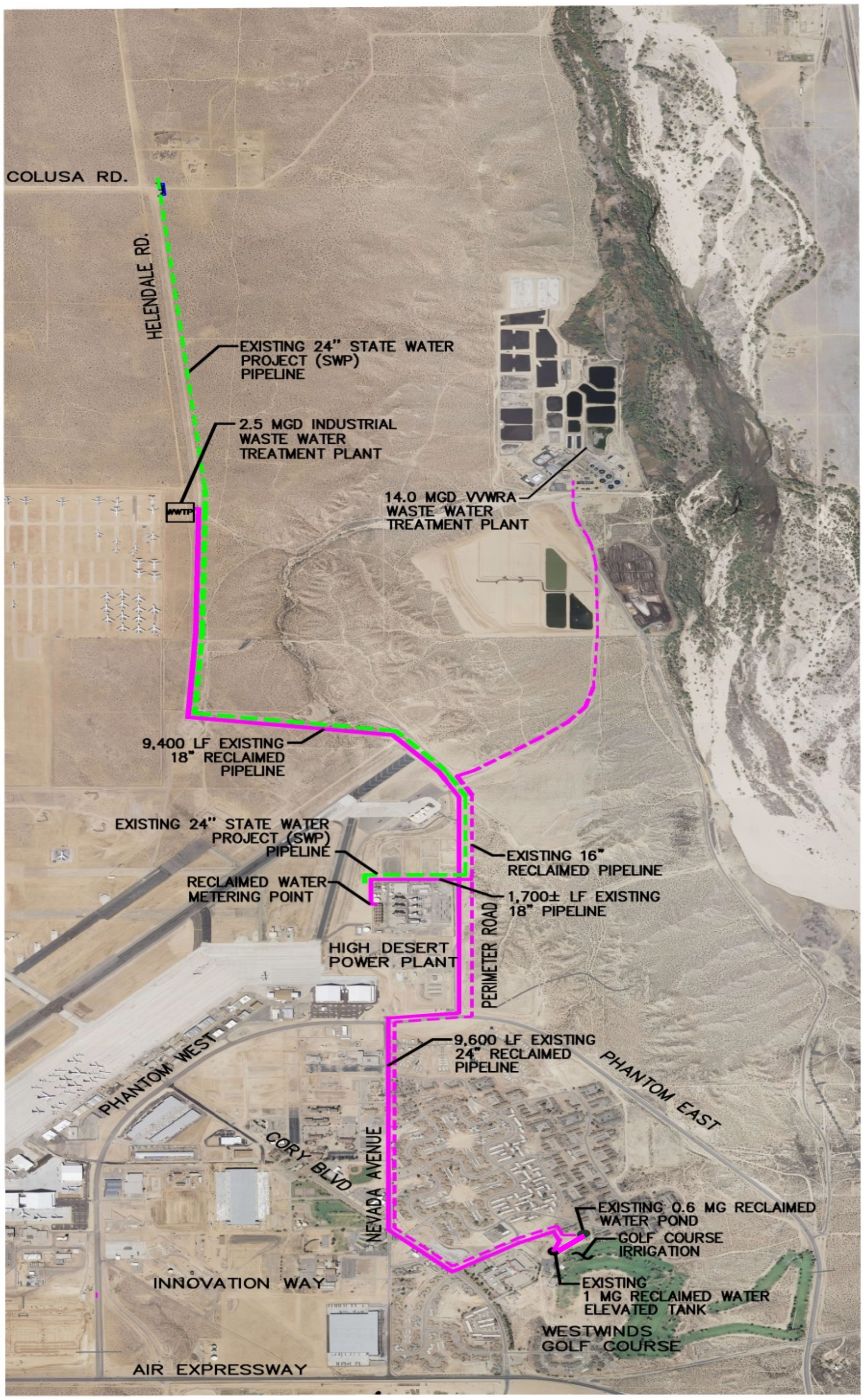

Figure 1. Map of the Facility Vicinity. This figure illustrates location of wastewater treatment plants and conveyance structures.

Table 2. Historical Monthly Recycled Water Use at the Facility.

Month/Year	Facility Water Consumption for Power Production - All Sources (AF)[1]	Recycled Water Consumption (AF)	Recycled Water Consumption for Power (%)
Jul-11	195.0	4.4	2.3%
Aug-11	228.9	24.1	10.5%
Sep-11	246.2	21.0	8.5%
Oct-11	157.6	12.9	8.2%
Nov-11	71.3	0	0.0%
Dec-11	152.9	6.0	3.9%
Jan-12	272.5	13.5	5.0%
Feb-12	243.3	15.1	6.2%
Mar-12	282.2	64.4	22.8%
Apr-12	275.0	18.7	6.8%
May-12	177.9	0	0.0%
Jun-12	285.9	0	0.0%
Jul-12	298.8	0	0.0%
Aug-12	347.7	0	0.0%
Sep-12	342.6	0	0.0%
Oct-12	302.3	0	0.0%
Nov-12	183.8	0	0.0%
Dec-12	350.3	0	0.0%
Jan-13	277.3	0	0.0%
Feb-13	255.8	0	0.0%
Mar-13	316.2	0	0.0%
Apr-13	317.4	0	0.0%
May-13	187.9	0	0.0%
Jun-13	353.2	0	0.0%
Jul-13	360.7	55.1	15.3%
Aug-13	244.0	9.6	3.9%
Sep-13	273.5	0	0.0%
Oct-13	237.0	0	0.0%
Nov-13	131.9	0	0.0%
Dec-13	332.7	0	0.0%
Jan-14	309.2	0	0.0%
Feb-14	178.3	16.4	9.2%
Mar-14	178.6	69.8	39.6%
Apr-14	206.0	142.0	68.9%
May-14	141.2	76.3	54.0%

Table 2. Historical Monthly Recycled Water Use at the Facility.

Month/Year	Facility Water Consumption for Power Production - All Sources (AF)[1]	Recycled Water Consumption (AF)	Recycled Water Consumption for Power (%)
Jun-14	297.4	161.9	54.4%
Jul-14	319.7	181.3	56.7%
Aug-14	326.0	192.2	58.9%
Sep-14	336.6	92.8	27.6%
Oct-14	358.5	126.7	35.3%
Nov-14	121.5	39.2	32.3%
Dec-14	204.3	40.9	20.0%
Jan-15	119.2	46.5	39.0%
Feb-15	214.9	35	16.3%
Mar-15	123.3	21.3	17.3%
Apr-15	175.6	34.3	19.5%
May-15	99.6	0	0.0%
Jun-15	301.6	77	25.5%

Source (J. Boyer, pers. comm., June 24, 2014, and July and August 2015)
(1): Volumes exclude water for banking.

Notwithstanding these Recycled Water quality and quantity issues, in February 2014 HDPP agreed to and began accepting delivery of the poorer-quality Recycled Water from the IWWTP. This out-of-spec Recycled Water supply was blended with Banked SWP Water during the 2014 SWP Water curtailment period (HDPP, 2014). This blending represents an additional expense to the Facility but produced a product water that is acceptable for use at the Facility.

As noted above, on March 21, 2014, the Facility exercised its right under the Agreement and notified VWD to increase: (1) annual delivery of Recycled Water to 4,000 AFY, and (2) instantaneous delivery rate to 4,000 gpm. This increase in Recycled Water delivery has only partially occurred because of various outages and maintenance activity at the VVWRA Shay Road Plant and overall VWD delivery issues described herein.

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.

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 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 as it currently is 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.

The Petition recommends that moving forward, actual blending will be based on chloride concentration in the circulating cooling water and HDPP's proposed "CT Blowdown Formula", both to be used to determine the need for certain source waters (blending) to maintain reliable operations. For the purposes of the Water Supply Scenarios presented in this report, it is projected that the maximum percentage of Recycled Water that can be utilized by the Facility on an instantaneous basis when blending with SWP Water will range from 20% (worst case) to 35% (best case); when blending with Banked SWP Water or MRB Adjudicated Water, the scenarios project that the maximum percentage of Recycled Water that can be utilized will range from 20% (worst case) to 40% (best case)[3]. Lastly, the Water Supply Scenarios also project that the order of blending water with Recycled Water will be SWP Water first, Banked SWP Water second, and MRB Adjudicated Water last. Each water supply will be fully utilized to the extent feasible before transitioning to the next priority source (e.g., all Banked SWP Water will be used before any MRB Adjudicated Water is pumped). The assumption that one supply would be fully utilized before moving to the next supply may not reflect all possible operating scenarios. There are, for example, times of the year under certain hydrological conditions when SWP Water is of high quality (seasonality) and may thus be used as a diluent for poorer quality Recycled Water. Conversely, there may be seasons during the year when SWP Water quality is of poor quality. During these times of poor quality, it may be necessary to move to a second diluent source before all SWP Water available is used.

2.1.2 Potential Future Recycled Water Availability

Forecasted amounts of Recycled Water available for the Facility have changed in recent years as a result of:

a) changes involving the major wastewater treatment plants,

b) changes in actual and projected population growth,

c) the anticipated implementation of two subregional wastewater reclamation plants that will reduce total flow to the VVWRA Shay Road Plant,

d) diversion of domestic flows that historically were conveyed to VVWRA and are now conveyed to IWWTP, and

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[3] Recycled Water use greater than these percentages did occur when temporary water treatment equipment was mobilized to the Facility during the feasibility study testing period that was ordered by the Commission, which concluded November 1, 2014. However, use of Recycled Water in excess of these percentages has not been demonstrated to be sustainable given current equipment capabilities and permit conditions as required in the Facility's SOIL&WATER-1(e) condition.

e) CEC approval of the Victorville 2 Hybrid Power Project which, if built, will also use a large amount of Recycled Water.

In an effort to determine the amount of Recycled Water available in the next 10 years, an evaluation was conducted based on: (1) existing planning documents associated with both the VVWRA Shay Road Plant and the IWWTP, and (2) data collected at these plants obtained through coordination with management staff. Because most of the available planning documents prepared by various local agencies (e.g., Urban Water Management Plans, General Plans, and water or wastewater master plans) that would support the determination of future availability of Recycled Water are 5 or more years old, and because population growth and other factors have changed considerably in recent years in response to nationwide economics and other factors, present-day usage and updated forecasted data were collected from VVWRA. More recent data collected were used to develop updated forecasts of Recycled Water availability for use at the Facility and then compared to the forecast that was available when the Facility was approved to use Recycled Water in 2009.

It is important to note that the actual inflows to the wastewater treatment plants are dependent on many factors, most of which are entirely out of the control of VVWRA or VWD. In fact, it is possible that there could be no increase for many years, or there could be decreases, particularly given the potential for long-term reductions in per capita indoor water usage though implementation of conservation and efficiency measures associated with the current drought. As was recently seen in this area, a nation-wide economic shift (such as from the real estate downturn in 2007 or the financial market crash in 2008) could directly affect future growth in the area. It is not impossible that local, regional or national factors could affect this area again and stop or significantly slow growth for an unknown number of years. In this context, projected increases of future wastewater flow as provided in planning documents prepared by the various local agencies are dependent upon many factors and assumptions. Those documents are, rightly, prepared from the agency perspective of needing to be prepared to accommodate the changing demands of their constituents in future years. From the Facility's perspective, however, if less Recycled Water is available because of slower growth, there will be operational concerns unless its alternative water supplies are contractually and physically maintained and accessible.

The following sections describe future wastewater flows to the treatment plants. As described in Section 2.1.1, the amount of Recycled Water produced by the wastewater treatment plants that can be utilized by the Facility is less than the wastewater treatment volumes described in the following sections because of treatment plant outages and dilution required to produce blended water quality that the Facility can reliably use. As described in Section 2.1.1, 15% downtime (85% uptime) is the projected worst case condition for both wastewater treatment plants in Water Supply Scenarios presented in this report under non-emergency conditions. Best case and average case uptime projected in the Water Supply Scenarios is 95% and 90%, respectively. Uptime percentage is referred to as a "Recycled Water Availability Factor" in the Water Supply Scenarios.

As described in Section 2.1.1, the Water Supply Scenarios presented in this report project the maximum fraction of Recycled Water that can be utilized by the Facility on a continuous and long term basis, and dependent on operating conditions and water qualities, ranges from 35% to 40% depending on diluent. The Water Supply Scenarios apply factors to the available flows identified in the following sections to determine the maximum amount of Recycled Water that the Facility could potentially utilize in a given year, subject to the availability of SWP Water, Banked SWP Water, or MRB Adjudicated Water for dilution.

2.1.2.1 Future Wastewater Flows to IWWTP

Mr. Steve Ashton, VWD's Water Supply Manager, provided information on past and projected future wastewater flows to the IWWTP (S. Ashton, pers. comm., June 2, 2014, and July 1, 2015). The IWWTP has an ultimate treatment capacity of 2.5 mgd and has historically treated wastewater generated from various commercial and domestic sources at SCLA, primarily the Dr Pepper/Snapple bottling plant and the Victorville Federal Correctional Complex, totaling approximately 0.5 million gallons per day (mgd). In February 2015, approximately 1.2 mgd of wastewater was permanently diverted from VVWRA's "Westside Feed" to the IWWTP, which represents approximately 10 percent of the total flow from the VVWRA service area (S. Ashton, pers. comm., July 1, 2015). VVWRA "Westside Feed" flows will not be impacted by future operation of the VVWRA subregional treatment plants. As of May 2015, the IWWTP is producing 1.65 mgd (1,848 AFY) of Recycled Water that is potentially available for use at the Facility after accounting for the previously described constraints.

The IWWTP was constructed to initially serve the Dr. Pepper/Snapple bottling plant and the Recycled Water produced by the IWWTP was to be readily available for reuse at the Facility. However, after the IWWTP went online, HDPP was told by VWD that Dr. Pepper/Snapple had changed its bottling processes from the original design and will produce wastewater of higher TDS concentration and less volume than originally planned. This unexpected change resulted in the production of Title 22 Recycled Water at the IWWTP of: (1) much lower flow than originally forecasted, and (2) out-of-spec quality (primarily higher TDS) that cannot be used at the Facility without considerable dilution by blending with additional other water of substantially better quality. The recent permanent diversion from VVWRA's "Westside Feed" has reduced the salinity of the Recycled Water produced by the IWWTP. Further water quality improvements are expected by approximately October 2015 as a result of VWD's actions to comply with the permit for IWWTPs Percolation Pond 14, which necessitates pretreatment at Dr. Pepper/Snapple that will result in significant salinity reductions in its waste stream (S. Ashton, pers. comm., July 1, 2015).

IWWTP has produced approximately 0.5 mgd of Recycled Water from SCLA influent sources for the past several years and VWD expects that this flow rate will continue without increases for many years. There are potential new commercial tenants that may or may not move to SCLA in the coming years, and prediction of timing or amounts of future increases to wastewater flows is not possible at this time. The recent permanent diversion of influent from VVWRA's "Westside Feed" may increase over time, to the extent that there is growth in that area. Growth projections for VVWRA's service area are described in the next section and are applied to the IWWTP "Westside Feed" diversion amounts moving forward. Table 3 provides projections of IWWTP treatment plant influent from 2015 thru 2024, which are utilized in the Water Supply Scenarios. It is projected that there are negligible losses in the treatment process such that influent flow is a good measure of the potential quantity of Recycled Water that may be available for use at the Facility after considering the previously described constraints.

Table 3. Projected Wastewater Influent Flows to IWWTP

Year	IWWTP Influent (AF)[1]		
	Low Growth	Moderate Growth	High Growth
2014	N/A	1,848	N/A
2015	1,854	1,859	1,865
2016	1,865	1,881	1,899
2017	1,876	1,903	1,933
2018	1,887	1,925	1,967
2019	1,898	1,947	2,001
2020	1,909	1,969	2,035
2021	1,920	1,991	2,069
2022	1,931	2,013	2,103
2023	1,942	2,035	2,137
2024	1,953	2,057	2,171

Notes:
1. Moderate growth per regional growth projections (pers. Comm. Olds, 2015): 2015 increase by 500 equivalent dwelling units (EDUs); 1,000 EDUs thereafter. 200 gallons per day per EDU. High and low growth assumed to be +/- 50% of regional growth projection. 10% of growth assigned to IWWTP.

2.1.2.2 Future Wastewater Flows to VVWRA Shay Road Plant

Data provided by, and discussions with Mr. Logan Olds, VVWRA's General Manager, were used to assess future wastewater flows to the VVWRA Shay Road Plant (L. Olds, pers. comm., June 10 and 17, 2014, and July 2015). The VVWRA Shay Road Plant currently treats approximately 12 mgd of commercial and domestic wastewater and, following a series of upgrades completed in 2008, has an ultimate treatment capacity of 18 mgd. Historical influent to the plant during the period 2003 through 2014 ranged from 9.4 to 12.6 mgd (10,530 to 14,115 acre-feet per year AFY), as shown in Table 4.

Table 4. Historical VVWRA Shay Road Plant Flows.

Year	VVWRA Flow (mgd)	VVWRA Flow (AF)
2003	9.35	10,473
2004	10.60	11,874
2005	12.03	13,475
2006	12.32	13,800
2007	12.43	13,923
2008	12.30	13,778
2009	12.07	13,520
2010	12.58	14,091
2011	12.26	13,733
2012	12.20	13,666
2013	12.12	13,576
2014	12.10	13,554

VVWRA monitors and reports the quantity of received wastewater flows, and hence its treatment volumes, using the industry-standard term Average Dry Weather Flows (ADWF). In regards to seasonal fluctuations in wastewater flow rates, the supplies of Recycled Water are expected to be relatively constant over the course of any given year due to the predominantly domestic nature of the VVWRA Shay Road Plant's customer's base. Historically there have not been significant seasonal fluctuations in flow volumes at the VVWRA Shay Road Plant. The same is projected to apply to IWWTP, particularly because the majority of the influent to that plant now comes from the VWD portion of the VVWRA service area.

Table 5 provides projections of VVWRA Shay Road Plant treatment plant influent from 2015 thru 2024, which are utilized in the Water Supply Scenarios. It is projected that there are negligible losses in the treatment process such that influent flow is a good measure of the potentially quantity of Recycled Water that may be available for use at the Facility after considering the previously described constraints.

The projected amount of influent flow to the VVWRA Shay Road Plant is based upon recent VVWRA projections of anticipated residential and commercial growth in their service area and projected diversions to two subregional treatment plants beginning in 2017. As mentioned above, growth projections are based upon a series of assumptions based upon short-term historical trends, and the actual change in wastewater flows to the VVWRA Shay Road Plant could be different, as discussed below. Growth assumptions are detailed in the Table 5 footnotes. Two subregional wastewater reclamation facilities have been planned and funded, and they are anticipated to start construction in 2015 and be operational by 2017 (L. Olds, pers. comm., June 10 and 17, 2014). These facilities will each capture 1 mgd (1,120 AFY) of the flows from the Hesperia and Apple Valley areas, respectively. The combined reduction of 2 mgd (2,240 AFY) will correspondingly reduce the amount of available Recycled Water available from the VVWRA Shay Road Plant for use at the Facility. Water quality changes are not anticipated in association with these reductions in flow to the VVWRA Shay Road Plant.

Table 5. Projected Wastewater Influent Flows to VVWRA Shay Road Plant.

Year	VVWRA Influent (AF)[1,2]		
	Low Growth	Moderate Growth	High Growth
2014	N/A	13,554	N/A
2015	12,260	12,311	12,361
2016	12,361	12,513	12,663
2017	10,222	10,475	10,725
2018	10,323	10,677	11,027
2019	10,424	10,879	11,329
2020	10,525	11,081	11,631
2021	10,626	11,283	11,933
2022	10,727	11,485	12,235
2023	10,828	11,687	12,537
2024	10,929	11,889	12,839

Notes:

1. Moderate growth per regional growth projections (pers. Comm. Olds, 2015): 2015 increase by 500 equivalent dwelling units (EDUs); 1,000 EDUs thereafter. 200 gallons per day per EDU. High and low growth assumed to be +/- 50% of regional growth projection. 90% assigned to VVWRA
2. Includes influent loss for diversion to subregional plants beginning in 2017 (pers. Comm. Olds, 2014) and 1.2 mgd diversion to IWWPT starting in 2015.

There are small losses in the VVWRA treatment process, which includes a minor amount of onsite recycled water use (L. Olds, pers. comm., July 2015). These losses are considered negligible and influent flow is considered a good measure of the potential quantity of Recycled Water that may be available for use at the Facility after other Recycled Water demands are accounted for and after considering the previously described constraints.

Other than the Facility, there are three existing and future demands for Recycled Water:

1. Environmental Flow Releases to Mojave River (existing)
2. Westwinds Golf Course (existing)
3. Victorville 2 Hybrid Power Project (future)

Each Recycled Water demand is described below.

Environmental Flow Releases to Mojave River. In accordance with the 2003 Memorandum of Understanding (MOU) between the California Department of Fish and Game (DFG; now known as the California Department of Fish and Wildlife) and VVWRA, VVWRA is required to discharge 9,000 AFY of Recycled Water from the VVWRA Shay Road Plant to the Mojave River Transition Zone. Secondary- or tertiary-treated water may be used to meet the requirement either as discharges to VVWRA's percolation ponds or discharges directly to the Mojave River.

The required discharge amount will vary each year in association with the following criteria:

1. VVWRA's discharge need not be more than is necessary to produce, in combination with base flow of the Mojave River as measured at the Lower Narrows gage, a total of 15,000 AFY (see Table 6 below for summary of historical post-Judgment base flow and values utilized in the Water Supply Scenarios).
2. If the combined flows at the Lower Narrow gage exceed 15,000 AFY for the prior water year, VVWRA may decrease its discharge by an amount equal to the prior water year's combined flow exceedance over 15,000 AFY.
3. VVWRA is also required to discharge to the Mojave River not less than 20 percent of the *increase in* Recycled Water flows conveyed to the VVWRA Shay Road Plant compared to 2003, the date of the DFG MOU.
4. VVWRA may subtract Recycled Water delivered to irrigate Westwinds Golf Course from the 9,000 AFY of "available Recycled Water" that is required to be diverted to the Mojave River Transition Zone.

It is reasonable to assume that the MOU will continue to operate and that the supplies required to meet VVWRA's obligations under the MOU will continue to be used for those purposes.

