Groundwater Management, Monitoring, and Mitigation Plan

For

The Cadiz Valley Groundwater Conservation, Recovery and Storage Project[1]

~~July~~September 2012

[1] This Management Plan shall not become final or effective until approved by the Santa Margarita Water District and the County of San Bernardino Board of Supervisors ~~after a noticed public meeting by the respective agencies~~.

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Groundwater Management, Monitoring, and Mitigation Plan For the Cadiz Valley Groundwater Conservation, Recovery, and Storage Project

EXECUTIVE SUMMARY

The fundamental purpose of the Cadiz Valley Groundwater Conservation, Recovery, and Storage Project (Project) is to conserve and recover substantial quantities of groundwater that in the absence of the Project would otherwise evaporate. The Project is a 50-year groundwater recovery, conservation and conjunctive use storage project located within the collective Fenner, Orange Blossom Wash, Bristol and Cadiz Watersheds in the Eastern Mojave Desert. It will provide reliable water supply to the Santa Margarita Water District (SMWD) and other participating water agencies. Phase I of the Project provides for the initial extraction of groundwater in amounts not to exceed an annual average of up to 50,000 acre-feet per year (afy)[2] from a wellfield in the area within and south/southwest of the Fenner Gap. Phase II of the Project, if proposed and implemented, would use available aquifer capacity to operate a one million acre-feet groundwater storage bank to facilitate the storage and recovery of imported water over the Project's 50-year term. Phase II is not proposed at this time and will be subject to subsequent environmental and regulatory review. The full term of the Project's operation, including Phase I and Phase II, shall be limited to 50 years.

This Groundwater Management, Monitoring, and Mitigation Plan (Management Plan) will govern the operation and management of the Project by Fenner Valley Mutual Water Company (FVMWC) through a joint powers agreement ~~initally~~**initially** between FVMWC and SMWD. The Management Plan is prepared to comply with the County of San Bernardino's (County) Desert Groundwater Management Ordinance (Ordinance) as an excluded Project under the exclusion provisions set forth in Article 5, Section 33.06552 of the County Code. As part of its compliance with the exclusion provisions of the Ordinance, SMWD, FVMWC, Cadiz Inc. (Cadiz), and the County approved a May 2012 Memorandum of Understanding (MOU).

The Management Plan requires monitoring of aquifer health and safe yield, groundwater levels and rates of decline, groundwater quality, subsidence, surface vegetation, air quality, third-party wells and springs, and corrective measures to address potential significant adverse impacts to critical resources[3] and Undesirable

[2] Actual total pumping would vary depending on Project participant supply needs. The maximum extraction rate in any given year would be limited to 75,000 afy with the long-term average of up to 50,000 afy as measured over a rolling 10-year period.

[3] SMWD has prepared an Environmental Impact Report (EIR) that evaluates the potential for the Project to result in significant impacts to the environment pursuant to Public Resources Code section 21000 et

- Brine resources of Bristol and Cadiz Dry Lakes;
- Air quality **in the Mojave Desert region;**
- **Vegetation** in the Mojave Desert region; and
- Adjacent areas, including the Colorado River and its tributary sources of water.

By definition, the Project intends to implement a managed drawdown in water levels to achieve specific conservation objectives. This Management Plan is designed to prevent significant adverse impacts to critical resources and Undesirable Results traditionally associated with groundwater pumping by collecting data and determining if observed changes in groundwater levels, groundwater quality, and land subsidence are consistent with changes projected in groundwater modeling **of Project impacts** as described in this Management Plan and references cited herein. If there are deviations from the groundwater modeling projections **of Project impacts**, those deviations will prompt further investigation and assessment under this Management Plan, and if necessary, implementation of corrective measures so as to avoid potential adverse impacts to critical resources and Undesirable Results. The Project approval is limited to a defined period of operations (50 years).[5]

The Management Plan incorporates a comprehensive network of monitoring features and data collection facilities, which include:

- Local springs;
- Observation wells at various locations, several of which will be clustered wells with depth-discrete screened intervals;
- Project production wells;
- Land survey benchmarks **and extensometers**;
- Downhole flowmeter surveys;

[5] The option agreements for the Project participants contemplate that the Project participants may elect to extend the term of the Project beyond the 50-year term. If such an election were made, new purchase agreements would be required and full environmental review would be developed prior to consideration and potential approval of an extended term, which would include the development of a new management plan. The new plan would be subject to discretionary review by the County under its Desert Groundwater Management Ordinance and pursuant to any surviving provisions of the MOU **and Chapter 7 of this Management Plan**.

- Gamma-ray and dual induction electric logs;
- Nephelometers for dust monitoring; and
- Weather stations.

The Management Plan establishes a process for scientific review of the observations and data obtained from monitoring features and facilities, and sets forth action criteria, and if appropriate, corrective measures to be taken if an action criterion is or may be triggered. The Management Plan has taken a conservative approach in its action criteria and potential corrective measures in the following areas:

- Local springs;
- Third-party wells;
- Land subsidence;
- Induced flow of lower-quality water from Bristol and Cadiz Dry Lakes;
- Brine resources underlying Bristol and Cadiz Dry Lakes;
- Air quality;
- **Project area vegetation**; and
- Adjacent groundwater basins, including the Colorado River and its tributary sources of water.

This Management Plan includes measures that are also required by the California Environmental Quality Act (CEQA) as mitigation for potential Project impacts, as well as additional Project design features to monitor and verify Project operations and predicted effects and confirm protection of critical resources. These additional Project design features are not required under CEQA but, for the avoidance of doubt and to satisfy the County's Ordinance, they have been included to provide a comprehensive monitoring program for the groundwater basin and all critical resources within the watershed.

The Project will be carried out as a public-private partnership between SMWD and Cadiz. While the lands and water rights to be used for the Project are owned by Cadiz, SMWD will be responsible for management and control of Project operations and will act as the approving authority for the design and construction of the Project. The Project will be operated by FVMWC (all the memberships of which will be owned by

SMWD and the other Project participants) under the management and supervision of SMWD through a Joint Powers Authority (JPA) formed initially between FVMWC and SMWD. Through the JPA, FVMWC and SMWD will lease to own all Project facilities and control and operate the Project during its entire duration. As a mutual water company, FVMWC will be controlled by the Project participants, with SMWD being the lead participant, during both the Project development and operations periods. While SMWD and FVMWC will carry out the Project through the JPA, this Management Plan sets forth how the County will participate in the Project to ensure that groundwater resources within the County's jurisdiction are appropriately managed.

As set forth in the MOU, compliance with this Management Plan shall be overseen and enforced by the County. SMWD is the Project's Lead Agency with responsibility for mitigation of Project impacts pursuant to the Project's EIR and Public Resources Code section 21081.6. SMWD shall enforce, as a condition of Project approval, the implementation of all adopted mitigation measures, including those measures which correspond to provisions of the Management Plan. In recognition of the County's regulatory role in enforcing the Desert Groundwater Management Ordinance, SMWD shall share with the County enforcement responsibilities with regard to those impact areas and mitigations in the EIR's Mitigation Monitoring and Reporting Program (MMRP) that fall within the County's jurisdiction pursuant to the MOU and Ordinance. SMWD will, pursuant to CEQA Guideline section 15097(a), delegate the reporting and monitoring responsibilities for those mitigation measures to the County. SMWD shall be responsible for reviewing and considering the County's on-going determination of compliance with those mitigation measures, which are also provisions of this Management Plan, in assessing compliance with the MMRP and with conditions of Project approval. A Technical Review Panel (TRP) will be created to assist in evaluating monitoring protocols and methods of data collection and processing, water quality, the rate of decline in the groundwater elevations, monitoring the level of the water table in the Cadiz well-field in relation to an established safe floor, and the Project's potential to cause Undesirable Results, as defined in the MOU. The TRP may make recommendations to the County or the County may request recommendations from the TRP that require additional monitoring, mitigation, and modification to Project operations as set forth in Chapter 8.

SMWD as lead agency and the County, pursuant to Paragraph 3(d) of the 2012 MOU, will retain full authority and discretion to modify Project operations (including but not limited to the institution of corrective actions or the curtailment or cessation of Project-related groundwater pumping) as necessary to avoid Overdraft or Undesirable Results as such terms are defined in the MOU. This Management Plan and the work to be performed and liabilities that may be incurred under this

Management Plan create no vested rights, express or implied, in Cadiz, SMWD, or any other party to produce groundwater from the Project at a quantity or rate of pumping that results in Overdraft as the term is defined in the MOU and the County shall not be liable for damages to Cadiz, SMWD, or any other party resulting from its enforcement of the terms and conditions of this Management Plan.

The Management Plan requires that all technical data be made available to the public in the form of annual reports reviewed and maintained by the County, and it also calls for periodic water resources model refinements and incremental five-year projections of the physical impacts of Project operations to be set forth in periodic reports, together with any recommendations for Project improvements.

CHAPTER 1
INTRODUCTION AND BACKGROUND

1.1 The Cadiz Valley Water Conservation, Recovery, and Storage Project

This Groundwater Management, Monitoring and Mitigation Plan (Management Plan) is an integral part of the oversight of the Cadiz Valley Groundwater Conservation, Recovery, and Storage Project (Project). The Project is a water conservation supply and potential conjunctive use storage project undertaken by SMWD, in collaboration with Cadiz, that would make optimal use of the groundwater resources within the collective Fenner, Orange Blossom Wash, Bristol, and Cadiz Watersheds in the Eastern Mojave Desert, without displacing other beneficial uses (see Figure 1-1). The Project will develop a new water supply from the surplus waters of the Watersheds and enable the use of groundwater storage for future banking with participating water agencies as described herein.

The first phase of the Project, which is referred to herein as the "Conservation Component," would extract and convey groundwater at an initial average rate of up to 50,000 acre-feet per year (afy) from a wellfield in the area within and south/southwest of Fenner Gap via pipeline to the Colorado River Aqueduct (CRA). The 50,000 afy of extraction will make use of the long-term average annual natural recharge from the Fenner and Orange Blossom Wash Watersheds. Groundwater extraction will strategically lower groundwater levels within the immediate vicinity of the Project wellfield to intercept natural recharge and retrieve groundwater already held in storage beneath and downgradient of the wellfield before it can evaporate from the Dry Lakes, as discussed below.

Project production and the Cadiz agricultural operations exceed the average rate of 50,000 afy **as measured over any 10-year period**.

This Management Plan is designed to prevent significant adverse impacts to critical resources and **to avoid** Undesirable Results by collecting data and determining if observed changes in groundwater levels, groundwater quality, and land subsidence are consistent with changes projected in groundwater modeling, as described in this Management Plan and references cited herein. Critical resources identified in this Management Plan are as follows:

- The basin aquifers tapped by the Project;
- Springs within the Fenner Watershed, including springs of the Mojave National Preserve and BLM-managed lands;
- Brine resources of Bristol and Cadiz Dry Lakes;
- Air quality in the Mojave Desert region;
- Project area vegetation; and
- Adjacent groundwater basins, including the Colorado River and its tributary sources of water.[6]

This Management Plan establishes a comprehensive network of monitoring and data collection facilities combined with procedures for comprehensive scientific review of all actions and decisions. The Management Plan includes action criteria prior to the occurrence of adverse impacts on critical resources resulting from Project operations. Implementation of specific corrective actions are meant to ensure that the adverse effects to critical resources are avoided or reduced to below specific objective standards designed to safeguard the critical resources. For example, third-party well owners can participate in a monitoring program that will trigger corrective action (e.g., provision of replacement water) if static groundwater levels in their wells drop due to Project operations. Third-party well owners not participating in the monitoring program can trigger corrective action by providing a written complaint to FVMWC. See Chapter 6 for full details of the action criteria and corrective measures. For several critical

[6] As explained in Chapter 2 of this Management Plan, technical analysis to date concludes that there is no hydrogeologic connection between groundwater that would be extracted by the Project, and groundwater supplies to the northeast within watersheds that are tributary to the Colorado River. Nonetheless, this Management Plan proposes the monitoring of groundwater levels in the adjacent Piute Watershed, which is tributary to the Colorado River.

resources, including local springs, air quality, and the groundwater resources of neighboring basins, the Management Plan provides for monitoring of such critical resources even though technical research and available scientific data demonstrate that the Project is not anticipated to impact these critical resources. The monitoring is being undertaken to comport with the County's Ordinance and the recommendations of the Groundwater Stewardship Committee, a multi-disciplinary panel of earth science and water professionals assembled by Cadiz and SMWD to provide advice and comment on the Project (see Appendix A Groundwater Stewardship Committee, Current Summary of Findings and Recommendations, Cadiz Valley Groundwater Conservation, Recovery, and Storage Project).

This Management Plan mandates specific action criteria (triggering levels) for impacts to critical resources and specified responses if an action criterion is reached. It establishes a defined process for scientific and objective review of groundwater management and a decision-making process to protect critical resources. Refinements to this Management Plan may occur during the life of the Project as more data and understanding becomes available. Such refinements will be developed in consultation with the TRP and subject to County and SMWD review and approval. Management Plan reports will be of public record. This Management Plan is intended to comply with the County's Guidelines for Preparation of a Groundwater Monitoring Plan and its Desert Groundwater Ordinance, which provides, in part, that installation of groundwater extraction wells may be excluded from the Ordinance's permitting provisions if the Project is subject to an enforceable agreement with the County and will be managed consistent with a County-approved groundwater management plan (San Bernardino County Code §33.06552).

The Project will be comprised of three time periods: a pre-operational period, an operational period of 50 years, and a post-operational/closure period that will span a minimum of 10 years, subject to review ~~and a potential extension~~ by the TRP, FVMWC, SMWD, and the County **and as necessary to address any potential effects of the Project during the post-operational period**. The pre-operational phase will commence upon start of construction and will last a minimum of 12 months. Cadiz will complete and deliver all needed permits for monitoring facilities prior to the pre-operational phase. Cadiz will construct all facilities that are agreed to in this Management Plan and for which permits have been received.

