CHAPTER 3
Project Description

3.1 Project Overview

This chapter is organized in the following sections:

3.1.1 Introduction

Cadiz Inc., in collaboration with Santa Margarita Water District and other Project Participants, has developed the Cadiz Valley Water Conservation, Recovery and Storage Project to implement a comprehensive, long-term groundwater management program for the closed groundwater basin underlying its property that would allow for both the beneficial use of some of the groundwater and storage of imported surface water in the groundwater basin. The Project would provide a new, reliable water supply source and water storage local to the Southern California region, both contributing to improved water supply reliability for the region.

Cadiz Inc. is a private corporation that owns approximately 34,000 mostly contiguous acres in the Cadiz and Fenner Valleys, which are located in the Mojave Desert portion of eastern San Bernardino County, California (see Figure 1-1). Underlying the Cadiz and Fenner Valleys and the adjacent Bristol Valley is a vast groundwater basin that holds an estimated 17 to 34 MAF of fresh groundwater.[1] The freshwater aquifers here consist of saturated alluvial materials, carbonate rocks, metamorphic rocks, and igneous rocks with a depth to groundwater consistently more than 180 feet below ground surface (bgs) and reaching over 400 feet bgs in many areas.[2] In recent

[1] CH2M Hill, *Cadiz Groundwater Conservation and Storage Project*, July 2010, page 3-1.
[2] CH2M Hill, *Cadiz Groundwater Conservation and Storage Project*, July 2010, Figures 2-23 and 2-16.

studies, groundwater has been found in the alluvium as well as the carbonate and crystalline rocks. In parts of the Bristol, Cadiz, and Fenner Valleys, the groundwater extends to depths of nearly 2,000 feet bgs.[3]

Within this closed basin system, groundwater percolates and migrates downward from the higher elevations in the watersheds surrounding the Project area and eventually flows to Bristol and Cadiz Dry Lakes. Figure 1-1 shows the boundaries of the surrounding Fenner, Orange Blossom Wash, Bristol, and Cadiz Watersheds. These Watersheds span over 2,700 square miles, see Section 3.3.1 below. The Dry Lakes represent the low point in the closed watershed basin, meaning that all surface and groundwater within the Watersheds eventually flows down gradient to these Dry Lake areas and not beyond. Once the fresh groundwater reaches the Dry Lake areas, it evaporates, first mixing with the highly saline groundwater zone under the lake beds and getting trapped in the salt sink, no longer fresh, suitable, or available to support freshwater beneficial uses. The portion that evaporates is lost from the groundwater basin and is therefore also unable to support beneficial uses.

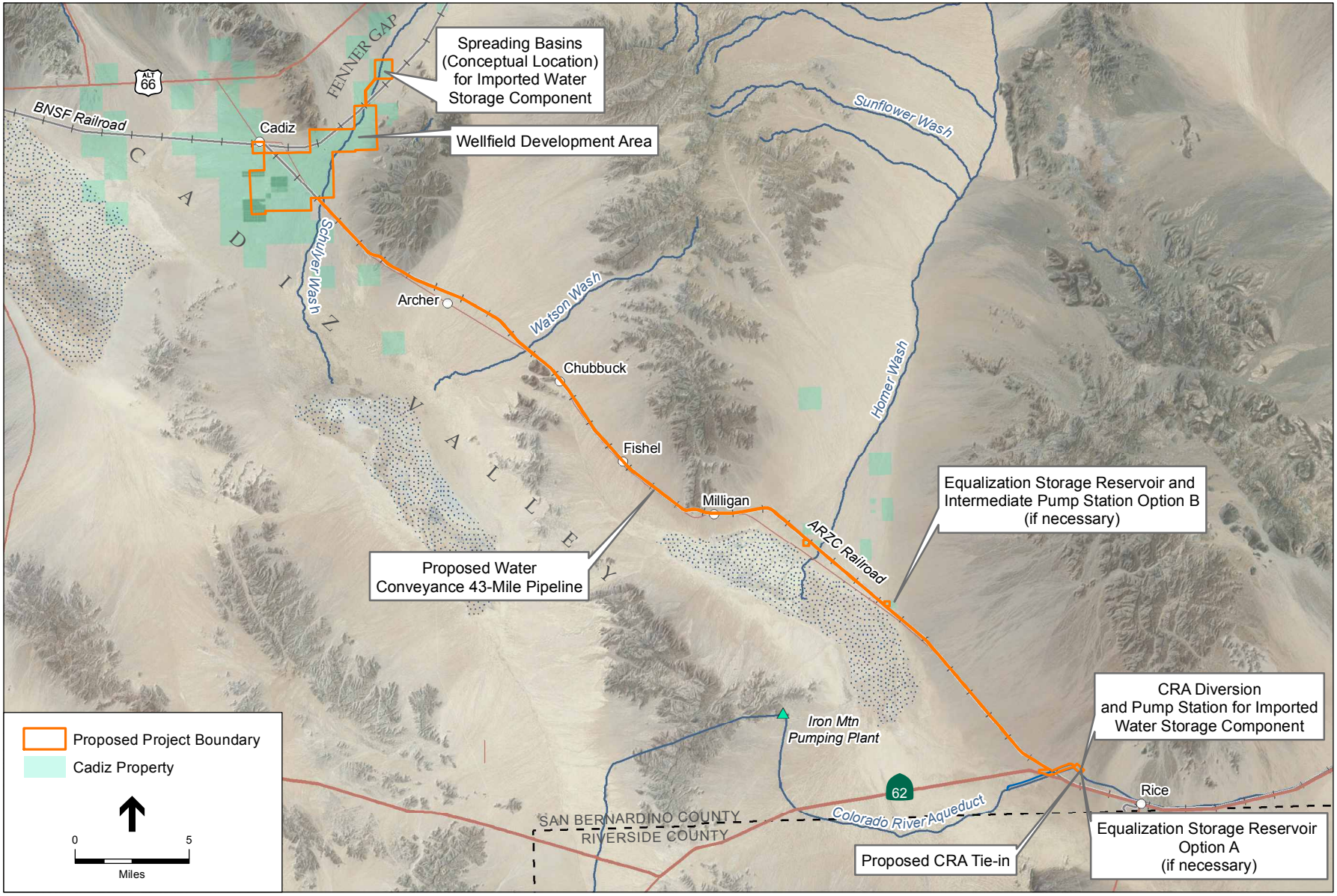
The proposed Project includes two distinct but related components:

1. Groundwater Conservation and Recovery Component
2. Imported Water Storage Component

In the Groundwater Conservation and Recovery Component, an annual average of 50,000 AF of groundwater would be pumped from the basin over a 50-year period for delivery to Project Participants (see Chapter 1, Section 1.2.3) in accordance with agreements with Cadiz Inc. and with the GMMMP. The GMMMP has been developed to guide the long-term groundwater management of the basin (for the Project). As described further in Section 3.3 below, the level of groundwater pumping proposed under the Groundwater Conservation and Recovery Component is designed specifically to extract and conserve groundwater that would otherwise migrate to the Dry Lakes, enter the brine zone, and evaporate. In addition, Project Participants could, in wet years, forego their annual groundwater delivery and instead “store” some or all of their annual share of water in the aquifer system for a future dry year. This is called carry-over storage.

The facilities proposed for this Component of the Project include a wellfield, manifold (piping) system, a 43-mile water conveyance pipeline, monitoring features, other appurtenances and fire suppression mechanisms. The wellfield and manifold (piping) system would be constructed on Cadiz Property to carry pumped groundwater to the conveyance pipeline, which would be constructed along the ARZC ROW and tie into the CRA. Water would be distributed to Project Participants via the CRA. A power conveyance system would be installed that would convey energy to the wellfield from natural gas engines or from electricity from the grid. In addition, to meet ARZC’s fire suppression and operational water needs, fire hydrants would be installed along the conveyance pipeline at strategic locations along the railroad tracks (e.g., at bridge trestles). Withdrawal of water for this Project component would be limited to a maximum of 75,000 AFY of water in any given year and a total of 50,000 AFY on average over the 50-year term of the Project. These proposed Project facilities are identified in **Figure 3-1** and are described in more detail below in Section 3.6.

[3] CH2M Hill, *Cadiz Groundwater Conservation and Storage Project*, July 2010, Figure 2-16.



SOURCE: Bing Maps, 2011; ESRI, 2010; Cadiz Inc., 2011; and ESA, 2011

Cadiz Valley Water Conservation, Recovery, and Storage Project

Figure 3-1

Key Project Facilities

The Groundwater Conservation and Recovery Component is intended to be consistent with the State's constitutional requirement that all waters of the State be put to their fullest, beneficial use and not be wasted. In relevant part, Article X, Section 2 of the California Constitution states:

> "[B]ecause of the conditions prevailing in this State *the general welfare requires that the water resources of the State be put to beneficial use to the fullest extent of which they are capable*, and that the waste or unreasonable use or unreasonable method of use of water be prevented, and that the conservation of such waters is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare. …" (emphasis added) (California Constitution Article X, Section 2).

The Imported Water Storage Component allows Project Participants to send surplus surface water supplies, when available, to the Project area to be recharged via spreading basins and held in storage until needed in future years. When needed, the stored surface water would be pumped out of the groundwater basin and returned to the appropriate Project Participant. The Imported Water Storage Component proposes to store up to 1 MAF, at any given time.

The facilities proposed for the Imported Water Storage Component of the Project include expansion of the Project wellfield; construction of spreading basins to recharge the surface water into the groundwater basin; additional roads, piping, power supply, and distribution facilities; and a CRA diversion structure and pump station. This Project component would utilize the pipeline constructed for the Groundwater Conservation and Recovery Component to convey stored water back to any Project Participants.

As part of the Imported Water Storage Component, one or more of the unused natural gas pipelines that exist in the Project area may be converted for use as a water conveyance facility. The purpose of this would be 1) to intertie the Project system to the SWP or other potential sources of surface water supply for import and storage at the Project site and/or 2) to connect to other potential Project Participants interested in storing water at the Project area. Initial study indicates that existing natural gas pipelines in the area could be converted for use as water conveyance pipelines with a maximum capacity of 30,000 AFY.

The importation of surplus water from the CRA to the Cadiz area was evaluated in an EIR/EIS published in 2001 by the BLM and Metropolitan. The BLM certified the Final EIS and offered a right of way grant to Metropolitan in 2002. Although the program considered by the 2001 EIR/EIS was not approved by Metropolitan, extensive technical review, modeling and evaluation of impacts was undertaken concerning the storage and recovery of imported water.