The volume of Recycled Water required to achieve a combined flow of at least 15,000 AF at the Lower Narrow gage varies each year according to the current year's base flow and prior year's combined flows.

Table 6. Mojave River Base Flow at Lower Narrows Gage.

Historical Data			Wettest 10-Year Period		Average 10-Year Period		Driest 10-Year Period	
Year	Flow (AF)	10-Yr Average	Year	Flow (AF)	Year	Flow (AF)	Year	Flow (AF)
1994	9,253	-	1994	9,253	-	-	-	-
1995	7,385	-	1995	7,385	-	-	-	-
1996	6,558	-	1996	6,558	-	-	-	-
1997	6,613	-	1997	6,613	-	-	-	-
1998	11,282	-	1998	11,282	1998	11,282	-	-
1999	8,122	-	1999	8,122	1999	8,122	-	-
2000	5,806	-	2000	5,806	2000	5,806	2000	5,806
2001	4,738	-	2001	4,738	2001	4,738	2001	4,738
2002	4,557	-	2002	4,557	2002	4,557	2002	4,557
2003	3,478	**6,779**	2003	3,478	2003	3,478	2003	3,478
2004	4,135	6,267	-	-	2004	4,135	2004	4,135
2005	8,839	6,413	-	-	2005	8,839	2005	8,839
2006	6,627	6,420	-	-	2006	6,627	2006	6,627
2007	4,396	**6,198**	-	-	2007	4,396	2007	4,396
2008	4,680	5,538	-	-	-	-	2008	4,680
2009	3,713	**5,097**	-	-	-	-	2009	3,713
2010	6,752	5,191	-	-	-	-	-	-
2011	10,887	5,806	-	-	-	-	-	-
2012	8,594	6,210	-	-	-	-	-	-
2013	7,190	6,581	-	-	-	-	-	-
2014	5,856	6,753	-	-	-	-	-	-
	Maximum	6,779						
	Average	6,104						
	Minimum	5,097						

Source: Mojave Basin Area Watermaster Annual Reports.
http://www.mojavewater.org/downloads.html

Westwinds Golf Course. The Westwinds Golf Course has been irrigated since 2003 with Recycled Water from the VVWRA Shay Road Plant, as approved by Water Board Order R6V-2003-028 (Water Board, 2003). Deliveries of Recycled Water to the golf course for its use have ranged from an annual average of 80,000 gallons per day (gpd) (90 AFY) (in 2013) to 340,000 gpd (381 AFY) (in 2009). Based upon projected golf course irrigation demands and continuing operations, VVWRA suggests a planning-level estimate of future average annual use of 120,000 gpd (134 AFY) (L. Olds, pers. comm., June 10 and 17, 2014). However, VWD recently stated that Recycled Water will only be used at the golf course if it is available and cannot be used by the Facility (S. Aston, pers. comm., July 1, 2015). If Recycled Water is used at the golf course it does not affect availability of Recycled Water in the following year because the usage is debited from the required environmental flow releases to Mojave River. Based on the foregoing, it is not necessary to consider further Recycled Water use at the golf course in the Water Supply Scenarios.

Victorville 2 Hybrid Power Project. The Victorville 2 Hybrid Power Project is a proposed power generation facility that would include both gas-fired combustion turbine generators and solar electrical generation technology. Victorville 2 is to be located immediately north of SCLA. The City of Victorville, owner of the proposed Victorville 2 facility, has received CEC approval for the project with a start-of-construction deadline of July 16, 2018. The CEC approval contemplated that the project would use 3,150 AFY of Recycled Water (at an average flow rate of 2,603 gpm).

Given the potential future development of Victorville 2 and its associated demands on available Recycled Water, consideration of availability of Recycled Water for Facility uses is considered in the Water Supply Scenarios 2A-2C.

2.2 State Water Project Water

SWP Water is purchased by HDPP from VWD, the local retail water agency, who obtains it from MWA, the regional SWP contractor.

In 2001 the City of Victorville executed a Water Service Agreement that enables SWP Water delivery to the Facility (City of Victorville, 2001). Pursuant to the agreement, the City of Victorville agrees to deliver up to 8,000 AFY of SWP Water requested by HDPP, provided the City is able to obtain such water from MWA. Historically, HDPP has requested 6,500 – 8,000 AF of SWP Water each year from the City of Victorville. The City of Victorville then makes a request to MWA.

MWA has a SWP entitlement (a.k.a. “Table A entitlement”) administered by California Department of Water Resources (DWR). As of May 2015, MWA’s Table A maximum annual entitlement is 85,800 AFY. Each year DWR evaluates SWP conditions and allocates available SWP water supplies to the State Water Contractors. The allocation is issued as a percentage of the contractors’ Table A entitlements.

Each year, MWA reviews its Table A allocation and water demands and then allocates available SWP Water among the retail water agencies and groundwater recharge projects within its service area. The Board of Directors’ general policy in times of limited Table A allocation is to allocate available Table A entitlement proportionally to requesting customers as a percentage of their 5-year average historical demands, up to a maximum of the lesser of their delivery request or their 5-year average use (MWA, 2015). In practice, HDPP’s annual allocation of SWP Water has typically exceeded the amount that would be expected from strict application of this general policy. Table 7 summarizes historical SWP Water availability, HDPP requests, and Facility usage.

Future Table A allocations will be a function of hydrology on the SWP system and Delta flow requirements necessary for protection of endangered and threatened fish species and protection of fish and wildlife beneficial uses in the Bay Delta estuary. SWP water supplies may be highly variable based on hydrology alone; a wet water year may be followed by a dry or critically dry year (DWR, 2015a). Additionally, because of the various regulatory requirements placed on the SWP's Bay-Delta operations, the ability to accurately determine the SWP's water delivery capability in a given year is a significant challenge (DWR, 2015a). The regulatory requirements have resulted in a decrease in SWP exports from the Bay-Delta since 2005, although the bulk of the change occurred around 2009 as federal Biological Opinions[4] went into effect (DWR, 2015a).

Because SWP operations are continuously evolving in response to regulatory requirements and new understanding gained through monitoring and operational modifications, the use of historical Table A allocations in the Water Supply Scenarios would not be representative of future conditions. In April 2015, DWR issued the Draft State Water Project Delivery Capability Report 2015 (DWR, 2015a). Among other things, the report presents the existing overall delivery capability of the SWP system and the allocation of that capacity to each contractor under a range of hydrologic conditions based on best available information. Table B.23 of the DWR report provides specific forecasts of MWA Table A allocations using historical hydrology and considering current regulatory requirements and operations. These projections are tabulated in Appendix A.

Table 7. Historical State Water Project Availability and Use at the Facility.

Year	DWR SWP Allocation to MWA (% of Table A)[1]	SWP Requested by Facility (AF)[2]	SWP Allocation from MWA (AF)[3]	Total SWP Use at Facility (AF)[2]	SWP Water Consumption (AF)[2]	SWP Injected into ABS (AF)[2]
2004	65%	8,000	8,000	3,434	2,932	502
2005	90%	8,000	8,000	3,191	2,418	773
2006	100%	8,000	8,000	3,915	2,484	1,431
2007	60%	8,000	8,000	3,154	2,617	537
2008[4]	35%	8,000	3,280	3,229	2,852	377
2009	40%	8,000	2,706	2,532	2,025	507
2010	50%	8,000	3,486	2,814	2,261	553
2011	80%	6,500	6,500	1,518	1,176	342
2012	65%	6,500	6,500	3,833	3,013	820
2013	35%	6,500	6,500	2,313	1,911	402
2014	5%	6,500	565	564	471	93
2015	20%	6,500	2,171	In Progress	In Progress	In Progress

1. Source: (DWR, 2015b)
2. Source: (J. Boyer, pers. comm., July and August 2015).
3. Source: (R. Cullison, pers. comm., 2015)
4. First year of increased flow restrictions on SWP Delta conveyance pursuant to the 2008 (and later 2009) Biological Opinions.

[4] A biological opinion (BO) is a document that states the opinion of the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS) as to whether or not an action by another federal agency is likely to jeopardize the continued existence of species listed under the federal Endangered Species Act (ESA) as threatened or endangered. Several BOs have been issued since the 1990s on the effects of coordinated SWP / Central Valley Project operations on several listed species in the Delta.

As discussed above, MWA allocates its available Table A allocation amongst the retail water agencies and groundwater recharge projects within its service area. A projected relationship was developed between SWP Table A allocation and the SWP allocation provided to HDPP by MWA by considering historical allocations provided to HDPP, historical SWP Water use at the Facility, and historical SWP Table A allocations. The projected relationship is shown in Table 8.

Table 8. MWA SWP Table A Allocations and Projected HDPP Allocations.

MWA Table A %	Projected HDPP Allocation (AF)
<10%	500
10-19%	1,250
20-29%	2,000
30-39%	2,500
40-49%	3,000
50-59%	3,500
>=60%	6,500

The relationship between SWP Table A allocation and the SWP allocation provided to HDPP by MWA (Table 8) is combined with DWR's MWA Table A allocation forecasts in Appendix A to arrive at projected SWP Water allocations for the Facility under wet, average, and dry non-emergency conditions. The results are shown in Table 9. The allocations listed in Table 9 represent the maximum amount of SWP Water HDPP could potentially use in a given year.

Table 9. HDPP SWP Water Allocations Used in Water Supply Model.

Wettest 10-Year Period			Average 10-Year Period			Driest 10-Year Period		
Hydrology Year	Predicted Table A %	Projected HDPP Allocation (AF)	Hydrology Year	Predicted Table A %	Projected HDPP Allocation (AF)	Hydrology Year	Predicted Table A %	Projected HDPP Allocation (AF)
1978	81%	6,500	1942	70%	6,500	1924	24%	2,000
1979	74%	6,500	1943	89%	6,500	1925	41%	3,000
1980	100%	6,500	1944	42%	3,000	1926	52%	3,500
1981	56%	3,500	1945	74%	6,500	1927	70%	6,500
1982	100%	6,500	1946	68%	6,500	1928	77%	6,500
1983	100%	6,500	1947	55%	3,500	1929	23%	2,000
1984	79%	6,500	1948	52%	3,500	1930	37%	2,500
1985	75%	6,500	1949	38%	2,500	1931	33%	2,500
1986	89%	6,500	1950	61%	6,500	1932	32%	2,500
1987	21%	2,000	1951	78%	6,500	1933	42%	3,000

See Appendix A for Table A % projections.

Although SWP Water may be allocated to HDPP in a given year, there are periods of time each year that SWP cannot be used due to delivery curtailments or because the water quality is not suitable for HDPP use. Daily SWP availability and suitability was evaluated and considered in the Water Supply Scenarios.

To assess SWP Water availability, the ideal dataset would be daily flow in the SWP aqueduct serving MWA; however, such data were not available for this analysis. As an alternative, SWP Water availability was assessed using continuous water quality monitoring records at Check 41 on the SWP East Branch (the DWR continuous water quality monitoring station located closest to HDPP), (Table 10). It was projected that any day in which the continuous electrical conductivity (EC) sensor at Check 41 did not report data indicates a day with no aqueduct flow. Daily EC sensor data were downloaded from DWR's website and used to determine the number of days each year with no data reported (second column in Table 10) (DWR, 2015c). The number of days per year with no data was converted to a percentage of time that SWP Water is projected to be flowing in the SWP East Branch and, thus, potentially available for use by HDPP (fifth column in Table 10). This analysis used 2009 and later data to reflect the SWP operations after the federal Biological Opinions affecting SWP exports from the Bay-Delta went into effect. The approach for assessing SWP Water availability is conservative with respect to estimating potential HDPP MRB Adjudicated Water use because HDPP's operators note that SWP Water was not available during February through August 2014, which equates to 42% availability for 2014, as compared to 90% availability suggested by the EC sensor data (R. Cullison, pers. comm., 2015). It is possible that SWP Water was flowing in the aqueduct, but was needed to fill reservoirs and/or MWA needed it for higher priority uses during that time.

Table 10. SWP Water Availability and Suitability for HDPP Use.

Year	Days With Continuous EC Probe Data	Days with Continous EC Probe <670 uS/cm	Percent of Time SWP Suitable	Percent of Time SWP Available[1]	Percent of Time SWP is Suitable and Available[2]
2009	347	341	98%	95%	93%
2010	336	336	100%	92%	92%
2011	324	324	100%	89%	89%
2012	355	355	100%	97%	97%
2013	348	348	100%	95%	95%
2014	329	327	99%	90%	90%
				Average:	93%

Notes:

(1) Based on number of days per year with continuous EC sensor data at Check 41 as an assumed indicator of flow.

(2) %Time Suitable and Available = %Time Suitable X %Time Available

To assess SWP Water suitability, the EC sensor data were used to assess the percentage of time that SWP Water EC was less than 670 micro Siemens per centimeter (uS/cm), a threshold value derived from equipment tolerance/design considerations and operational history (R. Cullison, pers. comm., 2015). Again, this analysis used 2009 and later data to reflect the SWP operations after the federal Biological Opinions affecting SWP exports from the Bay-Delta went into effect. Table 10 shows the number of days each year in which EC was less than the 670 uS/cm threshold (third column). The number of days per year in which EC was less than 670 uS/cm was converted to a percentage of time that SWP Water is projected to be suitable for use by HDPP (fourth column in Table 10).

The percentage of time that SWP Water may be available and suitable for use by HDPP was calculated as the product of the availability and suitability percentages and is shown in the sixth column of Table 10. The percentage of time SWP Water may be available and suitable ranges from 89% to 97% of the time. The average is 93%. For the purposes of the Water Supply Scenarios presented in this report, it is projected that SWP Water is available and suitable for use by HDPP from 89% (worst case) to 97% (best case) of the time under non-emergency conditions. Average case SWP Water availability is projected to be 93% of the time.

2.3 Banked State Water Project Water

The Facility was originally certified by the CEC to treat SWP Water with the Facility's aquifer banking system (ABS) and store SWP Water in an underground aquifer (Aquifer Bank) via well injection (Banked SWP Water) for later use when SWP Water is not available to the Facility. VWD began banking SWP Water for HDPP when the Facility began commercial operation in 2003. Banked SWP Water is received, treated, injected, and re-delivered to the Facility under an agreement between HDPP and the VWD. The ABS treatment process consists of gravity filters to remove course suspended solids and ultrafiltration to remove smaller suspended solids. Under the agreement, VWD owns and operates a group of four wells that are used to inject and extract Banked SWP Water from the Aquifer Bank for use by the Facility. The wells are located approximately 4 to 5 miles south of the Facility. HDPP reimburses VWD for the cost to maintain and operate the wells. The VWD's well and pipeline delivery system is designed to deliver 2,850 gpm or approximately 4,600 AFY if operated continuously (R. Cullison, pers. comm., 2015).

The volume of Banked SWP Water available to the Facility is limited to the volume of water HDPP has injected into the aquifer less 1,000 AF and less the amount of dissipated groundwater, which is periodically calculated by CEC staff. Table 11 summarizes historical ABS operations.

As shown in Table 11, 7,881 AF of SWP Water has been injected into the ABS and 4,719 AF has been extracted through the end of 2014. The net volume injected to date is, therefore, 3,162 AF. The available volume of Banked SWP Water is less than the net volume injected due to dissipation losses and the CEC requirement to subtract 1,000 AF from the amount water injected. The available volume of Banked SWP Water at the end of 2014 was approximately 1,780 AF[5]. This is the starting balance used in the Water Supply Scenarios.

Table 11. Summary of Historical Aquifer Banking System Operations[1].

Year	Injection (AF)	Extraction (AF)	Net Volume Injected (AF)	Storage (AF)[2,3]
2002	0	42	(42)	(42)
2003	1,544	66	1,478	1,436
2004	502	4	498	1,934
2005	773	11	762	2,696
2006	1,431	25	1,406	4,102
2007	537	214	323	4,425
2008	377	526	(149)	4,276
2009	507	723	(216)	4,060

[5] The volume of available Banked SWP Water cannot be determined precisely until updated CEC dissipation calculations become available.

Table 11. Summary of Historical Aquifer Banking System Operations[1].

Year	Injection (AF)	Extraction (AF)	Net Volume Injected (AF)	Storage (AF)[2,3]
2010	553	98	455	4,515
2011	342	33	309	4,824
2012	820	288	532	5,356
2013	402	1,308	(906)	4,450
2014	93	1,381	(1,288)	3,162
TOTAL	7,881	4,719	3,162[2]	N/A

1. Source: 2014 Annual Monitoring Report (HDPP, LLC, 2015)
2. The Net Volume Injected total and Storage column does not include losses due to dissipation. Cumulative dissipation losses were 342 AF through the end of second quarter 2013. Source: (Abulaban, 2013).
3. Available storage is 1,000 AF less than storage and dissipation losses due to the requirement to subtract 1,000 AF from the amount of water available to the project, throughout the life of the project, as specified in Soil and Water-5.

It is important to note that in order to treat and bank SWP Water, the following conditions must first be met:

a) SWP Water must be available and allocated to HDPP for its use by MWA,

b) The allocated quantity must be in excess of the Facility's operating needs,

c) SWP Water must meet concentration thresholds (for total dissolved solids and trihalomethanes) in order to be injected, and

d) The Facility must be operating, or have sufficient residual heat during shut-down, in order to provide the thermal energy needed to treat SWP Water for banking.

Given the above-described conditions and SWP Water availability and quality, the average annual quantity of water that has been banked historically is 576 AFY[6] (R. Cullison, pers. comm., 2015).

2.4 Mojave River Basin Adjudicated Water

On September 10, 2014, in response to a drought induced curtailment of SWP Water, the CEC approved a modification to the Facility's CEC conditions of certification allowing HDPP to obtain MRB Adjudicated Water for use as an alternative water supply. The approval allows HDPP to obtain water rights 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 "Judgment"). The Judgment allows any party, including HDPP, to become a Party to the Judgment and (1) acquire and use existing water rights adjudicated under the Judgment, or (2) pay applicable Replacement Water Assessments that pay for imported water for recharge to replace pumped groundwater. The CEC limited HDPP's consumption of MRB Adjudicated Water to no more than 2,000 AF in water year 2014/2015 and no more than 2,000 AF in water year 2015/2016. Use of MRB

[6] The 576 AFY average annual banked volume is the average during operating years 2004-2014. Operating year 2003 was excluded because the Facility began commercial operation in April 2003 and did not operate for the entire year.

Adjudicated Water is currently approved by CEC through September 30, 2016. The Petition proposes use of MRB Adjudicated Water as a 4th priority backup supply on a permanent basis.

The Facility receives MRB Adjudicated Water through an agreement with VWD.

2.4.1 Sustainable Management of Mojave River Basin Groundwater

HDPP's proposed use of MRB Adjudicated Water that is consistent with the Loading Sequence will not adversely affect groundwater resources because the Watermaster is required to manage the Mojave River Basin (Basin) in accordance with the adjudication which thereby mitigates adverse effect of all groundwater use to a level that is less than significant for the reasons described below.

The Replacement Water Assessment provision of the Judgment and MWA's SWP contract has allowed Watermaster to successfully maintain groundwater levels within the operational range established for the Alto Subarea. The Watermaster uses the Replacement Water Assessments to acquire surplus SWP Water available in above normal years for percolation into the basin. The Watermaster has banked water in the Basin, which has provided a buffer for drought water years. At the end of water year 2013/14, over 100,000 AF of water remained in the Alto Subarea storage account (equivalent to approximately 2-years of consumptive use).

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. Per the Watermaster (2014 report): "Conservation, importation of State Water Project water, MWA's 'R-cubed' program, and implementation of the Judgment have resulted in hydrologic balance in Alto. The water supply conditions in Alto Subarea are sustainable." Furthermore, 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. Free Production Allowance (FPA) rampdown in the Alto Subarea is 60% of the Base Annual Production right (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.

HDPP's use of MRB Adjudicated Water will have minimal impact on the Basin. Production safe yield of the Alto Subarea is 69,862 acre-feet per year. Using two key water supply scenarios discussed in this report (one with the Victorville 2 Hybrid power plant (VV2) built and operating and the other without it), projected use of MRB Adjudicated Water as modeled over the next 10 years will have a small effect on the Basin. Under typical, foreseeable operating scenarios, HDPP's impact on MRB Adjudicated Water would be minimal, resulting in use of:

1. Less than 0.2% of the Alto Subarea safe yield groundwater during average climatic conditions when the Facility is operating at high capacity.
2. Less than 2% when operating at or below historical average capacity, regardless of climate.
3. Less than 2% in extreme dry periods when operating at high capacity.
4. Less than 6% during a complete State Water Project outage combined with zero availability of Recycled Water (i.e., emergency conditions), providing the full design basis demand of 4,000 AFY.

HDPP's use of MRB Adjudicated Water is the last and final source water to be used in the Loading Sequence, causing negligible stress on the aquifer due to infrequent pumping. Moreover, and probably most importantly, in all operating conditions MRB Adjudicated Water would be funded for replenishment after use on a 2:1 basis, resulting in a net gain to the Basin.

3. Water Supply Scenarios

The following sections describe the Water Supply Scenarios and results.

3.1 Water Supply Scenario Descriptions

The information described in Section 2 was used to develop two sets of Water Supply Scenarios that assess water availability under non-emergency conditions during a 10-year future period (2015-2024) under proposed operations described in the Petition for Alternative Water Supplies to "drought-proof" the Facility (i.e., permanent access to MRB Adjudicated Water as a 4th priority, backup supply) (Table 12). Scenarios 1A-1C project that the Victorville 2 Hybrid Power Project is not built. Scenarios 2A-2C project the Victorville 2 Hybrid Power Project is built and uses 3,150 AFY of Recycled Water.

Each set of Water Supply Scenarios includes three "sub-scenarios" designed to evaluate water availability under a range of non-emergency "Water Supply Conditions" (e.g., climate or population growth) (Table 12). The Scenarios do not explicitly address emergency conditions (e.g., a prolonged SWP outage caused by an extended drought on the SWP system or an earthquake near the Bay Delta that precludes delivery of all SWP supplies). However, MRB Adjudicated Water usage under emergency conditions can be inferred from the scenario results and are discussed in the results section. Best Case, non-emergency conditions (the "A" scenarios) include wet climate and high population growth assumptions and, therefore, reflect the highest expected Recycled Water, SWP Water, and Banked SWP usage. Worst Case non-emergency conditions ("C" scenarios) utilize dry climate and low growth assumptions and, therefore, reflect the lowest expected Recycled Water, SWP Water, and Banked SWP availability under non-emergency conditions. Average Case non-emergency conditions ("B" scenarios) utilize average climate and moderate growth assumptions and, therefore, are intended to reflect average non-emergency conditions.