This Management Plan and the MOU are not subject to extension by the parties. At the end of the Project's operational life, however, Cadiz, FVMWC, and SMWD may seek a new authorization from the County for the extraction and conveyance of groundwater from the aquifer. Any new authorization will be subject to County review and approval

of Project approval. SMWD will, pursuant to CEQA Guideline section 15097(a), delegate to the County the reporting and monitoring responsibilities for those mitigation measures and conditions of approval that are subject to County jurisdiction under its Ordinance and the MOU. SMWD shall review and consider the County's on-going determination of compliance with those mitigation measures which are also provisions of the Management Plan in assessing compliance with the Mitigation Monitoring and Reporting Program and with the conditions of Project approval.

1.4.2 *Cadiz Inc.*

Founded in 1983, Cadiz Inc. (Cadiz) is a renewable resources company based in Los Angeles. Using integrated satellite imagery and geological, geophysical, and geochemical survey methods, the company has identified and acquired 34,000 acres of land in Cadiz Valley situated over a large, naturally recharging basin. Cadiz's goal is for this basin to provide a high-quality, reliable water supply to Southern Californians, as well as much-needed underground storage for surplus water, all without causing material adverse impacts to the local environment.

1.4.3 *County of San Bernardino*

The proposed Project lies within the unincorporated desert area of eastern San Bernardino County, where groundwater production is regulated under the County's Desert Groundwater Management Ordinance (Ordinance) (San Bernardino Code §§ 33.06551 *et seq*.). A project may qualify for exclusion from the Ordinance's permitting procedures where the operator has developed a groundwater management, monitoring and mitigation plan approved by the County that is consistent with guidelines developed by the County[7] and the County and the operator have executed a memorandum of understanding that complies with the provisions of the Ordinance (San Bernardino Code §33.06552(b)(1)). This Management Plan and the MOU amongst FVMWC, SMWD, the County, and Cadiz together are designed to serve as the Project's compliance with the County Groundwater Management Ordinance and ensure the Project is operated to avoid significant adverse impacts to critical resources and Undesirable Results. Because approval of the Management Plan is necessary to qualify the Project for exclusion from the Ordinance and is a discretionary action, Santa

[7] This Groundwater Management Plan has been prepared to satisfy the County's Guidelines for Preparation of a Groundwater Monitoring Plan, which were last revised in June 2000. ~~The~~**This** Groundwater ~~Monitoring~~**Management** Plan**, for example,** includes methods and procedures to measure groundwater production, groundwater levels, water quality**,** and potential land subsidence (see County Guidelines for Preparation of a Groundwater Monitoring Plan, § 1.1).

- Reduce dependence on imported water by utilizing a source of water that is not dependent upon surface water resources from the Colorado River or the Sacramento-San Joaquin Delta;
- Enhance dry-year water supply reliability within SMWD and other Southern California water provider Project participants;
- Enhance water supply opportunities and delivery flexibility for SMWD and other participating water providers through the provision of carry-over storage and, for Phase II, imported water storage;
- Support operational water needs of the ARZC in the Project area;
- Create additional water storage capacity in Southern California to enhance water supply reliability;
- Locate and design the Project in a manner that minimizes significant environmental effects and provides for sustainable operations.

1.7 Existing Groundwater Management

Cadiz owns 34,000 acres of largely contiguous land in the Cadiz and Fenner Valleys of eastern San Bernardino County, where it has farmed successfully for more than 15 years, as shown in Figure 1-3. Approximately 1,600 acres of this land has been cultivated for citrus and stone fruit orchards, vineyards, and specialty row crops.

In 1993, San Bernardino County certified ~~a Final~~an Environmental Impact Report (~~FEIR~~EIR), and granted various land use approvals for expansion of agricultural operations up to 9,600 acres on this property~~. As a component of this approval~~ **(referred to as the Cadiz Agricultural Program). The 1993 EIR indicated that there was, at the time, up to 1,440 acres in cultivation and that the Program would expand agricultural production in phases over a 10- to 15-year period at a rate of approximately one section (640 acres) per year. The Agricultural Program contemplated groundwater withdrawals to reach a maximum of 30,000 afy within a 40-year production period, ending in 2030. The 1993 approvals also required Cadiz to comply with a Mitigation Monitoring Program (MMP) to address the potentially significant impacts of the Agricultural Program on the environment, including groundwater resources.**

As a component of the earlier approvals, the County identified specific groundwater monitoring activities to be undertaken by Cadiz. To comply with these monitoring requirements, **Cadiz developed** the Cadiz Valley Agricultural Development Ground

Water Monitoring Plan (GWMP) ~~was developed in cooperation with San Bernardino County to monitor all potential environmental impacts that could result from the agricultural irrigation. The GWMP governs~~**to monitor** water use, storage, and extraction ~~for~~**under** the **proposed** agricultural operations ~~and ensures~~**. The GWMP and MMP together were meant to ensure** that Project operations and future irrigation under the Cadiz Valley agricultural development ~~will~~**would** be conducted without adverse impacts to critical resources.

In 2002, the County and Cadiz entered a Memorandum of Understanding (MOU) which granted Cadiz an exclusion from the County's newly enacted Desert Groundwater Management Ordinance for implementation of the Cadiz Agricultural Program. The 2002 MOU required Cadiz to implement and comply with the Agricultural Program MMP and GWMP. While Cadiz may continue production of groundwater to irrigate agriculture within the Project area, ~~such agricultural irrigation will be commensurately~~**the County in its consideration of this Management Plan is expected to adopt the following conditions of approval: 1) production under the Agricultural Program shall remain subject to the Agricultural Program MMP and GWMP, 2) agricultural production cannot exceed 30,000 afy, and 3) will be** phased out ~~as~~**by 2030. Groundwater** production ~~by the Project increases to ensure that the initial average extraction rate of 50,000 afy is not exceeded~~**that occurs after 2030 for agricultural purposes will be conducted under this Management Plan or a separate approval secured pursuant to the County's Desert Groundwater Management Ordinance**. In addition, FVMWC shall ensure proper closure of any agricultural wells that will be taken out of production or ~~use~~**used** with the new Project. Regardless of any phasing, the average annual extraction over the 50 years of Project operations will ~~be no greater than~~**not exceed** 50,000 afy from all **combined** Cadiz **Agricultural Program** and Project pumping.

1.8 Purpose and Scope of Management Plan

The Management Plan is prepared to comply with the County Desert Groundwater Management Ordinance and the MOU by and between SMWD, FVMWC, Cadiz, and the County. The Management Plan requires monitoring of aquifer health and safe yield, groundwater levels, groundwater quality, subsidence, surface vegetation, air quality, third-party wells, and springs and to address, through corrective measures, potential significant adverse impacts to critical resources and Undesirable Results attributable to the Project. The Management Plan sets forth the plan of action to optimally manage groundwater resources, monitor and mitigate physical effects of the Project, and ensures that Project operations will be conducted without significant adverse impacts to critical resources.

Woman Mountains, Ship Mountains, Clipper Mountains, Wood Mountains, and Hackberry Mountains (CH2M Hill, July 2010).

Most of the precipitation in the Eastern Mojave Desert accumulates during the winter months from November through March. Early summer and late fall are typically periods of little rainfall. The amount of precipitation in the Bristol, Cadiz, and Fenner Watersheds vary with differences in altitude. Average annual precipitation ranges from approximately 3 inches on the Cadiz and Bristol Dry Lakes (elevations of 545 to 595 ft amsl) to over 12 inches in the Providence and New York mountains (elevations over 7,000 ft amsl). However, most of the larger watershed area receives, on the average, 4 to 6 inches of rain annually (Geoscience, September 2011). A conceptualized model of groundwater recharge in the area is shown in Figure 2-~~1.~~**13.**

2.4 Hydrogeology

Based on available geologic and geophysical data, the principal geologic deposits in the Project area that can store and transmit groundwater (i.e., aquifers) can be divided into three units: an upper alluvial aquifer, a lower alluvial aquifer, and a bedrock aquifer consisting of Tertiary fanglomerate, Paleozoic carbonates, and fractured and faulted granitic rock. In general, these three units are in hydraulic continuity with each other and the separation is primarily due to stratigraphic differences (Geoscience, September 2011).

The alluvial aquifer system consists mainly of Quaternary alluvial sediments which consist of stream-deposited sand and gravel with lesser amounts of silt. The thickness of the alluvial aquifer varies between 200 and 800 feet. To the west of Fenner Gap, the upper aquifer is separated from the lower aquifer system by discontinuous layers of silt and clay. The average thickness of the upper aquifer in Fenner Gap is approximately 500 feet. The upper aquifer is very permeable in places and can yield 3,000 gallons per minute (gpm) or more to wells with less than 20 feet of drawdown (Geoscience, September 2011).

The lower alluvial aquifer consists of older sediments, including interbedded sand, gravel, silt, and clay. The maximum thickness of the lower aquifer is unknown but may reach over 6,000 feet in the vicinity of Bristol Dry Lake. Where these materials extend below the water table, they yield water freely to wells but are generally less permeable than the upper aquifer sediments. The Cadiz agricultural wells are screened primarily in the lower alluvial aquifer and typically yield 1,000 to 2,000 gpm (Geoscience, September 2011).

Table 3-1: Summary of Net Savings from Proposed Project Production (Average 50,000 afy/50 Years)

Natural Recharge	Time	Cumulative Reduction of Evaporative Losses [acre-feet]	Cumulative Depletion of Storage [acre-feet]	Fresh Groundwater Storage Impacted by Saline Migrations [acre-feet]	Cumulative Net Water Saving[8] from Project [acre-feet]
32,000 acre-ft/yr	At the End of 100 Years	2,210,000	220,000	173,000	~~1,871,000~~1,817,000
	At the End of 50 years	1,360,000	1,090,000	177,000	~~93,0000~~93,000
16,000 acre-ft/yr	At the End of 100 Years	1,544,000	870,000	215,000	459,000
	At the End of 50 Years	745,000	1,684,000	175,000	-1,114,000
5,000 acre-ft/yr	At the End of 100 Years	470,000	1,870,000	183,000	-1,583,000
	At the End of 50 Years	221,000	2,155,000	126,000	-2,060,000

By lowering groundwater levels in the alluvial aquifers, the Project will also create space in the Sub-Basin to store imported water as part of the potential future water banking project use that may occur for the second phase of the Project. In sum, the Project will capture natural recharge, optimize conservation by retrieving groundwater presently in storage before it can evaporate, allow for the carryover of native water in storage, and set the stage of a new water bank storage opportunity that does not presently exist. As explained below in Chapters 5 and 6, this Management Plan

Net water savings is derived from subtracting depletion of storage and amount of freshwater storage impaired by migration of saline water from the reduction of evaporative losses. The 100-year time frame assumes no Project pumping during years 51 through 100. **Calculations of projected conservation benefits are reduced if pumping is expected to occur during years 51 through 100.**

provides for comprehensive monitoring of potential significant adverse impacts to critical resources, together with a series of action criteria and potential corrective measures, to ensure that the Project does not cause significant adverse environmental impacts to critical resources or Undesirable Results.

CHAPTER 4
ASSESSMENTS OF POTENTIAL SIGNIFICANT ADVERSE IMPACTS TO CRITICAL RESOURCES IN OR ADJACENT TO THE PROJECT AREA

As discussed above, the objectives of this Management Plan are to ensure compliance with the County Groundwater Management Ordinance and MOU and avoid material adverse impacts to critical resources or Undesirable Results. This Management Plan addresses the following critical resources:

- The basin aquifers tapped by the Project;
- Brine resources of Bristol and Cadiz Dry Lakes;
- Springs within the Fenner Watershed including springs of the Mojave National Preserve and BLM-managed lands;
- Air quality in the Mojave Desert region;
- Project area vegetation; and
- Adjacent groundwater basins, including the Colorado River and its tributary sources of water.

This chapter takes a conservative approach in its technical analysis of the potential adverse impacts to these critical resources as a result of the Project operations.

4.1 Potential Significant Adverse Impacts to Critical Resources Related to Basin Aquifers

For the purposes of this Management Plan, the basin aquifers include aquifers of the Fenner, Bristol, and Cadiz Watersheds as described in Section 2.4. However, emphasis is placed on the aquifers in the vicinity of the northern Bristol/Cadiz Sub-Basin and Fenner Valley Watershed along with any aquifers that extend toward the Bristol and Cadiz Dry Lakes where analysis has shown that Project operations may have an effect. Potential ~~significant adverse~~ impacts to critical resources ~~within this area~~**or Undesirable Results** include:

- ~~Decline of~~**Progressive decline in** groundwater levels and ~~storage that impairs identified critical resources or manifests other Undesirable Results~~**freshwater storage below the floor established in Section 6.9 of this Management Plan**;

- Impacts to wells owned by neighboring landowners (including wells operated in the larger Fenner Watershed area) due to Project operations;

- Land subsidence and loss of groundwater storage capacity due to groundwater withdrawal; and

- Induced flow of lower quality water from Bristol and Cadiz Dry Lakes.

Water resources models were developed and applied to assess these potential impacts. The specific models and their application are described below in Sections ~~4.1.1~~**4.1.1.1** and ~~4.1.2.~~**4.1.1.2.**

4.1.1 *Water Resources Modeling*

Water resources models developed during the pre-operational phase of the Project have been, and are planned to be, used to simulate the impacts of planned Project operations. These models include the INFIL3.0 soil-moisture budget model, MODFLOW-2000/MT3D groundwater flow and solute transport model, and SEAWAT-2000 model (note that selection of models may change subject to concurrence with the TRP, SMWD, and the County based on either updates to these models or availability of comparable models). The results of simulations using these models have been used to assess potential impacts during Project operations. Results of these simulations are used to identify monitoring features and conditions to be monitored and locations and frequency of monitoring during Project operations in order to verify these model projections. During Project operations, the results of monitoring will be used to evaluate whether any action criteria are triggered and to verify simulations. Evaluation of monitoring results could result in refinements to action criteria as well as identifying areas where collection of additional data may be needed to improve the monitoring network and accuracy of simulations. Any refinements to models that monitoring data indicate may be needed will be made in accordance with the decision-making process described in Chapters 6 and 8. The specific attributes of, and simulation results from, each of the models is discussed next.