Participants for the Imported Water Storage Component of the Project have not yet been identified. Withdrawal and return of groundwater upon implementation of the Imported Water Storage Component would be limited to a combined maximum of 105,000 AFY, which reflects the capacity of the 43-mile conveyance pipeline and the potential additional 30,000 AFY capacity of any converted natural gas pipelines. In accordance with *CEQA Guidelines* Sections 15161 and 15378(a), the Groundwater Conservation and Recovery Component is being analyzed at a project level in this Draft EIR. Where possible, the Imported Water Storage Component is also analyzed at a project level (i.e., select facilities that are sufficiently defined), but because participants have

not been identified and certain elements of the design are still under conceptual development, including the potential quantity and schedule for surface water import, spreading, storage, and extraction, the Imported Water Storage Component of the proposed Project is analyzed primarily at a programmatic level in this Draft EIR in accordance with *CEQA Guidelines* Section 15168. At a time when the Imported Water Storage Component is to be implemented, additional review will be conducted pursuant to Section 15168 and the technical work, studies and modeling previously undertaken will be updated to account for, among other things, proposed project parameters, newly developed information and modeling.

The Project would be operated by the FVMWC, which would be formed as a non-profit California mutual water company to deliver water at cost to its shareholders. Shareholders of FVMWC would include the Project Participants and Cadiz Inc. The full term of the Project's operation, including the first and second phases, would be limited to 50-years. In the event that circumstances beyond the control of the Project operator required additional time to complete contracted water deliveries, the Project term may be extended for a limited time under the terms of the agreements. If Project Participants elect to extend the Project for an additional term, new agreements and a new environmental analysis would be required.

3.1.2 Project Location

The facilities to be constructed for the Project would be located at the confluence of the Fenner, Orange Blossom Wash, Cadiz, and Bristol Watersheds (see Chapter 1, Figure 1-1) approximately 220 miles east of Los Angeles, 75 miles southwest of Needles, and 65 miles northeast of Twentynine Palms (see Figure 3-1). The water would be conveyed from the Project area to the service areas of the Project Participants shown on Figures 1-2 and 1-3 via the CRA.

The proposed wellfield and observation wells described in the GMMMP would be located on private property. The proposed 43-mile conveyance pipeline would be located within the ARZC ROW and extend from the wellfield on Cadiz Property southwest to the CRA. Two of the observation wells in the proposed 17-well monitoring network are proposed to be located on Cadiz Property in the Danby and Piute Valleys which lie adjacent to and east of Fenner Valley respectively; the other proposed observation wells and equipment most likely would be located at the main Project site. All Project facilities would be built on private land, with the entire pipeline and some of the wells on pre-disturbed land. Specific facility site location maps for proposed Project facilities are provided in subsequent sections. The Project location considered in this Draft EIR also includes the broader region within which the water supply provided by this Project would be used. Thus, the service areas of the water provider Project Participants are included as well as the broader service area of Metropolitan, since the Groundwater Conservation and Recovery Component still has capacity for other water providers to elect to participate.

3.2 Project Objectives

The California Constitution mandates maximizing the reasonable and beneficial use of water and the avoidance of waste. *The fundamental purpose of the Project* is to save substantial quantities of groundwater that are presently wasted and lost to evaporation by natural processes. In the absence

of this Project, approximately 3 MAF of groundwater presently held in storage between the proposed wellfield and the Dry Lakes will become saline and evaporate over the next 100 years. By strategically managing groundwater levels, the Project would conserve up to 2 million AF of this water, retrieving it from storage before it is lost to evaporation. The conservation opportunity is unique and garners special emphasis. The proposed conservation is not dependent upon future rainfall, snow pack or the needs and demands of others: the groundwater is already in storage. Moreover, the conservation and resulting water supply augmentation can be achieved independently from the environmental and regulatory conditions that generally constrain the importation of water to Southern California. The geographic isolation of the groundwater makes it non-tributary to the Colorado River system, and therefore eligible for distinctive treatment under federal regulations that may unlock additional complementary storage opportunities, both within the Basin and in Lake Mead.

The Project makes available a reliable water supply for Southern California Project Participants, to supplement or replace existing supplies and enhance dry-year supply reliability. Both the SWP and Colorado River water supplies are experiencing reductions from historic deliveries. As a result, Southern California water providers are looking for affordable new supplies to replace or augment current supplies and enhance dry-year supply reliability. The Project would optimize the reasonable and beneficial use of water within the aquifer system in a sustainable fashion—conserving water that would otherwise be wasted—to create a local water supply alternative for Southern California water providers.

The objectives for this Project are as follows:

- Maximize beneficial use of groundwater in the Bristol, Cadiz, and Fenner Valleys by conserving and using water that would otherwise be lost to brine and evaporation;
- Improve water supply reliability for Southern California water providers by developing a long term source of water that is not significantly affected by drought;
- 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 the service areas of 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, design, and operate the Project in a manner that minimizes significant environmental effects and provides for long-term sustainable operations.

3.3 Groundwater Basin Overview

3.3.1 Watersheds

The overall drainage basin in which the proposed Project would be constructed consists of the Fenner, Orange Blossom Wash, Bristol, and Cadiz Watersheds (collectively, the Watersheds) (see Figure 1-1). The Watersheds are considered one topographically-closed drainage system because all surface water and groundwater drain to the interior of the overall drainage basin. In summary, the total area of the combined Fenner (including Orange Blossom Wash), Bristol and Cadiz groundwater basin system is approximately 2,710 square miles and consists of the Fenner Watershed (1,100 square miles), the Orange Blossom Wash Watershed (160 square miles), Bristol Watershed (1,170 square miles), and the Cadiz Watershed (540 square miles).[4]

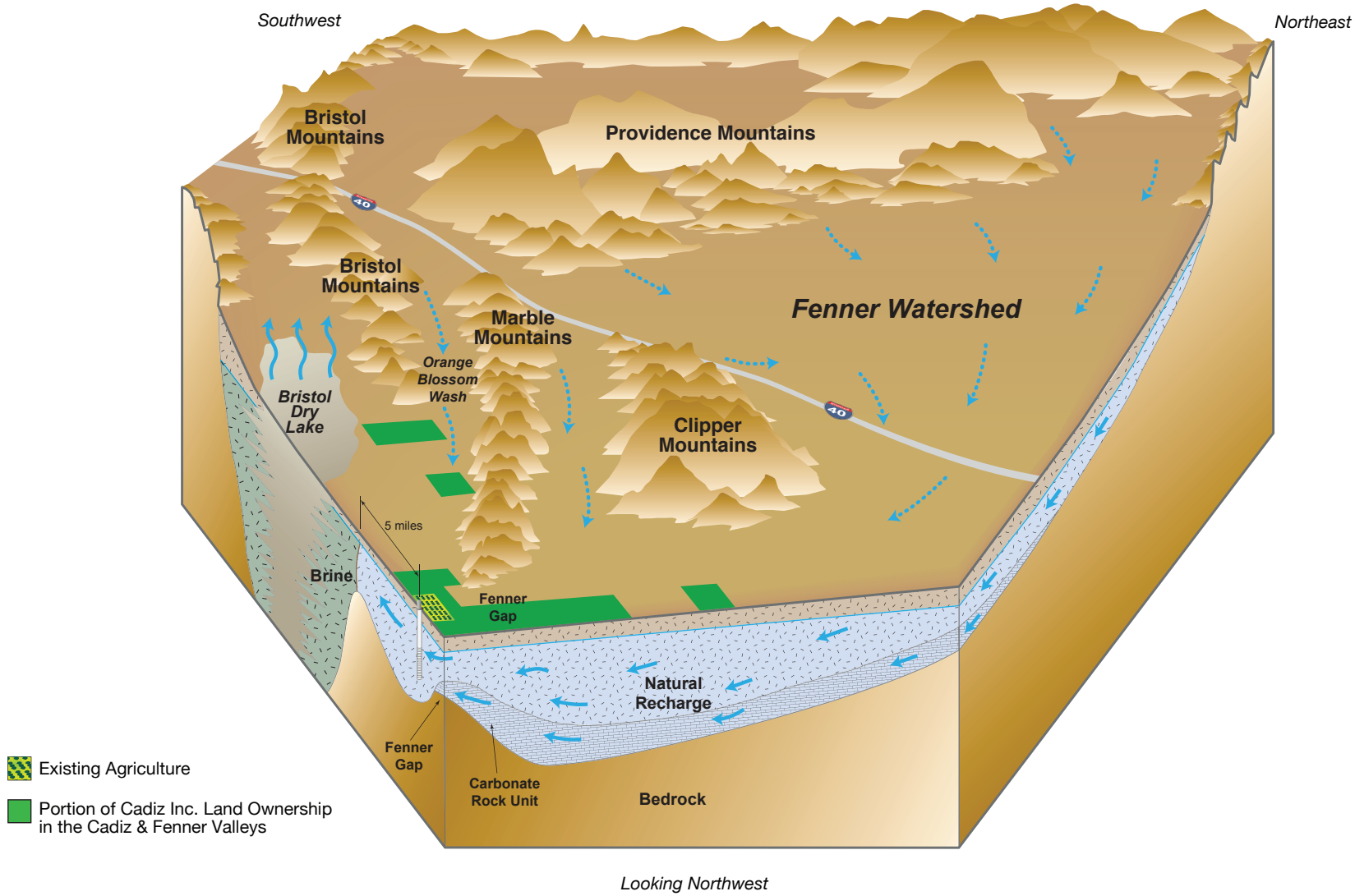
The Fenner Watershed is located in the northern portion of the Project area. Generally, the Fenner Valley slopes south to southwest toward the Fenner Gap at an elevation of about 900 feet National Geodetic Vertical Datum (NGVD). The Fenner Gap occurs at the southern end of the Fenner Watershed between the Marble and Ship Mountains. At this location, surface water drainage and groundwater flow from the Fenner Watershed and enter the Bristol and Cadiz Watersheds to the south. The Orange Blossom Wash Watershed comprises approximately 160 square miles and drains to the southeast into the Bristol Watershed. For the purposes of the proposed Project, the Orange Blossom Wash Watershed is generally assumed to be included in references to the Fenner Watershed because both watersheds provide the proposed production source and storage capacity for the Project.

Since the Watersheds are part of a closed drainage system, the only natural outlet for surface water and groundwater is through evaporation at the Bristol and Cadiz Dry Lake surfaces. These surfaces are normally dry but flash flooding from high intensity rain storms can result in standing water that can remain for weeks before evaporating.

3.3.2 Aquifer Properties

The alluvial sediments of the groundwater basin underlying the northern Bristol, Cadiz, and Fenner Valleys are underlain by igneous and metamorphic rocks, forming a rock-bounded basin overlain with sands and gravels many hundreds of feet thick. Groundwater can be found in significant quantities not only in the alluvium, but also in the caverns of the carbonate and fractures of the crystalline rock. Groundwater ranges from approximately 270 to 400 feet bgs in the northeastern portion of the Project area to 180 feet bgs in the southwest, becoming shallower with increasing proximity to the Dry Lakes. **Figure 3-2** provides a schematic cross section of the Fenner Gap and Bristol Dry Lake.

[4] GEOSCIENCE Support Services, Inc., *Cadiz Groundwater Conservation and Storage Project Phase I – Conservation Scenarios,* August 2011, page 2.



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SOURCE: CH2M Hill, 2010; and ESA, 2011.