Although the Scenarios begin in 2015, the intent is to model a hypothetical 10-year period under the above-described "Best," Average," and "Worst" case non-emergency "Water Supply Conditions beginning in 2015 including either Victorville 2 Hybrid Power Project Recycled Water Demands (Scenarios 1A-1C) or not (Scenarios 2A-2C). Therefore, the 2015 scenario results are <u>not</u> intended to be compared to actual 2015 conditions.

The Water Supply Scenario calculations assume the Facility's design water demand of 4,000 AFY, which corresponds to the Facility generating approximately 5.1 million MWh per year (R. Cullison, pers. comm., 2015). The actual water demand will vary depending on energy market conditions, ambient conditions and other operational factors. If the plant does not use its design water demand, there would be less water used *in reverse priority order*. For perspective, from 2004-2014, the Facility's average annual energy production has been 3.91 million MWh per year and the annual average water usage for power generation has been 2,741 AFY (R. Cullison, pers. comm., 2015).

As described above, the Water Supply Scenario calculations assume design basis Facility water demand, which results in conservative estimates of MRB Adjudicated Water use under non-emergency conditions. In a further attempt to ensure the results are conservative with respect to MRB Adjudicated Water use, SWP Water banking is limited to the maximum, average, and minimum annual quantity of water that has been injected historically for the best, average, and worst case scenarios, respectively (Table 1).

The inputs for each Scenario are listed in Table 12. The inputs and assumptions utilized in the Water Supply Scenarios were previously discussed in Section 2. The scenario calculations are included in Appendices B-G. Additional calculations were performed to calculate the amount of MRB Adjudicated Water that would be needed for different generation amounts for each scenario. The calculations were performed by varying the Facility water demand in the spreadsheets shown in Appendices B-G.

Table 12. Water Supply Scenarios.

	Normal Range of Expected Operations			Normal Range of Expected Operations Plus Victorville 2 Recycled Water Demand		
Scenario No.	**1a**	**1b**	**1c**	**2a**	**2b**	**2c**
Non Emergency Water Supply Condition	**Best Case**	**Average Case**	**Worst Case**	**Best Case**	**Average Case**	**Worst Case**
Facility Water Demand						
Facility Design Water Demand (AFY)	4,000					
Recycled Water - IWWTP						
Initial Flow (AFY)[1]	1,865	1,859	1,854	1,865	1,859	1,854
Flow Increase Due to Population Growth[2]	High	Moderate	Low	High	Moderate	Low
Recycled Water Availability Factor[3]	95%	90%	85%	95%	90%	85%
Percentage of Recycled Water When Blending with SWP Water That Meets Cooling Tower Blowdown Monitoring Parameters[4]	35%	25%	20%	35%	25%	20%
Percentage of Recycled Water When Blending Banked SWP Water or Groundwater That Meets Cooling Tower Blowdown Monitoring Parameters[4]	40%	30%	20%	40%	30%	20%
Recycled Water - VVWRA						
Initial Flow (AFY)[5]	12,361	12,311	12,260	12,361	12,311	12,260
Flow Increase Due to Population Growth[2]	High	Moderate	Low	High	Moderate	Low
Losses to Subregional Plants (AFY)[6]	2,240					
V2 Hybrid Power Plant Demand (AFY)[7]	0	0	0	3,150	3,150	3,150
Recycled Water Availability Factor[3]	95%	90%	85%	95%	90%	85%
Percentage of Recycled Water When Blending with SWP Water That Meets Cooling Tower Blowdown Monitoring Parameters[4]	35%	25%	20%	35%	25%	20%
Percentage of Recycled Water When Blending Banked SWP Water or Groundwater That Meets Cooling Tower Blowdown Monitoring Parameters[4]	40%	30%	20%	40%	30%	20%
Mojave River Base Flow at Lower Narrows[8]	Wet	Average	Dry	Wet	Average	Dry
State Water Project						
SWP Availability[9]	Wet	Average	Dry	Wet	Average	Dry
Percentage of Time SWP Water Is Available and Suitable for Cooling[10]	97%	93%	89%	97%	93%	89%
Banked State Water Project Water						
Banked State Water Project Water Use	3rd priority water source, used only as needed and available					
SWP Banking Volume Cap (AFY)[11]	1,431	576	93	1,431	576	93
Mojave River Basin Groundwater						
MRB Adjudicated Groundwater Use	4th priority water source, used only as needed					

Notes:
1. See Table 3 and text for further explanation.
2. Growth assumptions per VVWRA (pers. Comm. Olds, 2015). See text for further explanation.
3. Defined as the average percentage of time the treatment plant is capable of producing and delivering recycled water. See text for further explanation.
4. Source: Pers. comm., Cullison, 2015; see text for further explanation.
5. See Table 5 and text for further explanation.
6. Two 1 mgd subregional wastewater reclamation facilities are under construction near Hesperia and Apple Valley and are expected to be operational in 2017 (pers. Comm., Olds 2015).
7. Victorville 2 CEC approval contemplated that the project would use 3,150 AFY of Recycled Water. Scenarios 1A-1C assume Victorville 2 project is not built.
8. See Table 6 and text for further explanation.
9. See Table 9 and text for further explanation.
10. See text for further explanation.
11. SWP Banking is limited to the average annual banked volume achieved historically. See text for further explanation.
12. The 576 AFY average annual banked volume is the average during operating years 2004-2014. Operating year 2003 was excluded because the Facility began commercial operation in April 2003 and did not operate for the entire year.

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3.2 Scenario Results

The results of the Water Supply Scenarios are presented in Tables 13 and 14 and Figure 2, and described in the following sections.

3.2.1 Scenarios 1A-1C Results Summary

Water Supply Scenarios 1A-1C assess water availability under proposed operations described in the Petition for Alternative Water Supplies to "drought-proof" the Facility (i.e., permanent use of MRB Adjudicated Water as a 4th priority, backup supply) with the assumption that the Victorville 2 Hybrid Power Project is not built. The results of Scenarios 1A-1C are summarized below.

Scenario 1A (Best Case Non-Emergency Water Supply Conditions – No Victorville 2 Plant): Under wet conditions and high population growth assumptions, all Facility water demands would be met using a combination of Recycled Water, SWP Water, and Banked SWP Water (Table 13 and Figure 2). MRB Adjudicated Water would not be needed to meet Facility water demands (Tables 13 and 14). Average Recycled Water, SWP Water, and Banked SWP Water use during the 10-year scenario period would be 1,419, 2,350, and 230 AF, respectively. Additionally, 7,176 AF of available Banked SWP Water is estimated to remain at the end of the 10-year scenario period, constituting a sizable amount water in storage for future HDPP use (plus an additional 1,000 AF that remains available in the bank, per the Facility's Conditions of Certification.)[7].

Scenario 1B (Average Case Non-Emergency Water Supply Conditions – No Victorville 2 Plant): Under average climate conditions and moderate population growth assumptions, all Facility water demands would be met using a combination of Recycled Water, SWP Water, and Banked SWP Water (Table 13 and Figure 2). Average Recycled Water, SWP Water, and Banked SWP Water use during the 10-year scenario period would be 1,034, 2,492, and 474 AF, respectively. Additionally, 2,142 AF of available Banked SWP Water is estimated to remain at the end of the 10-year scenario period.

Scenario 1C (Worst Case Non-Emergency Water Supply Conditions – No Victorville 2 Plant): Under dry climate conditions and low population growth assumptions, all Facility water demands would be met using a combination of Recycled Water, SWP Water, Banked SWP Water, and MRB Adjudicated Water (Table 13 and Figure 2). Average Recycled Water, SWP Water, Banked SWP Water, and MRB Adjudicated Water use during the 10-year scenario period would be 800, 2,234, 262, and 704 AF, respectively. Additionally, 298 AF of available Banked SWP Water is estimated to remain at the end of the 10-year scenario period. MRB Adjudicated Water would be needed under Scenario 1C conditions whenever the Facility operates in excess of approximately 50% of its historical average annual energy production of 3.91 MMWh (Table 13).

3.2.2 Scenarios 2A-2C Results Summary

Water Supply Scenarios 2A-2C assess water availability under proposed operations described in the Petition for Alternative Water Supplies to "drought-proof" the Facility (i.e., permanent use of MRB Adjudicated Water as a 4th priority, backup supply) with the assumption that the Victorville 2 Hybrid

[7] For each Scenario reported, the SWP Banked water is referred to as "available" because an additional 1,000 AF of Banked SWP Water remains in the bank and is not used, per the Facility's Conditions of Certification.

Power Project is built and uses 3,150 AFY of Recycled Water. The results of Scenarios 2A-2C are summarized below.

Scenario 2A (Best Case Non-Emergency Water Supply Conditions –Victorville 2 Plant Online): Under wet conditions and high population growth assumptions, all Facility water demands are met using a combination of Recycled Water, SWP Water, and Banked SWP Water (Table 13 and Figure 2). Average Recycled Water, SWP Water, and Banked SWP Water use during the 10-year scenario period would be 1,269, 2,134, and 597, AF, respectively. Additionally, 5,633 AF of available Banked SWP Water is estimated to remain at the end of the 10-year scenario period.

Scenario 2B (Average Case Non-Emergency Water Supply Conditions –Victorville 2 Plant Online): Under average climate conditions and moderate population growth assumptions, all Facility water demands are met using a combination of Recycled Water, SWP Water, Banked SWP Water, and MRB Adjudicated Water (Table 13 and Figure 2). Average Recycled Water, SWP Water, Banked SWP Water, and MRB Adjudicated Water use during the 10-year scenario period are 903, 2,295, 667, and 135 AF respectively. Additionally, 1,007 AF of available Banked SWP Water is estimated to remain at the end of the 10-year scenario period. MRB Adjudicated Water would be needed under Scenario 2B conditions whenever the Facility operates in excess of approximately 3.85 MMWH (98% of the Facility's historical average annual energy production of 3.91 MMWh (Table 13).

Scenario 2C (Worst Case Non-Emergency Water Supply Conditions –Victorville 2 Plant Online): Under dry climate conditions and low population growth assumptions, all Facility water demands are met using a combination of Recycled Water, SWP Water, Banked SWP Water, and MRB Adjudicated Water (Table 13 and Figure 2). Average Recycled Water, SWP Water, Banked SWP Water, and MRB Adjudicated Water use during the 10-year scenario period are 580, 2,149, 262, and 1,010 AF respectively. Additionally, 272 AF of available Banked SWP Water is estimated to remain at the end of the 10-year scenario period. MRB Adjudicated Water would be needed under Scenario 2C conditions whenever the Facility operates in excess of 50% of its historical average annual energy production of 3.91 MMWh (Table 13).

3.2.3 Emergency Conditions

The most probable emergency conditions that could affect the Facility's water supply is an extended critical drought on 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. Under such emergency conditions, little to no SWP Water may be available for several years. If such an emergency occurs at a time when little to no Banked SWP reserves exist and the Facility is operating at design capacity, the Plant would require 2,400 to 3,344 AFY of MRB Adjudicated Water if there is no Victorville 2 Hybrid Power Project Recycled Water demand (Scenarios 1A-1C) and 2,976 to 3,654 AFY if the Victorville 2 Hybrid Power Project exists and is using 3,150 AFY of Recycled Water (Scenarios 2A - 2C). The MRB Adjudicated Water usage under emergency conditions was calculated using the same approach shown in Appendices B-G, except that SWP Water and initial Banked SWP Water were set to zero.

If there was a supply of Banked SWP Water present at the start of the emergency conditions, this supply would be used first, and then the annual amounts of MRB Adjudicated Water would need to be tapped to continue HDPP operations. If Recycled Water is also not available during the emergency, 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.

Even though these are scenarios under potential emergency conditions, the contractual arrangement with Mojave Water Agency is for 2:1 replacement of MRB Adjudicated Water which would be conducted by MWA as soon as SWP deliveries are re-established and resulting in a net increase of groundwater in storage.

Table 13. Results of Water Supply Scenarios.

Year	**Scenario 1A** Normal Range of Expected Operations Best Case Non-Emergency Water Supply Conditions						**Scenario 1B** Normal Range of Expected Operations Average Case Non-Emergency Water Supply Conditions						**Scenario 1C** Normal Range of Expected Operations Worst Case Non-Emergency Water Supply Conditions					
	Recycled Water Used (AF)	SWP Used (AF)	Banked SWP Used (AF)	MRB Adjudicated Groundwater Used (AF)	Total Cooling Water Used (AF)	ABS Storage Balance (AF)	Recycled Water Used (AF)	SWP Used (AF)	Banked SWP Used (AF)	MRB Adjudicated Groundwater Used (AF)	Total Cooling Water Used (AF)	ABS Storage Balance (AF)	Recycled Water Used (AF)	SWP Used (AF)	Banked SWP Used (AF)	MRB Adjudicated Groundwater Used (AF)	Total Cooling Water Used (AF)	ABS Storage Balance (AF)
2015	1,416	2,396	188	0	4,000	1,780	1,033	2,511	456	0	4,000	1,780	800	1,780	1,420	0	4,000	1,780
2016	1,416	2,396	188	0	4,000	3,023	1,033	2,511	456	0	4,000	1,900	800	2,421	453	326	4,000	453
2017	1,416	2,396	188	0	4,000	4,265	1,033	2,511	456	0	4,000	2,019	800	2,421	93	686	4,000	93
2018	1,416	2,396	188	0	4,000	5,508	1,033	2,511	456	0	4,000	2,052	800	2,421	93	686	4,000	93
2019	1,416	2,396	188	0	4,000	6,424	1,033	2,511	456	0	4,000	2,171	800	2,421	93	686	4,000	93
2020	1,416	2,396	188	0	4,000	7,666	1,033	2,511	456	0	4,000	2,291	800	1,780	93	1,327	4,000	93
2021	1,416	2,396	188	0	4,000	8,909	1,033	2,511	456	0	4,000	2,411	800	2,225	93	882	4,000	93
2022	1,416	2,396	188	0	4,000	10,151	1,045	2,325	630	0	4,000	2,530	800	2,225	93	882	4,000	93
2023	1,416	2,396	188	0	4,000	11,394	1,033	2,511	456	0	4,000	2,075	800	2,225	93	882	4,000	93
2024	1,451	1,940	609	0	4,000	12,637	1,033	2,511	456	0	4,000	2,195	800	2,421	93	686	4,000	93
Averages	**1,419**	**2,350**	**230**	**0**	**4,000**	**7,176**	**1,034**	**2,492**	**474**	**0**	**4,000**	**2,142**	**800**	**2,234**	**262**	**704**	**4,000**	**298**

Year	**Scenario 2A** Normal Range of Expected Operations + V2 RW Demand Best Case Non-Emergency Water Supply Conditions						**Scenario 2B** Normal Range of Expected Operations + V2 RW Demand Average Case Non-Emergency Water Supply Conditions						**Scenario 2C** Normal Range of Expected Operations + V2 RW Demand Worst Case Non-Emergency Water Supply Conditions					
	Recycled Water Used (AF)	SWP Used (AF)	Banked SWP Used (AF)	MRB Adjudicated Groundwater Used (AF)	Total Cooling Water Used (AF)	ABS Storage Balance (AF)	Recycled Water Used (AF)	SWP Used (AF)	Banked SWP Used (AF)	MRB Adjudicated Groundwater Used (AF)	Total Cooling Water Used (AF)	ABS Storage Balance (AF)	Recycled Water Used (AF)	SWP Used (AF)	Banked SWP Used (AF)	MRB Adjudicated Groundwater Used (AF)	Total Cooling Water Used (AF)	ABS Storage Balance (AF)
2015	1,136	2,134	730	0	4,000	1,780	791	2,234	975	0	4,000	1,780	540	1,780	1,680	0	4,000	1,780
2016	1,416	2,396	188	0	4,000	2,481	1,033	2,511	456	0	4,000	1,381	560	2,266	193	982	4,000	193
2017	1,109	2,133	758	0	4,000	3,724	1,033	2,511	456	0	4,000	1,500	546	2,266	93	1,095	4,000	93
2018	1,128	2,103	769	0	4,000	4,397	802	2,193	1,005	0	4,000	1,533	549	2,258	93	1,100	4,000	93
2019	1,148	2,072	780	0	4,000	5,025	811	2,176	1,013	0	4,000	1,104	552	2,251	93	1,104	4,000	93
2020	1,416	2,396	188	0	4,000	5,676	820	2,158	667	355	4,000	667	556	1,780	93	1,571	4,000	93
2021	1,416	2,396	188	0	4,000	6,918	829	2,141	576	454	4,000	576	800	2,225	93	882	4,000	93
2022	1,206	1,980	814	0	4,000	8,161	838	2,124	576	462	4,000	576	562	2,225	93	1,120	4,000	93
2023	1,260	1,918	822	0	4,000	8,778	1,033	2,511	376	80	4,000	376	565	2,225	93	1,117	4,000	93
2024	1,461	1,813	726	0	4,000	9,387	1,041	2,387	572	0	4,000	576	568	2,213	93	1,126	4,000	93
Averages	**1,269**	**2,134**	**597**	**0**	**4,000**	**5,633**	**903**	**2,295**	**667**	**135**	**4,000**	**1,007**	**580**	**2,149**	**262**	**1,010**	**4,000**	**272**

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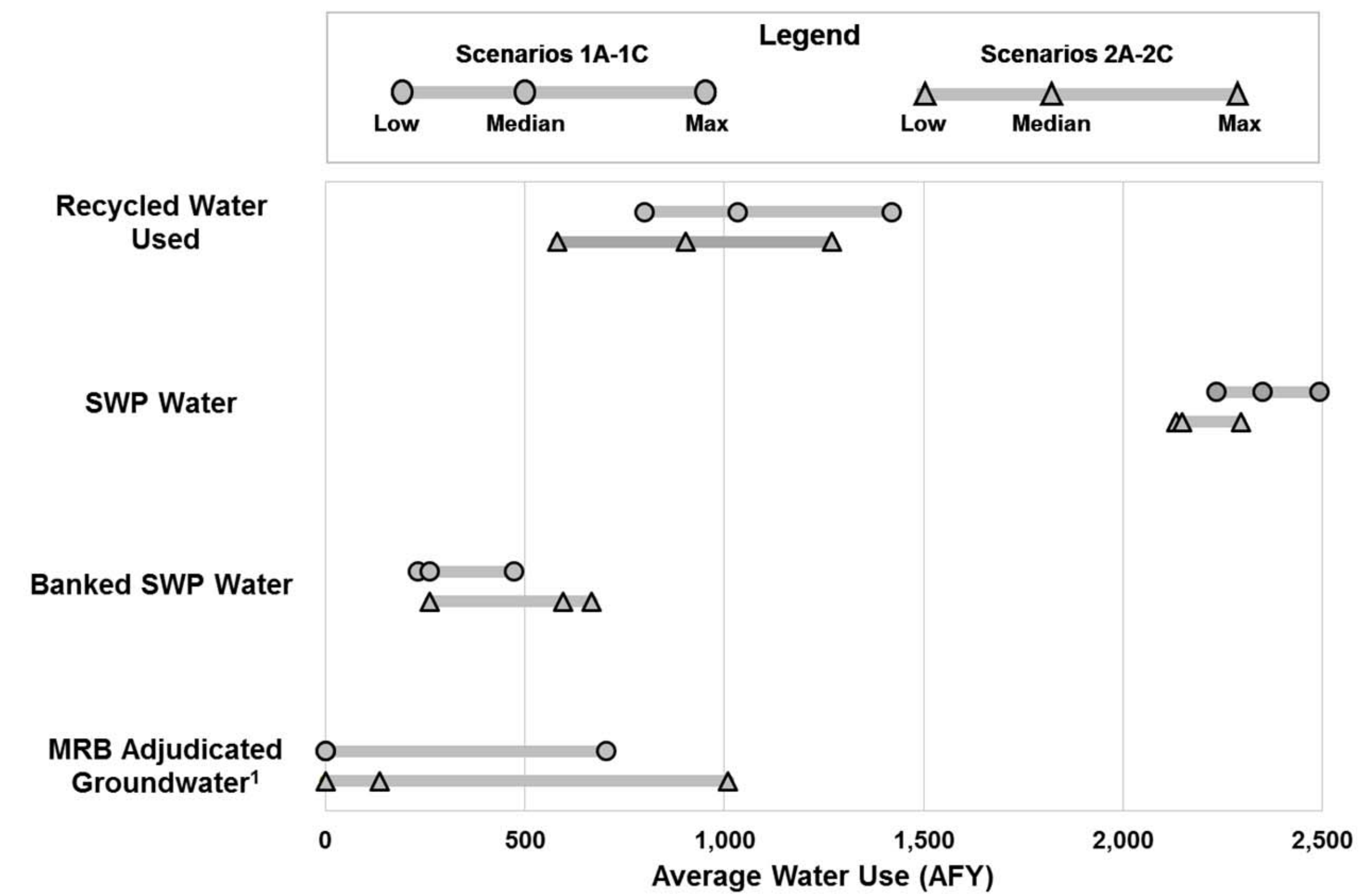
Figure 2. Water Supply Scenario Results – Average 10-Year Usage by Water Source.



Notes: 1. Scenario 1A and 1B results are both zero.

Table 14. Facility Operations and Estimated Mojave River Basin Adjudicated Water Use.

Estimated Generation Associated with Facility Water Demand (Million Megawatt Hours)[2]	Annual Facility Water Demand (AF)	Scenario[1]					
		1A	1B	1C	2A	2B	2C
0.64	500	0	0	0	0	0	0
1.28	1,000	0	0	0	0	0	0
1.92	1,500	0	0	31	0	0	31
2.56	2,000	0	0	128	0	0	175
3.21	2,500	0	0	225	0	0	544
3.85	3,000	0	0	330	0	46	776
4.49	3,500	0	0	488	0	86	842
5.13	4,000	0	0	704	0	135	1,010

Notes:

(1) Results presented in this table were calculated in the same manner described in this report and shown in Appendices B-G, except that the Facility Water Demand values as shown in this table were used instead of the 4,000 AFY as used in the original scenarios.