4.1.1.1 INFIL3.0

INFIL3.0 is a grid-based, distributed–parameter, deterministic water-balance watershed model, released for public use by the USGS in 2008, which is used to estimate the areal and temporal net infiltration of precipitation below the root zone (USGS, 2008). This model was used to estimate potential recoverable water for the Project. The model is based on earlier versions of INFIL code that were developed by the USGS in cooperation with the Department of Energy to estimate net infiltration and groundwater recharge at the Yucca Mountain high-level nuclear-waste repository site in Nevada. Net infiltration is the downward movement of water that escapes below the root zone, is no longer affected by evapotranspiration, and is capable of percolating to and recharging groundwater. Net infiltration may originate as three sources: rainfall, snow melt, and surface water runon (runoff and streamflow). Application of INFIL3.0 to the Fenner and Orange Blossom Wash Watersheds produced long-term average annual natural recharge estimates of approximately 32,000 afy.

This model will be updated and refined during Project operations based on data obtained from the monitoring features.

4.1.1.2 MODFLOW-2000/MT3D - Groundwater Flow and Transport Model

Geoscience Support Services, Inc. (Geoscience) developed a numerical groundwater flow and solute transport simulation of a large portion of the larger watershed area, utilizing MODFLOW2000 and MT3D. This model provides the basis for developing the variable density model described in the next section. This model, along with other identified models in Section ~~4.1.1,~~**4.1.1.1,** will be updated and refined during Project operations based on monitoring data, and the monitoring network and action criteria refined during the Project. MODFLOW-2000 is a modular finite-difference flow model developed by the USGS to solve the groundwater flow equation.

The numerical groundwater flow and solute transport model was developed based on a conceptual model developed during the pre-operations stage incorporating the area of interest, aquifer systems, and boundary conditions. This conceptual model of hydrogeology and groundwater flow conditions in the larger watershed area will be further refined based upon a thorough analysis of the available hydrogeologic data for the modeled area, as additional information is collected from installation of the monitoring wells and extraction wells, and as monitoring data are compiled during the operations stage. The groundwater flow model will integrate quantities and distribution of recharge and discharge estimated from updates to INFIL3.0 and Project extractions. INFIL3.0 was released for public use by USGS in 2008.

between the layers. The model accounted for both natural and artificial recharge, as well as discharge via evaporation at the Dry Lakes and agricultural pumping. Geoscience applied the industry standard "history matching" technique to both steady state and transient calibration. For each calibration run, the relative error was 0.15 percent for the steady-state model and 1.7 percent for the transient model, both well below the recommended relative error of 10 percent.

Geoscience simulated three recharge scenarios, including 5,000 afy, 16,000 afy, and 32,000 afy to assess effects on groundwater levels, the movement of the freshwater/saltwater interface near the Dry Lakes, and land subsidence. The 32,000 afy recharge scenario is based on USGS INFIL3.0 modeling of the soil-moisture water budget for the Fenner and Orange Blossom Wash Watershed areas. Geoscience simulated this large range in long-term average annual recharge by reducing the projected recharge by 50 percent (16,000 afy) and then to an amount that is generally equivalent to Cadiz historical agricultural pumping (5,000 afy) in order to increase the conservatism of the analysis (identify potential worst-case impacts).

After the model was calibrated, Geoscience simulated 100-year predictive runs for each of the three ranges of recharge scenarios, including 32,000 afy, 16,000 afy, and 5,000 afy. The Project Scenario assumed 32,000 afy of natural recharge and a Project wellfield clustered around Fenner Gap (Configuration A). The 32,000 afy recharge scenario was based on USGS INFIL3.0 modeling of the soil-moisture water budget for the Fenner and Orange Blossom Wash Watersheds. The two Sensitivity Scenarios, which assumed less natural recharge and a Project wellfield spread out from the Fenner Gap (Configuration B), allowed Geoscience to evaluate the potential range of worst-case impacts on groundwater levels, migration of the saline-freshwater interface, and subsidence.[9] Configuration A was utilized for the Project Scenario to account for higher transmissivity values allowing for use of fewer high capacity wells installed in the carbonate aquifer with less drawdown than comparable wells in the alluvial aquifer. Configuration B was used under the two Sensitivity Scenarios due to lower transmissivity values and the corresponding need for a greater number of wells spread out over the wellfield to limit drawdown. The model scenarios and assumptions used in each are summarized in Table 4-1.

[9] The Project is intended to pump an average of 50,000 AFY for 50 years. The Sensitivity Scenarios, however, were used to evaluate potential environmental impacts of the Project under CEQA and are not an authorization of any specific operating scenario that would cause Overdraft or Undesirable Results as the terms are defined in this Management Plan. This Management Plan in some respects involves stricter operating parameters as a precaution against Overdraft and Undesirable Results.

higher shrub zone was the region with higher vegetation activity that appeared to have the highest potential for connection of vegetation to groundwater. (*Id.*)

The HydroBio study explains that there are three shrub species that grow around the Bristol Playa: creosote bush [Larrea tridentata], cattle saltbush [Atriplex polycarpa] and four-wing saltbush [Atriplex canescens]. Of these, the only species that may act as a phreatophyte (a plant species that uses groundwater), is the four-wing saltbush, and this species is specifically a facultative phreatophyte, meaning it can benefit from but does not require shallow groundwater. (*Id.*) To determine whether any of the four-wing salt brush in the area are presently accessing groundwater, HydroBio reconstructed a curve for depth to water (DTW) versus elevation based on hydrographic data collected in the region of the Cadiz Ranch. A DTW point was added on the Bristol Playa that was reconstructed using photogrammetry. The study found that together, these points describe a highly linear relationship of DTW versus elevation above sea level (r2 = 99.9%). (*Id.*) Based on the robust and accurate relationship of the DTW curve, HydroBio estimated the DTW at the lowermost edge of the higher vegetation cover – the location most likely to have a vegetation/groundwater connection was 65 feet. Root excavations of four-wing saltbush have been measured to reach a maximum of 25 feet on only rare occasions when soils and hydrology permit, while typical root depths for the species average about 13 feet. Thus, based on measured and estimated DTW, the HydroBio study concluded that the shallowest water table position is 40 feet below the record rooting depth for the four-wing salt brush – the only species that could be potentially affected by groundwater decline. HydroBio therefore concluded that there is no connection of vegetation to groundwater in the Project area. (*Id.*) HydroBio further hypothesized that the promotional effect of periodic surface flows from the upstream catchments is the reason for the apparent promotion of this vegetation. (*Id.*) **For these reasons, the EIR and HydroBio study concluded that the Project is not anticipated to have any material effect on surface vegetation in the Project area. Nonetheless, consistent with the County's anticipated conditions under its Ordinance and as discussed in Chapters 5 and 6, this Management Plan provides for monitoring to confirm these technical conclusions and corrective actions if necessary.**

4.6 Potential Significant Adverse Impacts to Critical Resources: the Colorado River and its Tributary Sources of Water

It is assumed that the groundwater that would be extracted by the Project at the Fenner Gap is not tributary to the Colorado River because the aquifer systems within the Fenner, Bristol and Cadiz Watersheds are believed to be a closed basin, isolated from aquifer systems to the east that are tributary to the Colorado River by bedrock and groundwater divides. It is important to ensure that the Project groundwater is not

This Management Plan will be implemented with a set of monitoring features and parameters as discussed in this Chapter 5. The term "feature" refers to any fixed object, either natural or man-made, from which data will be collected. Man-made features include wells from which water level measurements and water quality samples could be retrieved, weather stations, bench marks, etc. A detailed list of monitoring features is given in this Chapter 5. As new data become available during Project operations, these monitoring features, monitored parameters, and monitoring frequency may be refined to protect critical resources in and adjacent to the Project area. Refinements to monitoring features will be made in accordance with the decision-making process described in Chapters 6 and 8.

A total of ~~twelve~~**thirteen** different types of monitoring features have been identified for assessing potential impacts to critical resources during the term of the Project, as identified in Chapter 4. A summary of these ~~twelve~~**thirteen** types of monitoring features, as well as monitoring frequencies and parameters to be monitored, is provided in Tables 5-1 and 5-2. Locations are shown in Figures 5-1 and 5-2.

Installation of certain monitoring features, where construction of facilities is required, will be subject to site-specific approval and permitting by applicable regulatory agencies. Cadiz will complete and deliver all needed permits for monitoring facilities as soon as practicable prior to the 12-month pre-operational phase. Cadiz will construct all facilities that are agreed to in this Management Plan and for which permits have been received. Construction of these facilities will be completed within one year of receipt of permits. If the implementation of monitoring features currently contained in this Management Plan is not approved, Cadiz will evaluate and implement alternate monitoring sites subject to approval by SMWD and the County and the applicable regulatory agencies.

The following text describes in detail the various proposed monitoring features.

5.1 Springs (Feature 1)

An inventory of 28 known springs within the Fenner Watershed was completed by the USGS (USGS, 1984). Locations of these springs are shown on Figure 5-3. As discussed in detail in Chapter 4, the potential significant adverse impacts to these critical spring resources has been evaluated. It is not anticipated that the Project will have any impact on the springs. Nonetheless, this Management Plan provides for quarterly monitoring of the Bonanza Spring as an "indicator spring" because it is the spring that is in closest proximity to the Project wellfield (approximately 11 miles from the center of Fenner

Gap), and, of all springs within the Fenner Watershed, this one would be the first one to be affected by the Project, if it were somehow possible to be in hydraulic connection with the alluvial aquifers, which appears unlikely. The Whiskey and Vontrigger Springs, which are located beyond the Project's projected effects on groundwater levels in the alluvial aquifers of the Fenner Watershed, will also be monitored quarterly to compare variations in spring flow from those springs to variations in spring flow from the Bonanza Spring to assist in determining whether any material reduction of flow at the Bonanza Spring is attributable to the Project operation, or instead, is attributable to regional climate conditions.

The springs will be monitored on a quarterly basis by visual observations and flow measurements **described in more detail in Section 6.7.2, below**. Visual observations will include starting and ending points of observed ponded or flowing water, estimated depth of ponded water and flow rate of flowing water, conductivity, pH and temperature of water, any colorations of water, and general type and extent of adjacent vegetation.

5.2 Observation Wells (~~Features~~Feature 2)

A total of 14 existing observation wells and 2 new observation wells will be used to monitor groundwater levels during the Project (see Tables 5-1 and 5-2). Locations of these wells are shown on Figures 5-1 and 5-2. ~~Five~~**Six** of these wells were installed in the 1960's by Southern California Edison as part of a regional investigation (wells whose designation begins with "SCE"). Four of the observation wells (Labor Camp, Dormitory, 6/15-29, 6/15-1) are owned and monitored by Cadiz as part of their agricultural operation. Existing well CI-3 was installed in Fenner Gap during the pilot spreading basin test for the Project. Existing wells at Essex, Fenner, Goffs, and Archer Siding #1 are related to railroad operations or municipal supply. All of these existing wells will be **inspected to assess their ability to be** utilized as observation wells, provided that appropriate permission and approval is obtained. **If they are not in a condition to be utilized as observation wells, replacement wells will be constructed in the vicinity of each well deemed unusable.**

One new well, Piute-1, will be installed in the Piute Watershed, north of the Fenner Watershed, and is tributary to the Colorado River. This well will be installed on property owned by Cadiz and will be used as a "background" monitoring well to monitor undisturbed groundwater levels in an adjacent watershed, to provide information on groundwater level variations due to climatic changes only. In addition, this will serve to demonstrate that the Project will not impact groundwater that is tributary to the Colorado River.

Another new well, Danby-1, will be installed in the Danby Watershed to the east. Similar to Piute-1, this Danby-1 observation well will be used to demonstrate that impacts on groundwater levels do not extend beyond the Cadiz Watershed on the west. This well will also provide information on regional groundwater level conditions and is expected to provide additional background monitoring and information concerning groundwater level changes that may be due to climatic variations as well.

In addition to the observation wells, ~~five additional~~**new monitoring facilities, each composed of** well clusters will be located between Cadiz and Bristol Dry Lakes on the freshwater side of the saline-freshwater interface to monitor the potential migration of saline water in an area in which historical data on subsurface conditions is limited and a greater degree of certainty on geologic conditions and saline water migration is necessary. These new well clusters are set forth in Features ~~3~~**3, 8** and 9 and are depicted in Figures 5-1 and 5-2 as Proposed Induced Flow and Brine Migration Cluster Wells. ~~Additional monitoring well clusters to monitor for potential saline water migration may be necessary in areas along the saline freshwater interface where there is an ability to assess whether saline water migration may exceed the action criteria presented in Section 6.~~

Groundwater levels will be measured in accordance with the monitoring procedure presented in Appendix B[9]. All water samples would be collected according to the protocol described in Appendix C. Field parameters such as groundwater temperature, pH, electrical conductivity, and total dissolved solids (TDS) will be collected at each well during well purging and prior to sampling. Samples from each well will be analyzed for the general mineral and physical parameters specified in Appendix D. In addition, all samples collected during the pre-operational phase will also be analyzed for bromide, boron, iodide barium, arsenic, hexavalent chromium, total chromium, nitrate, and perchlorate. The sample analytical protocol is presented in Appendix D.

Groundwater monitoring frequency will be revisited as determined appropriate by the decision-making process should any of the action criteria be exceeded, as discussed in Chapter 6.