Cadiz Valley Water Conservation, Recovery, and Storage Project

Figure 3-2

Conceptual Surface and Groundwater Flow

Evaporation of groundwater and surface water from the Dry Lakes over the past several million years has resulted in thick deposits of salt (primarily calcium chloride and sodium chloride) and brine-saturated sediments.[5] Two surface soil samples taken from Bristol Playa show that it is high in sodium and chloride with sulfate in small quantities increasing from the playa edge.[6]

The primary sources of recharge to the aquifer system in the Project area include: 1) direct infiltration of precipitation (both rainfall and snowfall) into fractured bedrock that is exposed in mountainous terrain, and 2) infiltration of ephemeral stream flow in sand-bottomed washes, particularly in the higher elevations of the watershed. The source of much of the groundwater recharge occurs at higher elevations.[7]

The natural recharge in the Watersheds has been the subject of several studies since 1970. The most recent estimate, presented in 2010 by CH2M Hill, is 32,000 AFY. The 32,000AFY estimate is calculated from newly compiled data bases and publicly available data, based on the 2008 U.S. Geological Survey (USGS) INFIL3.0 model. The USGS INFIL3.0 model is a comprehensive model that computes a wide-range of daily, monthly, and annual average water-balance components for multi-year simulations.[8]

3.3.3 Groundwater Movement and Storage

In general, groundwater within the Watersheds flows down gradient in the same direction as the slope of the land surface. In the Fenner Valley, groundwater flows southward and discharges through Fenner Gap toward the Bristol and Cadiz Dry Lakes. In Orange Blossom Wash, located between the Marble and Bristol mountains, groundwater flows southeast from the Granite Mountains and then turns south into the Bristol Dry Lake.[9]

Total fresh groundwater in storage within the Watersheds is estimated to range from 17 to 34 MAF. Groundwater water levels in the Fenner Valley are found at elevations above 610 feet at the Fenner Gap, while groundwater levels at the Cadiz and Bristol Dry Lakes are as low as 545 feet in elevation. This groundwater elevation difference between the Fenner Gap and the Dry Lakes drives groundwater downslope toward the Dry Lakes. It is estimated that between 4 and 10 MAF of groundwater exists in the freshwater zone south of the Fenner Gap.[10]

3.4 Project Components

The Project would be constructed in two phases. This section first explains how each of the two Project components, Groundwater Conservation and Recovery and Imported Water Storage, would be developed and operated and then summarizes the monitoring and management program that would be implemented as a design feature of the Project.

5 CH2M Hill, *Cadiz Groundwater Conservation and Storage Project*, July 2010, page 2-8.
6 HydroBio, *Fugitive Dust and Effects from Changing Water Table at Bristol Play, San Bernardino, California*, January 2011, page 9.
7 CH2M Hill, *Cadiz Groundwater Conservation and Storage Project*, July 2010, page 2-8.
8 CH2M Hill, *Cadiz Groundwater Conservation and Storage Project*, July 2010, page ES 3.
9 CH2M Hill, *Cadiz Groundwater Conservation and Storage Project*, July 2010, page 2-9.
10 CH2M Hill, *Cadiz Groundwater Conservation and Storage Project*, July 2010.

3.4.1 Groundwater Conservation and Recovery Component

Groundwater Pumping Operations

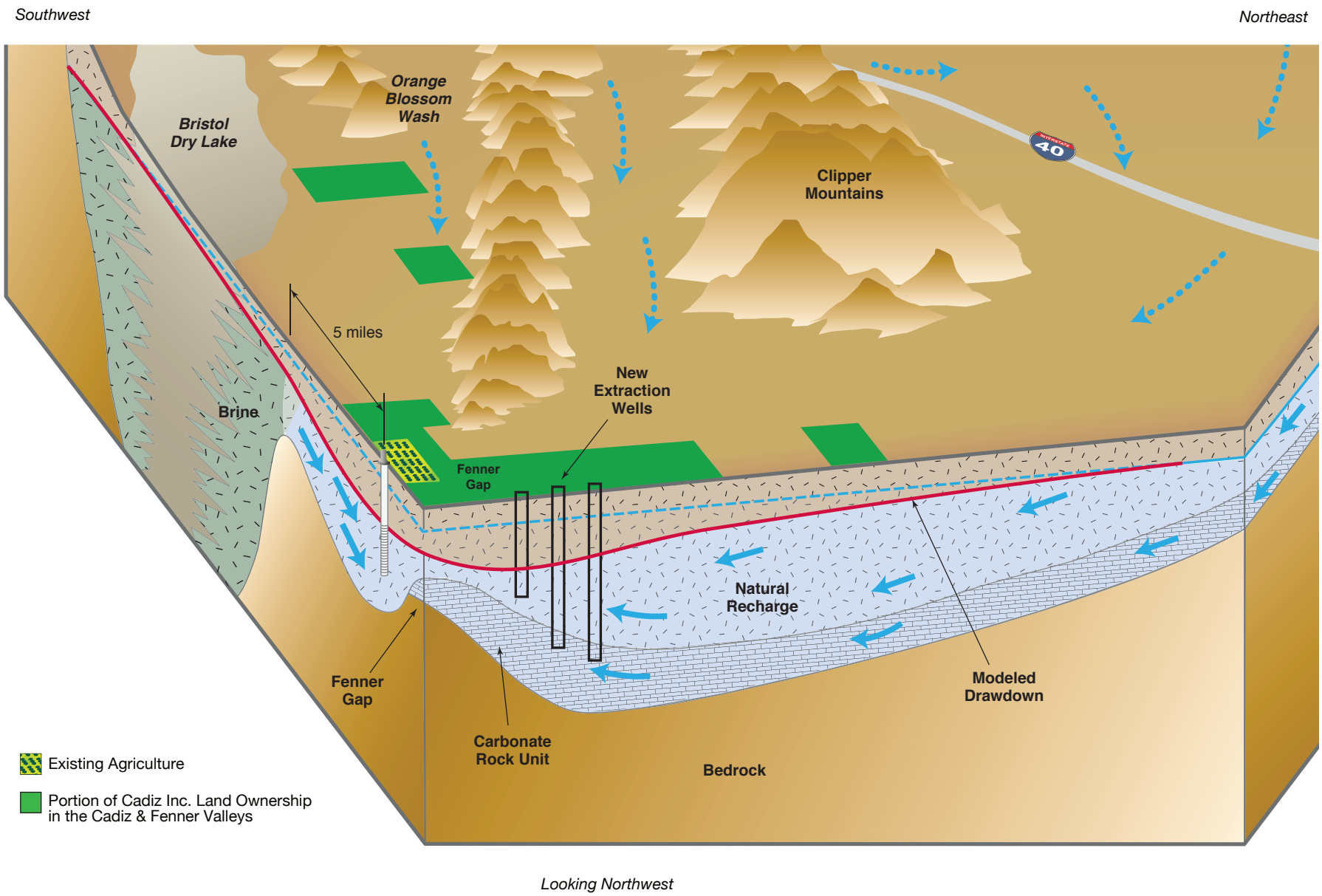
For the Groundwater Conservation and Recovery Component, a wellfield would be installed near the narrow Fenner Gap area and spread south and southwest toward Bristol Dry Lake to extract groundwater from the basin and prevent the loss to high-salinity and evaporation.

Groundwater pumping would be coordinated to lower the water table in the wellfield so that: (1) annually replenished groundwater that naturally flows through the Fenner Valley and the Orange Blossom Wash can be intercepted and conserved for use before it naturally migrates to the hyper-saline Bristol and Cadiz Dry Lakes; and (2) groundwater in storage south of the proposed wellfield and presently migrating towards Bristol and Cadiz Dry Lakes can be retrieved and conserved for beneficial use.

Groundwater modeling and associated studies completed to develop the proposed Project operations determined that in order to (1) intercept groundwater that is upstream of the wellfield before it flows down past the wellfield to the Dry Lakes and (2) to pull back and recover the fresh groundwater that is already down gradient of the proposed wellfield and on its way to the Dry Lakes area, sufficient groundwater pumping in excess of the natural recharge rate must be implemented. This pumping would lower the groundwater levels at the wellfield to create a pumping depression, referred to as a cone of depression, and establish hydraulic control of the local groundwater flow. The modeling evaluated the extent of retrieval and conservation that would occur from the fresh water zone. **Figure 3-3a** illustrates the drawdown effect of the proposed wellfield showing how lowering the groundwater table enough at the wellfield would induce some of the groundwater to flow towards the wells rather than continue its down gradientmigration to the salt sink under the Dry Lakes and eventual evaporation. **Figure 3-3b** provides a schematic view of the relationship of pumping over time and evaporation off the Dry Lakes. As illustrated in Figure 3-3b, the planned strategic groundwater pumping of 50,000 AFY on average and lowering of the groundwater table in the targeted area near the Fenner Gap, establishes hydraulic control of the groundwater flow and allows the conservation of groundwater that without such control would continue to migrate to the Dry Lakes. This would potentially conserve 1.36 MAF of groundwater that otherwise would have evaporated over the 50-year operational period of the Project. This amount increases to 2 MAF after 100 years, since evaporation would increase slowly over time as groundwater levels recover once pumping stops.[11]

In addition to identifying the existence of a substantial conservation opportunity, the modeling work suggests a strong correlation between the quantity of groundwater pumped in the earlier years and the ability to efficiently retrieve groundwater from evaporation. Over the Project's 50-year operational period, greater pumping rates in excess of natural recharge are expected to generally result in higher conservation benefits.

[11] CH2M Hill, *Cadiz Groundwater Conservation and Storage Project*, July 2010.