(2) The Facility's average annual generation over the period 2004 - 2014 was 3.91 MMWh.

3.3 Observations and Conclusions Based upon Water Supply Scenario Calculations

This review focused on two sets of Water Supply Scenarios. Water Supply Scenarios 1A-1C project permanent use of MRB Adjudicated Water as a 4^{th} priority, backup water supply and that the Victorville 2 Plant is not built. Water Supply Scenarios 2A-2C differ only in the projection that the Victorville 2 Hybrid Power Project is built and uses 3,150 AFY of Recycled Water.

Each set of Water Supply Scenarios includes three “sub-scenarios” designed to evaluate water availability under a normal (i.e., non-emergency) range of expected operations as influenced by varying “Water Supply Conditions” (e.g., climate or population growth) as described in Section 3.1 and Table 11. The Scenarios are not intended to address a prolonged SWP outage (e.g., extended critical drought on the SWP system or a Bay Delta earthquake with levee failures). However, MRB Adjudicated Water usage under emergency conditions was calculated using the same approach and is discussed in the results section.

Based upon results and other information discussed in Section 2, the following observations can be made:

1. The amount of Recycled Water (the highest priority water supply) utilized by the Facility is limited by (a) the dilution required to produce water quality that the Facility can functionally utilize, (b) SWP Water availability and suitability for blending, and (c) wastewater treatment plant outages (both planned and un-planned outages). The scenario results indicate that the maximum annual average percentage of Recycled Water that can be utilized by the Facility is 35%; this utilization rate will occur during the occasional very wet climatic periods when high quality diluent water is also available.

2. During high energy production operations, the ability to significantly increase Banked SWP Water volumes is limited to the best-case scenarios, which reinforces the need for backup water supply (i.e., MRB Adjudicated Water).

3. The amount of MRB Adjudicated Water utilized by the Facility is less than approximately 800 acre-feet per year under low to average energy production operations, regardless of the water supply conditions.

4. The Facility will not likely need MRB Adjudicated Water during non-emergency conditions under best-case assumptions, regardless of energy production.

5. MRB Adjudicated Water will not be needed during non-emergency conditions, except under worst-case conditions or when producing at or above the historical average energy production under average-case water supply conditions with Victorville 2 Plant recycled water demands.

6. When operating at 50% or more of the historical average energy production rate under worst-case conditions, the Facility may utilize between approximately 31 and 1,010 AFY of MRB Adjudicated Water.

7. Under emergency conditions (extended drought on the SWP system or catastrophic event that critically disables the SWP), and if SWP Banked Water supplies were depleted, the Facility could

require up to 2,400 to 3,344 AFY of MRB Adjudicated Water if there is no Victorville 2 Hybrid Power Project Recycled Water demand and 2,976 to 3,654 AFY if the Victorville 2 Hybrid Power Project exists and is using 3,150 AFY of Recycled Water.

8. Under emergency conditions (extended drought on the SWP system or catastrophic event that critically disables the SWP), and in the unlikely event that SWP Banked Water supplies were depleted and Recycled Water were not available, the Facility could require up to 4,000 AFY MRB Adjudicated Water.

9. HDPP's impact on MRB Adjudicated Water would be minimal, resulting in use of:

    a. Less than 0.2% of the Alto Subarea safe yield groundwater during average climatic conditions when the Facility is operating at high capacity.

    b. Less than 2% when operating at or below historical average capacity, regardless of climate.

    c. Less than 2% in extreme dry periods when operating at high capacity.

    d. A maximum of 4,000 AFY during a complete SWP outage with no Banked SWP Water or Recycled Water – representing less than 6% of the Alto Subarea Safe Yield.

10. HDPP's use of MRB Adjudicated Water is the last and final source of water to be used in the Loading Sequence, following use of all available SWP and Banked SWP water first. Because of the infrequent need to pump this water, the stress on the aquifer will be less than significant (negligible).

11. For all operating conditions, all MRB Adjudicated Water used by HDPP would be funded to the Watermaster for replenishment on a 2:1 basis, resulting in a net increase of groundwater in storage.

12. Because the anticipated potential annual demands for MRB Adjudicated Water are variable, it would be appropriate to include a rolling average condition for the permitted annual amount of MRB Adjudicated Water.

13. The Facility's design basis requires water delivered on an instantaneous basis (4,000 gpm, 24 hours a day, 7 days a week, 365 days a year). The annualized quantification of water supplies in acre-feet per year terms is only useful at the coarsest of planning perspectives.

14. Having a backup water supply (MRB Adjudicated Water) is critical to ensure the Facility's ability to reliably meet its mandate and purpose to provide power.

Based upon the analyses provided in this report, it is clear that the Facility cannot rely entirely on Recycled Water, SWP Water, and Banked SWP Water alone except during wet periods and during average to dry periods when the Facility is operated at very low capacity. MRB Adjudicated Water may also be needed during (a) temporary interruptions of Recycled Water and/or SWP Water supplies and (b) during an extended drought on the SWP system or catastrophic event that cripples the SWP. Based on the foregoing, the Facility will need access to MRB Adjudicated Water for blending with other supplies to avoid possible generation curtailments and to drought-proof the facility.

3.4 Water Supply Scenario Calculation Limitations

The variables studied here with the Scenarios are illustrative of those variables that we believe will have the greatest potential effects on water supplies, though these are not, and are not intended to be, an exhaustive list of variables potentially affecting future supplies. For example, if lower growth assumptions were used, Recycled Water availability would be less than simulated and water supply shortages would be more pronounced. Further, these analyses did not assume that additional subregional wastewater reclamation facilities are built in the future or that the two known facilities would expand their capacity. If additional subregional wastewater reclamation facilities are built or the two facilities under construction are expanded, these actions would further limit Recycled Water supplies available to the Facility.

Future SWP Water availability is subject to considerable uncertainty due to variable hydrology on the SWP system, climate change, and regulatory requirements necessary for protection of endangered and threatened fish species and protection of fish and wildlife beneficial uses in the Bay Delta estuary. Because of the various regulatory requirements placed on the SWP's Bay Delta operations, the ability to accurately determine the SWP's water delivery capability is a significant challenge (DWR, 2015a). SWP operations are continuously evolving in response to regulatory requirements and new understanding gained through monitoring and operational modifications. Furthermore, SWP Water may not be available at all times throughout a given year, potentially exacerbating short-term water supply shortages.

Significantly, the Water Supply Scenarios focused on annual water usage. Annualized projections do not account for the Facility's design basis need for water delivery instantaneously of 4,000 gpm on a 24-hour day, 7 days a week, 365 days a year basis. That is, while 4,000 AFY of water supplies could be available on an annual basis, this simplified analysis does not account for whether there would be up to 4,000 gpm available during those times when the Facility is required to run at full capacity.

4. References

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Appendix A

DWR State Water Project Table A Allocation Projections

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Table A-1

SWP Model Simulation Result for MWA			Wettest 10-Year Period		Average 10-Year Period		Driest 10-Year Period	
Hydrology Year	Percent of Maximum Table A	10-Yr Average	Hydrology Year	Predicted Table A %	Hydrology Year	Predicted Table A %	Hydrology Year	Predicted Table A %
1922	77%	-	-	-	-	-	-	-
1923	63%	-	-	-	-	-	-	-
1924	24%	-	-	-	-	-	1924	24%
1925	41%	-	-	-	-	-	1925	41%
1926	52%	-	-	-	-	-	1926	52%
1927	70%	-	-	-	-	-	1927	70%
1928	77%	-	-	-	-	-	1928	77%
1929	23%	-	-	-	-	-	1929	23%
1930	37%	-	-	-	-	-	1930	37%
1931	33%	50%	-	-	-	-	1931	33%
1932	32%	45%	-	-	-	-	1932	32%
1933	42%	**43%**	-	-	-	-	1933	42%
1934	26%	43%	-	-	-	-	-	-
1935	67%	46%	-	-	-	-	-	-
1936	75%	48%	-	-	-	-	-	-
1937	75%	49%	-	-	-	-	-	-
1938	100%	51%	-	-	-	-	-	-
1939	54%	54%	-	-	-	-	-	-
1940	65%	57%	-	-	-	-	-	-
1941	87%	62%	-	-	-	-	-	-
1942	70%	66%	-	-	1942	70%	-	-
1943	89%	71%	-	-	1943	89%	-	-
1944	42%	72%	-	-	1944	42%	-	-
1945	74%	73%	-	-	1945	74%	-	-
1946	68%	72%	-	-	1946	68%	-	-
1947	55%	70%	-	-	1947	55%	-	-
1948	52%	66%	-	-	1948	52%	-	-
1949	38%	64%	-	-	1949	38%	-	-
1950	61%	64%	-	-	1950	61%	-	-
1951	78%	**63%**	-	-	1951	78%	-	-
1952	91%	65%	-	-	-	-	-	-
1953	63%	62%	-	-	-	-	-	-
1954	64%	64%	-	-	-	-	-	-
1955	42%	61%	-	-	-	-	-	-
1956	89%	63%	-	-	-	-	-	-
1957	55%	63%	-	-	-	-	-	-
1958	100%	68%	-	-	-	-	-	-
1959	55%	70%	-	-	-	-	-	-
1960	48%	69%	-	-	-	-	-	-
1961	42%	65%	-	-	-	-	-	-
1962	56%	61%	-	-	-	-	-	-
1963	66%	62%	-	-	-	-	-	-
1964	64%	62%	-	-	-	-	-	-
1965	66%	64%	-	-	-	-	-	-

Table A-1 (continued)

SWP Model Simulation Result for MWA			Wettest 10-Year Period		Average 10-Year Period		Driest 10-Year Period	
Hydrology Year	Percent of Maximum Table A	10-Yr Average	Hydrology Year	Predicted Table A %	Hydrology Year	Predicted Table A %	Hydrology Year	Predicted Table A %
1966	63%	62%	-	-	-	-	-	-
1967	100%	66%	-	-	-	-	-	-
1968	54%	61%	-	-	-	-	-	-
1969	100%	66%	-	-	-	-	-	-
1970	76%	69%	-	-	-	-	-	-
1971	68%	71%	-	-	-	-	-	-
1972	52%	71%	-	-	-	-	-	-
1973	78%	72%	-	-	-	-	-	-
1974	85%	74%	-	-	-	-	-	-
1975	71%	75%	-	-	-	-	-	-
1976	42%	73%	-	-	-	-	-	-
1977	11%	64%	-	-	-	-	-	-
1978	81%	66%	1978	81%	-	-	-	-
1979	74%	64%	1979	74%	-	-	-	-
1980	100%	66%	1980	100%	-	-	-	-
1981	56%	65%	1981	56%	-	-	-	-
1982	100%	70%	1982	100%	-	-	-	-
1983	100%	72%	1983	100%	-	-	-	-
1984	79%	71%	1984	79%	-	-	-	-
1985	75%	72%	1985	75%	-	-	-	-
1986	89%	76%	1986	89%	-	-	-	-
1987	21%	**77%**	1987	21%	-	-	-	-
1988	21%	72%	-	-	-	-	-	-
1989	64%	70%	-	-	-	-	-	-
1990	24%	63%	-	-	-	-	-	-
1991	15%	59%	-	-	-	-	-	-
1992	24%	51%	-	-	-	-	-	-
1993	66%	48%	-	-	-	-	-	-
1994	46%	44%	-	-	-	-	-	-
1995	91%	46%	-	-	-	-	-	-
1996	77%	45%	-	-	-	-	-	-
1997	85%	51%	-	-	-	-	-	-
1998	88%	58%	-	-	-	-	-	-
1999	77%	59%	-	-	-	-	-	-
2000	74%	64%	-	-	-	-	-	-
2001	31%	66%	-	-	-	-	-	-
2002	64%	70%	-	-	-	-	-	-
2003	61%	69%	-	-	-	-	-	-
	Maximum	77%						
	Average	63%						
	Minimum	43%						

Source: Table B.23. Mojave WA: Existing Conditions, from The SWP Draft Delivery Capability Report 2015

Appendix B

Scenario 1A Calculations

Scenario 1A Calculations - IWWTP Recycled Water Blended with SWP Water

	SWP Supply[1]	Fraction of Time SWP Water is Available and Suitable for Cooling[2]	Not Used	Banked SWP Availability[3]	IWWTP Flow[4]	ABS Backwash to IWWTP[5]	Total IWWTP Flow	IWWTP Recycled Water Availability Factor[6]	Allowable Recycled Water Fraction When Blending with SWP Water [7]	Potentially Usable IWWTP RW if Blended with SWP Water	SWP Blending Water Required	SWP Used for IWWTP RW Blending	IWWTP RW Blended with SWP Water
Units	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)
Column	A	B	C	D	E	F	G	H	I	J	K	L	M
Calculation	N/A	N/A	N/A	See Footnote	N/A	N/A	E+F	N/A	N/A	Logical[8]	(1-I)*J/I	Logical[9]	L*I/(1-I)
Year													
2,014													
2,015	6,500	0.97	-	1,780	1,865	-	1,865	0.95	0.35	602	1,117	1,117	602
2,016	6,500	0.97	-	3,023	1,899	-	1,899	0.95	0.35	612	1,137	1,137	612
2,017	6,500	0.97	-	4,265	1,933	-	1,933	0.95	0.35	623	1,158	1,158	623
2,018	3,500	0.97	-	5,508	1,967	-	1,967	0.95	0.35	634	1,178	1,178	634
2,019	6,500	0.97	-	6,424	2,001	-	2,001	0.95	0.35	645	1,199	1,199	645
2,020	6,500	0.97	-	7,666	2,035	-	2,035	0.95	0.35	656	1,219	1,219	656
2,021	6,500	0.97	-	8,909	2,069	-	2,069	0.95	0.35	667	1,239	1,239	667
2,022	6,500	0.97	-	10,151	2,103	-	2,103	0.95	0.35	678	1,260	1,260	678
2,023	6,500	0.97	-	11,394	2,137	-	2,137	0.95	0.35	689	1,280	1,280	689
2,024	2,000	0.97	-	12,637	2,171	-	2,171	0.95	0.35	700	1,300	1,300	700

Notes:
1. See Table 9 and text for further explanation.
2. See Text for further explanation.
3. Equals sum of historical injections minus extractions, minus dissipation, minus 1,000 acre-foot buffer. Dissipation is based on average through 2013, which was approximately 34 AFY (Abulaban, 2013).
4. See Table 3 and text for further explanation of values. IWWTP water is provided by the City of Victorville as first priority over VVWRA (pers. Comm., Boyer, 2015).
5. Not used.
6. Fraction of time wastewater plant is capable of producing Recycled Water. Value varies with scenario. See text for further information.
7. Maximum fraction of Recycled Water that can be blended with SWP Water and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
8. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand, SWP availability, and blending fraction.
9. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A) and availability (column B).

Scenario 1A Calculations - VVWRA Recycled Water Blended with SWP Water

	Adjusted VVWRA Flow[10]	Growth Factor for DFG MOU[11]	Required Discharge to Mojave River	Mojave River Base Flow @ Lower Narrows[12]	Required Discharge + Base Flow	Excess Discharge (Credit if Positive)	Required Discharge to Mojave River	Recycled Water Not Needed to Meet F&G MOU Requirements	Victorville 2 RW Water Demand[15]	Potentially Available VVWRA RW	VVWRA Recycled Water Availability Factor[17]	Allowable Recycled Water Fraction When Blending with SWP Water [18]	Potentially Usable VVWRA RW if Blended with SWP Water	SWP Blending Water Required	SWP Used for VVWRA RW Blending	VVWRA RW Blended with SWP Water
Units	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)
Column	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
Calculation	N/A	See Footnote	9,000+O	N/A	P+Q	R-15,000	Logical[14]	N-T	N/A	Logical[16]	N/A	N/A	Logical[19]	(1-Y)*Z/Y	Logical[20]	AB*Y/(1-Y)
Year																
2,014	13,554	616	9,616	5,856	15,472	472										
2,015	12,361	378	9,378	9,253	18,631	3,631	9,144	3,217	-	3,217	0.95	0.35	689	1,279	1,279	689
2,016	12,663	438	9,438	7,385	16,823	1,823	5,747	6,916	-	6,916	0.95	0.35	678	1,258	1,258	678
2,017	10,725	50	9,050	6,558	15,608	608	7,615	3,110	-	3,110	0.95	0.35	667	1,238	1,238	667
2,018	11,027	111	9,111	6,613	15,724	724	8,442	2,585	-	2,585	0.95	0.35	656	1,218	1,218	656
2,019	11,329	171	9,171	11,282	20,453	5,453	8,387	2,942	-	2,942	0.95	0.35	645	1,197	1,197	645
2,020	11,631	232	9,232	8,122	17,354	2,354	3,718	7,913	-	7,913	0.95	0.35	634	1,177	1,177	634
2,021	11,933	292	9,292	5,806	15,098	98	6,878	5,055	-	5,055	0.95	0.35	623	1,157	1,157	623
2,022	12,235	352	9,352	4,738	14,090	(910)	9,194	3,041	-	3,041	0.95	0.35	612	1,136	1,136	612
2,023	12,537	413	9,413	4,557	13,969	(1,031)	9,352	3,184	-	3,184	0.95	0.35	601	1,116	1,116	601
2,024	12,839	473	9,473	3,478	12,951	(2,049)	9,413	3,426	-	3,426	0.95	0.35	590	1,096	640	344

Notes:

10. 2014 data from VVWRA; 2015 - 2024 values are 2014 plus increase due to growth minus diversions to subregional plants and IWWTP. See Table 5 and text for further information.
11. Calculated as 20% of VVWRA ADWF increase compared to 2003 ADWF baseline, per CDFG MOU.
12. Value varies with scenario. See Table 6 and text for further explanation.
14. Equals prior year required discharge if no prior year credit. Equals prior year required discharge less credit if one is available.
15. Varies with scenario. See Table 12 for further explanation.
16. Logic statement prevents negative values. U-V, unless result is negative. Zero if result would be negative.
17. Fraction of time wastewater plant is capable of producing Recycled Water. Value varies with scenario. See text for further information.
18. Maximum fraction of Recycled Water that can be blended with SWP Water and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
19. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand, SWP availability, and blending fraction.
20. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A), availability (column B) and prior use (column L). -

Scenario 1A Calculations - IWWTP and VVWRA Recycled Water Blended with Banked SWP Water and MRB Adjudicated Groundwater

	Remaining Potentially Usable IWWTP RW	Allowable Recycled Water Fraction When Blending with Banked SWP Water or MRB Adjudicated Groundwater[21]	IWWTP RW Blended with Banked SWP Water or MRB Adjudicated Groundwater	Banked SWP or MRB Adjudicated Groundwater Needed For Blending	Banked SWP Used for IWWTP RW Blending	Adjudicated MRB Groundwater Used for IWWTP RW Blending	Remaining Potentially Usable VVWRA RW	Allowable Recycled Water Fraction When Blending with Banked SWP Water or MRB Adjudicated Groundwater[21]	VVWRA RW Blended with Banked SWP Water or MRB Adjudicated Groundwater	Banked SWP or MRB Adjudicated Groundwater Needed For Blending	Banked SWP Used for VVWRA RW Blending	Adjudicated MRB Groundwater Used for VVWRA RW Blending
Units	(AF)	(-)	(AF)	(AF)	(AF)	(AF)	(AF)	(-)	(AF)	(AF)	(AF)	(AF)
Column	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO
Calculation	(G*H)-M	N/A	Logical[22]	AF*(1-AE)/AE	Logical[23]	AG-AH	(W*X)-AC	N/A	Logical[22]	AL*(1-AK)/AK	Logical[23]	AM-AN
Year												
2,014												
2,015	1,170	0.40	126	188	188	-	2,367	0.40	-	-	-	-
2,016	1,192	0.40	126	188	188	-	5,892	0.40	-	-	-	-
2,017	1,213	0.40	126	188	188	-	2,288	0.40	-	-	-	-
2,018	1,234	0.40	126	188	188	-	1,800	0.40	-	-	-	-
2,019	1,256	0.40	126	188	188	-	2,150	0.40	0	0	0	-
2,020	1,277	0.40	126	188	188	-	6,883	0.40	-	-	-	-
2,021	1,298	0.40	126	188	188	-	4,179	0.40	-	-	-	-
2,022	1,320	0.40	126	188	188	-	2,277	0.40	-	-	-	-
2,023	1,341	0.40	126	188	188	-	2,424	0.40	-	-	-	-
2,024	1,362	0.40	406	609	609	-	2,910	0.40	0	0	0	-

Notes:

21. Maximum fraction of Recycled Water that can be blended with Banked SWP Water or MRB Groundwater and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
22. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand and blending fraction.
23. Logic statement prevents result from exceeding available Banked SWP Water.

Scenario 1A Calculations - Unblended Banked SWP Water and MRB Adjudicated Groundwater Use; Total Water Use; and SWP Banking

	Total RW Used For Cooling	Total SWP Used for RW Blending	Total Banked SWP Used for RW Blending	Total Adjudicated MRB Groundwater Used for RW Blending	Total Blended Water Used for Cooling	Deficit After Using Blended Water	Remaining SWP Available for Cooling	Remaining Banked SWP Available for Cooling	Total SWP Used Directly for Cooling	Total Banked SWP Used Directly for Cooling	Total Adjudicated MRB Groundwater Used Directly for Cooling	Total Water Used for Cooling	SWP Banked[26]
Units	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)
Column	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB
Calculation	M+AC+AF+AL	L+AB	AH+AN	AI+AO	AP+AQ+AR+AS	4800-AT	(A*B)-AQ	D-AR	Logical[24]	Logical[25]	AU-AX-AY	AT+AX+AY+AZ	See Footnote
Year													
2,014													
2,015	1,416	2,396	188	-	4,000	-	3,909	1,592	-	-	-	4,000	1,431
2,016	1,416	2,396	188	-	4,000	-	3,909	2,834	-	-	-	4,000	1,431
2,017	1,416	2,396	188	-	4,000	-	3,909	4,077	-	-	-	4,000	1,431
2,018	1,416	2,396	188	-	4,000	-	999	5,319	-	-	-	4,000	1,104
2,019	1,416	2,396	188	-	4,000	-	3,909	6,235	-	-	-	4,000	1,431
2,020	1,416	2,396	188	-	4,000	-	3,909	7,478	-	-	-	4,000	1,431
2,021	1,416	2,396	188	-	4,000	-	3,909	8,720	-	-	-	4,000	1,431
2,022	1,416	2,396	188	-	4,000	-	3,909	9,963	-	-	-	4,000	1,431
2,023	1,416	2,396	188	-	4,000	-	3,909	11,206	-	-	-	4,000	1,431
2,024	1,451	1,940	609	-	4,000	-	-	12,027	-	-	-	4,000	60

Notes:

24. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A), availability (column B) and prior uses (column AQ).
25. Logic statement prevents result from exceeding available Banked SWP Water when considering prior uses (column AR).
26. Remaining available SWP water is banked. Banking is volume capped at historical average banking volume. See text for further information.