5.3 Proposed Observation Well Clusters **in Project Vicinity** (Feature 3)

~~Three~~**Two** well clusters will be established in the immediate vicinity of the Project wellfield (see Figure 5-2). These cluster wells will provide a basis to compare groundwater level and water quality changes in both the shallow and deep portions of the alluvial and bedrock aquifer systems. ~~Two~~**The** well clusters~~, using~~ **will consist of**

[9] ~~These procedures are being reviewed for consistency and will be made available on October 26, 2012.~~

existing monitoring ~~well~~**wells. One well cluster will include monitoring wells** MW-7, MW-7a, and TW-1, and **the second cluster will use** TW-2 and TW-2MW**. Bother well clusters** will ~~be established~~**allow** for monitoring in the immediate vicinity of the Project. ~~The~~**Selected wells have** screened intervals ~~are~~ in **either** the upper alluvial, carbonate aquifer, and bedrock. TW-1 and MW-7 will monitor depths in the carbonate aquifer **in their clusters respectively**. ~~The other~~

In addition, three **new** Proposed Induced Flow and Brine Migration Cluster Wells will be installed ~~in~~**on** the ~~area~~**freshwater side of the interface** between Bristol Dry Lake and the Project wellfield to monitor groundwater elevations and water quality **(the locations of the wells are depicted in Figure 5-2)**. All new Project monitoring wells shall be designed, installed, and completed in manner consistent with all applicable state and local regulations and industry standards. Monitoring will occur as presented in Tables ~~5.1~~**5-1** and ~~5.2.~~**5-2.**

5.4 Project Production Wells (Feature 4)

Data from the wellfield (new Project wells and existing Cadiz agricultural wells) will be collected to provide information on the groundwater levels and discharge rates. Each well will be equipped with a flow meter to monitor well discharge and a sounding tube for obtaining groundwater level measurements. Production data from the Project wells will also be collected using totaled readings of flow at the CRA.

5.4.1 *Existing Cadiz Agricultural Wells*

The Cadiz agricultural operation owns and operates seven agricultural wells used for irrigation, which are located west and southwest of Fenner Gap (see Figure 1-3). Five of the seven Cadiz irrigation wells could be incorporated into the Project wellfield (Wells 21S, 27N, 27S, 28, and 33). The remaining two wells (21N and 22) could used as standby pumping or monitoring wells.

5.4.2 *New Production Wells*

The Project wellfield would consist of between approximately 17 and 29 additional production wells (depending on Configuration) to be located as shown on Figure 5-2. Each new well would be completed to a depth of about 1,000 feet (see Figure 5-4). This well design may be modified based on observations in the field and expectations of drawdown that may be encountered during Project operations. The total capacity of the wellfield would allow for a pumping range of 25,000 afy to 75,000 afy. All new Project production wells shall be designed, installed, and completed in manner consistent with

5.5 Land Surface Monitoring (Feature 5)

A network of approximately ~~20~~23 land survey benchmarks will be installed at the approximate locations shown on Figure 5-2 to monitor changes in land surface elevation should they occur. Horizontal and vertical accuracy will be established in accordance with a second order Class I survey standard (1:50,000). Each benchmark will be established and surveyed by a California licensed land surveyor. All locations will be dependent upon permitting from the appropriate agencies. Benchmark surveys will be conducted on an annual basis during the term of the Project (see Table 5-1).

Pre-operational baseline Interferometric Synthetic Aperture Radar (InSAR) will be used to evaluate potential impacts in conjunction with the benchmarks. Cadiz will obtain surveyed baseline land surface elevations which then will be compared to each other along with any InSAR data collected by FVMWC during the course of the Project. The InSAR data would be used to monitor relative changes of land surface elevation that could be related to aquifer system deformation in the Project area. This pre-operational InSAR data (collected at two separate times during the year prior to the operational phase of the Project) will complement the land survey data to establish changes in land surface elevations. During the operational phase, annual benchmark surveys will be conducted and InSAR images will be obtained and evaluated every 5 years to evaluate potential impacts. During the post-operational phase, InSAR data and benchmark survey will be obtained every 5 years (Table 5-1).

5.6 Extensometers (Feature 6)

To evaluate potential impacts during the operational phase, FVMWC will construct three extensometers in the area of the highest probability of subsidence (see Figure 5-2). One extensometer will be located north of existing Cadiz agricultural supply well 21S. Another extensometer will be located at the eastern margin of Bristol Dry Lake near the location of a planned monitoring well cluster described in Section ~~5.9~~5.8 below. Another extensometer will be located near well ~~PW~~TW-~~1~~2 within the wellfield. The extensometers will be constructed to continuously measure non-recoverable compaction of fine-grained materials interbedded within the alluvial aquifer systems.

5.7 Flowmeter Surveys (Feature 7)

Downhole static and dynamic flowmeter surveys will be generated in five selected new extraction wells. This is expected to occur during the initial period of operation and also after 10 years to assess whether flow conditions have changed as a result of Project operations. The flowmeter surveys will provide data regarding vertical variation in

groundwater flow to the well screens. Depth-specific water quality samples will also be collected to assess vertical variation of groundwater quality in the Project wellfield area. Data will be used to help refine geohydrologic parameters regarding layer boundaries used in the groundwater models.

5.8 Proposed Observation Well Clusters At Bristol Dry Lake (Feature 8)

A total of three new observation well clusters will be installed and monitored in the vicinity of Bristol Dry Lake during the initial phases of the Project (see Table 5-1 and Figure 5-2). Two well clusters will be located along the eastern margin of Bristol Dry Lake to monitor the effects of Project operations on the movement of the saline-freshwater interface **on the saline side of the interface as shown** (see Figure 5-2). One additional well cluster will be installed on the Bristol Dry Lake playa to monitor brine levels and chemistry at different depths beneath the Dry Lake surface. This well cluster will be positioned in relation to the well clusters at the margin of the Dry Lake so as to provide optimum data for the variable density transport model.

A typical observation well cluster completion is illustrated on Figure 5-5. Screened intervals for each of the wells within each cluster will be determined from the logging of cuttings and geophysical logging of the deep borehole which will be drilled first. Each deep well will be completed with PVC or other suitable well casings and screens to allow for dual induction geophysical logging. Shallow wells will be completed with PVC or other suitable well casings and screens.

During the pre-operational phase, static groundwater levels will be monitored on a continuous basis from each well cluster using downhole pressure transducers. Project monitoring will begin immediately following well installation and development.

5.9 Proposed Observation Well Clusters At Cadiz Dry Lake (Feature 9)

At least two well clusters will be located along the northern margin of Cadiz Dry Lake to monitor the migration of the saline~~-~~ **water on the** freshwater **side of the** interface ~~between the wellfield and Cadiz Dry Lake (see Figure 5-1)~~**(proximate locations are illustrated on Figure 5-1). The final precise locations of these well clusters will be identified in consultation with the TRP and County**. The third well cluster will monitor brine levels and depth distribution of water quality on the Cadiz Dry Lake, similar in nature to Bristol Dry Lake. This well cluster will be positioned in relation to the well clusters at the margin of the Dry Lake so as to provide optimum data for the variable density transport model. During the pre-operational phase, static groundwater levels will be monitored on a continuous basis from the well clusters using downhole

transducers. Project monitoring will begin immediately following well installation and development and continue through the post-operational period (Gamma-Ray/Dual Induction Downhole Geophysical Logs (Feature 10)).

5.10 Gamma Ray/Dual Induction Logging (Feature 10)

Gamma-Ray and Dual Induction electric logs will be run for the deepest observation wells of each well cluster to be installed at the Dry Lakes (four total). These Downhole geophysical techniques allow for the measurement of groundwater electrical conductivity with depth and could be conducted in observation wells constructed of PVC casings and screens.

Gamma-Ray/Dual Induction geophysical logs will be run as a one-time measurement to be conducted during observation well cluster installation during the pre-operational phase of the Project.

5.11 ~~5.11~~ Weather Stations (Feature 11)

Data from four existing weather stations will be collected over the course of the Project (see Figures 5-1). Existing weather stations include the Mitchell Caverns weather station (located in the Providence Mountains), the Project weather station (located in Fenner Gap adjacent to the spreading basins), the Cadiz CIMIS station (operated by/for CDWR at the Cadiz Field Office), and the Amboy weather station (located near Bristol Dry Lake in the town of Amboy).

The Mitchell Caverns weather station would provide precipitation, temperature, and other climatic data for the mountain regions of the Fenner Watershed. The Fenner Gap weather station would provide climatic data in the immediate vicinity of the Project area. The Amboy and Cadiz Field Office weather stations would provide climatic data representative of the lowest area of the regional watershed. Data obtained from the weather stations will be incorporated into the water resource models described in Chapter 4, along with complementing data analysis of Feature 12.

5.12 ~~5.12~~ Air Quality Monitoring (Feature 12)

5.12.1 ~~5.12.1~~ Monitoring at Bristol and Cadiz Dry Lakes

The relationship between groundwater and the surface of Bristol and Cadiz Dry Lakes has been evaluated in a technical study conducted by HydroBio.[11] The technical study

[11] HydroBio, Fugitive Dust and Effects from Changing Water Table at Bristol and Cadiz Playas, San Bernardino, California, August 30, 2011, pg. i

compared to baseline data to evaluate whether Project operations result in a significant adverse impact to critical air quality resources.

5.13 Project Area Vegetation (Feature 13)

As discussed in Chapter 4, above, it is not anticipated that the Project will have any impact on surface vegetation. Nonetheless, this Management Plan provides for baseline and annual monitoring of surface vegetation in the Project area to verify whether any material reduction in the extent or character of vegetation is attributable to Project operations or, instead, to seasonal or regional climatic conditions.

CHAPTER 6
MONITORING AND MITIGATION OF SIGNIFICANT ADVERSE IMPACTS TO CRITICAL RESOURCES (ACTION CRITERIA, DECISION-MAKING PROCESS AND CORRECTIVE MEASURES)

This Management Plan identifies specific quantitative criteria or trends (action criteria) that will "trigger" review and corrective actions where necessary to protect critical resources or otherwise avoid Undesirable Results. When action criterion are triggered, a review of the triggering event will be conducted to determine whether the event is attributable to or exacerbated by Project operations, and if so, which specific corrective measures should be implemented to avoid adverse impacts to critical resources or Undesirable Results. It is the intent of this Management Plan to identify deviations from baseline conditions, along with deviations from groundwater model projections, at monitoring features as early as possible in order to identify and prevent the occurrence of adverse impacts to critical resources or Undesirable Results as a result of Project operations.[13] Triggering events may, in some circumstances, necessitate immediate corrective actions and subsequent review to ensure that the triggering event resulted from Project operations.

6.1 Decision-Making Process

A decision-making process has been developed which outlines the process to be followed in the event an action criterion is triggered, or when refinements to the Management Plan are considered. Potential corrective measures to be implemented, if appropriate, are identified. Critical resources and Undesirable Results, action criteria, the decision-making process, and potential corrective measures are discussed in Chapter 6 and summarized in Table 6-1.

[13] **"Project operations" in this Chapter 6 shall include groundwater pumping attributed solely to this Project or to the combined operations of this Project and the Cadiz Agricultural Program.**

The initial action criteria and corrective measures presented in this Management Plan are considered conservative. ~~FVMWC may propose refinements~~**Refinements** to the action criteria and monitoring network **may be proposed** after additional data has been accumulated ~~which indicates that the monitoring is unnecessary~~. However, any such refinement would occur in accordance with the terms of this Management Plan. If FVMWC proposes a refinement to action criteria or monitoring features, it will submit a written proposal describing the refinement along with supporting data and materials to the TRP. The TRP will then issue a recommendation concerning the proposed refinement to the County **and SMWD**, which will determine whether the refinement is warranted, based on all available technical data, all Project conditions of approval, the analysis set forth in the Project EIR, and adopted CEQA findings. Before any refinement to an action criteria or monitoring feature which is also a mitigation measure adopted by SMWD as part of its approval of the Project may occur, SMWD must first determine that substantial evidence supports a finding that the refined action criteria or monitoring feature will continue to mitigate the impact identified in the Project EIR. The County and SMWD will make a decision regarding the proposed refinement in accordance with the decision-making process presented here, and further described in Chapter 8.

Action criteria are intended to be used as predictors of potential adverse impacts to critical resources, and these criteria as applied are meant to help avoid material adverse impacts to critical resources and Undesirable Results.

The decision-making process followed in this Management Plan, if an action criterion is triggered or when the County considers refinements to the Management Plan, is described in detail as follows.

Initial Notification – 10 Business Days

If an action criterion (as defined in this Chapter 6) is triggered, FVMWC will, within ten (10) business days of the ~~trigger~~**triggering event**, inform SMWD, the County Representative (Chief Executive Officer), and the members of TRP that an action criterion has been triggered and commence the decision-making process described herein. If the action criterion threatens an immediate or irreparable injury to a critical resource or other immediate Undesirable Result, FVMWC will promptly implement appropriate corrective action(s) or the County may promptly issue an administrative ~~enforcement~~ order as set forth in Section 8.2, below.

Initial Assessment and Recommendation – 60 Calendar Days

Within sixty (60) calendar days of issuing notice that an action criterion is triggered, FVMWC will undertake a three-step assessment process. First, FVMWC will assess whether the triggering of any action criterion is attributable to Project operations. Second, for any triggering of an action criterion attributable to Project operations, FVMWC will assess whether the triggering of the action criterion constitutes a potential adverse impact. Third, for any triggering of an action criterion that is attributable to the Project and constitutes a potential adverse impact **or threatens to cause an Undesirable Result**, FVMWC will assess, recommend, and implement corrective measure(s) (including refinements in monitoring or to this Management Plan) necessary to avoid or mitigate the potential adverse impact or Undesirable Result.

FVMWC shall provide its written assessment and recommendation, along with supporting **and any conflicting** data, to SMWD, the County Representative, and the members of TRP within the sixty (60) day assessment period.