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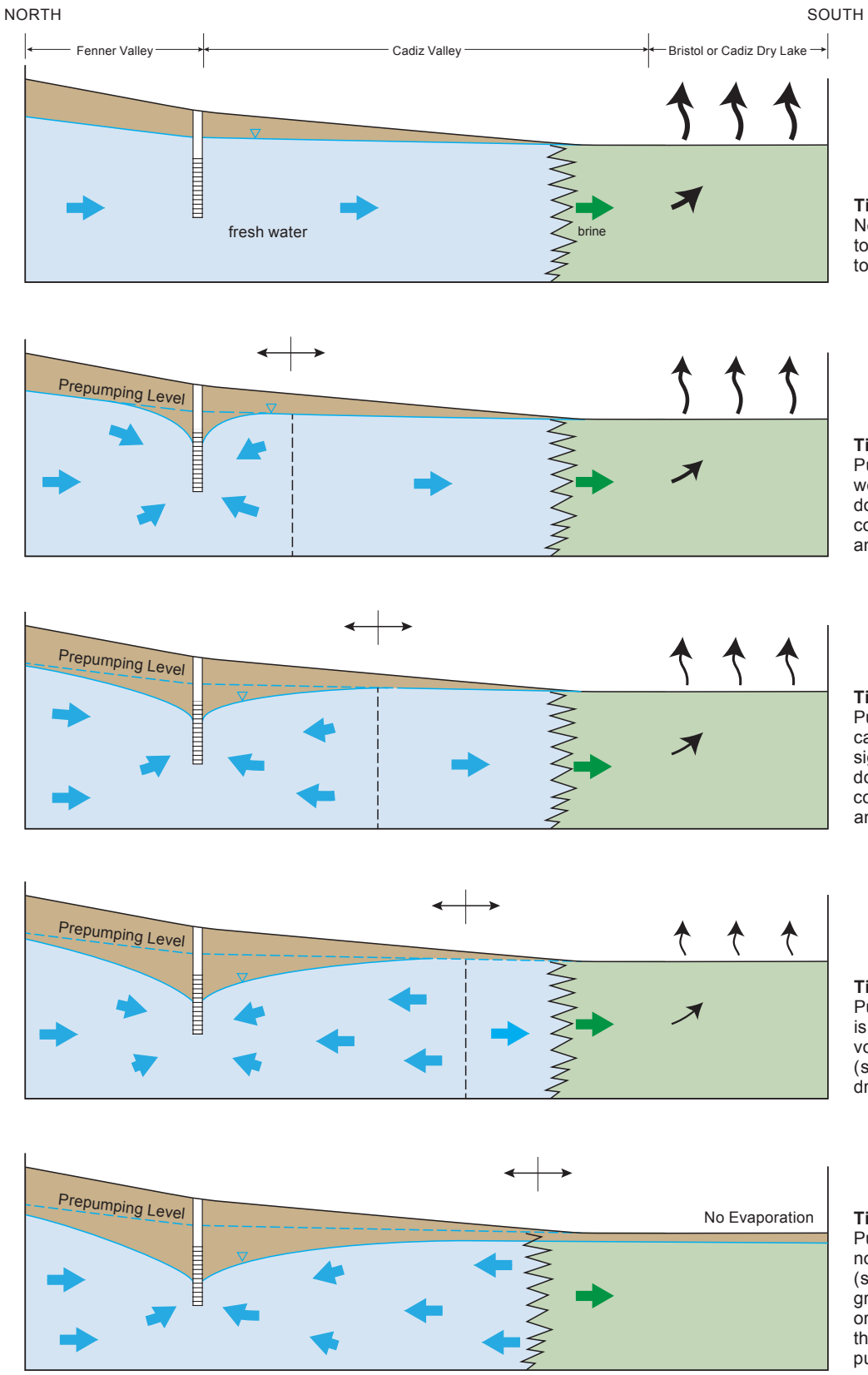
SOURCE: CH2M Hill, 2010; and ESA, 2011.

Cadiz Valley Water Conservation, Recovery, and Storage Project

Figure 3-3a

Conceptual Surface and Groundwater Flow with Project after 50 Years



Time 0
No pumping. Groundwater flows equal to rate of natural recharge (southeast) toward the dry lake and evaporates.

Time 1
Pumping begins. Groundwater near well is captured, but most groundwater downgradient (southeast) of well continues to flow toward the dry lake and evaporates.

Time 2
Pumping continues. Groundwater is captured further from the well, but a significant volume of groundwater downgradient (southeast) of the well continues to flow toward the dry lake and evaporates.

Time 3
Pumping continues. Most groundwater is captured and now only a small volume of groundwater downgradient (southeast) of the well flows toward the dry lake and evaporates.

Time 4
Pumping continues. All groundwater is now captured downgradient (southeast) of the well and no groundwater flows toward the dry lake or evaporates. Some of the brine near the dry lake moves slightly toward the pumping well.

SOURCE: CH2M HILL, 2011.

Cadiz Valley Water Conservation, Recovery, and Storage Project

Figure 3-3b
Conceptual Cross Section Showing Groundwater Flow and Evaporation

Modeling suggests that the most effective method of operating for the single purpose of groundwater retrieval is to maximize groundwater pumping in the first years of Project operation and to curtail extractions in the last years, resulting in a 50-year average of 50,000AFY. There is an estimated 4 to 10 MAF of groundwater in the area south and downgradient of the Fenner Gap that is moving towards the Dry Lakes. The greater the pumping in excess of natural recharge, the more effective and successful the retrieval and conservation of this stored groundwater.

Proposed groundwater pumping for the 50-year operational period for the Project would recover a fraction of the 17-34 MAF presently in storage to create the lowered water table and would enable the interception of the natural recharge and the retrieval of groundwater from that portion of groundwater in storage south of the wellfield (4-10 MAF) conserving it for beneficial use.

Establishing hydraulic control of the groundwater at the wellfield allows Project Participants flexibility in determining the actual annual quantity of groundwater that they would remove from the Project in any year. If they do not need their full contracted allotment in a given year, it can remain in groundwater storage (carry-over storage) south of the Fenner Gap protected through the hydraulic control mechanism from being lost to the Dry Lakes and evaporation. This emulates groundwater management practices in many basins in Southern California and would give Project Participants some operating flexibility by allowing them to maximize conjunctive use of Project water with other supplies in their portfolios, further improving the management and reliability of their water supply.

Under the Groundwater Conservation and Recovery Component of the Project, groundwater from the Project, which is non-tributary to the Colorado River, would be introduced into the CRA as “new” water. For potential participants who have contracts with the Bureau of Reclamation for Colorado River water, this creates the opportunity for establishing Intentionally Created Surplus

Credits on that system. This opportunity could allow a participant to further leverage its water supplies and improve supply reliability. Such a request would require compliance with a separate administrative process.

Annual Pumping Scenarios

The annual average groundwater pumping under the Groundwater Conservation and Recovery Component of the Project over the 50-year operating period would be 50,000 AFY. Actual total pumping in a given year would vary depending on Project Participant supply needs and may range from 25,000 AFY up to 75,000 AFY in any one year. In certain wet years, Project Participants may opt to decrease or forego their contracted annual groundwater deliveries and instead store their water in the aquifer system at the Project site. This stored water, or “carry-over water,” could then be conveyed in a future dry-year as a supplement to the contracted annual supply. As previously stated, the Project would be limited to a maximum of 75,000 AFY in any given year and a long-term annual average of 50,000 AFY over the 50-year term of the Project. Pumping would be conducted over a period of 10 months each year.

Relationship of Groundwater Operations for the Groundwater Conservation and Recovery Component and the Imported Water Storage Component

One of the benefits of the Groundwater Conservation and Recovery Component is that it would prepare the groundwater basin to safely and efficiently store imported water. Lowering the water table to retrieve and intercept groundwater as part of the Groundwater Conservation and Recovery Component would allow for the subsequent storage and retention of imported surface water in the groundwater basin for the second phase of the Project. Thus, the Project promotes the fullest beneficial use of water, as mandated by the California Constitution, in three ways: (1) conservation and recovery of approximately 50,000 AFY of groundwater supply, (2) avoidance of loss of water to salinity and evaporation, and (3) the resultant creation of space in the groundwater basin to store imported water that can be held behind the hydraulic control to minimize loss and evaporation.

This approach is greatly preferred to a strategy of implementing the Imported Water Storage Component alone, for the following reasons. First, there is already a natural gradient driving groundwater toward the Dry Lakes. Without the initial dewatering, storing additional water in the groundwater basin would increase this downslope pressure (by mounding) toward the Dry Lakes, accelerating the potential loss of groundwater which would operate at cross-purposes with the conservation objective. Second, implementation of the Imported Water Storage Component once groundwater levels have been drawn down and after a hydraulic gradient can be established would also allow Project Participants the opportunity to put conserved water from Phase 1 to beneficial use. Third, this approach avoids the practical concern of finding a short-term beneficial use for vast quantities of groundwater simultaneous with the initiation of recharge activity that aims to put imported water in the ground.

Role of the Fenner Valley Mutual Water Company

The FVMWC would operate the Project and implement the GMMMP. The FVMWC would be formed as a non-profit California mutual water company to deliver water at cost to its shareholders, which would be comprised of the participating water providers, Cadiz Inc., and the ARZC. Mutual water companies are unregulated, non-profit, private corporations organized for the purpose of acquiring water rights and distributing water to shareholders (*Consolidated People's Ditch Co. v. Foothill Ditch Co*. [1928] 205 Cal. 54, 63). They are administered by a board of directors and incorporated pursuant to the California Corporations Code, Sections 14300 et seq. Mutual water companies are allowed to provide water to a limited set of non-shareholders, such as schools and public agencies, but if they offer water service to the public at large, then they become regulated public utilities (see California Public Utilities Code § 2705). While the CPUC regulates privately owned and operated for-profit water services that provide water to the public, they do not regulate non-profit mutual water companies.

3.4.2 Imported Water Storage Component

The Imported Water Storage Component of the Project would allow for storage of imported surface water from the Colorado River or the State Water Project in the aquifer system at the

Project area. When water is available by direct delivery or exchange, such as surplus water in wet years, a Project Participant could convey water from the CRA to the Project site via the water conveyance pipeline that would be constructed under the first phase of the Project. This water would be recharged into the aquifer system via proposed spreading basins that would be constructed on Cadiz Property. A pump station would be constructed to convey the water from the CRA to the spreading basins. Existing unused natural gas pipelines in the Project area may also be converted for water conveyance and employed to deliver water from the State Water Project system to the Project spreading basins.

The Project participants for the second phase of the Project may include Colorado River rights holders located in Southern California and potentially providers with rights to water from the State Water Project. Whether the imported water comes from the Colorado River or the State Water Project, when needed, previously stored surface water would be withdrawn from storage, conveyed to the CRA and delivered through the CRA delivery system to Project participants. Existing unused natural gas pipelines that traverse the Cadiz Property converted for water conveyance also could be used to convey water to Project Participants.

Provided that groundwater extractions proceed as planned in the first phase of the Project with an annual average of 50,000 AFY, then the aquifer system could ultimately accommodate 1 MAF of imported water without unreasonable mounding. There is an existing natural downward gradient between the proposed wellfield and the Dry Lakes that causes groundwater to flow downward to the west and south to the Dry Lakes, where it evaporates. Without the benefit of the drawdown in the proposed wellfield and the resulting hydraulic control, the Storage and Recovery phase would face the challenge of incurring substantial losses.

Based on the available storage capacity in the Fenner Valley, withdrawal of groundwater stored in the aquifer, should the Imported Water Storage Project Component be implemented, would be limited to a combined maximum of 105,000 AFY as compared to the 150,000 AFY that was evaluated previously in 2001 by Metropolitan. This reflects the capacity of the 43-mile conveyance pipeline to the CRA and, potentially, an additional 30,000 AFY that could be conveyed through a converted natural-gas pipeline. The wellfield would be expanded so that a total of 105,000 AFY of imported water could be returned to the CRA and, potentially, the SWP.