Appendix C

Scenario 1B Calculations

Scenario 1B Calculations - IWWTP Recycled Water Blended with SWP Water

	SWP Supply[1]	Fraction of Time SWP Water is Available and Suitable for Cooling[2]	Not Used	Banked SWP Availability[3]	IWWTP Flow[4]	ABS Backwash to IWWTP[5]	Total IWWTP Flow	IWWTP Recycled Water Availability Factor[6]	Allowable Recycled Water Fraction When Blending with SWP Water [7]	Potentially Usable IWWTP RW if Blended with SWP Water	SWP Blending Water Required	SWP Used for IWWTP RW Blending	IWWTP RW Blended with SWP Water
Units	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)
Column	A	B	C	D	E	F	G	H	I	J	K	L	M
Calculation	N/A	N/A	N/A	See Footnote	N/A	N/A	E+F	N/A	N/A	Logical[8]	(1-I)*J/I	Logical[9]	L*I/(1-I)
Year													
2,014													
2,015	6,500	0.93	-	1,780	1,859	-	1,859	0.90	0.25	389	1,167	1,167	389
2,016	6,500	0.93	-	1,900	1,881	-	1,881	0.90	0.25	394	1,181	1,181	394
2,017	3,000	0.93	-	2,019	1,903	-	1,903	0.90	0.25	398	1,195	1,195	398
2,018	6,500	0.93	-	2,052	1,925	-	1,925	0.90	0.25	403	1,208	1,208	403
2,019	6,500	0.93	-	2,171	1,947	-	1,947	0.90	0.25	407	1,222	1,222	407
2,020	3,500	0.93	-	2,291	1,969	-	1,969	0.90	0.25	412	1,236	1,236	412
2,021	3,500	0.93	-	2,411	1,991	-	1,991	0.90	0.25	417	1,250	1,250	417
2,022	2,500	0.93	-	2,530	2,013	-	2,013	0.90	0.25	421	1,264	1,264	421
2,023	6,500	0.93	-	2,075	2,035	-	2,035	0.90	0.25	426	1,277	1,277	426
2,024	6,500	0.93	-	2,195	2,057	-	2,057	0.90	0.25	430	1,291	1,291	430

Notes:
1. See Table 9 and text for further explanation.
2. See Text for further explanation.
3. Equals sum of historical injections minus extractions, minus dissipation, minus 1,000 acre-foot buffer. Dissipation is based on average through 2013, which was approximately 34 AFY (Abulaban, 2013).
4. See Table 3 and text for further explanation of values. IWWTP water is provided by the City of Victorville as first priority over VVWRA (pers. Comm., Boyer, 2015).
5. Not used.
6. Fraction of time wastewater plant is capable of producing Recycled Water. Value varies with scenario. See text for further information.
7. Maximum fraction of Recycled Water that can be blended with SWP Water and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
8. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand, SWP availability, and blending fraction.
9. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A) and availability (column B).

Scenario 1B Calculations - VVWRA Recycled Water Blended with SWP Water

	Adjusted VVWRA Flow[10]	Growth Factor for DFG MOU[11]	Required Discharge to Mojave River	Mojave River Base Flow @ Lower Narrows[12]	Required Discharge + Base Flow	Excess Discharge (Credit if Positive)	Required Discharge to Mojave River	Recycled Water Not Needed to Meet F&G MOU Requirements	Victorville 2 RW Water Demand[15]	Potentially Available VVWRA RW	VVWRA Recycled Water Availability Factor[17]	Allowable Recycled Water Fraction When Blending with SWP Water [18]	Potentially Usable VVWRA RW if Blended with SWP Water	SWP Blending Water Required	SWP Used for VVWRA RW Blending	VVWRA RW Blended with SWP Water
Units	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)
Column	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
Calculation	N/A	See Footnote	9,000+O	N/A	P+Q	R-15,000	Logical[14]	N-T	N/A	Logical[16]	N/A	N/A	Logical[19]	(1-Y)*Z/Y	Logical[20]	AB*Y/(1-Y)
Year																
2,014	13,554	616	9,616	5,856	15,472	472										
2,015	12,311	368	9,368	11,282	20,650	5,650	9,144	3,167	-	3,167	0.90	0.25	448	1,344	1,344	448
2,016	12,513	408	9,408	8,122	17,530	2,530	3,718	8,795	-	8,795	0.90	0.25	443	1,330	1,330	443
2,017	10,475	0	9,000	5,806	14,806	(194)	6,878	3,597	-	3,597	0.90	0.25	439	1,316	1,316	439
2,018	10,677	41	9,041	4,738	13,778	(1,222)	9,000	1,676	-	1,676	0.90	0.25	434	1,303	1,303	434
2,019	10,879	81	9,081	4,557	13,638	(1,362)	9,041	1,838	-	1,838	0.90	0.25	430	1,289	1,289	430
2,020	11,081	122	9,122	3,478	12,600	(2,400)	9,081	2,000	-	2,000	0.90	0.25	425	1,275	1,275	425
2,021	11,283	162	9,162	4,135	13,297	(1,703)	9,122	2,161	-	2,161	0.90	0.25	420	1,261	1,261	420
2,022	11,485	202	9,202	8,839	18,041	3,041	9,162	2,323	-	2,323	0.90	0.25	416	1,247	1,061	354
2,023	11,687	243	9,243	6,627	15,869	869	6,162	5,525	-	5,525	0.90	0.25	411	1,234	1,234	411
2,024	11,889	283	9,283	4,396	13,679	(1,321)	8,374	3,515	-	3,515	0.90	0.25	407	1,220	1,220	407

Notes:

10. 2014 data from VVWRA; 2015 - 2024 values are 2014 plus increase due to growth minus diversions to subregional plants and IWWTP. See Table 5 and text for further information.
11. Calculated as 20% of VVWRA ADWF increase compared to 2003 ADWF baseline, per CDFG MOU.
12. Value varies with scenario. See Table 6 and text for further explanation.
14. Equals prior year required discharge if no prior year credit. Equals prior year required discharge less credit if one is available.
15. Varies with scenario. See Table 12 for further explanation.
16. Logic statement prevents negative values. U-V, unless result is negative. Zero if result would be negative.
17. Fraction of time wastewater plant is capable of producing Recycled Water. Value varies with scenario. See text for further information.
18. Maximum fraction of Recycled Water that can be blended with SWP Water and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
19. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand, SWP availability, and blending fraction.
20. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A), availability (column B) and prior use (column L). -

Scenario 1B Calculations - IWWTP and VVWRA Recycled Water Blended with Banked SWP Water and MRB Adjudicated Groundwater

	Remaining Potentially Usable IWWTP RW	Allowable Recycled Water Fraction When Blending with Banked SWP Water or MRB Adjudicated Groundwater[21]	IWWTP RW Blended with Banked SWP Water or MRB Adjudicated Groundwater	Banked SWP or MRB Adjudicated Groundwater Needed For Blending	Banked SWP Used for IWWTP RW Blending	Adjudicated MRB Groundwater Used for IWWTP RW Blending	Remaining Potentially Usable VVWRA RW	Allowable Recycled Water Fraction When Blending with Banked SWP Water or MRB Adjudicated Groundwater[21]	VVWRA RW Blended with Banked SWP Water or MRB Adjudicated Groundwater	Banked SWP or MRB Adjudicated Groundwater Needed For Blending	Banked SWP Used for VVWRA RW Blending	Adjudicated MRB Groundwater Used for VVWRA RW Blending
Units	(AF)	(-)	(AF)	(AF)	(AF)	(AF)	(AF)	(-)	(AF)	(AF)	(AF)	(AF)
Column	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO
Calculation	(G*H)-M	N/A	Logical[22]	AF*(1-AE)/AE	Logical[23]	AG-AH	(W*X)-AC	N/A	Logical[22]	AL*(1-AK)/AK	Logical[23]	AM-AN
Year												
2,014												
2,015	1,284	0.30	196	456	456	-	2,402	0.30	(0)	(0)	(0)	-
2,016	1,299	0.30	196	456	456	-	7,472	0.30	(0)	(0)	(0)	-
2,017	1,314	0.30	196	456	456	-	2,798	0.30	0	0	0	-
2,018	1,330	0.30	196	456	456	-	1,075	0.30	(0)	(0)	(0)	-
2,019	1,345	0.30	196	456	456	-	1,225	0.30	(0)	(0)	(0)	-
2,020	1,360	0.30	196	456	456	-	1,375	0.30	(0)	(0)	(0)	-
2,021	1,375	0.30	196	456	456	-	1,525	0.30	(0)	(0)	(0)	-
2,022	1,390	0.30	270	630	630	-	1,737	0.30	-	-	-	-
2,023	1,406	0.30	196	456	456	-	4,562	0.30	(0)	(0)	(0)	-
2,024	1,421	0.30	196	456	456	-	2,757	0.30	(0)	(0)	(0)	-

Notes:
21. Maximum fraction of Recycled Water that can be blended with Banked SWP Water or MRB Groundwater and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
22. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand and blending fraction.
23. Logic statement prevents result from exceeding available Banked SWP Water.

Scenario 1B Calculations - Unblended Banked SWP Water and MRB Adjudicated Groundwater Use; Total Water Use; and SWP Banking

	Total RW Used For Cooling	Total SWP Used for RW Blending	Total Banked SWP Used for RW Blending	Total Adjudicated MRB Groundwater Used for RW Blending	Total Blended Water Used for Cooling	Deficit After Using Blended Water	Remaining SWP Available for Cooling	Remaining Banked SWP Available for Cooling	Total SWP Used Directly for Cooling	Total Banked SWP Used Directly for Cooling	Total Adjudicated MRB Groundwater Used Directly for Cooling	Total Water Used for Cooling	SWP Banked[26]
Units	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)
Column	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB
Calculation	M+AC+AF+AL	L+AB	AH+AN	AI+AO	AP+AQ+AR+AS	4800-AT	(A*B)-AQ	D-AR	Logical[24]	Logical[25]	AU-AX-AY	AT+AX+AY+AZ	See Footnote
Year													
2,014													
2,015	1,033	2,511	456	-	4,000	-	3,534	1,324	-	-	-	4,000	576
2,016	1,033	2,511	456	-	4,000	-	3,534	1,443	-	-	-	4,000	576
2,017	1,033	2,511	456	-	4,000	-	279	1,563	-	-	-	4,000	489
2,018	1,033	2,511	456	-	4,000	-	3,534	1,595	-	-	-	4,000	576
2,019	1,033	2,511	456	-	4,000	-	3,534	1,715	-	-	-	4,000	576
2,020	1,033	2,511	456	-	4,000	-	744	1,835	-	-	-	4,000	576
2,021	1,033	2,511	456	-	4,000	-	744	1,954	-	-	-	4,000	576
2,022	1,045	2,325	630	-	4,000	-	-	1,900	-	-	-	4,000	175
2,023	1,033	2,511	456	-	4,000	-	3,534	1,619	-	-	-	4,000	576
2,024	1,033	2,511	456	-	4,000	-	3,534	1,738	-	-	-	4,000	576

Notes:

24. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A), availability (column B) and prior uses (column AQ).
25. Logic statement prevents result from exceeding available Banked SWP Water when considering prior uses (column AR).
26. Remaining available SWP water is banked. Banking is volume capped at historical average banking volume. See text for further information.

Appendix D

Scenario 1C Calculations

Scenario 1C Calculations - IWWTP Recycled Water Blended with SWP Water

	SWP Supply[1]	Fraction of Time SWP Water is Available and Suitable for Cooling[2]	Not Used	Banked SWP Availability[3]	IWWTP Flow[4]	ABS Backwash to IWWTP[5]	Total IWWTP Flow	IWWTP Recycled Water Availability Factor[6]	Allowable Recycled Water Fraction When Blending with SWP Water [7]	Potentially Usable IWWTP RW if Blended with SWP Water	SWP Blending Water Required	SWP Used for IWWTP RW Blending	IWWTP RW Blended with SWP Water
Units	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)
Column	A	B	C	D	E	F	G	H	I	J	K	L	M
Calculation	N/A	N/A	N/A	See Footnote	N/A	N/A	E+F	N/A	N/A	Logical[8]	(1-I)*J/I	Logical[9]	L*I/(1-I)
Year													
2,014													
2,015	2,000	0.89	-	1,780	1,854	-	1,854	0.85	0.2	281	1,122	1,122	281
2,016	3,000	0.89	-	453	1,865	-	1,865	0.85	0.2	282	1,129	1,129	282
2,017	3,500	0.89	-	93	1,876	-	1,876	0.85	0.2	284	1,135	1,135	284
2,018	6,500	0.89	-	93	1,887	-	1,887	0.85	0.2	286	1,142	1,142	286
2,019	6,500	0.89	-	93	1,898	-	1,898	0.85	0.2	287	1,149	1,149	287
2,020	2,000	0.89	-	93	1,909	-	1,909	0.85	0.2	289	1,155	1,155	289
2,021	2,500	0.89	-	93	1,920	-	1,920	0.85	0.2	290	1,162	1,162	290
2,022	2,500	0.89	-	93	1,931	-	1,931	0.85	0.2	292	1,169	1,169	292
2,023	2,500	0.89	-	93	1,942	-	1,942	0.85	0.2	294	1,175	1,175	294
2,024	3,000	0.89	-	93	1,953	-	1,953	0.85	0.2	295	1,182	1,182	295

Notes:
1. See Table 9 and text for further explanation.
2. See Text for further explanation.
3. Equals sum of historical injections minus extractions, minus dissipation, minus 1,000 acre-foot buffer. Dissipation is based on average through 2013, which was approximately 34 AFY (Abulaban, 2013).
4. See Table 3 and text for further explanation of values. IWWTP water is provided by the City of Victorville as first priority over VVWRA (pers. Comm., Boyer, 2015).
5. Not used.
6. Fraction of time wastewater plant is capable of producing Recycled Water. Value varies with scenario. See text for further information.
7. Maximum fraction of Recycled Water that can be blended with SWP Water and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
8. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand, SWP availability, and blending fraction.
9. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A) and availability (column B).

Scenario 1C Calculations - VVWRA Recycled Water Blended with SWP Water

	Adjusted VVWRA Flow[10]	Growth Factor for DFG MOU[11]	Required Discharge to Mojave River	Mojave River Base Flow @ Lower Narrows[12]	Required Discharge + Base Flow	Excess Discharge (Credit if Positive)	Required Discharge to Mojave River	Recycled Water Not Needed to Meet F&G MOU Requirements	Victorville 2 RW Water Demand[15]	Potentially Available VVWRA RW	VVWRA Recycled Water Availability Factor[17]	Allowable Recycled Water Fraction When Blending with SWP Water [18]	Potentially Usable VVWRA RW if Blended with SWP Water	SWP Blending Water Required	SWP Used for VVWRA RW Blending	VVWRA RW Blended with SWP Water
Units	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)
Column	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
Calculation	N/A	See Footnote	9,000+O	N/A	P+Q	R-15,000	Logical[14]	N-T	N/A	Logical[16]	N/A	N/A	Logical[19]	(1-Y)*Z/Y	Logical[20]	AB*Y/(1-Y)
Year																
2,014	13,554	616	9,616	5,856	15,472	472										
2,015	12,260	357	9,357	5,806	15,163	163	9,144	3,116	-	3,116	0.85	0.2	325	1,299	658	164
2,016	12,361	378	9,378	4,738	14,115	(885)	9,194	3,167	-	3,167	0.85	0.2	323	1,292	1,292	323
2,017	10,222	-	9,000	4,557	13,557	(1,444)	9,378	844	-	844	0.85	0.2	321	1,285	1,285	321
2,018	10,323	-	9,000	3,478	12,478	(2,522)	9,000	1,323	-	1,323	0.85	0.2	320	1,279	1,279	320
2,019	10,424	-	9,000	4,135	13,135	(1,865)	9,000	1,424	-	1,424	0.85	0.2	318	1,272	1,272	318
2,020	10,525	10	9,010	8,839	17,849	2,849	9,000	1,525	-	1,525	0.85	0.2	316	1,265	625	156
2,021	10,626	31	9,031	6,627	15,657	657	6,162	4,464	-	4,464	0.85	0.2	315	1,259	1,063	266
2,022	10,727	51	9,051	4,396	13,447	(1,553)	8,374	2,353	-	2,353	0.85	0.2	313	1,252	1,056	264
2,023	10,828	71	9,071	4,680	13,751	(1,249)	9,051	1,777	-	1,777	0.85	0.2	311	1,246	1,050	262
2,024	10,929	91	9,091	3,713	12,804	(2,196)	9,071	1,858	-	1,858	0.85	0.2	310	1,239	1,239	310

Notes:

10. 2014 data from VVWRA; 2015 - 2024 values are 2014 plus increase due to growth minus diversions to subregional plants and IWWTP. See Table 5 and text for further information.

11. Calculated as 20% of VVWRA ADWF increase compared to 2003 ADWF baseline, per CDFG MOU.

12. Value varies with scenario. See Table 6 and text for further explanation.

14. Equals prior year required discharge if no prior year credit. Equals prior year required discharge less credit if one is available.

15. Varies with scenario. See Table 12 for further explanation.

16. Logic statement prevents negative values. U-V, unless result is negative. Zero if result would be negative.

17. Fraction of time wastewater plant is capable of producing Recycled Water. Value varies with scenario. See text for further information.

18. Maximum fraction of Recycled Water that can be blended with SWP Water and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.

19. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand, SWP availability, and blending fraction.

20. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A), availability (column B) and prior use (column L). -

Scenario 1C Calculations - IWWTP and VVWRA Recycled Water Blended with Banked SWP Water and MRB Adjudicated Groundwater

	Remaining Potentially Usable IWWTP RW	Allowable Recycled Water Fraction When Blending with Banked SWP Water or MRB Adjudicated Groundwater[21]	IWWTP RW Blended with Banked SWP Water or MRB Adjudicated Groundwater	Banked SWP or MRB Adjudicated Groundwater Needed For Blending	Banked SWP Used for IWWTP RW Blending	Adjudicated MRB Groundwater Used for IWWTP RW Blending	Remaining Potentially Usable VVWRA RW	Allowable Recycled Water Fraction When Blending with Banked SWP Water or MRB Adjudicated Groundwater[21]	VVWRA RW Blended with Banked SWP Water or MRB Adjudicated Groundwater	Banked SWP or MRB Adjudicated Groundwater Needed For Blending	Banked SWP Used for VVWRA RW Blending	Adjudicated MRB Groundwater Used for VVWRA RW Blending
Units	(AF)	(-)	(AF)	(AF)	(AF)	(AF)	(AF)	(-)	(AF)	(AF)	(AF)	(AF)
Column	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO
Calculation	(G*H)-M	N/A	Logical[22]	AF*(1-AE)/AE	Logical[23]	AG-AH	(W*X)-AC	N/A	Logical[22]	AL*(1-AK)/AK	Logical[23]	AM-AN
Year												
2,014												
2,015	1,295	0.20	259	1,036	1,036	-	2,484	0.20	96	384	384	-
2,016	1,303	0.20	195	779	453	326	2,369	0.20	-	-	-	-
2,017	1,311	0.20	195	779	93	686	396	0.20	(0)	(0)	(0)	-
2,018	1,318	0.20	195	779	93	686	805	0.20	-	-	-	-
2,019	1,326	0.20	195	779	93	686	892	0.20	(0)	(0)	(0)	-
2,020	1,334	0.20	267	1,067	93	974	1,140	0.20	88	353	-	353
2,021	1,342	0.20	244	975	93	882	3,529	0.20	-	-	-	-
2,022	1,349	0.20	244	975	93	882	1,736	0.20	-	-	-	-
2,023	1,357	0.20	244	975	93	882	1,248	0.20	-	-	-	-
2,024	1,365	0.20	195	779	93	686	1,269	0.20	(0)	(0)	(0)	-

Notes:

21. Maximum fraction of Recycled Water that can be blended with Banked SWP Water or MRB Groundwater and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
22. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand and blending fraction.
23. Logic statement prevents result from exceeding available Banked SWP Water.

Scenario 1C Calculations - Unblended Banked SWP Water and MRB Adjudicated Groundwater Use; Total Water Use; and SWP Banking

	Total RW Used For Cooling	Total SWP Used for RW Blending	Total Banked SWP Used for RW Blending	Total Adjudicated MRB Groundwater Used for RW Blending	Total Blended Water Used for Cooling	Deficit After Using Blended Water	Remaining SWP Available for Cooling	Remaining Banked SWP Available for Cooling	Total SWP Used Directly for Cooling	Total Banked SWP Used Directly for Cooling	Total Adjudicated MRB Groundwater Used Directly for Cooling	Total Water Used for Cooling	SWP Banked[26]
Units	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)
Column	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB
Calculation	M+AC+AF+AL	L+AB	AH+AN	AI+AO	AP+AQ+AR+AS	4800-AT	(A*B)-AQ	D-AR	Logical[24]	Logical[25]	AU-AX-AY	AT+AX+AY+AZ	See Footnote
Year													
2,014													
2,015	800	1,780	1,420	-	4,000	-	-	360	-	-	-	4,000	93
2,016	800	2,421	453	326	4,000	-	249	-	-	-	-	4,000	93
2,017	800	2,421	93	686	4,000	-	694	-	-	-	-	4,000	93
2,018	800	2,421	93	686	4,000	-	3,364	-	-	-	-	4,000	93
2,019	800	2,421	93	686	4,000	-	3,364	-	-	-	-	4,000	93
2,020	800	1,780	93	1,327	4,000	-	-	-	-	-	-	4,000	93
2,021	800	2,225	93	882	4,000	-	-	-	-	-	-	4,000	93
2,022	800	2,225	93	882	4,000	-	-	-	-	-	-	4,000	93
2,023	800	2,225	93	882	4,000	-	-	-	-	-	-	4,000	93
2,024	800	2,421	93	686	4,000	-	249	-	-	-	-	4,000	93

Notes:

24. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A), availability (column B) and prior uses (column AQ).
25. Logic statement prevents result from exceeding available Banked SWP Water when considering prior uses (column AR).
26. Remaining available SWP water is banked. Banking is volume capped at historical average banking volume. See text for further information.