TRP Review and Recommendation – 90 Calendar Days

Upon receiving FVMWC's written assessment and recommendation, the TRP will have ninety (90) calendar days to determine whether it concurs with the assessment and recommendation (including but not limited to modifications to the monitoring network, corrective actions, etc.). During the TRP review period, the TRP may request additional data and analysis from FVMWC and will have access to all monitoring data. Within the ninety (90)-day TRP review period, the TRP will issue a written report of its review of FVMWC's assessment and recommendation, including whether it concurs with the assessment and recommendation, to the County Representative, FVMWC, and SMWD, and if it does not concur, the basis of its disagreement and any alternative recommended actions. The TRP's written report shall state whether or not the report reflects a consensus of the TRP members. If the TRP members cannot reach a consensus, the members' differing opinions and recommendations shall be set forth in the written report.

County Review and Determination

The County Representative will consider the findings and actions taken or recommended by FVMWC and the TRP, but will exercise his or her own independent judgment concerning whether the triggering of the action criterion is attributable to Project operations, whether the triggering of the action criterion involves a potential adverse impact or Undesirable Result, and to determine the appropriate corrective measure(s) necessary to avoid or mitigate the potential adverse impact or Undesirable Result. The County will issue its determination in writing to FVMWC, SMWD, and to each member of the TRP. FVMWC shall promptly comply with the determination and

instructions set forth in the County's written correspondence concerning the matter. With the exception of corrective actions necessary to address an immediate or irreparable threat of harm, the oversight, management, and enforcement actions concerning assessment, application, and refinement of action criteria and corrective measures shall be made by the County subject to the dispute resolution provisions of the MOU set forth in Chapter 8.

As lead agency for the Project, SMWD shall enforce the implementation of all adopted mitigation measures~~, including those measures which correspond to provisions of the Management Plan,~~ as conditions of Project approval. SMWD will, pursuant to CEQA Guideline section 15097(a), delegate ~~the reporting and monitoring~~**oversight** responsibilities for those mitigation measures **which correspond to provisions of the Management Plan** to the County. SMWD shall review and consider the County's ongoing determination of compliance with those mitigation measures ~~which are also provisions of the Management Plan~~ in assessing **the Project's overall** compliance with the Mitigation Monitoring and Reporting Program and ~~with~~ the **Project's** conditions of ~~Project~~ approval.

Because compliance with the Management Plan is a condition of SMWD's approval of the Project, SMWD in its discretion, will also consider the findings and actions taken or recommended by FVMWC and the TRP, and will exercise its own independent judgment concerning whether the triggering of the action criterion is attributable to Project operations, whether the triggering of the action criterion involves a potential adverse impact or Undesirable Result, and to determine the appropriate corrective measure(s) necessary to avoid or mitigate the potential adverse impact or Undesirable Result. If SMWD determines that appropriate corrective measure(s) are necessary to avoid or mitigate the potential adverse impact or Undesirable Result, but the County does not, SMWD will independently impose those corrective measures it determines necessary to avoid adverse impacts to critical resources or Undesirable Results, provided that independent enforcement by SMWD shall be subject to the same procedural requirements and remedies applicable as if the County were enforcing the Management Plan, including the dispute resolution procedure in Section 8.3.

Communications by and to FVMWC, the TRP, SMWD and the County, as provided in this chapter, shall be made by and to, respectively, a point of contact for the FVMWC designated by the FVMWC Board of Directors (FVMWC Representative), a member of the TRP designated by the TRP as its point of contact (TRP Chair), the SMWD General Manager and a point of contact for the County designated by the County (County Representative).

6.2 Third-Party Wells

It is the intent of the Project to operate without adverse material impacts to wells owned by neighboring landowners in the vicinity of the Project area, and those operated in conjunction with salt mining operations on the Bristol or Cadiz Dry Lakes. To avoid such potential impacts, the groundwater monitoring network will include monitoring wells located in and around the wellfield, near neighboring landholdings, and on and adjacent to the Dry Lakes (see Figures 5-1 and 5-2). Groundwater levels will be monitored on a continuous to semi-annual basis (see Table ~~5-1~~**5-1**) during the pre-operational and operational periods, then annually during the post-operational period. Water quality will be monitored on a quarterly to annual basis during the pre-operational period, annually during the operational period of the Project, and triennially during the post-operational period (see Table ~~5-1~~**5-1**). Further, FVMWC shall monitor static (non-pumping) water levels within any third-party wells that are representative of the local groundwater impacts and located within the northern Bristol/Cadiz Sub-Basin or elsewhere in the Fenner Watershed. Such monitoring of third-party wells will be performed on a semi-annual basis during the pre-operational and operational periods, then annually during the post-operational period as established in the Closure Plan.

6.2.1 *Action Criteria*

The decision-making process will be initiated if any of the action criteria are triggered. The action criteria are: 1) a decline of static water levels of more than twenty feet from pre-Project static water levels or to a degree in which the reduction in static water levels results in an inability to meet existing ~~the~~ production of any third-party well drawing water from the northern Bristol/Cadiz Sub-Basin or elsewhere in the Fenner Watershed; ~~and~~**or** 2) the receipt of a written complaint from one or more well owner(s) regarding decreased groundwater production yield, degraded water quality, or increased pumping costs submitted by neighboring landowners or the salt mining operators on the Bristol and Cadiz Dry Lakes. Any written complaint by a well owner in accordance with this action criterion shall be directed to FVMWC.

6.2.2 *Decision-Making Process*

If any of the action criteria are triggered, the decision-making process will include:

- If a written complaint with a documented change in water level as provided for in Section 6.2.1 is received from a third-party well owner located within the ~~area of influence~~**Limits of the Maximum Projected**

20 ft Drawdown (see Figure 5-1), FVMWC will immediately implement Corrective Measure 6.2.3.1, below;

- Assessment of whether water level changes, decreased yields, increased pumping costs, and/or degraded water quality in the third-party wells are attributable to Project operations or other causes;

- If such water level changes, decreased yields, increased pumping costs and/or degraded water quality are determined to not be attributable to Project operations~~,~~ **in conformance with the decision-making process in Section 6.1,** then FVMWC would discontinue any interim arrangement to provide water as set forth in Section 6.2.3.1;

- If such water level changes, decreased yields, increased pumping costs and/or degraded water quality are determined to be attributable to Project operations, then one or more of the corrective measures set forth in Section 6.2.3 shall be implemented.

6.2.3 *Corrective Measures*

6.2.3.1 *Interim Water Supply*. If a written complaint as provided for in Section 6.2.1 is received from a third-party well owner located within the area described above (see Figure 5-1), FVMWC will arrange for an immediate interim supply of water to the third-party well owner until the decision-making process is complete in an amount necessary to fully offset any reduced yield to the third-party well owner, as compared to the yield from the impacted well prior to Project operations or, if the impacted well was installed after Project operations commenced, then as compared to the yield of the well immediately after installation.

6.2.3.2 *Further Corrective Measures*. If any of the Action Criteria set forth in 6.2.1 are triggered and the impacts are determined to be attributable to Project operations, one or more of the following further corrective measures shall be implemented to correct the impairment to the beneficial use of the groundwater:

- Continued provision of substitute water supplies;

- Deepening or otherwise improving the efficiency of the impacted well(s);

- Blending of impacted well water with another local source;
- Constructing replacement well(s) on disturbed land subject to the same mitigation measures imposed on the Project wellfield as set forth in the SMWD's Mitigation Monitoring and Reporting Program;
- Paying the impacted third-party well owner for any increased material pumping costs incurred by the well owner; or
- Entering into a mitigation agreement with the impacted third-party well owner.

6.2.3.3 ***Alternative Corrective Measures.*** **If the preceding corrective measures are ineffective or infeasible, Project operations shall be modified to address the adverse impacts on third-party wells. For the purposes of these action criteria, "ineffective" shall be defined as a corrective measure that when put into place did not meet the objective set forth in the corrective action. "Infeasible" is a corrective measure which cannot be implemented due to cost, technical challenges, or legal restraints. Modifications to Project operations shall include one or more of the following:**

- **Reduction in pumping from Project well(s);**
- **Revision or reconfiguration of pumping locations within the Project wellfield; or**
- **Stoppage of groundwater extraction for a duration necessary to correct the adverse impact.**

6.3 Land Subsidence

Twenty **three** land survey benchmarks will be established and surveyed by a licensed land surveyor on an annual basis to identify and quantify potential subsidence within the Project area (see Figures 5-1 and 5-2). Three extensometers will be constructed in areas of projected subsidence (see Figure 5-2). The extensometers, which would be monitored continuously from installation through the post-operational period, would verify if the land surface changes (also potentially identified from land surveys and InSAR satellite data obtained and analyzed every 5 years through the post-operational period) are due to (1) subsidence due to groundwater withdrawal; or (2) other mechanisms (e.g. regional tectonic movement).

6.3.1 *Action Criteria*

The decision-making process will be initiated if either of the action criteria is triggered. The action criteria are: 1) ~~a trend in~~ subsidence that would result in a decline in the ground surface elevation of more than 0.3 feet ~~within 10 years~~ when compared to baseline ~~Project conditions~~**data collected from the extensometers and corroborated by the land survey benchmarks or InSAR data and analysis**; or 2) a trend in subsidence which, if continued, would be of a magnitude within 10 years that impacts existing infrastructure within the Project area. The magnitude for the railroad tracks is more than one inch vertically over 62 feet linearly along the existing railroad tracks.

6.3.2 *Decision-Making Process*

If either of the action criteria is triggered, the decision-making process will include:

- Assessment as to whether the subsidence is attributable to Project operations;
- If the subsidence is determined to be attributable to Project operations, then an assessment will be made to **update trends and projections in subsidence over the remaining Project life and to** determine whether the subsidence constitutes a potential adverse impact to ~~the~~ aquifer **health** or surface uses. Potential adverse impacts include potential damage to surface structures as a result of differential settlement or fissuring, general subsidence sufficient to alter natural drainage patterns or cause damage to structures, or ~~a non-recoverable loss of~~**adverse changes to the geologic integrity of the** aquifer**, its** storage capacity ~~that affects the beneficial uses of the storage capacity of the aquifer system~~**, or its water quality**;
- If no such significant adverse impacts to critical resources are identified, potential actions may include:
  - No action;
  - Proposed refinements to the action criteria;
  - Additional verification monitoring, including a field reconnaissance to assess and detect any differential settlement; or
  - Proposed revisions to the benchmark survey and/or InSAR monitoring frequency.

- ~~o~~ If the subsidence is determined to be attributable to Project operations and the subsidence is determined to constitute a potential adverse impact to ~~the~~surface drainage, aquifer ~~or~~health, surface uses or infrastructure, then one or more of the corrective measures set forth in Section ~~6.3.3~~6.3.4 shall be implemented.

6.3.3 *Criteria for Subsequent Review of Subsidence and Overdraft*

As an additional management feature, if during the decision-making process in Section 6.3.2, above, it is determined that permanent subsidence is anticipated to exceed the predicted subsidence by fifty percent under Sensitivity Scenario 1 at the locations monitored and shown on Table 4.6 within 50 years as measured by at least two extensometers and corroborated by benchmark surveys and InSAR data and analysis, then the County in consultation with the TRP shall conduct a comprehensive review and analysis of subsidence. The comprehensive review will evaluate whether, notwithstanding post-project replenishment, the imposed floor on groundwater levels, and prior and planned corrective actions, the subsidence involves a progressive, long-term, and permanent decline in ground surface elevations over the pumping period of the Project and, if so, whether that subsidence evidences the occurrence of Overdraft as defined in this Management Plan. If the County or SMWD reasonably determines that the levels of subsidence indicate that Overdraft will occur, then Project operations shall be modified by one or more of the following corrective measures:

- Reduction in pumping from Project well(s);
- Revision or reconfiguration of pumping locations within the Project wellfield; or
- Stoppage of groundwater extraction for a duration necessary to arrest the subsidence.

6.3.4 ~~6.3.3~~ *Corrective Measures*

Corrective measures that shall be implemented to repair damaged structures and/or arrest the subsidence shall include one or more of the following:

- Repairing any structures damaged as a result of subsidence attributable to Project operations;
- Entering into a mitigation agreement with any impacted party(s).

If the forgoing corrective measures are ineffective or infeasible **or if subsidence would potentially alter natural drainage patterns or result in adverse changes to the geologic integrity of the aquifer, its storage capacity, or its water quality**, Project operations shall be modified to arrest the subsidence. For the purposes of these action criteria, "ineffective" shall be defined as a corrective measure that when put into place ~~did~~**will** not meet the objective set forth in the corrective action~~, i.e., to~~**(e.g., it will not protect aquifer health or** repair damaged structures and arrest the subsidence**)**. "Infeasible" is a corrective measure which cannot be implemented due to cost, technical challenges, or legal restraints. Modifications to Project operations shall include one or more of the following**:**

- Reduction in pumping from Project well(s);
- Revision or reconfiguration of pumping locations within the Project wellfield; or
- Stoppage of groundwater extraction for a duration necessary to correct the adverse impact.

6.4 Induced Flow of Lower-Quality Water from Bristol and Cadiz Dry Lakes

Saline water migration is allowed up to and not to exceed 6,000 feet from the baseline location of the saline-freshwater interface. To prevent migration of saline groundwater beyond 6,000 feet, FVMWC will implement mitigation measures that may include injection or extraction wells or other physical means to maintain the saline-freshwater interface. If these physical measures prove ineffective, reductions in Project pumping will be required (see ~~Sections 6.4.3,~~**Section 6.4.4,** below).