The Imported Water Storage Component could also provide storage opportunities with in-lieu arrangements between FVMWC, Metropolitan and the Project Participants. Water could be delivered through the CRA to Project Participants in lieu of extracting groundwater from the basin. Although the storage and recovery of water imported from the CRA was reviewed at a project level in the 2002 EIR/EIS, the Imported Water Storage Component is still under conceptual development. Because the sources of the imported water, the possibility of banking both Colorado River and other water, and the potential quantity and schedule for spreading, storage, and extraction are all unknown, the Imported Water Storage Component will be analyzed at a programmatic level in this Draft EIR, pursuant to *CEQA Guidelines* § 15168 (14 California Code of Regulations § 15168). Further environmental review will be conducted as appropriate and required under CEQA when specific Project participants are identified and express an interest in accessing the basin storage. For example, additional information regarding the specific location

and design of the proposed wellfield expansion will be necessary to fully evaluate groundwater quality impacts associated with the Imported Water Storage Component.

3.4.3 Groundwater Management, Monitoring, and Mitigation

Overview

The GMMMP establishes a monitoring protocol and oversight authority to ensure that operation of the Project is managed effectively to optimize beneficial uses and avoid adverse impacts for the life of the Project. The FVMWC would implement the GMMMP, including installation of observation features and data collection, as an integral part of the Project. It is attached to this Draft EIR as Appendix B1.

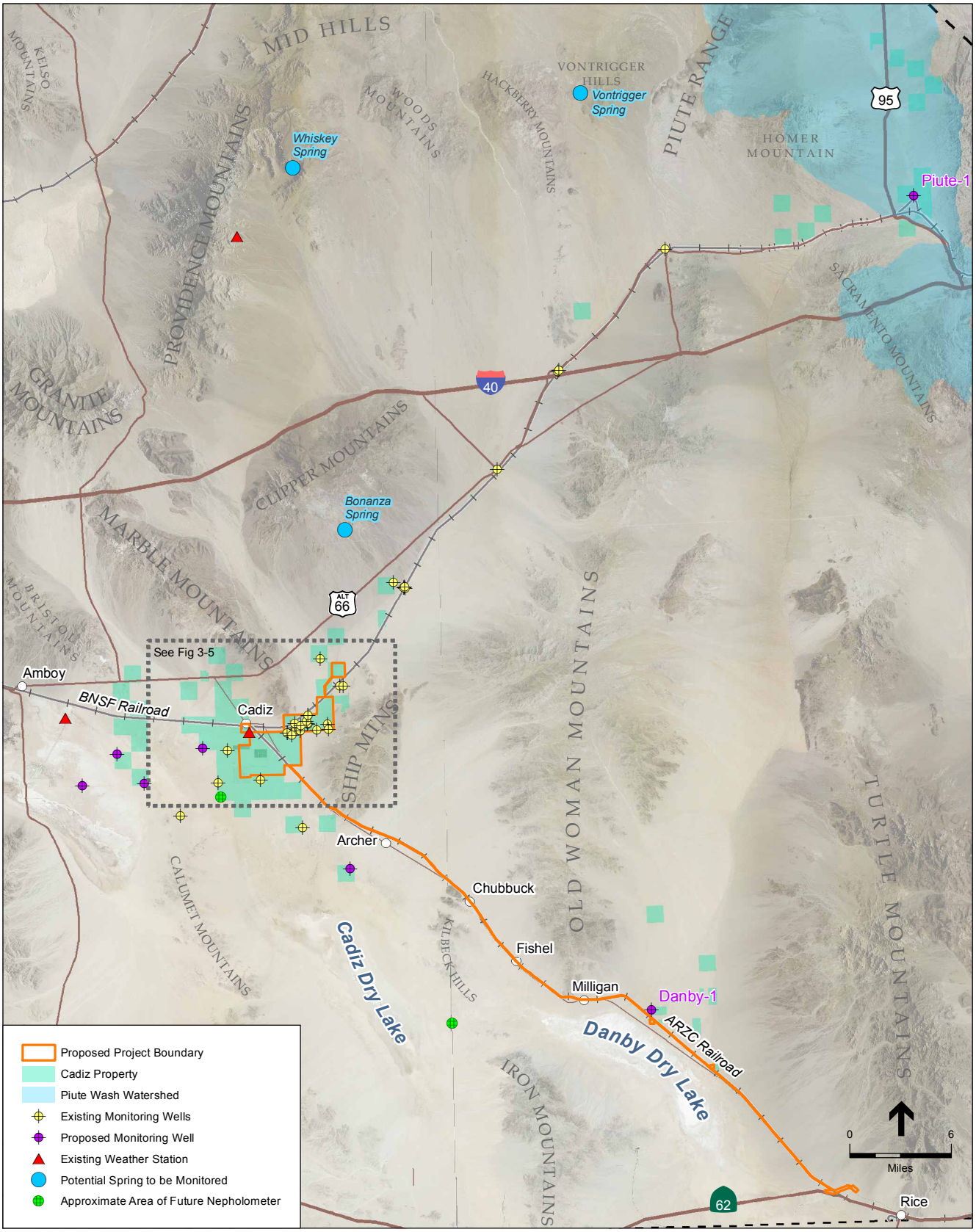
The GMMMP includes a detailed monitoring and mitigation response program for the first phase of the Project, the Groundwater Conservation and Recovery Component. When the Imported Water Storage Component of the Project is developed and ready for project-level environmental review, the GMMMP would be updated to incorporate a detailed monitoring and response program for that phase of the Project, as appropriate.

The GMMMP evaluated Project operations with respect to critical resources that include the following:

- Groundwater aquifer system (including groundwater quality, subsidence, and existing users)
- Natural springs in the watershed
- Brine resources
- Air Quality
- Adjacent watersheds

In order to monitor potential effects to these critical resources, the GMMMP integrates the use of monitoring equipment in the field, routine visual inspection, and the ongoing use of the groundwater model to track Project operations. The monitoring program would make use of a network of observation wells (both existing and new) to monitor both groundwater levels and water quality; a series of land survey benchmarks and extensometers to evaluate land subsidence; and nephelometers to assess airborne dust. These monitoring facilities and activities are described below. **Figures 3-4 and 3-5** show the locations of the monitoring facilities (wells, extensometers, and nephelometer stations).

For each critical resource, the GMMMP establishes specific action criteria (trigger levels) and corrective measures, to be implemented if necessary, to address potential adverse impacts resulting from the Project. The GMMMP establishes a defined protocol for scientific review and decision-making processes. All data collected by the GMMMP would be in the public record available for public review. A Technical Review Panel (TRP) would be established to review data reports and propose management refinements to the Lead Agency over the life of the Project.

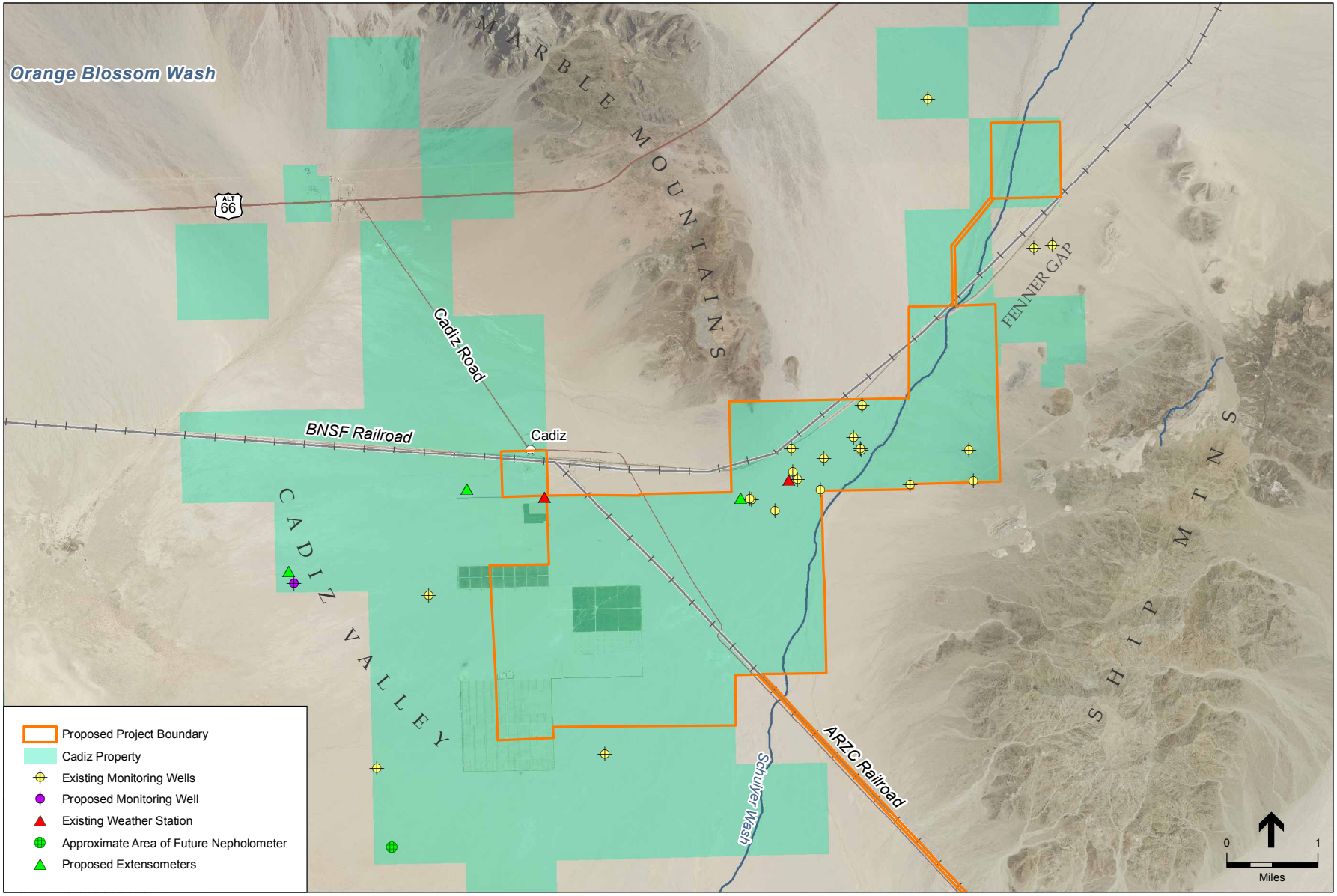


SOURCE: USDA, 2009; ESRI, 2010; Cadiz Inc., 2011; San Bernardino Co., 2010; and ESA, 2011.

Cadiz Valley Water Conservation, Recovery, and Storage Project

Figure 3-4

Regional Monitoring Facilities (Wells, Nephelometer Station)



SOURCE: USDA, 2009; ESRI, 2010; Cadiz Inc., 2011; San Bernardino Co., 2010; and ESA, 2011

Cadiz Valley Water Conservation, Recovery, and Storage Project

Figure 3-5

Monitoring Facilities
(Wells, Extensometers, Nephelometer Station)

Groundwater Monitoring – Water Levels and Water Quality

A total of approximately 15 existing observation wells would be used to monitor groundwater levels and water quality during Project operations. Two additional observation wells would be installed outside the Project area, one in the Piute Wash Watershed tributary to the Colorado River, and one in the Danby Watershed to the southeast of the wellfield. In addition, four observation well clusters would be installed consisting of 2-3 wells each: one within the wellfield using existing wells, one between the wellfield and Bristol Dry Lake, one on Bristol Dry Lake, and one at Cadiz Dry Lake. Each well cluster would be installed on private land.