Appendix E

Scenario 2A Calculations

Scenario 2A Calculations - IWWTP Recycled Water Blended with SWP Water

	SWP Supply[1]	Fraction of Time SWP Water is Available and Suitable for Cooling[2]	Not Used	Banked SWP Availability[3]	IWWTP Flow[4]	ABS Backwash to IWWTP[5]	Total IWWTP Flow	IWWTP Recycled Water Availability Factor[6]	Allowable Recycled Water Fraction When Blending with SWP Water [7]	Potentially Usable IWWTP RW if Blended with SWP Water	SWP Blending Water Required	SWP Used for IWWTP RW Blending	IWWTP RW Blended with SWP Water
Units	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)
Column	A	B	C	D	E	F	G	H	I	J	K	L	M
Calculation	N/A	N/A	N/A	See Footnote	N/A	N/A	E+F	N/A	N/A	Logical[8]	(1-I)*J/I	Logical[9]	L*I/(1-I)
Year													
2,014													
2,015	6,500	0.97	-	1,780	1,865	-	1,865	0.95	0.35	602	1,117	1,117	602
2,016	6,500	0.97	-	2,481	1,899	-	1,899	0.95	0.35	612	1,137	1,137	612
2,017	6,500	0.97	-	3,724	1,933	-	1,933	0.95	0.35	623	1,158	1,158	623
2,018	3,500	0.97	-	4,397	1,967	-	1,967	0.95	0.35	634	1,178	1,178	634
2,019	6,500	0.97	-	5,025	2,001	-	2,001	0.95	0.35	645	1,199	1,199	645
2,020	6,500	0.97	-	5,676	2,035	-	2,035	0.95	0.35	656	1,219	1,219	656
2,021	6,500	0.97	-	6,918	2,069	-	2,069	0.95	0.35	667	1,239	1,239	667
2,022	6,500	0.97	-	8,161	2,103	-	2,103	0.95	0.35	678	1,260	1,260	678
2,023	6,500	0.97	-	8,778	2,137	-	2,137	0.95	0.35	689	1,280	1,280	689
2,024	2,000	0.97	-	9,387	2,171	-	2,171	0.95	0.35	700	1,300	1,300	700

Notes:
1. See Table 9 and text for further explanation.
2. See Text for further explanation.
3. Equals sum of historical injections minus extractions, minus dissipation, minus 1,000 acre-foot buffer. Dissipation is based on average through 2013, which was approximately 34 AFY (Abulaban, 2013).
4. See Table 3 and text for further explanation of values. IWWTP water is provided by the City of Victorville as first priority over VVWRA (pers. Comm., Boyer, 2015).
5. Not used.
6. Fraction of time wastewater plant is capable of producing Recycled Water. Value varies with scenario. See text for further information.
7. Maximum fraction of Recycled Water that can be blended with SWP Water and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
8. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand, SWP availability, and blending fraction.
9. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A) and availability (column B).

Scenario 1A Calculations - VVWRA Recycled Water Blended with SWP Water

	Adjusted VVWRA Flow[10]	Growth Factor for DFG MOU[11]	Required Discharge to Mojave River	Mojave River Base Flow @ Lower Narrows[12]	Required Discharge + Base Flow	Excess Discharge (Credit if Positive)	Required Discharge to Mojave River	Recycled Water Not Needed to Meet F&G MOU Requirements	Victorville 2 RW Water Demand[15]	Potentially Available VVWRA RW	VVWRA Recycled Water Availability Factor[17]	Allowable Recycled Water Fraction When Blending with SWP Water[18]	Potentially Usable VVWRA RW if Blended with SWP Water	SWP Blending Water Required	SWP Used for VVWRA RW Blending	VVWRA RW Blended with SWP Water
Units	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)
Column	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
Calculation	N/A	See Footnote	9,000+O	N/A	P+Q	R-15,000	Logical[14]	N-T	N/A	Logical[16]	N/A	N/A	Logical[19]	(1-Y)*Z/Y	Logical[20]	AB*Y/(1-Y)
Year																
2,014	13,554	616	9,616	5,856	15,472	472										
2,015	12,361	378	9,378	9,253	18,631	3,631	9,144	3,217	-	3,217	0.95	0.35	689	1,279	1,279	689
2,016	12,663	438	9,438	7,385	16,823	1,823	5,747	6,916	-	6,916	0.95	0.35	678	1,258	1,258	678
2,017	10,725	50	9,050	6,558	15,608	608	7,615	3,110	-	3,110	0.95	0.35	667	1,238	1,238	667
2,018	11,027	111	9,111	6,613	15,724	724	8,442	2,585	-	2,585	0.95	0.35	656	1,218	1,218	656
2,019	11,329	171	9,171	11,282	20,453	5,453	8,387	2,942	-	2,942	0.95	0.35	645	1,197	1,197	645
2,020	11,631	232	9,232	8,122	17,354	2,354	3,718	7,913	-	7,913	0.95	0.35	634	1,177	1,177	634
2,021	11,933	292	9,292	5,806	15,098	98	6,878	5,055	-	5,055	0.95	0.35	623	1,157	1,157	623
2,022	12,235	352	9,352	4,738	14,090	(910)	9,194	3,041	-	3,041	0.95	0.35	612	1,136	1,136	612
2,023	12,537	413	9,413	4,557	13,969	(1,031)	9,352	3,184	-	3,184	0.95	0.35	601	1,116	1,116	601
2,024	12,839	473	9,473	3,478	12,951	(2,049)	9,413	3,426	-	3,426	0.95	0.35	590	1,096	640	344

Notes:

10. 2014 data from VVWRA; 2015 - 2024 values are 2014 plus increase due to growth minus diversions to subregional plants and IWWTP. See Table 5 and text for further information.
11. Calculated as 20% of VVWRA ADWF increase compared to 2003 ADWF baseline, per CDFG MOU.
12. Value varies with scenario. See Table 6 and text for further explanation.
14. Equals prior year required discharge if no prior year credit. Equals prior year required discharge less credit if one is available.
15. Varies with scenario. See Table 12 for further explanation.
16. Logic statement prevents negative values. U-V, unless result is negative. Zero if result would be negative.
17. Fraction of time wastewater plant is capable of producing Recycled Water. Value varies with scenario. See text for further information.
18. Maximum fraction of Recycled Water that can be blended with SWP Water and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
19. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand, SWP availability, and blending fraction.
20. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A), availability (column B) and prior use (column L). -

Scenario 1A Calculations - IWWTP and VVWRA Recycled Water Blended with Banked SWP Water and MRB Adjudicated Groundwater

	Remaining Potentially Usable IWWTP RW	Allowable Recycled Water Fraction When Blending with Banked SWP Water or MRB Adjudicated Groundwater[21]	IWWTP RW Blended with Banked SWP Water or MRB Adjudicated Groundwater	Banked SWP or MRB Adjudicated Groundwater Needed For Blending	Banked SWP Used for IWWTP RW Blending	Adjudicated MRB Groundwater Used for IWWTP RW Blending	Remaining Potentially Usable VVWRA RW	Allowable Recycled Water Fraction When Blending with Banked SWP Water or MRB Adjudicated Groundwater[21]	VVWRA RW Blended with Banked SWP Water or MRB Adjudicated Groundwater	Banked SWP or MRB Adjudicated Groundwater Needed For Blending	Banked SWP Used for VVWRA RW Blending	Adjudicated MRB Groundwater Used for VVWRA RW Blending
Units	(AF)	(-)	(AF)	(AF)	(AF)	(AF)	(AF)	(-)	(AF)	(AF)	(AF)	(AF)
Column	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO
Calculation	(G*H)-M	N/A	Logical[22]	AF*(1-AE)/AE	Logical[23]	AG-AH	(W*X)-AC	N/A	Logical[22]	AL*(1-AK)/AK	Logical[23]	AM-AN
Year												
2,014												
2,015	1,170	0.40	126	188	188	-	2,367	0.40	-	-	-	-
2,016	1,192	0.40	126	188	188	-	5,892	0.40	-	-	-	-
2,017	1,213	0.40	126	188	188	-	2,288	0.40	-	-	-	-
2,018	1,234	0.40	126	188	188	-	1,800	0.40	-	-	-	-
2,019	1,256	0.40	126	188	188	-	2,150	0.40	0	0	0	-
2,020	1,277	0.40	126	188	188	-	6,883	0.40	-	-	-	-
2,021	1,298	0.40	126	188	188	-	4,179	0.40	-	-	-	-
2,022	1,320	0.40	126	188	188	-	2,277	0.40	-	-	-	-
2,023	1,341	0.40	126	188	188	-	2,424	0.40	-	-	-	-
2,024	1,362	0.40	406	609	609	-	2,910	0.40	0	0	0	-

Notes:

21. Maximum fraction of Recycled Water that can be blended with Banked SWP Water or MRB Groundwater and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
22. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand and blending fraction.
23. Logic statement prevents result from exceeding available Banked SWP Water.

Scenario 1A Calculations - Unblended Banked SWP Water and MRB Adjudicated Groundwater Use; Total Water Use; and SWP Banking

	Total RW Used For Cooling	Total SWP Used for RW Blending	Total Banked SWP Used for RW Blending	Total Adjudicated MRB Groundwater Used for RW Blending	Total Blended Water Used for Cooling	Deficit After Using Blended Water	Remaining SWP Available for Cooling	Remaining Banked SWP Available for Cooling	Total SWP Used Directly for Cooling	Total Banked SWP Used Directly for Cooling	Total Adjudicated MRB Groundwater Used Directly for Cooling	Total Water Used for Cooling	SWP Banked[26]
Units	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)
Column	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB
Calculation	M+AC+AF+AL	L+AB	AH+AN	AI+AO	AP+AQ+AR+AS	4800-AT	(A*B)-AQ	D-AR	Logical[24]	Logical[25]	AU-AX-AY	AT+AX+AY+AZ	See Footnote
Year													
2,014													
2,015	1,416	2,396	188	-	4,000	-	3,909	1,592	-	-	-	4,000	1,431
2,016	1,416	2,396	188	-	4,000	-	3,909	2,834	-	-	-	4,000	1,431
2,017	1,416	2,396	188	-	4,000	-	3,909	4,077	-	-	-	4,000	1,431
2,018	1,416	2,396	188	-	4,000	-	999	5,319	-	-	-	4,000	1,104
2,019	1,416	2,396	188	-	4,000	-	3,909	6,235	-	-	-	4,000	1,431
2,020	1,416	2,396	188	-	4,000	-	3,909	7,478	-	-	-	4,000	1,431
2,021	1,416	2,396	188	-	4,000	-	3,909	8,720	-	-	-	4,000	1,431
2,022	1,416	2,396	188	-	4,000	-	3,909	9,963	-	-	-	4,000	1,431
2,023	1,416	2,396	188	-	4,000	-	3,909	11,206	-	-	-	4,000	1,431
2,024	1,451	1,940	609	-	4,000	-	-	12,027	-	-	-	4,000	60

Notes:

24. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A), availability (column B) and prior uses (column AQ).
25. Logic statement prevents result from exceeding available Banked SWP Water when considering prior uses (column AR).
26. Remaining available SWP water is banked. Banking is volume capped at historical average banking volume. See text for further information.

Scenario 1B Calculations - IWWTP Recycled Water Blended with SWP Water

	SWP Supply[1]	Fraction of Time SWP Water is Available and Suitable for Cooling[2]	Not Used	Banked SWP Availability[3]	IWWTP Flow[4]	ABS Backwash to IWWTP[5]	Total IWWTP Flow	IWWTP Recycled Water Availability Factor[6]	Allowable Recycled Water Fraction When Blending with SWP Water [7]	Potentially Usable IWWTP RW if Blended with SWP Water	SWP Blending Water Required	SWP Used for IWWTP RW Blending	IWWTP RW Blended with SWP Water
Units	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)
Column	A	B	C	D	E	F	G	H	I	J	K	L	M
Calculation	N/A	N/A	N/A	See Footnote	N/A	N/A	E+F	N/A	N/A	Logical[8]	(1-I)*J/I	Logical[9]	L*I/(1-I)
Year													
2,014													
2,015	6,500	0.93	-	1,780	1,859	-	1,859	0.90	0.25	389	1,167	1,167	389
2,016	6,500	0.93	-	1,900	1,881	-	1,881	0.90	0.25	394	1,181	1,181	394
2,017	3,000	0.93	-	2,019	1,903	-	1,903	0.90	0.25	398	1,195	1,195	398
2,018	6,500	0.93	-	2,052	1,925	-	1,925	0.90	0.25	403	1,208	1,208	403
2,019	6,500	0.93	-	2,171	1,947	-	1,947	0.90	0.25	407	1,222	1,222	407
2,020	3,500	0.93	-	2,291	1,969	-	1,969	0.90	0.25	412	1,236	1,236	412
2,021	3,500	0.93	-	2,411	1,991	-	1,991	0.90	0.25	417	1,250	1,250	417
2,022	2,500	0.93	-	2,530	2,013	-	2,013	0.90	0.25	421	1,264	1,264	421
2,023	6,500	0.93	-	2,075	2,035	-	2,035	0.90	0.25	426	1,277	1,277	426
2,024	6,500	0.93	-	2,195	2,057	-	2,057	0.90	0.25	430	1,291	1,291	430

Notes:
1. See Table 9 and text for further explanation.
2. See Text for further explanation.
3. Equals sum of historical injections minus extractions, minus dissipation, minus 1,000 acre-foot buffer. Dissipation is based on average through 2013, which was approximately 34 AFY (Abulaban, 2013).
4. See Table 3 and text for further explanation of values. IWWTP water is provided by the City of Victorville as first priority over VVWRA (pers. Comm., Boyer, 2015).
5. Not used.
6. Fraction of time wastewater plant is capable of producing Recycled Water. Value varies with scenario. See text for further information.
7. Maximum fraction of Recycled Water that can be blended with SWP Water and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
8. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand, SWP availability, and blending fraction.
9. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A) and availability (column B).

Scenario 1B Calculations - VVWRA Recycled Water Blended with SWP Water

	Adjusted VVWRA Flow[10]	Growth Factor for DFG MOU[11]	Required Discharge to Mojave River	Mojave River Base Flow @ Lower Narrows[12]	Required Discharge + Base Flow	Excess Discharge (Credit if Positive)	Required Discharge to Mojave River	Recycled Water Not Needed to Meet F&G MOU Requirements	Victorville 2 RW Water Demand[15]	Potentially Available VVWRA RW	VVWRA Recycled Water Availability Factor[17]	Allowable Recycled Water Fraction When Blending with SWP Water [18]	Potentially Usable VVWRA RW if Blended with SWP Water	SWP Blending Water Required	SWP Used for VVWRA RW Blending	VVWRA RW Blended with SWP Water
Units	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)
Column	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
Calculation	N/A	See Footnote	9,000+O	N/A	P+Q	R-15,000	Logical[14]	N-T	N/A	Logical[16]	N/A	N/A	Logical[19]	(1-Y)*Z/Y	Logical[20]	AB*Y/(1-Y)
Year																
2,014	13,554	616	9,616	5,856	15,472	472										
2,015	12,311	368	9,368	11,282	20,650	5,650	9,144	3,167	-	3,167	0.90	0.25	448	1,344	1,344	448
2,016	12,513	408	9,408	8,122	17,530	2,530	3,718	8,795	-	8,795	0.90	0.25	443	1,330	1,330	443
2,017	10,475	0	9,000	5,806	14,806	(194)	6,878	3,597	-	3,597	0.90	0.25	439	1,316	1,316	439
2,018	10,677	41	9,041	4,738	13,778	(1,222)	9,000	1,676	-	1,676	0.90	0.25	434	1,303	1,303	434
2,019	10,879	81	9,081	4,557	13,638	(1,362)	9,041	1,838	-	1,838	0.90	0.25	430	1,289	1,289	430
2,020	11,081	122	9,122	3,478	12,600	(2,400)	9,081	2,000	-	2,000	0.90	0.25	425	1,275	1,275	425
2,021	11,283	162	9,162	4,135	13,297	(1,703)	9,122	2,161	-	2,161	0.90	0.25	420	1,261	1,261	420
2,022	11,485	202	9,202	8,839	18,041	3,041	9,162	2,323	-	2,323	0.90	0.25	416	1,247	1,061	354
2,023	11,687	243	9,243	6,627	15,869	869	6,162	5,525	-	5,525	0.90	0.25	411	1,234	1,234	411
2,024	11,889	283	9,283	4,396	13,679	(1,321)	8,374	3,515	-	3,515	0.90	0.25	407	1,220	1,220	407

Notes:
10. 2014 data from VVWRA; 2015 - 2024 values are 2014 plus increase due to growth minus diversions to subregional plants and IWWTP. See Table 5 and text for further information.
11. Calculated as 20% of VVWRA ADWF increase compared to 2003 ADWF baseline, per CDFG MOU.
12. Value varies with scenario. See Table 6 and text for further explanation.
14. Equals prior year required discharge if no prior year credit. Equals prior year required discharge less credit if one is available.
15. Varies with scenario. See Table 12 for further explanation.
16. Logic statement prevents negative values. U-V, unless result is negative. Zero if result would be negative.
17. Fraction of time wastewater plant is capable of producing Recycled Water. Value varies with scenario. See text for further information.
18. Maximum fraction of Recycled Water that can be blended with SWP Water and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
19. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand, SWP availability, and blending fraction.
20. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A), availability (column B) and prior use (column L). -

Scenario 1B Calculations - IWWTP and VVWRA Recycled Water Blended with Banked SWP Water and MRB Adjudicated Groundwater

	Remaining Potentially Usable IWWTP RW	Allowable Recycled Water Fraction When Blending with Banked SWP Water or MRB Adjudicated Groundwater[21]	IWWTP RW Blended with Banked SWP Water or MRB Adjudicated Groundwater	Banked SWP or MRB Adjudicated Groundwater Needed For Blending	Banked SWP Used for IWWTP RW Blending	Adjudicated MRB Groundwater Used for IWWTP RW Blending	Remaining Potentially Usable VVWRA RW	Allowable Recycled Water Fraction When Blending with Banked SWP Water or MRB Adjudicated Groundwater[21]	VVWRA RW Blended with Banked SWP Water or MRB Adjudicated Groundwater	Banked SWP or MRB Adjudicated Groundwater Needed For Blending	Banked SWP Used for VVWRA RW Blending	Adjudicated MRB Groundwater Used for VVWRA RW Blending
Units	(AF)	(-)	(AF)	(AF)	(AF)	(AF)	(AF)	(-)	(AF)	(AF)	(AF)	(AF)
Column	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO
Calculation	(G*H)-M	N/A	Logical[22]	AF*(1-AE)/AE	Logical[23]	AG-AH	(W*X)-AC	N/A	Logical[22]	AL*(1-AK)/AK	Logical[23]	AM-AN
Year												
2,014												
2,015	1,284	0.30	196	456	456	-	2,402	0.30	(0)	(0)	(0)	-
2,016	1,299	0.30	196	456	456	-	7,472	0.30	(0)	(0)	(0)	-
2,017	1,314	0.30	196	456	456	-	2,798	0.30	0	0	0	-
2,018	1,330	0.30	196	456	456	-	1,075	0.30	(0)	(0)	(0)	-
2,019	1,345	0.30	196	456	456	-	1,225	0.30	(0)	(0)	(0)	-
2,020	1,360	0.30	196	456	456	-	1,375	0.30	(0)	(0)	(0)	-
2,021	1,375	0.30	196	456	456	-	1,525	0.30	(0)	(0)	(0)	-
2,022	1,390	0.30	270	630	630	-	1,737	0.30	-	-	-	-
2,023	1,406	0.30	196	456	456	-	4,562	0.30	(0)	(0)	(0)	-
2,024	1,421	0.30	196	456	456	-	2,757	0.30	(0)	(0)	(0)	-

Notes:

21. Maximum fraction of Recycled Water that can be blended with Banked SWP Water or MRB Groundwater and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
22. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand and blending fraction.
23. Logic statement prevents result from exceeding available Banked SWP Water.

Scenario 1B Calculations - Unblended Banked SWP Water and MRB Adjudicated Groundwater Use; Total Water Use; and SWP Banking

	Total RW Used For Cooling	Total SWP Used for RW Blending	Total Banked SWP Used for RW Blending	Total Adjudicated MRB Groundwater Used for RW Blending	Total Blended Water Used for Cooling	Deficit After Using Blended Water	Remaining SWP Available for Cooling	Remaining Banked SWP Available for Cooling	Total SWP Used Directly for Cooling	Total Banked SWP Used Directly for Cooling	Total Adjudicated MRB Groundwater Used Directly for Cooling	Total Water Used for Cooling	SWP Banked[26]
Units	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)
Column	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB
Calculation	M+AC+AF+AL	L+AB	AH+AN	AI+AO	AP+AQ+AR+AS	4800-AT	(A*B)-AQ	D-AR	Logical[24]	Logical[25]	AU-AX-AY	AT+AX+AY+AZ	See Footnote
Year													
2,014													
2,015	1,033	2,511	456	-	4,000	-	3,534	1,324	-	-	-	4,000	576
2,016	1,033	2,511	456	-	4,000	-	3,534	1,443	-	-	-	4,000	576
2,017	1,033	2,511	456	-	4,000	-	279	1,563	-	-	-	4,000	489
2,018	1,033	2,511	456	-	4,000	-	3,534	1,595	-	-	-	4,000	576
2,019	1,033	2,511	456	-	4,000	-	3,534	1,715	-	-	-	4,000	576
2,020	1,033	2,511	456	-	4,000	-	744	1,835	-	-	-	4,000	576
2,021	1,033	2,511	456	-	4,000	-	744	1,954	-	-	-	4,000	576
2,022	1,045	2,325	630	-	4,000	-	-	1,900	-	-	-	4,000	175
2,023	1,033	2,511	456	-	4,000	-	3,534	1,619	-	-	-	4,000	576
2,024	1,033	2,511	456	-	4,000	-	3,534	1,738	-	-	-	4,000	576

Notes:

24. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A), availability (column B) and prior uses (column AQ).
25. Logic statement prevents result from exceeding available Banked SWP Water when considering prior uses (column AR).
26. Remaining available SWP water is banked. Banking is volume capped at historical average banking volume. See text for further information.

