
GROUNDWATER MONITORING AND MANAGEMENT PLAN

SECTION 1 INTRODUCTION

This Groundwater Monitoring and Management Plan (Management Plan) is an integral part of the Cadiz Groundwater Storage and Dry-Year Supply Program (Cadiz Project). The Management Plan governs water use, storage and extraction for the Cadiz Project and ensures that project operations and future irrigation under the Cadiz Valley agricultural development will be conducted without adverse impacts to critical resources. Agricultural irrigation will also remain subject to the Cadiz Valley Agricultural Development Ground Water Monitoring Plan required by the County of San Bernardino. The Management Plan is designed to ensure there would be no adverse impacts by providing “early warning” of potential adverse impacts to critical resources. With such early warning, adverse impacts would be prevented by implementation of corrective actions. Critical resources identified in the Management Plan are as follows:

- Springs Within Affected Watersheds Including Springs of the Mojave National Preserve and BLM-Managed Lands.
- Aquifer System.
- Brine Resources of Bristol and Cadiz Dry Lakes.
- Air Quality in the Mojave Desert Region.

The 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 mandates specific action criteria (trigger levels) and specified responses if an action criterion is reached. It establishes a defined process for scientific review of groundwater management, weather and air quality information, a decision-making process to protect critical resources and allows for refinements to the Management Plan. Management Plan reports will be of public record.

The Management Plan has been prepared by the Bureau of Land Management (BLM), National Park Service (NPS), United States Geological Survey (USGS), the Metropolitan Water District of Southern California (Metropolitan), the County of San Bernardino, and Cadiz Inc. Metropolitan will operate the Cadiz Project in compliance with the provisions of the Management Plan. The BLM Authorized Officer will enforce compliance with the Management Plan as terms and conditions of any right-of-way grant(s) issued for the Cadiz Project facilities. The BLM will invite the participation of technical specialists from other public agencies as appropriate in a Technical Review Panel (TRP). The TRP will be established to review data, technical analyses, and Metropolitan’s assessment, proposed refinements to the Management Plan, and corrective measures presented to the BLM Authorized Officer and provide technical guidance to the BLM Authorized Officer regarding compliance with the provisions of the Management Plan. The TRP will be comprised of representatives from government agencies such as the NPS, the County of San Bernardino, the USGS, BLM and others as appropriate.

The BLM Authorized Officer will consider the recommendations of the TRP. In the event that there was not a consensus recommendation by members of the TRP, the recommendations of all TRP members will be presented to the BLM Authorized Officer. The BLM Authorized Officer will make a decision in accordance with the terms and conditions set forth in the right-of-way grant(s) issued for the Cadiz Project facilities, and inform Metropolitan of its decision. Metropolitan, in consultation with the BLM Authorized Officer and the TRP, will implement the Management Plan with an initial set of monitoring

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features and parameters developed from existing data as described in Section 5. The composition, duties and responsibilities of the TRP and the BLM Authorized Officer, and the decision-making process are described in Sections 7, 9 and 10.

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, staff gages, etc. A detailed list of monitoring features is shown in Table 1. As new data become available during project operations, these features and parameters will 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 Sections 7, 9 and 10.

The project will be comprised of three phases: a pre-operational phase, an operational phase of 50 years, and a post-operational monitoring phase of 10 years or as required by the BLM Authorized Officer. The pre-operational phase will commence upon final BLM approval of the Record of Decision for the Cadiz Project and Metropolitan’s receipt of necessary grant(s) of right-of-way required to construct the project facilities. The pre-operational phase will last a minimum of 15 months and maximum of 24 months. The NPS and BLM will complete and deliver all needed permits for monitoring facilities in accordance with the schedule contained in the Record of Decision, as soon as practicable within the pre-operational phase. The project will construct all facilities that are agreed to in the Management Plan and for which permits have been received. Construction of these facilities will be completed within one year of receipt of permits.