Springs Monitoring

The monitoring program includes quarterly inspection of select springs throughout the Project operation period. Proposed monitoring consists of visual observation and flow estimates to be performed at the Bonanza Spring in the Clipper Mountains, the Whisky Springs in the Providence Mountains (near Colton Hills), and Vontrigger Spring in the Vontrigger Hills, east of the Hackberry Mountains.

Land Subsidence Monitoring

A network of approximately 22 land survey benchmarks would be installed at the approximate locations shown on Figure 3-4 to monitor changes in land surface elevation. Each benchmark would be established and surveyed by a California licensed land surveyor. Benchmark surveys would be conducted on an annual basis during the term of the Project. To monitor the effects of Project operations, three extensometers would be installed in the area of the highest potential for subsidence (see Figure 3-5). These extensometers would measure non-recoverable compaction of fine-grained materials interbedded within the alluvial aquifer systems.

Dust Monitoring

One nephelometer would be installed downwind of Bristol Dry Lake and one would be installed downwind of Cadiz Dry Lake to measure visibility. In addition, the GMMMP would record annual observations of surface soils on the Dry Lakes to verify that no changes in soil characteristics have occurred.

3.5 Project Participants

3.5.1 Groundwater Conservation and Recovery Component

Project Participants

As of the publication date of this Draft EIR, Project Participants include SMWD, Three Valleys Municipal Water District, Golden State Water Company, Suburban Water Systems, Jurupa Community Services District, and California Water Service Company, which cover some or all of the following five counties: San Bernardino, Riverside, Orange, Ventura, and Los Angeles (see Figures 1-2 and 1-3). These Project Participants are “public water systems” which is defined as a system for the provision of water for human consumption through pipes or other constructed

conveyance that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year.[12]

The ARZC is also a Project Participant. The Project would serve railroad water demands along the ROW including fire suppression and would also provide ARZC access to certain facilities, including the road along the pipeline that will be constructed as part of the Project. The Project will also serve as additional railroad purposes that have been identified by ARZC but which would be the subject of additional and subsequent environmental review.[13] These Project Participants are described in Chapter 1, Introduction. They are briefly identified below.

Santa Margarita Water District Service Area

The SMWD service area encompasses 97 square miles at the southern end of Orange County, California and includes Rancho Santa Margarita, Coto de Caza, Las Flores, Ladera Ranch, Talega, and portions of Mission Viejo (see Figure 1-2).

Three Valleys Municipal Water District Service Area

The area served by Three Valleys covers 133.3 square miles in Los Angeles County, California, and includes Azusa, City of Industry, Covina, Claremont, Diamond Bar, Glendora, Hacienda Heights, La Puente, La Verne, Pomona, Rowland Heights, San Dimas, Walnut, and West Covina (see Figure 1-2).

Golden State Water Company Service Area

Golden State's operations are organized into three water service regions and one electric customer service region, representing 21 customer service areas in 75 communities within 10 California counties. Region I consists of 7 customer service areas in northern and central California and Ventura Counties; Region II consists of 4 customer service areas located in Los Angeles and Orange Counties; and Region III consists of 10 customer service areas in eastern Los Angeles County and in Orange, San Bernardino, and Imperial Counties (see Figure 1-3). Golden State would utilize conserved Project water to serve 17 customer service areas primarily in Regions II and III but including one (Simi Valley) in Region I.

Suburban Water Systems Service Area

Suburban serves an approximately 42-square-mile area that covers all or portions of Glendora, Covina, West Covina, La Puente, Hacienda Heights, City of Industry, Whittier, La Mirada, La Habra, Buena Park, and unincorporated portions of California's Los Angeles and Orange Counties. The service area is divided into two regions which are 3 miles apart and separated by the La Puente Hills (see Figure 1-2).

Jurupa Community Services District Service Area

JCSD is a public agency responsible for providing water, sewer, and street lights to over 101,000 people located throughout 48 square miles in the Jurupa area of Riverside County. JCSD serves

[12] California Health and Safety Code, §116275(h).
[13] The total quantity of groundwater pumped for all users for all purposes will not exceed 50,000 AFY.

unincorporated areas of Riverside County as well as the communities of Jurupa Valley and Eastvale (see Figure 1-2).

California Water Service Company Service Area

Cal Water distributes and sells water to 1.7 million Californians through 435,000 connections. Its 24 separate water systems serve 63 communities from Chico in Southern California to the Palos Verdes Peninsula in Southern California. Cal Water would utilize conserved Project water to serve one of its water systems, the Westlake District, which is an 8,200 acre community located in the eastern section of Ventura County within the City of Thousand Oaks (see Figure 1-2), and may also use Project water to serve its Dominguez and East Los Angeles Districts.

Arizona & California Railroad Company

The Arizona & California Railroad Company operates the ARZC, a 259-mile short line railroad. The ARZC begins at an interchange with the BNSF in Cadiz, California and continues southeast across the Mojave Desert.

Project Water Subscriptions

Table 3-1 lists the Project Participants and their contracted water subscriptions. SMWD is the CEQA Lead Agency, and was the first Project Participant to enter into an Option Agreement for water supply, carry-over storage, and sharing CEQA costs with Cadiz Inc. The other water provider Project Participants have entered into similar Option Agreements for water supply, carry-over storage, and sharing CEQA costs with Cadiz Inc.

TABLE 3-1
PROJECT WATER SUBSCRIPTIONS FOR
THE GROUNDWATER CONSERVATION AND RECOVERY COMPONENT

Project Participants	Contracted Annual Amount (AF)
Santa Margarita Water District	5,000 – 15,000[a]
Three Valleys Municipal Water District	5,000
Golden State Water Company	5,000
Suburban Water Systems	5,000
Jurupa Community Services District	5,000
California Water Service Company	5,000
ARZC rail operations support supply	10 – 100
Total Annual Project Water Subscribed	**30,100 – 40,100**
Project Supply Available for Subscription	**9,900 – 19,900**
TOTAL PROJECT SUPPLY	**50,000**

a SMWD has an option to take an additional 10,000 AFY for a total of up to 15,000 AFY. If SMWD exercises this option then the total Project water subscribed out of the 50,000 AFY available would be 40,100 AFY and the total remaining supply available for additional participants would be 9,900 AFY.

b. ARZC has reserved rights to conserved water from Project for identified railroad purposes that may require additional environmental review. However, the total quantity of groundwater pumped for all uses for all purposes will not exceed 50,000 AFY.

SOURCE: ESA, 2011.

Upon completion of the environmental review and permitting process, each water agency would have the right to acquire 5,000 AFY at a pre-determined formula competitive with their incremental cost of new water. SMWD also has the added option to purchase an additional 10,000 AFY. Additional Project Participants may join the Project at any time until the established Project capacity is reached. In addition, ARZC has requested up to 10,000 gallons per day in Project water supply to support its current and future operations.

3.5.2 Imported Water Storage Component

The participants for the Imported Water Storage Component of the Project have not yet been identified. Given the strategic location of the Project and the proposed interties with the CRA system and possibly the SWP system, potential participants might be located throughout the broad southern California region or beyond. For purposes of providing programmatic-level review of this future component of the Project, it is assumed that participants in the Imported Water Storage component would be located in Southern California within Metropolitan's service area. Once specific participants are identified and specific operations for the Imported Water Storage Component are developed, additional project-level environmental review, documentation, and permitting will be completed as appropriate.

3.6 Proposed Project Facilities

Under the Groundwater Conservation and Recovery Component of the proposed Project, Cadiz would construct a wellfield and manifold system (including connecting piping and natural gas supply), an approximately 43-mile underground water conveyance pipeline between Cadiz Property and the CRA, and a tie-in to the CRA. In addition, an observation well system would be installed throughout the Bristol, Cadiz, and Fenner Valley Watersheds with additional observation wells located in the adjacent Danby and Piute Wash Watersheds. The Project would be constructed under a design-build type of contract where one contractor would be retained to design and construct the facilities.

The proposed Project would utilize approximately 150 acres of Cadiz Property in the Cadiz and Fenner Valleys to construct the wellfield and related facilities, approximately 450 linear acres of pre-disturbed land within the ARZC ROW to build the conveyance pipeline as well as approximately 300 acres of Cadiz Property near Danby Dry Lake for construction staging areas. In comparison with Cadiz Inc.'s total land position at the Project area of 25,000 acres, the total land disturbance of the Groundwater Conservation and Recovery Component's proposed facilities would be less than 2 percent.

The Imported Water Storage Component would utilize the facilities of the Groundwater Conservation and Recovery Component and also require the expansion of the Project wellfield, construction of spreading basins to the northeast of the Project wellfield, and construction of a CRA diversion and pump station at the CRA. In addition, if determined feasible, an existing unused natural gas pipeline would be converted for the conveyance of water between the Project and the SWP. Such a line would likely run northwest from the Cadiz Property to Kern County. Facilities are described in more detail below.

3.6.1 Groundwater Conservation and Recovery Component

Facilities associated with the Groundwater Conservation and Recovery Component include the following:

- Wellfield with approximately 34 wells.
- Interconnecting access road with underground utilities and manifold system.
- Power distribution system.
- 43-mile water conveyance pipeline.
- Tie-in to the CRA.
- Equalization storage reservoir and pump station near CRA (if necessary).
- ARZC rail operations' support, supply, and access.