Scenario 1C Calculations - IWWTP Recycled Water Blended with SWP Water

	SWP Supply[1]	Fraction of Time SWP Water is Available and Suitable for Cooling[2]	Not Used	Banked SWP Availability[3]	IWWTP Flow[4]	ABS Backwash to IWWTP[5]	Total IWWTP Flow	IWWTP Recycled Water Availability Factor[6]	Allowable Recycled Water Fraction When Blending with SWP Water [7]	Potentially Usable IWWTP RW if Blended with SWP Water	SWP Blending Water Required	SWP Used for IWWTP RW Blending	IWWTP RW Blended with SWP Water
Units	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)
Column	A	B	C	D	E	F	G	H	I	J	K	L	M
Calculation	N/A	N/A	N/A	See Footnote	N/A	N/A	E+F	N/A	N/A	Logical[8]	(1-I)*J/I	Logical[9]	L*I/(1-I)
Year													
2,014													
2,015	2,000	0.89	-	1,780	1,854	-	1,854	0.85	0.2	281	1,122	1,122	281
2,016	3,000	0.89	-	453	1,865	-	1,865	0.85	0.2	282	1,129	1,129	282
2,017	3,500	0.89	-	93	1,876	-	1,876	0.85	0.2	284	1,135	1,135	284
2,018	6,500	0.89	-	93	1,887	-	1,887	0.85	0.2	286	1,142	1,142	286
2,019	6,500	0.89	-	93	1,898	-	1,898	0.85	0.2	287	1,149	1,149	287
2,020	2,000	0.89	-	93	1,909	-	1,909	0.85	0.2	289	1,155	1,155	289
2,021	2,500	0.89	-	93	1,920	-	1,920	0.85	0.2	290	1,162	1,162	290
2,022	2,500	0.89	-	93	1,931	-	1,931	0.85	0.2	292	1,169	1,169	292
2,023	2,500	0.89	-	93	1,942	-	1,942	0.85	0.2	294	1,175	1,175	294
2,024	3,000	0.89	-	93	1,953	-	1,953	0.85	0.2	295	1,182	1,182	295

Notes:
1. See Table 9 and text for further explanation.
2. See Text for further explanation.
3. Equals sum of historical injections minus extractions, minus dissipation, minus 1,000 acre-foot buffer. Dissipation is based on average through 2013, which was approximately 34 AFY (Abulaban, 2013).
4. See Table 3 and text for further explanation of values. IWWTP water is provided by the City of Victorville as first priority over VVWRA (pers. Comm., Boyer, 2015).
5. Not used.
6. Fraction of time wastewater plant is capable of producing Recycled Water. Value varies with scenario. See text for further information.
7. Maximum fraction of Recycled Water that can be blended with SWP Water and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
8. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand, SWP availability, and blending fraction.
9. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A) and availability (column B).

Scenario 1C Calculations - VVWRA Recycled Water Blended with SWP Water

	Adjusted VVWRA Flow[10]	Growth Factor for DFG MOU[11]	Required Discharge to Mojave River	Mojave River Base Flow @ Lower Narrows[12]	Required Discharge + Base Flow	Excess Discharge (Credit if Positive)	Required Discharge to Mojave River	Recycled Water Not Needed to Meet F&G MOU Requirements	Victorville 2 RW Water Demand[15]	Potentially Available VVWRA RW	VVWRA Recycled Water Availability Factor[17]	Allowable Recycled Water Fraction When Blending with SWP Water [18]	Potentially Usable VVWRA RW if Blended with SWP Water	SWP Blending Water Required	SWP Used for VVWRA RW Blending	VVWRA RW Blended with SWP Water
Units	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)
Column	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
Calculation	N/A	See Footnote	9,000+O	N/A	P+Q	R-15,000	Logical[14]	N-T	N/A	Logical[16]	N/A	N/A	Logical[19]	(1-Y)*Z/Y	Logical[20]	AB*Y/(1-Y)
Year																
2,014	13,554	616	9,616	5,856	15,472	472										
2,015	12,260	357	9,357	5,806	15,163	163	9,144	3,116	-	3,116	0.85	0.2	325	1,299	658	164
2,016	12,361	378	9,378	4,738	14,115	(885)	9,194	3,167	-	3,167	0.85	0.2	323	1,292	1,292	323
2,017	10,222	-	9,000	4,557	13,557	(1,444)	9,378	844	-	844	0.85	0.2	321	1,285	1,285	321
2,018	10,323	-	9,000	3,478	12,478	(2,522)	9,000	1,323	-	1,323	0.85	0.2	320	1,279	1,279	320
2,019	10,424	-	9,000	4,135	13,135	(1,865)	9,000	1,424	-	1,424	0.85	0.2	318	1,272	1,272	318
2,020	10,525	10	9,010	8,839	17,849	2,849	9,000	1,525	-	1,525	0.85	0.2	316	1,265	625	156
2,021	10,626	31	9,031	6,627	15,657	657	6,162	4,464	-	4,464	0.85	0.2	315	1,259	1,063	266
2,022	10,727	51	9,051	4,396	13,447	(1,553)	8,374	2,353	-	2,353	0.85	0.2	313	1,252	1,056	264
2,023	10,828	71	9,071	4,680	13,751	(1,249)	9,051	1,777	-	1,777	0.85	0.2	311	1,246	1,050	262
2,024	10,929	91	9,091	3,713	12,804	(2,196)	9,071	1,858	-	1,858	0.85	0.2	310	1,239	1,239	310

Notes:

10. 2014 data from VVWRA; 2015 - 2024 values are 2014 plus increase due to growth minus diversions to subregional plants and IWWTP. See Table 5 and text for further information.
11. Calculated as 20% of VVWRA ADWF increase compared to 2003 ADWF baseline, per CDFG MOU.
12. Value varies with scenario. See Table 6 and text for further explanation.
14. Equals prior year required discharge if no prior year credit. Equals prior year required discharge less credit if one is available.
15. Varies with scenario. See Table 12 for further explanation.
16. Logic statement prevents negative values. U-V, unless result is negative. Zero if result would be negative.
17. Fraction of time wastewater plant is capable of producing Recycled Water. Value varies with scenario. See text for further information.
18. Maximum fraction of Recycled Water that can be blended with SWP Water and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
19. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand, SWP availability, and blending fraction.
20. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A), availability (column B) and prior use (column L). -

Scenario 1C Calculations - IWWTP and VVWRA Recycled Water Blended with Banked SWP Water and MRB Adjudicated Groundwater

	Remaining Potentially Usable IWWTP RW	Allowable Recycled Water Fraction When Blending with Banked SWP Water or MRB Adjudicated Groundwater[21]	IWWTP RW Blended with Banked SWP Water or MRB Adjudicated Groundwater	Banked SWP or MRB Adjudicated Groundwater Needed For Blending	Banked SWP Used for IWWTP RW Blending	Adjudicated MRB Groundwater Used for IWWTP RW Blending	Remaining Potentially Usable VVWRA RW	Allowable Recycled Water Fraction When Blending with Banked SWP Water or MRB Adjudicated Groundwater[21]	VVWRA RW Blended with Banked SWP Water or MRB Adjudicated Groundwater	Banked SWP or MRB Adjudicated Groundwater Needed For Blending	Banked SWP Used for VVWRA RW Blending	Adjudicated MRB Groundwater Used for VVWRA RW Blending
Units	(AF)	(-)	(AF)	(AF)	(AF)	(AF)	(AF)	(-)	(AF)	(AF)	(AF)	(AF)
Column	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO
Calculation	(G*H)-M	N/A	Logical[22]	AF*(1-AE)/AE	Logical[23]	AG-AH	(W*X)-AC	N/A	Logical[22]	AL*(1-AK)/AK	Logical[23]	AM-AN
Year												
2,014												
2,015	1,295	0.20	259	1,036	1,036	-	2,484	0.20	96	384	384	-
2,016	1,303	0.20	195	779	453	326	2,369	0.20	-	-	-	-
2,017	1,311	0.20	195	779	93	686	396	0.20	(0)	(0)	(0)	-
2,018	1,318	0.20	195	779	93	686	805	0.20	-	-	-	-
2,019	1,326	0.20	195	779	93	686	892	0.20	(0)	(0)	(0)	-
2,020	1,334	0.20	267	1,067	93	974	1,140	0.20	88	353	-	353
2,021	1,342	0.20	244	975	93	882	3,529	0.20	-	-	-	-
2,022	1,349	0.20	244	975	93	882	1,736	0.20	-	-	-	-
2,023	1,357	0.20	244	975	93	882	1,248	0.20	-	-	-	-
2,024	1,365	0.20	195	779	93	686	1,269	0.20	(0)	(0)	(0)	-

Notes:

21. Maximum fraction of Recycled Water that can be blended with Banked SWP Water or MRB Groundwater and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
22. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand and blending fraction.
23. Logic statement prevents result from exceeding available Banked SWP Water.

Scenario 1C Calculations - Unblended Banked SWP Water and MRB Adjudicated Groundwater Use; Total Water Use; and SWP Banking

	Total RW Used For Cooling	Total SWP Used for RW Blending	Total Banked SWP Used for RW Blending	Total Adjudicated MRB Groundwater Used for RW Blending	Total Blended Water Used for Cooling	Deficit After Using Blended Water	Remaining SWP Available for Cooling	Remaining Banked SWP Available for Cooling	Total SWP Used Directly for Cooling	Total Banked SWP Used Directly for Cooling	Total Adjudicated MRB Groundwater Used Directly for Cooling	Total Water Used for Cooling	SWP Banked[26]
Units	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)
Column	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB
Calculation	M+AC+AF+AL	L+AB	AH+AN	AI+AO	AP+AQ+AR+AS	4800-AT	(A*B)-AQ	D-AR	Logical[24]	Logical[25]	AU-AX-AY	AT+AX+AY+AZ	See Footnote
Year													
2,014													
2,015	800	1,780	1,420	-	4,000	-	-	360	-	-	-	4,000	93
2,016	800	2,421	453	326	4,000	-	249	-	-	-	-	4,000	93
2,017	800	2,421	93	686	4,000	-	694	-	-	-	-	4,000	93
2,018	800	2,421	93	686	4,000	-	3,364	-	-	-	-	4,000	93
2,019	800	2,421	93	686	4,000	-	3,364	-	-	-	-	4,000	93
2,020	800	1,780	93	1,327	4,000	-	-	-	-	-	-	4,000	93
2,021	800	2,225	93	882	4,000	-	-	-	-	-	-	4,000	93
2,022	800	2,225	93	882	4,000	-	-	-	-	-	-	4,000	93
2,023	800	2,225	93	882	4,000	-	-	-	-	-	-	4,000	93
2,024	800	2,421	93	686	4,000	-	249	-	-	-	-	4,000	93

Notes:

24. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A), availability (column B) and prior uses (column AQ).

25. Logic statement prevents result from exceeding available Banked SWP Water when considering prior uses (column AR).

26. Remaining available SWP water is banked. Banking is volume capped at historical average banking volume. See text for further information.

Scenario 2A Calculations - IWWTP Recycled Water Blended with SWP Water

	SWP Supply[1]	Fraction of Time SWP Water is Available and Suitable for Cooling[2]	Not Used	Banked SWP Availability[3]	IWWTP Flow[4]	ABS Backwash to IWWTP[5]	Total IWWTP Flow	IWWTP Recycled Water Availability Factor[6]	Allowable Recycled Water Fraction When Blending with SWP Water [7]	Potentially Usable IWWTP RW if Blended with SWP Water	SWP Blending Water Required	SWP Used for IWWTP RW Blending	IWWTP RW Blended with SWP Water
Units	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)
Column	A	B	C	D	E	F	G	H	I	J	K	L	M
Calculation	N/A	N/A	N/A	See Footnote	N/A	N/A	E+F	N/A	N/A	Logical[8]	(1-I)*J/I	Logical[9]	L*I/(1-I)
Year													
2,014													
2,015	6,500	0.97	-	1,780	1,865	-	1,865	0.95	0.35	602	1,117	1,117	602
2,016	6,500	0.97	-	2,481	1,899	-	1,899	0.95	0.35	612	1,137	1,137	612
2,017	6,500	0.97	-	3,724	1,933	-	1,933	0.95	0.35	623	1,158	1,158	623
2,018	3,500	0.97	-	4,397	1,967	-	1,967	0.95	0.35	634	1,178	1,178	634
2,019	6,500	0.97	-	5,025	2,001	-	2,001	0.95	0.35	645	1,199	1,199	645
2,020	6,500	0.97	-	5,676	2,035	-	2,035	0.95	0.35	656	1,219	1,219	656
2,021	6,500	0.97	-	6,918	2,069	-	2,069	0.95	0.35	667	1,239	1,239	667
2,022	6,500	0.97	-	8,161	2,103	-	2,103	0.95	0.35	678	1,260	1,260	678
2,023	6,500	0.97	-	8,778	2,137	-	2,137	0.95	0.35	689	1,280	1,280	689
2,024	2,000	0.97	-	9,387	2,171	-	2,171	0.95	0.35	700	1,300	1,300	700

Notes:
1. See Table 9 and text for further explanation.
2. See Text for further explanation.
3. Equals sum of historical injections minus extractions, minus dissipation, minus 1,000 acre-foot buffer. Dissipation is based on average through 2013, which was approximately 34 AFY (Abulaban, 2013).
4. See Table 3 and text for further explanation of values. IWWTP water is provided by the City of Victorville as first priority over VVWRA (pers. Comm., Boyer, 2015).
5. Not used.
6. Fraction of time wastewater plant is capable of producing Recycled Water. Value varies with scenario. See text for further information.
7. Maximum fraction of Recycled Water that can be blended with SWP Water and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
8. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand, SWP availability, and blending fraction.
9. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A) and availability (column B).

Scenario 2A Calculations - VVWRA Recycled Water Blended with SWP Water

	Adjusted VVWRA Flow[10]	Growth Factor for DFG MOU[11]	Required Discharge to Mojave River	Mojave River Base Flow @ Lower Narrows[12]	Required Discharge + Base Flow	Excess Discharge (Credit if Positive)	Required Discharge to Mojave River	Recycled Water Not Needed to Meet F&G MOU Requirements	Victorville 2 RW Water Demand[15]	Potentially Available VVWRA RW	VVWRA Recycled Water Availability Factor[17]	Allowable Recycled Water Fraction When Blending with SWP Water[18]	Potentially Usable VVWRA RW if Blended with SWP Water	SWP Blending Water Required	SWP Used for VVWRA RW Blending	VVWRA RW Blended with SWP Water
Units	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)
Column	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
Calculation	N/A	See Footnote	9,000+O	N/A	P+Q	R-15,000	Logical[14]	N-T	N/A	Logical[16]	N/A	N/A	Logical[19]	(1-Y)*Z/Y	Logical[20]	AB*Y/(1-Y)
Year																
2,014	13,554	616	9,616	5,856	15,472	472										
2,015	12,361	378	9,378	9,253	18,631	3,631	9,144	3,217	3,150	67	0.95	0.35	67	124	124	67
2,016	12,663	438	9,438	7,385	16,823	1,823	5,747	6,916	3,150	3,766	0.95	0.35	678	1,258	1,258	678
2,017	10,725	50	9,050	6,558	15,608	608	7,615	3,110	3,150	-	0.95	0.35	-	-	-	-
2,018	11,027	111	9,111	6,613	15,724	724	8,442	2,585	3,150	-	0.95	0.35	-	-	-	-
2,019	11,329	171	9,171	11,282	20,453	5,453	8,387	2,942	3,150	-	0.95	0.35	-	-	-	-
2,020	11,631	232	9,232	8,122	17,354	2,354	3,718	7,913	3,150	4,763	0.95	0.35	634	1,177	1,177	634
2,021	11,933	292	9,292	5,806	15,098	98	6,878	5,055	3,150	1,905	0.95	0.35	623	1,157	1,157	623
2,022	12,235	352	9,352	4,738	14,090	(910)	9,194	3,041	3,150	-	0.95	0.35	-	-	-	-
2,023	12,537	413	9,413	4,557	13,969	(1,031)	9,352	3,184	3,150	34	0.95	0.35	34	64	64	34
2,024	12,839	473	9,473	3,478	12,951	(2,049)	9,413	3,426	3,150	276	0.95	0.35	276	513	513	276

Notes:

10. 2014 data from VVWRA; 2015 - 2024 values are 2014 plus increase due to growth minus diversions to subregional plants and IWWTP. See Table 5 and text for further information.
11. Calculated as 20% of VVWRA ADWF increase compared to 2003 ADWF baseline, per CDFG MOU.
12. Value varies with scenario. See Table 6 and text for further explanation.
14. Equals prior year required discharge if no prior year credit. Equals prior year required discharge less credit if one is available.
15. Varies with scenario. See Table 12 for further explanation.
16. Logic statement prevents negative values. U-V, unless result is negative. Zero if result would be negative.
17. Fraction of time wastewater plant is capable of producing Recycled Water. Value varies with scenario. See text for further information.
18. Maximum fraction of Recycled Water that can be blended with SWP Water and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
19. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand, SWP availability, and blending fraction.
20. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A), availability (column B) and prior use (column L). -

Scenario 2A Calculations - IWWTP and VVWRA Recycled Water Blended with Banked SWP Water and MRB Adjudicated Groundwater

	Remaining Potentially Usable IWWTP RW	Allowable Recycled Water Fraction When Blending with Banked SWP Water or MRB Adjudicated Groundwater[21]	IWWTP RW Blended with Banked SWP Water or MRB Adjudicated Groundwater	Banked SWP or MRB Adjudicated Groundwater Needed For Blending	Banked SWP Used for IWWTP RW Blending	Adjudicated MRB Groundwater Used for IWWTP RW Blending	Remaining Potentially Usable VVWRA RW	Allowable Recycled Water Fraction When Blending with Banked SWP Water or MRB Adjudicated Groundwater[21]	VVWRA RW Blended with Banked SWP Water or MRB Adjudicated Groundwater	Banked SWP or MRB Adjudicated Groundwater Needed For Blending	Banked SWP Used for VVWRA RW Blending	Adjudicated MRB Groundwater Used for VVWRA RW Blending
Units	(AF)	(-)	(AF)	(AF)	(AF)	(AF)	(AF)	(-)	(AF)	(AF)	(AF)	(AF)
Column	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO
Calculation	(G*H)-M	N/A	Logical[22]	AF*(1-AE)/AE	Logical[23]	AG-AH	(W*X)-AC	N/A	Logical[22]	AL*(1-AK)/AK	Logical[23]	AM-AN
Year												
2,014												
2,015	1,170	0.40	468	702	702	-	-	0.40	-	-	-	-
2,016	1,192	0.40	126	188	188	-	2,900	0.40	-	-	-	-
2,017	1,213	0.40	485	728	728	-	-	0.40	-	-	-	-
2,018	1,234	0.40	494	741	741	-	-	0.40	-	-	-	-
2,019	1,256	0.40	502	753	753	-	-	0.40	-	-	-	-
2,020	1,277	0.40	126	188	188	-	3,891	0.40	-	-	-	-
2,021	1,298	0.40	126	188	188	-	1,187	0.40	-	-	-	-
2,022	1,320	0.40	528	792	792	-	-	0.40	-	-	-	-
2,023	1,341	0.40	536	805	805	-	-	0.40	-	-	-	-
2,024	1,362	0.40	484	726	726	-	-	0.40	-	-	-	-

Notes:

21. Maximum fraction of Recycled Water that can be blended with Banked SWP Water or MRB Groundwater and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
22. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand and blending fraction.
23. Logic statement prevents result from exceeding available Banked SWP Water.

Scenario 2A Calculations - Unblended Banked SWP Water and MRB Adjudicated Groundwater Use; Total Water Use; and SWP Banking

	Total RW Used For Cooling	Total SWP Used for RW Blending	Total Banked SWP Used for RW Blending	Total Adjudicated MRB Groundwater Used for RW Blending	Total Blended Water Used for Cooling	Deficit After Using Blended Water	Remaining SWP Available for Cooling	Remaining Banked SWP Available for Cooling	Total SWP Used Directly for Cooling	Total Banked SWP Used Directly for Cooling	Total Adjudicated MRB Groundwater Used Directly for Cooling	Total Water Used for Cooling	SWP Banked[26]
Units	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)
Column	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB
Calculation	M+AC+AF+AL	L+AB	AH+AN	AI+AO	AP+AQ+AR+AS	4800-AT	(A*B)-AQ	D-AR	Logical[24]	Logical[25]	AU-AX-AY	AT+AX+AY+AZ	See Footnote
Year													
2,014													
2,015	1,136	1,241	702	-	3,080	920	5,064	1,078	893	28	-	4,000	1,431
2,016	1,416	2,396	188	-	4,000	-	3,909	2,293	-	-	-	4,000	1,431
2,017	1,109	1,158	728	-	2,994	1,006	5,147	2,996	976	30	-	4,000	1,431
2,018	1,128	1,178	741	-	3,047	953	2,217	3,656	925	29	-	4,000	1,397
2,019	1,148	1,199	753	-	3,099	901	5,106	4,272	873	27	-	4,000	1,431
2,020	1,416	2,396	188	-	4,000	-	3,909	5,487	-	-	-	4,000	1,431
2,021	1,416	2,396	188	-	4,000	-	3,909	6,730	-	-	-	4,000	1,431
2,022	1,206	1,260	792	-	3,257	743	5,045	7,369	720	22	-	4,000	1,431
2,023	1,260	1,344	805	-	3,409	591	4,961	7,973	574	18	-	4,000	1,431
2,024	1,461	1,813	726	-	4,000	-	127	8,660	-	-	-	4,000	187

Notes:

24. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A), availability (column B) and prior uses (column AQ).
25. Logic statement prevents result from exceeding available Banked SWP Water when considering prior uses (column AR).
26. Remaining available SWP water is banked. Banking is volume capped at historical average banking volume. See text for further information.