6.4.1 *Monitoring*

To monitor the influence of the Project's operation on the migration of the saline-freshwater interface located between the Project wellfield and the Bristol and Cadiz Dry Lakes, a network of "cluster type" observation wells will be established between the Project wellfield and the saline-freshwater interface. Groundwater TDS concentrations in the well clusters will be monitored on a quarterly basis during the pre-operational period of the Project, semi-annually throughout the operational period, and annually during the post-operational period of the Project. Of the monitoring well network, SCE Well no. 5 and SCE Well no. 11, along with other newly installed well clusters located between the interface and the Project wellfield will be located such that that they are appropriate to serve as "sentinel" wells to determine whether there is a progressive migration of the saline-freshwater interface. The locations of SCE Well no. 5, SCE Well

no. 11, and the other sentinel well clusters are shown in Figures 5-1 and 5-2. **As an additional management feature, an analysis shall be conducted of Project operations as part of the first Five Year Report to locate at least two additional monitoring well clusters along the saline-freshwater interface (and on Cadiz owned lands). The location of new monitoring well clusters shall be approved by the County representative and SMWD representative in consultation with the TRP and new wells will be placed by FVMWC within 10 years of commencement.**

6.4.2 *Action Criteria*

The decision-making process will be initiated if the action criterion is triggered. The action criterion is a migration of the interface, as measured by an increase in TDS concentration in excess of 600 mg/L in any cluster or observation well located within a distance of 6,000 feet from pre-Project locations of the interface.

6.4.3 *Decision-Making Process*

If the action criterion is triggered, the decision-making process will include:

- Assessment of whether the increased TDS concentration or migration of the saline-freshwater interface is attributable to Project ~~pumping~~**operations**;
- Assessment of trends and updated projections of whether and when the saline-freshwater interface is expected to migrate 6,000 feet from its baseline location;
- If the increased TDS concentration within the monitoring wells is determined to be attributable to the Project and the saline-freshwater interface is expected to migrate more than 6,000 feet from its baseline location within 10 years **and at any time during the Project's operation or post-operation periods**, then one or more of the corrective measures set forth in Section ~~6.4.3~~**6.4.4** shall be implemented.

6.4.4 *Corrective Measures*

Corrective measures that will be implemented to eliminate the further migration of saline groundwater towards the Project wellfield may include the following:

- Installing one or more extraction well(s) or injection well(s) at the northeastern edge of Bristol Playa and/or north of Cadiz Playa where

period of the Project and annually during the post-operational period. The Bonanza Spring will be monitored as an "indicator spring" because it is the spring that is in closest proximity to the Project wellfield (approximately 11 miles from the center of Fenner Gap). The Whiskey and Vontrigger Springs will be monitored to compare variations in spring flow **and other spring characteristics (e.g., location and elevation, spring type, discharge, spring length, water depth and width, water quality measurements, vegetative bank and emergent cover, substrate composition, photographic records, etc.)**[14] from those springs to variations in spring flow **and characteristics** from the Bonanza Spring to determine whether reductions of flow at the Bonanza Spring are attributable to the Project operations, or instead, are attributable to annual precipitation. Monitoring of groundwater levels in monitoring wells located between Bonanza Spring and the wellfield will also be conducted to provide data which could be used to correlate changes in groundwater levels attributed to the Project to changes in flow in the Bonanza Spring.

6.7.2 *Action Criteria*

The decision-making process will be initiated if the action criterion is triggered. The action criterion is a reduction in the average annual or seasonal flows **or degradation in the average annual or seasonal characteristics** at Bonanza Spring that exceed the baseline annual (or seasonal) flow fluctuations ~~established as correlated to precipitation and~~**or that deviate from annual baseline conditions** established during the first 10 years of monitoring. If such a reduction of flow ~~is measured~~**or spring condition is observed**, the decision-making process will be initiated.

6.7.3 *Decision-Making Process*

If the action criteria is triggered, the decision-making process will include:

- Assessment of whether the reduction in flow **or spring condition** is attributable to Project operations and not the result of changes in annual precipitation ~~or~~**,** climatic conditions**, or other conditions unrelated to the Project (e.g., fire, disease, etc.)**;

- If the reduction in flow **or spring condition** is determined to be attributable to Project operations, one or more of the corrective measures shall be implemented.

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[14] See, for example, the spring monitoring described by the Desert Research Institute in Spring Inventory and Monitoring Protocols (Conference Proceedings, Spring-fed Wetlands: Important Scientific and Cultural Resources of the Intermountain Region, 2002, http://www.wetlands.dri.edu).

6.7.4 *Corrective Measures*

Action(s) necessary to re-establish baseline **spring conditions and** flows shall include one or more of the following in addition to a reevaluation of the relationship between the aquifer and the springs within the watershed:

- Reduction in pumping from Project wells;
- Revision of pumping locations within the Project wellfield;
- Stoppage of groundwater extraction for a duration necessary to correct the predicted impact.

6.8 Air Quality

The EIR concludes that groundwater is not connected to the erosion potential of the Dry Lake surface soils and therefore the lowering groundwater levels beneath the Dry Lakes is not expected to increase dust generation from the Dry Lakes or otherwise affect regional air quality. Consistent with the recommendations of the Groundwater Stewardship Committee and as a conservative monitoring protocol to be conditioned by the County under its Ordinance, Cadiz will prepare a monitoring plan in consultation with the TRP to address possible sources of fugitive dust emissions (depth to groundwater, surface vegetation, surface soil chemistry) and local air quality over time (nephelometers and weather stations) to verify that the Project does not increase dust generation (i.e., particulate matter) from the Dry Lakes. The monitoring plan, at a minimum, shall set forth specific performance criteria and identify monitoring methods, the location of weather stations and nephelometers, measures to protect quality assurance and quality control, and reporting parameters. The monitoring plan shall be reviewed and approved by the County ~~Representatives~~**Representative** before the Project commences construction.

6.8.1 *Monitoring*

As described in Section ~~5.3,~~**5.2,** above, a network of observation wells will be established between the Project wellfield and Bristol and Cadiz Dry Lakes (see Figures 5-1 and 5-2). Groundwater levels will be monitored in many wells on a continuous basis throughout the term of the Project, which can help identify specific depths to groundwater and hydrological connections to surface soils and vegetation.

Furthermore, Cadiz will install weather stations and four nephelometers—upwind and downwind of the Bristol and Cadiz Dry Lakes—to establish baseline data of visibility in the valley, along with providing air quality data throughout the duration of Project

operations. In addition, FVMWC will conduct annual visual observations at four points on each of the Dry Lakes to record surface soil conditions. The visual observations will note soil texture and record susceptibility to wind erosion. Photographs of the soil will be taken. This data will record conditions over time at the same locations on each of these Dry Lake surfaces.

These nephelometers will provide data on a daily basis that records opacity of the air, measuring the effect of dust on visibility. Data will be collected in the early years of the Project, establishing a baseline before groundwater levels beneath the Dry Lake are affected and will continue during Project operations. Since wind velocity and dust storms are highly variable, the data will record trends over time. Data from the nephelometers will be analyzed by FVMWC, with the results of the analysis and associated data summaries submitted annually to the TRP. This data will inform the TRP on the environmental setting, augmenting the weather station data, and provide information for the long term management of the facilities in the valley. The TRP will provide recommendations over time regarding modifications to the verification data collection activities if needed.

6.8.2 *Action Criteria*

The decision-making process will be initiated if the action criteria are triggered. The action criteria are (1) changes in annual average or peak concentrations of airborne particulate matter as measured by nephelometers that exceed average annual or peak baseline conditions by 5 percent or more, or (2) changes in surface soil conditions on the Dry Lakes that show a degradation of soil structure and increased susceptibility to wind erosion compared to baseline conditions established through monitoring prior to Project pumping. If such changes are measured, the decision-making process will be initiated.

6.8.3 *Decision-Making Process*

If the action criteria is triggered, the decision-making process will ~~be~~ include:

- Assessment of whether the change in air quality or soil conditions are attributable to Project operations;
- If air quality changes are determined to be attributable to Project operations or if degradation of soil structure and increased susceptibility of wind erosion are determined to be attributable to Project operations, one or more of the corrective measures shall be implemented.

6.8.4 *Corrective Measures*

Action(s) necessary to re-establish baseline airborne particulate levels and soil structure shall include one or more of the following:

- Reduction in pumping from Project wells;
- Revision of pumping locations within the Project wellfield;
- Stoppage of groundwater extraction for a duration necessary to restore baseline air quality conditions to correct for Project impacts.

6.9 Management of Groundwater Floor

Pursuant to the MOU, the parties agreed to (i) identify the groundwater levels that will serve as monitoring targets and a "floor" for the maximum groundwater drawdown level in the Project wellfield, and (ii) establish a projected rate of decline in the groundwater table. The floor and rate of decline are designed to, among other things, set a designated maximum drawdown elevation in the Project wellfield and help assess trends and operate the Project in a manner that avoids Undesirable Results or other physical impacts enumerated in the MOU (including saline water migration).

6.9.1 *Groundwater Management Level*

The Project may drawdown the aquifer in the center of the Project wellfield area to a maximum drawdown level (the "floor") of elevation 530 feet (80 feet below baseline elevations). The floor will be calculated as an average groundwater elevation ~~over~~**within** a 2-mile radius from the center of the Project wellfield area. **The rate of decline in groundwater elevation can be expected to vary, being higher initially and gradually stabilizing to a lower long-term rate. With the 80-foot floor, the projected rate of decline is approximately 1.6 feet per year averaged over the Project's 50-year lifespan.** Once the floor is reached, and absent approval of a new floor by the County, pumping must be reduced to a quantity at or below the amount that will maintain water levels at or above the 80-foot floor. The floor is a management level, meaning annual, short-term incursions below the floor (3 consecutive years or less) are acceptable under the following conditions:

(a) No management criteria or corrective actions under this Management ~~Plant~~**Plan** have been triggered as necessary to avoid the threat of Undesirable Results; and

(b) Average groundwater levels must remain at or above the floor as measured on a 10-year average.

6.9.2 *Monitoring*

As described above, monitoring wells ~~will be placed~~ within a two-mile radius ~~of~~**from** the center of the Project ~~wellfields~~**wellfield will be used** to monitor declines in groundwater levels and to develop data to evaluate actual rates of recharge. Monitoring wells~~, if they do not exist, will also be added between the Project wellfields and the Bristol and Cadiz Dry Lakes to monitor groundwater flow directions and saline groundwater migration outside this two-mile radius area. Groundwater levels and migration~~ **will be selected from the following existing wells located in the Project wellfield area: CI-1, CI-2, CI-3, MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-7A, PW-1, TW-1, TW-2, TW2-MW, TW-3, CH-5 (the locations of these existing wells are depicted in Figure 5-2). Selected monitoring wells within the set may be substituted, if necessary, after the 5-Year project review period. Additional monitoring wells may be added within the 2-mile radius, if necessary, after the 5-Year project review period. Groundwater levels** will be monitored on a continuous basis throughout the term of the Project.

6.9.3 *Adaptive Management*

Any time after 15 years of operation, FVMWC or SMWD may apply to the County to lower the floor below **elevation** 530 feet (~~by~~ 80 feet **below baseline**) to **elevation** 510 feet (~~by~~ 100 feet **below baseline**), on the following conditions:

(a) FVMWC or SMWD shall first consult with and obtain a recommendation from the TRP on whether the following requirements can be satisfied:

(i) Sufficient operational data exists to support a decision concerning the floor or whether additional operational data is needed;

(ii) The Project will achieve additional conservation benefits at the proposed floor; and

(iii) The lowering of the floor will not trigger either the management criteria or the corrective actions under this Management Plan (other than the floor itself) in order to avoid the threat of Undesirable Results.

(b) The County must approve a lowering in the floor if it can make the following findings:

(i) Sufficient operational data exists to support a decision to lower the floor and avoid Undesirable Results;

(ii) The urban water management plans for each of the municipal water agencies and purveyors receiving water from the Project have disclosed the 50-year limit on the Cadiz water supply;

(iii) Additional conservation benefits will be realized at the proposed floor;

(iv) Lowering the floor would not result in the triggering of either the action criteria or the corrective actions under this Management Plan as necessary to avoid the occurrence of Undesirable Results; and

(v) There is no other threat of adverse environmental consequences that may arise due to changed or unforeseen circumstances.

(c) The new 510-foot (100-foot) floor would operate as a new management level, meaning annual, short-term incursions below the floor would be acceptable under the conditions set forth in Sections 6.9.1(a)-(b), above.

6.9.4 *Action Criteria*

The decision-making process will be initiated if the action criteria are triggered. The action criteria are trends in groundwater levels **(rate of decline)** that demonstrate that the designated floor elevation will be exceeded within 10 years. If such changes are measured, the decision-making process will be initiated.

6.9.5 *Decision-Making Process*

If the action criteria is triggered, the decision-making process will be include:

- Assessment of trends and updated projections of whether and when the Project is anticipated to reach the designated floor;
- If it is determined that the groundwater levels may drop below the designated floor within 10 years, one or more of the corrective measures shall be implemented.

6.9.6 *Corrective Measures*

Action(s) necessary to manage or avoid incurring below the designated floor shall include one or more of the following.

- Reduction in pumping from Project wells;
- Revision of pumping locations within the Project wellfield;
- Stoppage of groundwater extraction for a duration necessary to correct the predicted impact.

6.10 Project Area Vegetation

As discussed at Section 4.5 of Chapter 4 above, the Project is not anticipated to affect surface vegetation surrounding the wellfields, at the Playas, or within the surrounding Playa margins.

6.10.1 *Monitoring*

The Project is not anticipated to affect surface vegetation in the Project Area. However, as a conservative monitoring protocol conditioned under the County's Groundwater Management Ordinance and MOU, baseline and periodic visual observations shall be performed around the wellfields and at the Playas and surrounding Playa margins annually during the pre-operational and operational periods of the Project. Monitoring of groundwater levels will also be conducted to provide data which could be used to correlate changes in groundwater levels attributed to Project operations to changes in surface vegetation.

6.10.2 *Action Criteria*

The decision-making process will be initiated if the action criterion is triggered. The action criterion is a reduction in the extent or character of Project area vegetation from the baseline established in the first 10 years of monitoring. If such changes are observed, the decision-making process will be initiated.