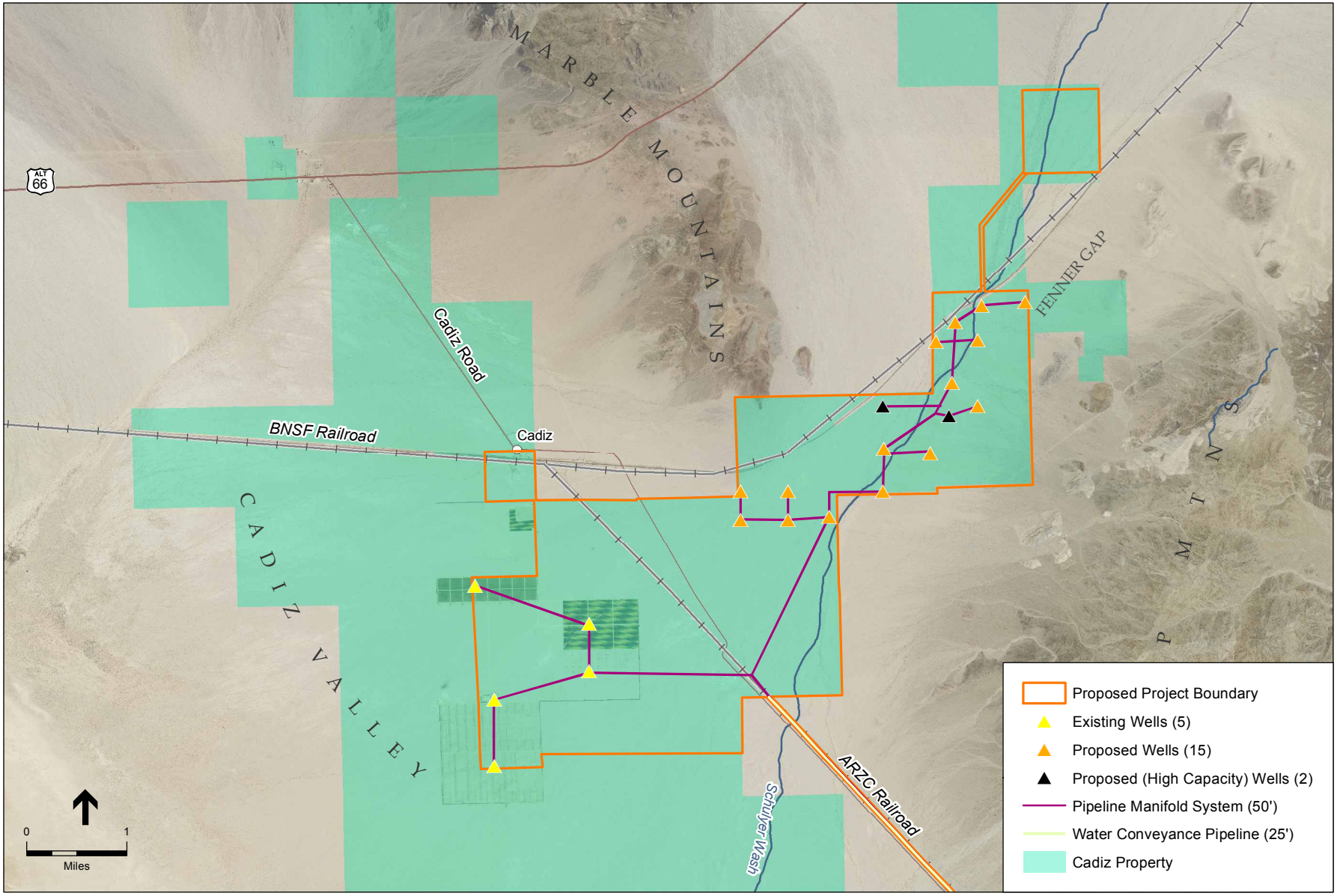
Project Wellfield

Under the Groundwater Conservation and Recovery Component, extraction wells would be constructed on Cadiz Property in the vicinity of the Fenner Gap to draw an average of 50,000 AFY from the groundwater basin, over the 50-year term of the Project, and place this water into a pipeline for conveyance to the CRA (see Figure 3-1). This Draft EIR assumes that the wellfield constructed under the Groundwater Conservation and Recovery Component would consist of approximately 34 wells, because 34 wells would be required to provide Project deliveries over the anticipated 10-month delivery schedule. Although the actual number of wells constructed under this phase of the Project is likely to be far fewer (i.e., 22 wells, including 2 high capacity wells[14]), depending on the yield of each well and the target annual maximum yield (see Section 3.5, Operations Plan), this Draft EIR evaluates two wellfield configurations (A and B), which ensures that all potential Project elements are evaluated at a project-level.

Figure 3-6a represents wellfield Configuration A and **Figure 3-6b** represents wellfield Configuration B. Both figures conceptually depict the proposed wellfield and manifold system, which would include extraction wells, pumps and electric motors, a natural gas or electricity supply system, individual well piping and control valves, collector piping, Supervisory Control and Data Acquisition (SCADA) system, and appurtenant facilities. The total wellfield disturbance area needed to install the wells and interconnecting manifold systems would be approximately 120 acres.

As shown in Figure 3-6a and 3-6b, the Project wellfield would incorporate into the manifold system five existing agricultural irrigation wells that would be upgraded to meet Project requirements, including conversion from the use of diesel engines to natural gas and/or solar powered engines. Power lines would either be underground or overhead, connecting to each well head following the access road network. Please note that the piping diagrams depicted in Figure 3-6a and 3-6b are conceptual; the final well locations and piping design for the Groundwater Conservation and Recovery Component wellfield is subject to change as Project design details are finalized, but such changes, if any, are not expected to affect analysis of impacts of the piping.

[14] High capacity wells yield 15,000 AFY compared to 2,250 AFY for other wells.

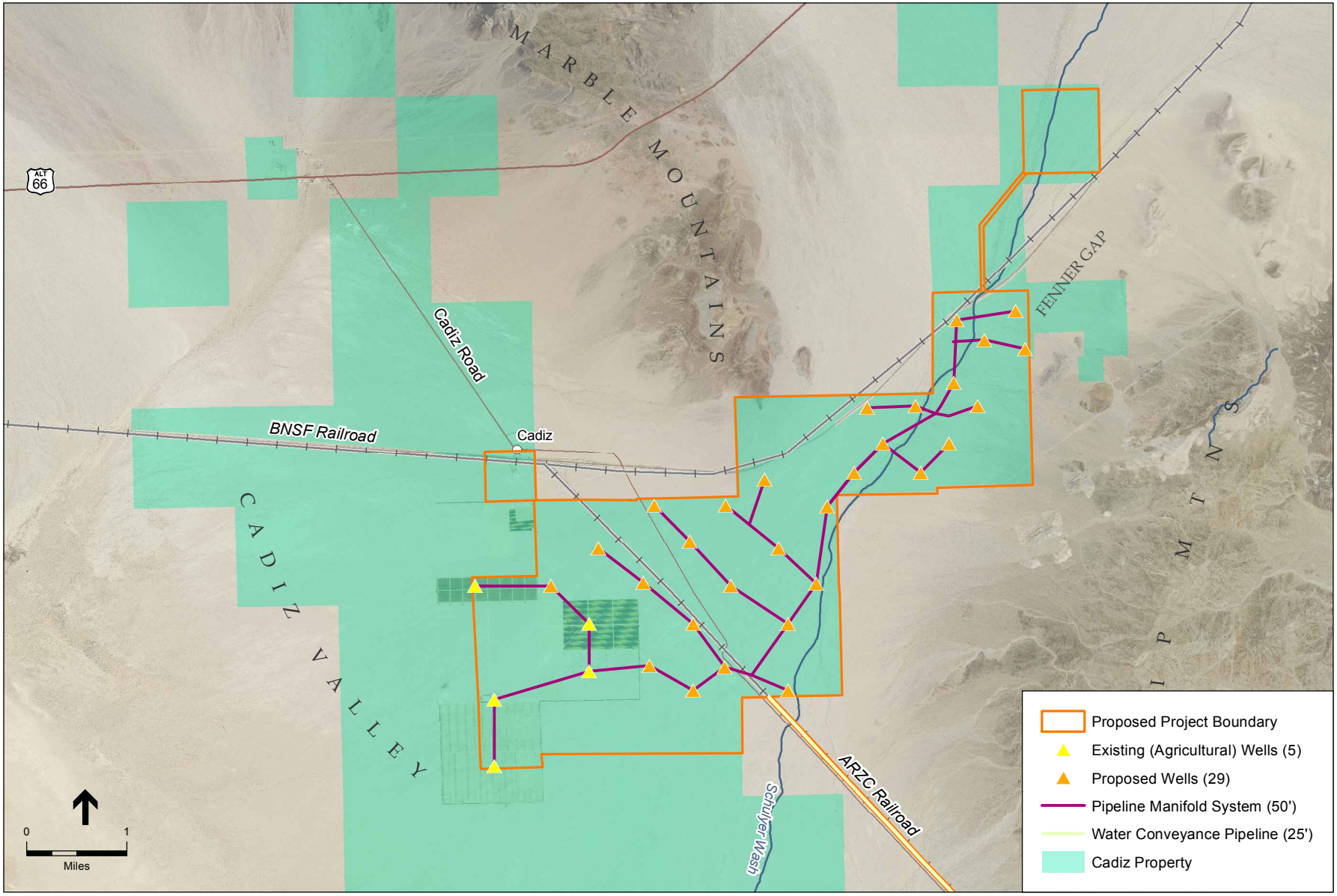


SOURCE: USDA, 2009; ESRI, 2010; Cadiz Inc., 2011; San Bernardino Co., 2010; and ESA, 2011

Cadiz Valley Water Conservation, Recovery, and Storage Project

Figure 3-6a

Proposed Wellfield and Manifold System:
Groundwater Conservation and Recovery Component
Wellfield Configuration A



SOURCE: USDA, 2009; ESRI, 2010; Cadiz Inc., 2011; San Bernardino Co., 2010; and ESA, 2011

Cadiz Valley Water Conservation, Recovery, and Storage Project

Figure 3-6b

Proposed Wellfield and Manifold System:
Groundwater Conservation and Recovery Component
Wellfield Configuration B

A typical well schematic is shown in **Figure 3-7**. Each new well would have an approximately 16 to 20-inch diameter casing and a design capacity of approximately 4.5 cubic feet per second (cfs) per well for a nominal wellfield design capacity of 100 to 125 cfs. Several high capacity wells, up to 30 cfs would be installed in the highly productive carbonate aquifers in the Fenner Gap.[15] The wells would be drilled to depths of approximately 1,000 feet bgs. There would be an electric motor installed at each well that would use between 350 and 500 horsepower (hp). Well pumps are assumed to operate 24 hours a day, 365 days a year.

Each well would be situated within a fenced wellpad area encompassing up to 1,000 square feet. The wellpads would be connected by service roads approximately 25 feet in width. Connecting utilities including electric, gas, data cables, and the water manifold system would be buried underground within the roadway easements. Wellpads may be equipped with lighting that would not be used except during infrequent nighttime maintenance activities. An electric control system would monitor pump discharge flow allowing for coordinated staging of pumps based on pumped flow and drawdown.