1.1 LOCATION OF PROJECT AREA

The Cadiz Project is located in eastern San Bernardino County as shown in Figure 1. The project spreading basins and wellfield will be located on Cadiz Inc. land, centered in the vicinity of Fenner Gap, located between the Marble and Ship mountains as shown in Figure 2.

1.2 PROJECT OBJECTIVES AND DESCRIPTION

The Cadiz Project has two objectives:

- Provide conjunctive-use storage of up to 150,000 acre-feet of imported Colorado River water per year, and total storage at any given time of up to 1 million acre-feet without adversely impacting critical resources. Water to be stored will be conveyed from Metropolitan's Colorado River Aqueduct (CRA) to spreading basins in the project area during periods of surplus supply. This stored water will subsequently be extracted by the project wellfield and conveyed back to the CRA as needed.
- Transfer (provide for the extraction and delivery) of indigenous groundwater to the CRA in compliance with the provisions of this Management Plan, including the avoidance of adverse impacts to critical resources.

The Cadiz Project involves construction and operation of the facilities shown on Figures 2 and 3 and as described below:

- Spreading basins and appurtenant facilities to be constructed on approximately 390 acres.
- A wellfield of approximately 30 extraction wells and appurtenant facilities.
- An approximately 35-mile-long conveyance pipeline and appurtenant facilities from the CRA to the project spreading basins and wellfield.
- A pumping plant on the conveyance pipeline, to be located in proximity to the Iron Mountain Pumping Plant.

**TABLE 1
PROPOSED MONITORING FEATURES AND FREQUENCIES**

Critical Resource Area	Feature No.	Monitoring Features ¹		No.	Pre-Operational Monitoring Frequency			Operational Monitoring Frequency ²									Post-Operational Monitoring Frequency			
								Recharge			Extraction			Storage						
					Water Level	Water Quality	Other Monitoring	Water Level	Water Quality	Other Monitoring	Water Level	Water Quality	Other Monitoring	Water Level	Water Quality	Other Monitoring	Water Level	Water Quality	Other Monitoring	
Springs in the Mojave National Preserve and BLM Managed Lands	1	S-Series Observation Wells ³ (2 to 3 per Cluster x 4 total Clusters)	New	4 clusters 8-12 wells	Continuous	Quarterly		Continuous	Annually	-	Continuous	Annually	-	Continuous	Annually		Continuous	Annually		
	2	Springs, Initial Characterization ⁴ (28+ total)	Existing	28+	-	-	One Time	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	Springs, Monitoring (Approximately 8) ⁵	Existing	8	Continuous at 2 Springs ⁶	Semi-Annually	Semi-Annually in Approximately 6 Springs	Continuous at 2 Springs	-	Semi-Annually in Approximately 6 Springs	Continuous at 2 Springs	-	Semi-Annually in Approximately 6 Springs	Continuous at 2 Springs	-	Semi-Annually in Approximately 6 Springs	Continuous at 2 Springs	-	Semi-Annually in 6 Springs	
Aquifer System	4	Observation Wells (15 total)	Existing	12	Monthly	4 Quarterly, 8 Annually	-	Monthly for First 3 Months of Cycle; Annually Thereafter	Annually	-	Monthly for First 3 Months of Cycle	Annually	-	Monthly for First 3 Months of Cycle	Annually	-	Annually	Triannually	-	
			Existing	2	Continuous	Annually	-	Continuous	Annually	-	Continuous	Annually	-	Continuous	Annually	-	Annually	Triannually	-	
			New	1	Monthly	Quarterly	-	Monthly for First 3 Months of Cycle; Annually Thereafter	Annually	-	Monthly for First 3 Months of Cycle	Annually	-	Monthly for First 3 Months of Cycle	Annually	-	Annually	Triannually	-	
	5	Project Area Well Clusters ^{7,8} - Unsaturated Zone Only (1 per Cluster x 3 total Clusters)	New	3 wells	-	-	-	Continuous	Semi-Annually	-	Continuous	Semi-Annually	-	Continuous	Semi-Annually	-	-	-	-	
	6	Project Area Well Clusters - Saturated Zone Only ⁸ (2 per Cluster x 3 total Clusters)	New	6 wells	Continuous	Quarterly	-	Continuous	Semi-Annually	-	Continuous	Semi-Annually	-	Continuous	Semi-Annually	-	Continuous (Until No Longer Deemed Necessary)	Annually	-	