6.10.3 *Decision-Making Process*

If the action criteria is triggered, the decision-making process will include:

- **Assessment of whether the reduction in extent or character of surrounding surface vegetation is attributable to Project operations and not the result of changes in annual precipitation or climatic conditions;**
- **If the reduction in the extent or character of surface vegetation is determined to be attributable to Project operations, one or more of the corrective measures shall be implemented.**

6.10.4 *Corrective Measures*

Action(s) necessary to re-establish baseline vegetation shall include one or more of the following in addition to a reevaluation of the relationship between the aquifer and surface vegetation within the watershed:

- **Reduction in pumping from Project wells;**
- **Revision of pumping locations within the Project wellfield;**
- **Stoppage of groundwater extraction for a duration necessary to correct the predicted impact.**

CHAPTER 7
CLOSURE PLAN AND POST-OPERATIONAL REPORTING

A Closure Plan will be developed as part of this Management Plan to ensure that no residual effects of Project operations after 50 years will result in adverse impacts to the groundwater system and environment (as defined in Chapter 4) in or adjacent to the Project wellfield area and outlying areas that monitoring has determined have been influenced by Project operations.

7.1 Closure Plan Approval

A draft Closure Plan will be prepared by FVMWC and submitted to SMWD, the TRP, and the County no later than December 31 of the 25th year of Project operations. FVMWC will consult with the TRP to provide input and guidance throughout the development and refinement of the draft Closure Plan. The TRP shall submit a formal written recommendation to the County within one year of its receipt of the draft Closure Plan from FVMWC. A final Closure Plan will be approved by the County, as it determines appropriate in its discretion after consideration of the draft Closure Plan and any recommendations of the TRP.

Once prepared, the Closure Plan will be reevaluated every 5 years in consultation with the TRP. Such reevaluation may include refinements to the Closure Plan. Any modification to the Closure Plan must be reviewed and approved by the County.

7.2 Closure Criteria

Subject to additional or alternative terms and conditions that may be developed as part of the Phase II Imported Water Storage Component, the Closure Plan shall, at a minimum, include the following conditions:

CHAPTER 8
PROJECT OVERSIGHT, MANAGEMENT, AND ENFORCEMENT

8.1 Technical Review Panel

An integral part of this Management Plan involves regular and ongoing review of data collected during the term of the Project. The understanding and analysis of the data will require technical expertise. For this reason, a Technical Review Panel (TRP) will be organized for the purpose of data review and analysis, report preparation, and advising the parties on technical aspects of the Project as set forth in Chapter 8. TRP Operating Procedures will be developed by the parties before the TRP is constituted to aid the TRP in fulfilling its roles under this Management Plan.

8.1.1 *Members*

The TRP shall consist of one technical representative appointed by the SMWD and one technical representative appointed by the County. Each of these individual appointments shall be in the discretion of the SMWD and the County, respectively. A third technical representative shall be jointly selected by the technical representatives from SMWD and the County, subject to review and approval by the County and SMWD. All three members of the TRP shall possess professional technical qualifications appropriate to the tasks of the TRP (e.g., state certifications in engineering, hydrology, or geology) and must have a minimum of 10 years professional experience working in the groundwater field. In the event the County and SMWD representatives cannot agree on the designation of the third representative, they may petition the San Bernardino Superior Court for the appointment of the third technical representative.

8.1.2 *Responsibilities*

The TRP is responsible for critical review and analysis of protocols for monitoring (including quality assurance and quality control) and methods of data collection and processing; data analysis, the rate of decline in the groundwater elevations; groundwater levels and quality; and the Project's potential to cause Undesirable Results. The TRP may make recommendations to SMWD and/or the County or SMWD and/or the County may request recommendations from the TRP on additional monitoring, mitigation, and modification to Project operations as set forth in Chapter 8.

As discussed above in Chapter 6, the TRP shall be responsible for data review and analysis along with advising SMWD and the County with respect to FVMWC's assessment of any triggering of an action criterion ~~concerning a potential impact to a~~

~~critical resource~~, corrective measures **proposed or** adopted, and any proposed refinements to the Management Plan. ~~The TRP shall review data, technical analyses compiled by FVMWC, as well as FVMWC's assessment of technical data and responsive actions, proposed refinements to the Management Plan, and corrective measures regarding compliance with the provisions of the Management Plan.~~ Determinations and recommendations from the TRP are to be provided to SMWD and the County for final oversight decisions. Whenever there are differing views among the TRP, those views will be provided, and the views of all members of the TRP shall be considered.

The TRP shall coordinate with FVMWC to review and monitor Project data and conditions in the northern Bristol/Cadiz Sub-Basin, as well as in the larger watershed area and adjacent region, including all information set forth for monitoring and reporting pursuant to Chapter 9 below, and shall issue recommendations to the County **concerning monitoring and reporting efforts for the Project**. The TRP may also undertake or cause to be made studies which may assist in determining the following: (i) status and trends in the progressive decline in groundwater levels and freshwater storage below the "floor" established in this Management Plan; (ii) the progressive decline in groundwater levels and freshwater storage at a rate greater than the established rate in this Management Plan; (iii) land subsidence; (iv) the progressive migration of hyper-saline water from beneath the Cadiz or Bristol Dry Lakes toward the Project wellsites; (v) increases in air quality particulate matter; (vi) loss of surface vegetation; or (vii) decreases in spring flows. FVMWC shall have the preliminary responsibility for collecting, collating, and verifying the data required under the monitoring program, and shall present the results thereof in annual monitoring reports provided to the TRP. FVMWC shall also make all raw data available to the TRP via an electronic network (e.g., a web page or FTP site within 90 days of its collection) or other appropriate means to enable regular updates on Project operation and management activities and to allow the TRP to verify the data and any results therefrom.

The TRP shall also review and comment to the County on annual reports developed by FVMWC as provided for in Chapter 9 ~~belowl~~**below**.

TRP's costs will be borne by FVMWC, including those of the technical representatives, provided that annual costs do not exceed $~~50,000~~**60,000** per year, escalated by 2 percent per year. Special reports recommended or prepared by the TRP may necessitate additional funding if so ordered by the County or SMWD or accepted by FVMWC.

8.1.3 *TRP Convening, Determinations, and Reporting*

As discussed above in Chapter 6, the TRP shall convene as necessary to review and advise the County with respect to any monitoring data or other assessments provided

the TRP. The County, in its sole determination, will issue any final determination of whether FVMWC's assessment of the triggering of action criteria and recommended responsive actions are appropriate based on all available technical data and are otherwise consistent with the EIR and its MMRP, the MOU, and the County Ordinance. If the County determines that FVMWC's assessment or recommended responsive actions are not appropriate, the County may order FVMWC to take alternative corrective actions as set forth in Chapter 6, above. If it is concluded by the County that corrective action or alternative corrective action is necessary, the County will provide notice of its determination and any administrative order in writing to FVMWC, SMWD, and to each member of the TRP. FVMWC shall, within a time period reasonable to the applicable circumstances, comply with the determination and instructions set forth in SMWD's or the County's written administrative order. The County in its administrative order may specify the time period that it deems reasonable for FVMWC to implement any corrective actions under the given circumstances. With the exception of enforcement actions concerning the threat of immediate or irreparable injury, including actions necessary to avoid Overdraft or Undesirable Results, the County's written determinations and administrative orders will be subject to the dispute resolution provisions of the MOU as referenced in Section 8.3. Likewise, certain administrative actions ~~by the County shall be~~**are** subject to direct judicial review, as set forth in **Paragraph 8 of** the MOU.

Because compliance with the Management Plan is a condition of SMWD's approval of the Project, SMWD in its discretion, will also consider the findings and actions taken or recommended by FVMWC and the TRP, and will exercise its own independent judgment concerning whether the triggering of the action criterion is attributable to Project operations, whether the triggering of the action criterion involves a potential adverse impact or Undesirable Result, and to determine the appropriate corrective measure(s) necessary to avoid or mitigate the potential adverse impact or Undesirable Result. If SMWD determines that appropriate corrective measure(s) are necessary to avoid or mitigate the potential adverse impact or Undesirable Result, but the County does not, SMWD will independently impose those corrective measures it determines necessary to avoid adverse impacts to critical resources or Undesirable Results, provided that independent enforcement by SMWD shall be subject to the same procedural requirements and remedies applicable as if the County were enforcing the Management Plan, including the dispute resolution procedure in Section 8.3.

Nothing in this process is intended to alter or supersede SMWD's responsibility, as the lead agency for the Project, to enforce, as a condition of Project approval, the implementation of all adopted mitigation measures, including those measures which correspond to provisions of the Management Plan.

8.3 Dispute Resolution

The County, SMWD, FVMWC, and Cadiz will exercise good faith and reasonable efforts to implement the Management Plan and to make any required determinations and resolve any issues, claims, or disputes that arise under the oversight and enforcement of the Management Plan, including without limitations matters concerning implementation and funding, the triggering of action criterion pertaining to critical resources, corrective measures, proposed refinements to action criteria or corrective measures, development and approval of the Closure Plan provided for in Chapter 7, edits to and completion of the reports provided for in Chapter 9, and any necessary actions to enforce the provisions of this Management Plan. As set forth in the MOU, in the event a dispute arises between the County, SMWD, FVMWC, and/or Cadiz relating to an action taken by FVMWC or a decision or determination concerning the County's and SMWD's management and enforcement responsibility under this Management Plan, the parties shall first attempt in good faith to resolve the dispute through informal means. In the event that such efforts are unsuccessful, any party may invoke the dispute resolution provisions set forth in Paragraph 8 of the MOU except where dispute resolution is excused due to the threat of immediate or irreparable injury (see MOU and Section 8.2, above).

CHAPTER 9
MONITORING AND REPORTING

9.1 Project Data Monitoring

Monitoring is essential to making informed decisions regarding Project operations. FVMWC will be responsible for preparation of the annual reports beginning one year after agreements for delivery of Project water are entered into or commencement of Project construction, whichever occurs first ~~and~~ **.** Five Year Reports shall be prepared **beginning** 5 years from commencement of Project construction. **The annual and 5 Year Reports will be prepared by a California Professional Geologist, Certified Hydrogeologist, or Professional Engineer with a minimum of 10 years professional experience in groundwater.**

9.2 Project Reports

9.2.1 *Annual Reports*

Each year during the operational and post-operational periods of the Project, an annual report shall be prepared by FVMWC that shall include a summary**, interpretation,** and

analysis of all Project data obtained through the monitoring described in Chapters 5 and 6, above. The report shall also include any requested or suggested changes in the monitoring proposed to occur in successive years. In addition to the components required under Section 2.5.1 of the County Guidelines for Preparation of a Groundwater Management Plan (June 2000), annual monitoring reports will ~~contain~~**include** the following components:

- Summary of precipitation from climate stations;
- Baseline groundwater level and water quality conditions (as referenced in the EIR). Presentation of baseline conditions will include groundwater level elevation contours, water quality contours, and a figure showing the results of the initial land survey;
- Tables summarizing annual groundwater production for each Project extraction well and cumulative extraction from the Project;
- Tables summarizing depth to static water level and groundwater elevation measurements for all observation wells;
- Report on Bonanza, Whiskey and Vontrigger Springs, including visual observations such as starting and ending points of observed ponded or flowing water, estimated depth of ponded water and flow rate of flowing water, conductivity, pH and temperature of water, any colorations of water, and general type and extent of vegetation;
- Hydrographs for all production and observation wells;
- Groundwater elevation contours;
- **Summary and results of surface vegetation monitoring;**
- Tables summarizing water quality analyses for the observation wells;
- Results of land subsidence monitoring surveys and any changes relative to baseline;
- Summary tables of any data collected from wells owned by neighboring landowners in proximity to the Project area (provided that permission was granted for such data collection);
- Summary of Project developments, such as changes in storage or extraction operations or construction of new production wells;

- Discussion of Project storage and extraction operations, and trends in groundwater levels and groundwater quality as compared to the baseline conditions;

- Updated groundwater flow, transport and variable density model results;

- Tables summarizing changes in frequency and severity of dust mobilization recorded on Bristol and Cadiz Dry Lakes and analysis correlating dust emissions with wind speed and direction, groundwater levels underlying the Dry Lakebeds and soil surface chemistry;

- Tables and figures (wind roses) summarizing wind data from regional meteorological towers addressing wind speed and direction, and stability frequency distributions. This data shall be collected during the operation phase of the Project, and may be extended if required by the County to address the post-operational (closure) period;

- Summary of FVMWC and TRP assessments, proposed refinements to the Management Plan, and corrective measures.