Appendix F

Scenario 2B Calculations

Scenario 2B Calculations - IWWTP Recycled Water Blended with SWP Water

	SWP Supply[1]	Fraction of Time SWP Water is Available and Suitable for Cooling[2]	Not Used	Banked SWP Availability[3]	IWWTP Flow[4]	ABS Backwash to IWWTP[5]	Total IWWTP Flow	IWWTP Recycled Water Availability Factor[6]	Allowable Recycled Water Fraction When Blending with SWP Water[7]	Potentially Usable IWWTP RW if Blended with SWP Water	SWP Blending Water Required	SWP Used for IWWTP RW Blending	IWWTP RW Blended with SWP Water
Units	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)
Column	A	B	C	D	E	F	G	H	I	J	K	L	M
Calculation	N/A	N/A	N/A	See Footnote	N/A	N/A	E+F	N/A	N/A	Logical[8]	(1-I)*J/I	Logical[9]	L*I/(1-I)
Year													
2,014													
2,015	6,500	0.93	-	1,780	1,859	-	1,859	0.90	0.25	389	1,167	1,167	389
2,016	6,500	0.93	-	1,381	1,881	-	1,881	0.90	0.25	394	1,181	1,181	394
2,017	3,000	0.93	-	1,500	1,903	-	1,903	0.90	0.25	398	1,195	1,195	398
2,018	6,500	0.93	-	1,533	1,925	-	1,925	0.90	0.25	403	1,208	1,208	403
2,019	6,500	0.93	-	1,104	1,947	-	1,947	0.90	0.25	407	1,222	1,222	407
2,020	3,500	0.93	-	667	1,969	-	1,969	0.90	0.25	412	1,236	1,236	412
2,021	3,500	0.93	-	576	1,991	-	1,991	0.90	0.25	417	1,250	1,250	417
2,022	2,500	0.93	-	576	2,013	-	2,013	0.90	0.25	421	1,264	1,264	421
2,023	6,500	0.93	-	376	2,035	-	2,035	0.90	0.25	426	1,277	1,277	426
2,024	6,500	0.93	-	576	2,057	-	2,057	0.90	0.25	430	1,291	1,291	430

Notes:
1. See Table 9 and text for further explanation.
2. See Text for further explanation.
3. Equals sum of historical injections minus extractions, minus dissipation, minus 1,000 acre-foot buffer. Dissipation is based on average through 2013, which was approximately 34 AFY (Abulaban, 2013).
4. See Table 3 and text for further explanation of values. IWWTP water is provided by the City of Victorville as first priority over VVWRA (pers. Comm., Boyer, 2015).
5. Not used.
6. Fraction of time wastewater plant is capable of producing Recycled Water. Value varies with scenario. See text for further information.
7. Maximum fraction of Recycled Water that can be blended with SWP Water and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
8. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand, SWP availability, and blending fraction.
9. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A) and availability (column B).

Scenario 2B Calculations - VVWRA Recycled Water Blended with SWP Water

	Adjusted VVWRA Flow[10]	Growth Factor for DFG MOU[11]	Required Discharge to Mojave River	Mojave River Base Flow @ Lower Narrows[12]	Required Discharge + Base Flow	Excess Discharge (Credit if Positive)	Required Discharge to Mojave River	Recycled Water Not Needed to Meet F&G MOU Requirements	Victorville 2 RW Water Demand[15]	Potentially Available VVWRA RW	VVWRA Recycled Water Availability Factor[17]	Allowable Recycled Water Fraction When Blending with SWP Water [18]	Potentially Usable VVWRA RW if Blended with SWP Water	SWP Blending Water Required	SWP Used for VVWRA RW Blending	VVWRA RW Blended with SWP Water
Units	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)
Column	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
Calculation	N/A	See Footnote	9,000+O	N/A	P+Q	R-15,000	Logical[14]	N-T	N/A	Logical[16]	N/A	N/A	Logical[19]	(1-Y)*Z/Y	Logical[20]	AB*Y/(1-Y)
Year																
2,014	13,554	616	9,616	5,856	15,472	472										
2,015	12,311	368	9,368	11,282	20,650	5,650	9,144	3,167	3,150	17	0.90	0.25	17	50	50	17
2,016	12,513	408	9,408	8,122	17,530	2,530	3,718	8,795	3,150	5,645	0.90	0.25	443	1,330	1,330	443
2,017	10,475	0	9,000	5,806	14,806	(194)	6,878	3,597	3,150	447	0.90	0.25	439	1,316	1,316	439
2,018	10,677	41	9,041	4,738	13,778	(1,222)	9,000	1,676	3,150	-	0.90	0.25	-	-	-	-
2,019	10,879	81	9,081	4,557	13,638	(1,362)	9,041	1,838	3,150	-	0.90	0.25	-	-	-	-
2,020	11,081	122	9,122	3,478	12,600	(2,400)	9,081	2,000	3,150	-	0.90	0.25	-	-	-	-
2,021	11,283	162	9,162	4,135	13,297	(1,703)	9,122	2,161	3,150	-	0.90	0.25	-	-	-	-
2,022	11,485	202	9,202	8,839	18,041	3,041	9,162	2,323	3,150	-	0.90	0.25	-	-	-	-
2,023	11,687	243	9,243	6,627	15,869	869	6,162	5,525	3,150	2,375	0.90	0.25	411	1,234	1,234	411
2,024	11,889	283	9,283	4,396	13,679	(1,321)	8,374	3,515	3,150	365	0.90	0.25	365	1,096	1,096	365

Notes:

10. 2014 data from VVWRA; 2015 - 2024 values are 2014 plus increase due to growth minus diversions to subregional plants and IWWTP. See Table 5 and text for further information.
11. Calculated as 20% of VVWRA ADWF increase compared to 2003 ADWF baseline, per CDFG MOU.
12. Value varies with scenario. See Table 6 and text for further explanation.
14. Equals prior year required discharge if no prior year credit. Equals prior year required discharge less credit if one is available.
15. Varies with scenario. See Table 12 for further explanation.
16. Logic statement prevents negative values. U-V, unless result is negative. Zero if result would be negative.
17. Fraction of time wastewater plant is capable of producing Recycled Water. Value varies with scenario. See text for further information.
18. Maximum fraction of Recycled Water that can be blended with SWP Water and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
19. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand, SWP availability, and blending fraction.
20. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A), availability (column B) and prior use (column L). -

Scenario 2B Calculations - IWWTP and VVWRA Recycled Water Blended with Banked SWP Water and MRB Adjudicated Groundwater

	Remaining Potentially Usable IWWTP RW	Allowable Recycled Water Fraction When Blending with Banked SWP Water or MRB Adjudicated Groundwater[21]	IWWTP RW Blended with Banked SWP Water or MRB Adjudicated Groundwater	Banked SWP or MRB Adjudicated Groundwater Needed For Blending	Banked SWP Used for IWWTP RW Blending	Adjudicated MRB Groundwater Used for IWWTP RW Blending	Remaining Potentially Usable VVWRA RW	Allowable Recycled Water Fraction When Blending with Banked SWP Water or MRB Adjudicated Groundwater[21]	VVWRA RW Blended with Banked SWP Water or MRB Adjudicated Groundwater	Banked SWP or MRB Adjudicated Groundwater Needed For Blending	Banked SWP Used for VVWRA RW Blending	Adjudicated MRB Groundwater Used for VVWRA RW Blending
Units	(AF)	(-)	(AF)	(AF)	(AF)	(AF)	(AF)	(-)	(AF)	(AF)	(AF)	(AF)
Column	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO
Calculation	(G*H)-M	N/A	Logical[22]	AF*(1-AE)/AE	Logical[23]	AG-AH	(W*X)-AC	N/A	Logical[22]	AL*(1-AK)/AK	Logical[23]	AM-AN
Year												
2,014												
2,015	1,284	0.30	385	899	899	-	-	0.30	-	-	-	-
2,016	1,299	0.30	196	456	456	-	4,637	0.30	(0)	(0)	(0)	-
2,017	1,314	0.30	196	456	456	-	-	0.30	-	-	-	-
2,018	1,330	0.30	399	931	931	-	-	0.30	-	-	-	-
2,019	1,345	0.30	403	941	941	-	-	0.30	-	-	-	-
2,020	1,360	0.30	408	952	667	285	-	0.30	-	-	-	-
2,021	1,375	0.30	413	963	576	387	-	0.30	-	-	-	-
2,022	1,390	0.30	417	973	576	397	-	0.30	-	-	-	-
2,023	1,406	0.30	196	456	376	80	1,727	0.30	(0)	(0)	(0)	-
2,024	1,421	0.30	245	572	572	-	-	0.30	-	-	-	-

Notes:

21. Maximum fraction of Recycled Water that can be blended with Banked SWP Water or MRB Groundwater and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
22. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand and blending fraction.
23. Logic statement prevents result from exceeding available Banked SWP Water.

Scenario 2B Calculations - Unblended Banked SWP Water and MRB Adjudicated Groundwater Use; Total Water Use; and SWP Banking

	Total RW Used For Cooling	Total SWP Used for RW Blending	Total Banked SWP Used for RW Blending	Total Adjudicated MRB Groundwater Used for RW Blending	Total Blended Water Used for Cooling	Deficit After Using Blended Water	Remaining SWP Available for Cooling	Remaining Banked SWP Available for Cooling	Total SWP Used Directly for Cooling	Total Banked SWP Used Directly for Cooling	Total Adjudicated MRB Groundwater Used Directly for Cooling	Total Water Used for Cooling	SWP Banked[26]
Units	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)
Column	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB
Calculation	M+AC+AF+AL	L+AB	AH+AN	AI+AO	AP+AQ+AR+AS	4800-AT	(A*B)-AQ	D-AR	Logical[24]	Logical[25]	AU-AX-AY	AT+AX+AY+AZ	See Footnote
Year													
2,014													
2,015	791	1,217	899	-	2,907	1,093	4,828	881	1,016	76	-	4,000	576
2,016	1,033	2,511	456	-	4,000	-	3,534	924	-	-	-	4,000	576
2,017	1,033	2,511	456	-	4,000	-	279	1,044	-	-	-	4,000	489
2,018	802	1,208	931	-	2,941	1,059	4,837	602	985	74	-	4,000	576
2,019	811	1,222	941	-	2,975	1,025	4,823	163	954	72	-	4,000	576
2,020	820	1,236	667	285	3,008	992	2,019	-	922	-	69	4,000	576
2,021	829	1,250	576	387	3,042	958	2,005	-	891	-	67	4,000	576
2,022	838	1,264	576	397	3,075	925	1,061	-	860	-	65	4,000	376
2,023	1,033	2,511	376	80	4,000	-	3,534	-	-	-	-	4,000	576
2,024	1,041	2,387	572	-	4,000	-	3,658	4	-	-	-	4,000	576

Notes:

24. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A), availability (column B) and prior uses (column AQ).
25. Logic statement prevents result from exceeding available Banked SWP Water when considering prior uses (column AR).
26. Remaining available SWP water is banked. Banking is volume capped at historical average banking volume. See text for further information.

Appendix G

Scenario 2C Calculations

Scenario 2C Calculations - IWWTP Recycled Water Blended with SWP Water

	SWP Supply[1]	Fraction of Time SWP Water is Available and Suitable for Cooling[2]	Not Used	Banked SWP Availability[3]	IWWTP Flow[4]	ABS Backwash to IWWTP[5]	Total IWWTP Flow	IWWTP Recycled Water Availability Factor[6]	Allowable Recycled Water Fraction When Blending with SWP Water [7]	Potentially Usable IWWTP RW if Blended with SWP Water	SWP Blending Water Required	SWP Used for IWWTP RW Blending	IWWTP RW Blended with SWP Water
Units	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)
Column	A	B	C	D	E	F	G	H	I	J	K	L	M
Calculation	N/A	N/A	N/A	See Footnote	N/A	N/A	E+F	N/A	N/A	Logical[8]	(1-I)*J/I	Logical[9]	L*I/(1-I)
Year													
2,014													
2,015	2,000	0.89	-	1,780	1,854	-	1,854	0.85	0.2	281	1,122	1,122	281
2,016	3,000	0.89	-	193	1,865	-	1,865	0.85	0.2	282	1,129	1,129	282
2,017	3,500	0.89	-	93	1,876	-	1,876	0.85	0.2	284	1,135	1,135	284
2,018	6,500	0.89	-	93	1,887	-	1,887	0.85	0.2	286	1,142	1,142	286
2,019	6,500	0.89	-	93	1,898	-	1,898	0.85	0.2	287	1,149	1,149	287
2,020	2,000	0.89	-	93	1,909	-	1,909	0.85	0.2	289	1,155	1,155	289
2,021	2,500	0.89	-	93	1,920	-	1,920	0.85	0.2	290	1,162	1,162	290
2,022	2,500	0.89	-	93	1,931	-	1,931	0.85	0.2	292	1,169	1,169	292
2,023	2,500	0.89	-	93	1,942	-	1,942	0.85	0.2	294	1,175	1,175	294
2,024	3,000	0.89	-	93	1,953	-	1,953	0.85	0.2	295	1,182	1,182	295

Notes:
1. See Table 9 and text for further explanation.
2. See Text for further explanation.
3. Equals sum of historical injections minus extractions, minus dissipation, minus 1,000 acre-foot buffer. Dissipation is based on average through 2013, which was approximately 34 AFY (Abulaban, 2013).
4. See Table 3 and text for further explanation of values. IWWTP water is provided by the City of Victorville as first priority over VVWRA (pers. Comm., Boyer, 2015).
5. Not used.
6. Fraction of time wastewater plant is capable of producing Recycled Water. Value varies with scenario. See text for further information.
7. Maximum fraction of Recycled Water that can be blended with SWP Water and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
8. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand, SWP availability, and blending fraction.
9. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A) and availability (column B).

Scenario 2C Calculations - VVWRA Recycled Water Blended with SWP Water

	Adjusted VVWRA Flow[10]	Growth Factor for DFG MOU[11]	Required Discharge to Mojave River	Mojave River Base Flow @ Lower Narrows[12]	Required Discharge + Base Flow	Excess Discharge (Credit if Positive)	Required Discharge to Mojave River	Recycled Water Not Needed to Meet F&G MOU Requirements	Victorville 2 RW Water Demand[15]	Potentially Available VVWRA RW	VVWRA Recycled Water Availability Factor[17]	Allowable Recycled Water Fraction When Blending with SWP Water [18]	Potentially Usable VVWRA RW if Blended with SWP Water	SWP Blending Water Required	SWP Used for VVWRA RW Blending	VVWRA RW Blended with SWP Water
Units	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(-)	(-)	(AF)	(AF)	(AF)	(AF)
Column	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
Calculation	N/A	See Footnote	9,000+O	N/A	P+Q	R-15,000	Logical[14]	N-T	N/A	Logical[16]	N/A	N/A	Logical[19]	(1-Y)*Z/Y	Logical[20]	AB*Y/(1-Y)
Year																
2,014	13,554	616	9,616	5,856	15,472	472										
2,015	12,260	357	9,357	5,806	15,163	163	9,144	3,116	3,150	-	0.85	0.2	-	-	-	-
2,016	12,361	378	9,378	4,738	14,115	(885)	9,194	3,167	3,150	17	0.85	0.2	17	67	67	17
2,017	10,222	-	9,000	4,557	13,557	(1,444)	9,378	844	3,150	-	0.85	0.2	-	-	-	-
2,018	10,323	-	9,000	3,478	12,478	(2,522)	9,000	1,323	3,150	-	0.85	0.2	-	-	-	-
2,019	10,424	-	9,000	4,135	13,135	(1,865)	9,000	1,424	3,150	-	0.85	0.2	-	-	-	-
2,020	10,525	10	9,010	8,839	17,849	2,849	9,000	1,525	3,150	-	0.85	0.2	-	-	-	-
2,021	10,626	31	9,031	6,627	15,657	657	6,162	4,464	3,150	1,314	0.85	0.2	315	1,259	1,063	266
2,022	10,727	51	9,051	4,396	13,447	(1,553)	8,374	2,353	3,150	-	0.85	0.2	-	-	-	-
2,023	10,828	71	9,071	4,680	13,751	(1,249)	9,051	1,777	3,150	-	0.85	0.2	-	-	-	-
2,024	10,929	91	9,091	3,713	12,804	(2,196)	9,071	1,858	3,150	-	0.85	0.2	-	-	-	-

Notes:

10. 2014 data from VVWRA; 2015 - 2024 values are 2014 plus increase due to growth minus diversions to subregional plants and IWWTP. See Table 5 and text for further information.

11. Calculated as 20% of VVWRA ADWF increase compared to 2003 ADWF baseline, per CDFG MOU.

12. Value varies with scenario. See Table 6 and text for further explanation.

14. Equals prior year required discharge if no prior year credit. Equals prior year required discharge less credit if one is available.

15. Varies with scenario. See Table 12 for further explanation.

16. Logic statement prevents negative values. U-V, unless result is negative. Zero if result would be negative.

17. Fraction of time wastewater plant is capable of producing Recycled Water. Value varies with scenario. See text for further information.

18. Maximum fraction of Recycled Water that can be blended with SWP Water and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.

19. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand, SWP availability, and blending fraction.

20. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A), availability (column B) and prior use (column L). -

Scenario 2C Calculations - IWWTP and VVWRA Recycled Water Blended with Banked SWP Water and MRB Adjudicated Groundwater

	Remaining Potentially Usable IWWTP RW	Allowable Recycled Water Fraction When Blending with Banked SWP Water or MRB Adjudicated Groundwater[21]	IWWTP RW Blended with Banked SWP Water or MRB Adjudicated Groundwater	Banked SWP or MRB Adjudicated Groundwater Needed For Blending	Banked SWP Used for IWWTP RW Blending	Adjudicated MRB Groundwater Used for IWWTP RW Blending	Remaining Potentially Usable VVWRA RW	Allowable Recycled Water Fraction When Blending with Banked SWP Water or MRB Adjudicated Groundwater[21]	VVWRA RW Blended with Banked SWP Water or MRB Adjudicated Groundwater	Banked SWP or MRB Adjudicated Groundwater Needed For Blending	Banked SWP Used for VVWRA RW Blending	Adjudicated MRB Groundwater Used for VVWRA RW Blending
Units	(AF)	(-)	(AF)	(AF)	(AF)	(AF)	(AF)	(-)	(AF)	(AF)	(AF)	(AF)
Column	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO
Calculation	(G*H)-M	N/A	Logical[22]	AF*(1-AE)/AE	Logical[23]	AG-AH	(W*X)-AC	N/A	Logical[22]	AL*(1-AK)/AK	Logical[23]	AM-AN
Year												
2,014												
2,015	1,295	0.20	259	1,036	1,036	-	-	0.20	-	-	-	-
2,016	1,303	0.20	261	1,042	193	850	-	0.20	-	-	-	-
2,017	1,311	0.20	262	1,049	93	956	-	0.20	-	-	-	-
2,018	1,318	0.20	264	1,055	93	962	-	0.20	-	-	-	-
2,019	1,326	0.20	265	1,061	93	968	-	0.20	-	-	-	-
2,020	1,334	0.20	267	1,067	93	974	-	0.20	-	-	-	-
2,021	1,342	0.20	244	975	93	882	851	0.20	-	-	-	-
2,022	1,349	0.20	270	1,079	93	986	-	0.20	-	-	-	-
2,023	1,357	0.20	271	1,086	93	993	-	0.20	-	-	-	-
2,024	1,365	0.20	273	1,092	93	999	-	0.20	-	-	-	-

Notes:

21. Maximum fraction of Recycled Water that can be blended with Banked SWP Water or MRB Groundwater and meet cooling tower blowdown monitoring parameters. See Table 12 and text for further explanation.
22. Logic statement prevents result from exceeding maximum amount of Recycled Water that can be used by Facility when considering water demand and blending fraction.
23. Logic statement prevents result from exceeding available Banked SWP Water.

Scenario 2C Calculations - Unblended Banked SWP Water and MRB Adjudicated Groundwater Use; Total Water Use; and SWP Banking

	Total RW Used For Cooling	Total SWP Used for RW Blending	Total Banked SWP Used for RW Blending	Total Adjudicated MRB Groundwater Used for RW Blending	Total Blended Water Used for Cooling	Deficit After Using Blended Water	Remaining SWP Available for Cooling	Remaining Banked SWP Available for Cooling	Total SWP Used Directly for Cooling	Total Banked SWP Used Directly for Cooling	Total Adjudicated MRB Groundwater Used Directly for Cooling	Total Water Used for Cooling	SWP Banked[26]
Units	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)	(AF)
Column	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB
Calculation	M+AC+AF+AL	L+AB	AH+AN	AI+AO	AP+AQ+AR+AS	4800-AT	(A*B)-AQ	D-AR	Logical[24]	Logical[25]	AU-AX-AY	AT+AX+AY+AZ	See Footnote
Year													
2,014													
2,015	540	1,122	1,036	-	2,698	1,302	658	744	658	644	-	4,000	93
2,016	560	1,196	193	850	2,798	1,202	1,474	-	1,070	-	132	4,000	93
2,017	546	1,135	93	956	2,730	1,270	1,980	-	1,130	-	140	4,000	93
2,018	549	1,142	93	962	2,746	1,254	4,643	-	1,116	-	138	4,000	93
2,019	552	1,149	93	968	2,762	1,238	4,636	-	1,102	-	136	4,000	93
2,020	556	1,155	93	974	2,778	1,222	625	-	625	-	597	4,000	93
2,021	800	2,225	93	882	4,000	-	-	-	-	-	-	4,000	93
2,022	562	1,169	93	986	2,810	1,190	1,056	-	1,056	-	134	4,000	93
2,023	565	1,175	93	993	2,826	1,174	1,050	-	1,050	-	124	4,000	93
2,024	568	1,182	93	999	2,842	1,158	1,488	-	1,031	-	127	4,000	93

Notes:

24. Logic statement prevents SWP water use in excess of available SWP Water when considering SWP supply (column A), availability (column B) and prior uses (column AQ).
25. Logic statement prevents result from exceeding available Banked SWP Water when considering prior uses (column AR).
26. Remaining available SWP water is banked. Banking is volume capped at historical average banking volume. See text for further information.