**TABLE 1
PROPOSED MONITORING FEATURES AND FREQUENCIES (CONTINUED)**

Critical Resource Area	Feature No.	Monitoring Features ¹		No.	Pre-Operational Monitoring Frequency			Operational Monitoring Frequency ²									Post-Operational Monitoring Frequency		
								Recharge			Extraction			Storage					
					Water Level	Water Quality	Other Monitoring	Water Level	Water Quality	Other Monitoring	Water Level	Water Quality	Other Monitoring	Water Level	Water Quality	Other Monitoring	Water Level	Water Quality	Other Monitoring
	7	Production Wells (30 total)	Existing	4	-	-	-	-	-	Summarize Data Monthly	-	-	Summarize Data Monthly	-	-	Summarize Data Monthly	-	-	-
			New	26	-	-	-	-	-	-	Summarize Data Monthly	-	-	Summarize Data Monthly	-	-	Summarize Data Monthly	-	-
	8	Recharge Water Quality ⁸	Existing	1	-	-	-	-	Weekly (Annually Title 22)	-	-	Weekly	-	-	Weekly	-	-	-	-
Aquifer System	9	Spreading Basins	New	1	-	-	-	-	-	Regular Basis	-	-	Summarize Data Monthly	-	-	Summarize Data Monthly	-	-	-
	10	Land Surface Elevation Surveys (22 total)	New Benchmark	20	-	-	Annually	-	-	Annually	-	-	Annually	-	-	Annually	-	-	-
			InSAR (if warranted)	2/yr (If Warranted)	-	-	Semi-Annually	-	-	Annually	-	-	Semi-Annually	-	-	Annually	-	-	-
	11	Extensometer (if warranted) (1 total)	New	1	-	-	-	-	-	Records Daily	-	-	Records Daily	-	-	Records Daily	-	-	-
	12	Microgravity Stations (if warranted) (10 total)	New	10	-	-	One Time	-	-	Annually (if warranted)	-	-	Annually (if warranted)	-	-	Annually (if warranted)	-	-	Annually (until no longer deemed necessary)
	13	Flowmeter Surveys (5 total)	New	5	-	One Time	One Time	-	-	-	-	-	-	-	-	-	-	-	-
Bristol and Cadiz Dry Lakes	14	Bristol Dry Lake Well Clusters ¹⁰ (3 per Cluster x 3 total Clusters)	New	3 clusters 9 wells	Continuous	Quarterly	-	Continuous	Semi-Annually	-	Continuous	Semi-Annually	-	Continuous	Semi-Annually	-	Continuous (until no longer deemed necessary)	Annually as necessary	-
	15	Cadiz Dry Lake Well Clusters ¹¹ (3 per Cluster x 3 total Clusters)	New	3 clusters 9 wells	Continuous	Quarterly	-	Continuous	Semi-Annually	-	Continuous	Semi-Annually	-	Continuous	Semi-Annually	-	Continuous (until no longer deemed necessary)	Annually as necessary	-

TABLE 1
PROPOSED MONITORING FEATURES AND FREQUENCIES (CONTINUED)

Notes:

- 1 See Table 2 for details of monitoring features.
- 2 Monitoring frequencies pertain to the initial monitoring period of operational phase. Monitoring frequencies may be increased or decreased based on the initial monitoring results.
- 3 Four well clusters: (1) in Orange Blossom Wash; (2) in Clipper Wash; (3) directly south of the Clipper Mountains; and (4) in Schulyer Wash (see Figure 4).
- 4 Identified springs will be field-investigated to determine site specific characterization which includes geology, hydrology, and vegetation characteristics.
- 5 To be determined.
- 6 To be monitored using a piezometer equipped with a pressure transducer in the immediate vicinity of the springs.
- 7 Well clusters will consist of 2 to 3 wells at the same location, screened (i.e. completed) at different intervals. (Note: Well Clusters in the recharge and extraction area will consist of 1 unsaturated zone monitoring well and 2 saturated zone monitoring wells).
- 8 Features 5 and 6 together comprise 3 total clusters. They have been separated on this table to more completely define the unsaturated and saturated zone monitoring.
- 9 Water quality samples of input to artificial recharge facilities (i.e. Colorado River Aqueduct water) will be taken from weekly measurements at Lake Havasu.
- 10 Two well clusters to be installed along the eastern margin of Bristol Dry Lake and one to be installed on Bristol Dry Lake. (Note: All 3 of the wells in these clusters will measure groundwater characteristics, i.e. water levels and quality).
- 11 Two well clusters to be installed along the northern margin of Cadiz Dry Lake and one to be installed on Cadiz Dry Lake. (See Note: under 9 above)
- 12 Surface water gages will measure depth of ponded storm water runoff at the ET stations on Bristol and Cadiz Dry Lakes.
- 13 Open air nephelometers measure light scattered by particles in the atmosphere at Bristol and Cadiz Dry Lakes.

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- A power distribution system to be constructed generally parallel to the alignment of the conveyance pipeline.
- Instrumentation and control systems to monitor all project storage and extraction operations.
- Observation wells, cluster wells, land survey benchmarks, evapotranspiration stations, meteorological towers, nephelometers, digital cameras, a weather station and other appurtenant facilities necessary for the Management Plan.

With the exception of most of the conveyance and power distribution facilities, certain observation wells, survey benchmarks, and other monitoring features, all project facilities will be located on land owned by Metropolitan or Cadiz Inc.

1.3 EXISTING GROUNDWATER BASIN MANAGEMENT

Cadiz Inc. owns more than 27,000 acres in the Cadiz and Fenner Valleys of eastern San Bernardino County as shown in Figure 1. Approximately 1,600 acres of this land have been developed for citrus and stone fruit orchards, vineyards, and specialty row crops.

In 1993, San Bernardino County certified a Final Environmental Impact Report (FEIR) and granted various land use approvals for expansion of agricultural operations on this property up to 9,600 acres. As a component of this approval, the County identified specific groundwater monitoring activities to be undertaken by Cadiz. To comply with these monitoring requirements, 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. This Management Plan governs water use, storage and extraction for the Cadiz Project, and ensures that project operations and future irrigation under the Cadiz Valley agricultural development will be conducted without adverse impacts to critical resources. Agricultural irrigation will also remain subject to the Cadiz Valley Agricultural Development Ground Water Monitoring Plan required by the County of San Bernardino.

1.4 PURPOSE AND SCOPE

The purpose of this Management Plan is to ensure protection of the critical resources in or near the Fenner, Bristol and Cadiz Valleys. For purposes of this Management Plan, project operations would be evaluated to include the agricultural operations as outlined in the GWMP.

This Management Plan includes the following:

- 1) Description of the Cadiz Project location and objectives;
- 2) Identification of the critical resources and potential adverse impacts in and surrounding the project area due to project groundwater storage and extraction operations;
- 3) Description of the modeling tools that will be used to refine the monitoring network, and will be used, in the future, to refine action criteria;
- 4) Description of the monitoring network and identification of the conceptual locations of the features of the monitoring network;
- 5) Description of the monitoring, testing, and reporting procedures that will be used to collect and analyze data;
- 6) Description of the potential adverse impacts that may occur to the critical resources;
- 7) Description of the action criteria established to avoid potential adverse impacts;
- 8) Description of the decision-making process to be used once the action criteria are met or when BLM considers refinements to the Management Plan;
- 9) Description of corrective measures that may be implemented to prevent adverse impacts;
- 10) Description of objectives and requirements for a Closure Plan; and
- 11) Description of the Technical Review Panel (TRP), and its responsibilities and procedures.