9.2.2 *Five-Year Reports*

As discussed in Chapters 2 and 4 above, it is anticipated that as the Project proceeds, new data and analysis as well as any new Project operational considerations will be used to refine the calibration of the Project's various water resources models. It is also appropriate to periodically report on observed trends in ~~observed~~ data from the monitoring features and **on** predictions of future trends. Thus, a "Five-Year Report" shall be prepared 5 years from commencement of construction, and on every five-year anniversary thereafter. In addition to the report components required under Section 2.5.2 of the County's Guidelines for Preparation of a Groundwater Monitoring Report, the Five-Year Report shall report on the following matters in addition to the contents of previous annual reports:

- Changes to the number or locations of monitoring features;

- Changes in monitoring frequency;

- Changes in monitoring technology;

- Refinements in the action criteria for critical resources;

Table ~~5.1~~5-1

Critical Resource Area	Feature No.	Monitoring Features		No.	Pre-Operational Monitoring Frequency			Operational Monitoring Frequency			Post-Operational Monitoring Frequency		
								Extraction					
					Water Level	Water Quality	Other Monitoring	Water Level	Water Quality	Other Monitoring	Water Level	Water Quality	Other Monitoring
Springs	**1**	**Springs, Monitoring**	Existing	3	~~-~~Quarterly	~~-~~Quarterly	Quarterly, Visual Observations and Flow at 3 Springs	~~-~~Quarterly	~~-~~Quarterly	Quarterly, Visual Observations and Flow at 3 Springs	~~-~~Annual	~~-~~Annual	Annual, Visual Observations and Flow 3 Springs
Aquifer System	**2**	**Observation Wells (16 total)**	Existing	12	Monthly	4 Quarterly, 8 Annually	-	Monthly for First 3 Months of Cycle, then Semi-Annually	Annually	-	Annually	Triannually	-
			Existing	2	Continuous	Annually	-	-	Annually	-	Annually	Triannually	-
			New	2	Monthly	Quarterly	-	Monthly for First 3 Months of Cycle, then Semi-Annually	Annually	-	Annually	Triannually	-
	3	**Project Area Well Clusters - Saturated Zone Only (1 x 3 well cluster + 2 x 2 well cluster = 2 existing and 3x2 new well**	Existing	5 wells	Continuous	Quarterly	-	Continuous	Semi-Annually	-	Continuous (Until No Longer Deemed Necessary)	Annually	-

Table ~~5.2~~5-2

Critical Resource Area	Feature No.	Feature Type	When Monitored	Name	State Well Number	Location Coordinates	Monitoring Protocol		
							Water Level	Water Quality	Other Monitoring
Springs in the Mojave National Preserve and BLM Wilderness Area	1	Springs, Monitoring	Pre-Operational Operational Post-Operational	Bonanza Spring	NA	34° 41' 08" N 115° 24' 20" W	-	-	See ~~Section~~Sections 5.1 and 6.1
		Springs, Monitoring	Pre-Operational Operational Post-Operational	Whiskey Spring	NA	34° 59' 52" N 115° 26' 59" W	-	-	See ~~Section~~Sections 5.1 and 6.1
		Springs, Monitoring	Pre-Operational Operational Post-Operational	Vontrigger Spring	NA	35° 03' 20" N 115° 08' 52" W	-	-	See ~~Section~~Sections 5.1 and 6.1
Aquifer System	2	Observation Well	Pre-Operational Operational Post-Operational	Dormitory	5N/14E-5F1	34° 32' 38" N 115° 31' 57" W	Transducer, See Sections 5.2 and 6.3	See Appendices B, C & D	-
		Observation Well	Pre-Operational Operational Post-Operational	6/15-1	6N/15E-01H	34° 38' 23" N 115° 21' 22" W	Transducer, See Sections 5.2 and 6.4	See Appendices B, C & D	-
		Observation Well	Pre-Operational Operational Post-Operational	6/15-29	6N/15E-29P1	34° 34' 20" N 115° 26' 04" W	Transducer, See Sections 5.2 and 6.4	See Appendices B, C & D	-
		Observation Well	Pre-Operational Operational Post-Operational	SCE-11	4N/14E-13J1	34° 25' 51 N 115° 27' 25" W	Transducer, See Sections 5.2 and 6.5	See Appendices B, C & D	-

		Observation Well	Pre-Operational Operational Post-Operational	SCE-18	5N/13E-11R1	34° 26' 37" N 115° 34' 59" W	Manual, See Appendix B	See Appendices C & D	-
Aquifer System	2	Observation Well	Pre-Operational Operational Post-Operational	Danby-1	5N/13E-11R1	34° 26' 37" N 115° 34' 59" W	Manual, See Appendix B	See Appendices C & D	-
		Observation Well	Pre-Operational Operational Post-Operational	Piute-1	TBD	34° 57' 22" N 114° 48' 16 W	Manual, See Appendix B	See Appendices C & D	-
	3	Project Area Well Cluster-Groundwater (3 well Cluster)	Pre-Operational Operational Post-Operational	MW-7a MW-7 TW-1	TBD	34° 31' 39" N 115° 26' 55" W	Transducer, See Sections 5.3 and 6.4	See Appendices C & D	Monitor Alluvium/Carbonates/Bedrock
		Project Area Well Cluster-Groundwater (2 well Cluster)	Pre-Operational Operational Post-Operational	TW-2MW TW-2	TBD	34° 31' 13" N 115° 26' 57" W	Transducer, See Sections 5.3 and 6.4	See Appendices C & D	Monitor Alluvium//Bedrock
		Project Area Well Cluster-Groundwater (2 well Cluster)	Pre-Operational Operational Post-Operational	New Cluster Well	TBD	TBD	Transducer, See Sections 5.3 and 6.4	See Appendices C & D	Monitor Alluvium//Bedrock
		Project Area Well Cluster-Groundwater (2 well Cluster)	Pre-Operational Operational Post-Operational	New Cluster Well	TBD	TBD	Transducer, See Sections 5.3 and 6.4	See Appendices C & D	Monitor Alluvium/Bedrock
		Project Area Well Cluster-Groundwater (2 well Cluster)	Pre-Operational Operational Post-Operational	New Cluster Well	TBD	TBD	Transducer, See Sections 5.3 and 6.4	See Appendices C & D	Monitor Alluvium/Bedrock
	4		Operational	28	5N/14E-28Q1	34° 31' 05" N 115° 29' 59" W	-	-	See ~~Sections~~Section 5.4

			Operational	27N	5N/14E-27B1	34° 29' 54" N115° 29' 59" W	-	-	See ~~Sections~~Section 5.4
			Operational	27S	5N/14E-27Q1	34° 28' 14" N 115° 29' 59" W	-	-	See ~~Sections~~Section 5.4
Project Area Aquifer	4		Operational	21S	5N/14E-21P1	34° 30' 08" N 115° 31' 12" W	-	-	See ~~Sections~~Section 5.4
			Operational	33	5N/14E-33K1	34° 28' 32" N 115° 31' 07" W	-	-	See ~~Sections~~Section 5.4
		New Production Wells (29 total)	Operational	TBD (see Figure 5-2)	TBD	TBD	-	-	See ~~Sections~~Section 5.4
	5	Benchmark Stations (~~20~~23 total)	Pre-Operational Operational Post-Operational	TBD	NA	~~TBD~~Figure 5-2	-	-	See Sections 5.5 and 6.3
		InSAR (2 per year)	Pre-Operational Operational Post-Operational	NA	NA	NA	-	-	See Sections 5.5 and 6.3
	6	Extensometer (3 total)	Pre-Operational Operational Post-Operational	TBD	NA	~~TBD~~Figure 5-2	-	-	See Sections 5.5 and 6.3
	7	Flowmeter Surveys (5 total)	Pre-Operational	TBD	TBD	TBD	-	-	See Section 5.7

Bristol and Cadiz Dry Lakes	8	Bristol Dry Lake Well Cluster[b]	Pre-Operational Operational Post-Operational	TBD	TBD	~~TBD~~Figure 5-2	Transducer, See Sections 5.8, 5.9, 6.4 and 6.5	See Appendices C & D	-
		Bristol Dry Lake Well Cluster[b]	Pre-Operational Operational Post-Operational	TBD	TBD	~~TBD~~Figure 5-2	Transducer, See Sections 5.8, 5.9, 6.4 and 6.5	See Appendices C & D	-
		Bristol Dry Lake Well Cluster[c]	Pre-Operational Operational Post-Operational	TBD	TBD	~~TBD~~Figure 5-2	Transducer, See Sections 5.8, 5.9, 6.4 and 6.5	See Appendices C & D	-
	9	Cadiz Dry Lake Well Cluster[d]	Pre-Operational Operational Post-Operational	TBD	TBD	~~TBD~~Figure 5-2	Transducer, See Sections 5.8, 5.9, 6.4 and 6.5	See Appendices C & D	-
		Cadiz Dry Lake Well Cluster[d]	Pre-Operational Operational Post-Operational	TBD	TBD	~~TBD~~Figure 5-2	Transducer, See Sections 5.8, 5.9, 6.4 and 6.5	See Appendices C & D	-
		Cadiz Dry Lake Well Cluster[e]	Pre-Operational Operational Post-Operational	TBD	TBD	~~TBD~~Figure 5-2	Transducer, See Sections 5.8, 5.9, 6.4 and 6.5	See Appendices C & D	-
	10	Gamma/EM Logs (up to 6 total)	Pre-Operational	TBD	TBD	TBD	-	-	See Section 5.10

Other (Basin-wide)	11	Weather Station	Pre-Operational Operational Post-Operational	Amboy	NA	34° 31' 52" N 115° 41' 42" W	-	-	See Section 5.11
		Weather Station	Pre-Operational Operational Post-Operational	Mitchell Caverns	NA	34° 56' 06" N 115° 30' 58" W	-	-	See Section 5.11
		Weather Station	Pre-Operational Operational	Fenner Gap	NA	34° 30' 57" N 115° 27' 45" W	-	-	See Section 5.11
		Weather Station	Pre-Operational Operational Post-Operational	Cadiz Field Office (CIMIS Station)	NA	34° 30' 49" N 115° 30' 39" W	-	-	See Section 5.11
Air Quality	12	Nephelometers	Pre-Operational Operational Post-Operational	TBD	NA	TBD	-	-	See Section 5.12
Vegetation	13	Vegetation Monitoring	Pre-operation Operational Post-Operational	NA	NA	Wellfields and Surrounding Bristol and Cadiz Playas	-	-	See Section 5.13

NOTES:
a - Location coordinates to be verified in the field during initial Pre-Operational activity.
b - Two new well clusters to be installed at eastern margin of Bristol Dry Lake (see Figure 5-1).
c - One new well cluster to be installed on Bristol Dry Lake (see Figure 5-1).
d - Two new well clusters to be installed north of Cadiz Dry Lake (see Figure 5-1).
e- One new well cluster to be installed on Cadiz Dry Lake (see Figure 5-1).
Also see Table 5-1 for details of proposed monitoring features and frequencies.

Table ~~6.1~~6-1

Cadiz Groundwater Conservation Recovery and Storage Project

Summary of Action Criteria, Impacts and Corrective Measures

Potential Impact	Method of Measurement	Triggers (Action Criteria)	"Close Watch" Measures	Corrective Measures
Third-Party Wells	Groundwater observation wells; voluntary third-party well monitoring	A decline of static water levels of more than twenty (20) feet from pre-Project static water levels or to a degree in which the reduction in static water levels results in an inability to meet existing production of any third-party well drawing water from the northern Bristol/Cadiz Sub-Basin or elsewhere in the Fenner Watershed Receipt of a written complaint by from one or more well owner(s) regarding documented decreased groundwater production yield, degraded water quality, or increased pumping costs submitted by neighboring landowners or the salt mining operators on the Bristol and Cadiz Dry Lakes	Investigation to determine if caused by Project operations, and significance of impact Provision of substitute water to impacted party	Continued provision of substitute water supplies Deepen or otherwise improve the efficiency of the impacted well(s) Blend impacted well water with another local source Construct replacement well(s) Compensation Enter into a mitigation agreement **Modification of Project wellfield operations**

Land subsidence	Benchmark stations; InSAR; extensometers	Land surface elevation ~~changes~~**decline** of greater than 0.3 ft ~~within ten years~~ when compared to baseline conditions A declining trend which if continued would be of a magnitude within ten years which impacts existing infrastructure in the Project area. The magnitude for railroad tracks is more one inch vertically over 62 feet linearly along the existing railroad tracks	Determine if elevation changes were directly attributable to Project operations Conduct ground surveys to look for evidence of differential compaction	Repair damaged structures Enter into a mitigation agreement Modification of Project wellfield operations to arrest subsidence
		A land surface elevation decline greater than predicted by fifty percent over Sensitivity Scenario 1 when compared to baseline conditions to trigger comprehensive review	**Comprehensive review includes examination of effects of subsidence on permanent overdraft**	**Modification of Project wellfield operations to arrest subsidence**
Induced flow of lower-quality water from Bristol and Cadiz Dry Lakes	Groundwater observation wells and cluster wells at Dry Lakes; cluster wells and sentinel wells between Dry Lakes and well-field	TDS concentration changes in excess of 600 mg/L at cluster wells located within a distance of 6,000 feet from pre-Project locations of the interface	Determine if concentration changes are directly attributable to Project operations Determine saline-freshwater	Compensation Installation of injection and/or extraction well(s) to maintain saline-freshwater interface within its 6,000-foot limit

			interface is expected to migrate more than 6,000 feet within ten years Install additional observation wells to further assess saline water migration	Modification of Project operations to maintain beneficial use
Brine resources underlying Bristol and Cadiz Dry Lakes	Groundwater observation wells and cluster wells at Dry Lakes	Changes in brine water levels of greater than 50 percent above water column of the brine company's pump intake in comparison to pre-operational static levels in cluster wells at the margins of the Dry Lakes Receipt of a written complaint from salt mining company	Determine if brine water level changes are directly attributable to Project operations	Compensation Installation of injection and/or extraction well(s) Enter into a mitigation agreement Modification of Project operations to maintain beneficial use
Adjacent groundwater basins	Groundwater observation wells	No action criteria necessary; verification monitoring only	None	None
Springs	Visual observation and manual flow measurements **and spring characteristics** annually of bonanza, whiskey, and Vontrigger springs and groundwater levels measurements in observation wells	Reduction in average annual or seasonal flow **or degradation in characteristics** at Bonanza Spring as correlated to precipitation	Determine if reduction in flow **or degradation in characteristics** is attributable to Project operations	Modification of Project operations to re-establish baseline flow **and spring characteristics**
Air quality	Groundwater observation wells (cluster wells at Dry Lakes), open-air nephelometers Soil testing	Changes in air quality that exceed baseline conditions by 5 percent Changes in soil conditions showing degradation of soil structure	Determine if change is air quality or soil structure is attributable to Project operations	Modification of Project operations to re-establish baseline air quality levels
Management of groundwater	Well monitoring within 2-	Lowering of groundwater	None.	Modification of Project

drawdown	mile radius of center of Project wellfield	level in Project wellfield area below management "floor."		operations to avoid drawdown below management "floor."
Vegetation	**Visual observation and correlation with groundwater levels**	**Reduction in the extent or character of Project area baseline vegetation**	**None**	**Modification of Project operations to re-establish baseline vegetation**