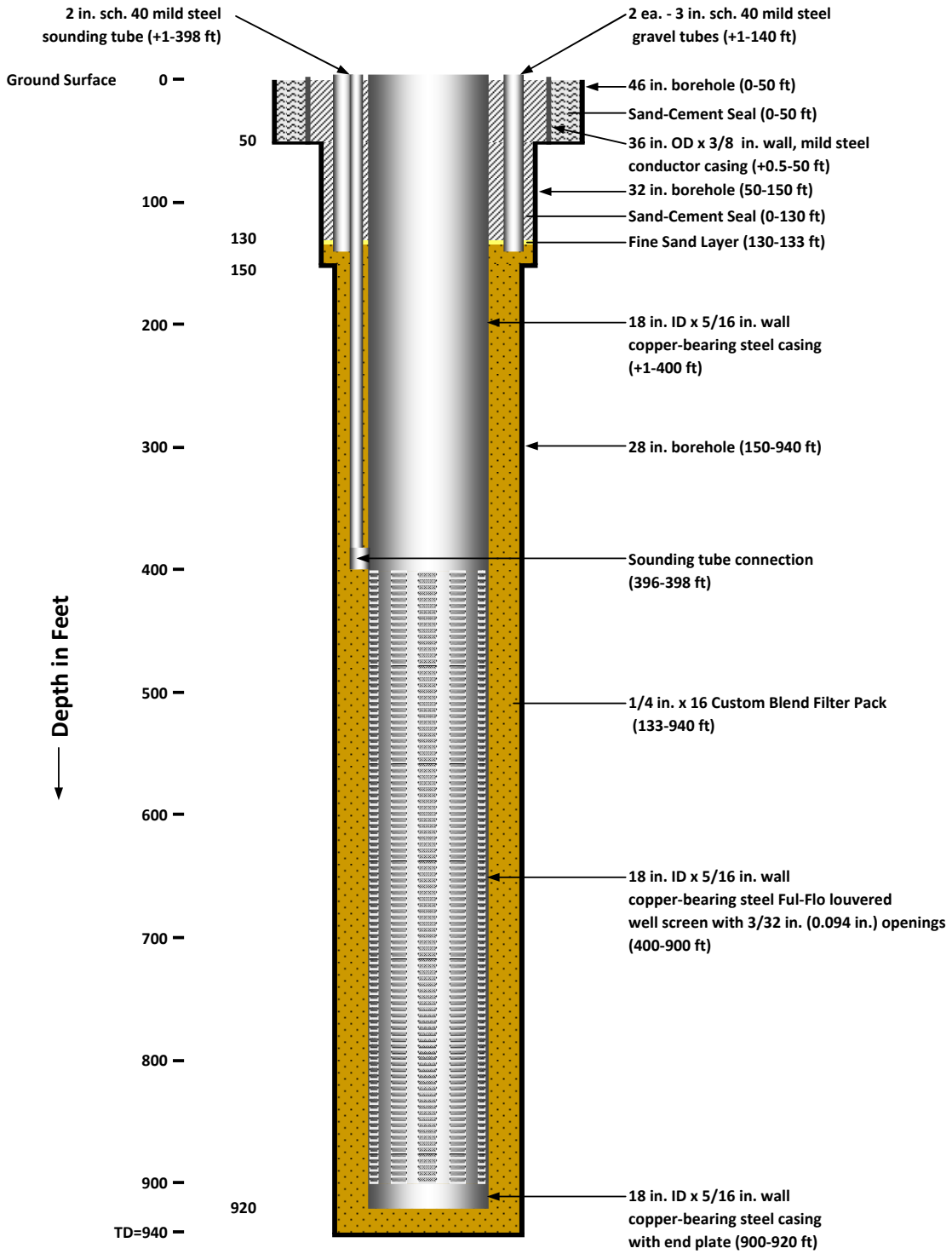
Water Conveyance Facility to Colorado River Aqueduct

Under the Groundwater Conservation and Recovery Component, an approximately 43-mile-long underground water conveyance pipeline would be constructed to deliver water extracted from the Project wellfield to the CRA for delivery to Project Participants through the existing CRA delivery system. The water conveyance pipeline would be constructed entirely within (and parallel to) the privately-owned ARZC ROW that runs north-south between the Cadiz Property and the CRA (see Figure 3-1). In 2008, Cadiz Inc. acquired a 99-year lease with the ARZC, that allows a conveyance pipeline and related facilities to be constructed and buried beside the railroad tracks within the segment of the railroad ROW that runs between mile post 189.0 at Cadiz, California and mile post 144.0 at Freda, California.[16] The ARZC ROW is 200 feet wide (approximately 100 feet on either side of the track centerline).[17] Appendix C includes a map book of the proposed pipeline alignment from the wellfield to the CRA.

From the connection point at the CRA, the proposed pipeline would extend approximately 43 linear miles from the CRA to a location where the ARZC ROW intersects the Cadiz Property within Section 36 Township 5N, Range 14E (see Figure 3-1), at which point the pipeline alignment would join with the wellfield manifold system described above. The pipeline would be constructed parallel to and predominantly southwest of the railroad tracks. A typical pipeline section and trench is shown in **Figure 3-8.**

The water conveyance facility would consist of a single barrel, pressurized pipeline with nominal design flow of up to 250 cfs, which would provide capacity to allow for implementation of the Imported Water Storage Component. This Draft EIR assumes that the pipe diameter would be 84 inches, although the pipe diameter could be anywhere between 54 and 84 inches, depending

[15] Scenario I (Wellfield A) includes two high capacity wells; Scenario 2 (Wellfield B) does not include high capacity wells.
[16] Longitudinal Lease Agreement between ARZC and Cadiz, September 17, 2008.
[17] Tetra Technologies, *Draft Preliminary Study: ARZC Railroad Alignment*, 2008, page 1.

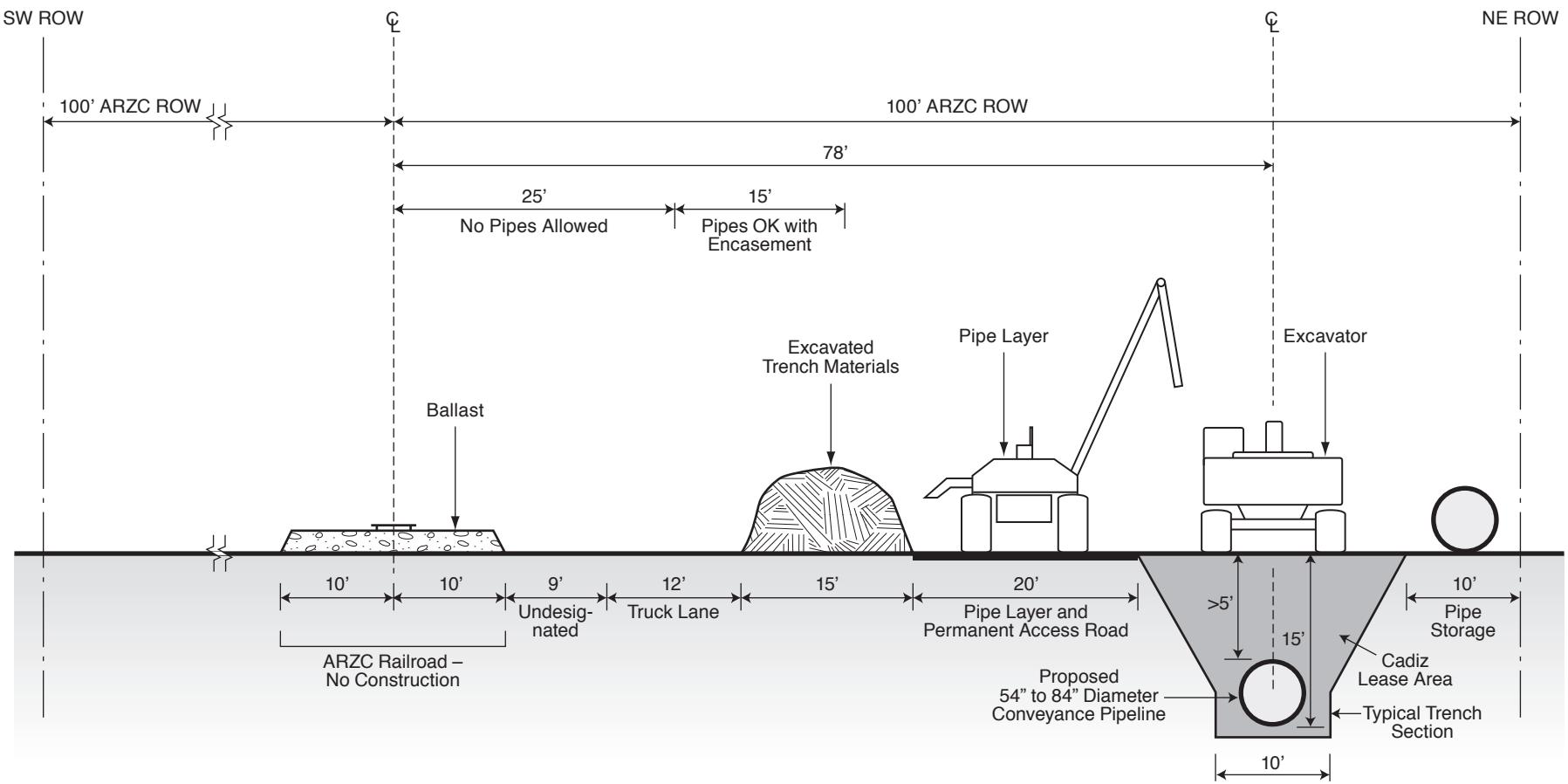


SOURCE: Geoscience, 2011.

Cadiz Valley Water Conservation, Recovery, and Storage Project

Figure 3-7

Typical Well Conceptual Diagram



NOTES:

1. Layout is based on typical trench section shown and 5' of cover on the proposed pipe.
2. Layout does not show existing railroad sidings.
3. Layout assumes the width of the railroad ballast as 20' wide.
4. A crane will be needed on site to complete the initial unloading of pipe off of the railroad cars and place the pipe on the far edge of the right-of-way as indicated in the cross section.
5. Typical section looking north/west.

0 10
Feet

SOURCE: Tetra Tech, 2008.

Cadiz Valley Water Conservation, Recovery, and Storage Project

Figure 3-8

Typical Pipeline Section / Trench

on the operational needs of the Project. Ultimately, pipe diameters would be finalized with pipe manufacturers during final design. The material of choice for the pipeline would be steel. The water conveyance pipeline would require pipeline appurtenances visible on the surface, including air relief/vacuum relief valves, blow-off facilities, and access manholes. The exact location of these facilities would be determined during final design. These appurtenances would be accessed periodically for maintenance. Air relief valves would be installed approximately every ½ mile. These appurtenant structures would encompass less than 500 square feet and be located directly over the pipeline. A five-foot tall "goose-neck" pipe on a concrete pad would be visible at the surface. **Figure 3-9** shows an example of a typical air valve of the type to be installed. The pipeline profile would be designed to minimize high points needing air relief valves, and low points needing blow-off valves. The highest point near Chubbuck would require installation of a series of air relief valves.

At each drainage crossing, the pipeline would be either encased in concrete or protected with an underground concrete apron. This reinforcement would protect against future scouring in the washes.

Construction and operation of Project facilities within the ARZC ROW would occur without affecting the operation of the railroad. The conveyance pipeline would be installed at a depth of 15 feet and would be installed more than 50 feet from the centerline of the existing track.[18] The pipeline may need to cross under the railroad tracks to avoid sensitive areas or geologic constraints. Such crossings would be subject to written approval by the ARZC and installed, maintained, renewed, and repaired at a depth of not less than 5 feet below the base of the rail.[19] Construction, staging, and laydown would occur entirely within the railroad ROW or on private lands abutting the railroad ROW. A 25-foot wide maintenance road would be constructed parallel to and within the railroad ROW adjacent to the pipeline along the entire alignment. **Figures 3-10a** through **3-10c** show potential staging areas.

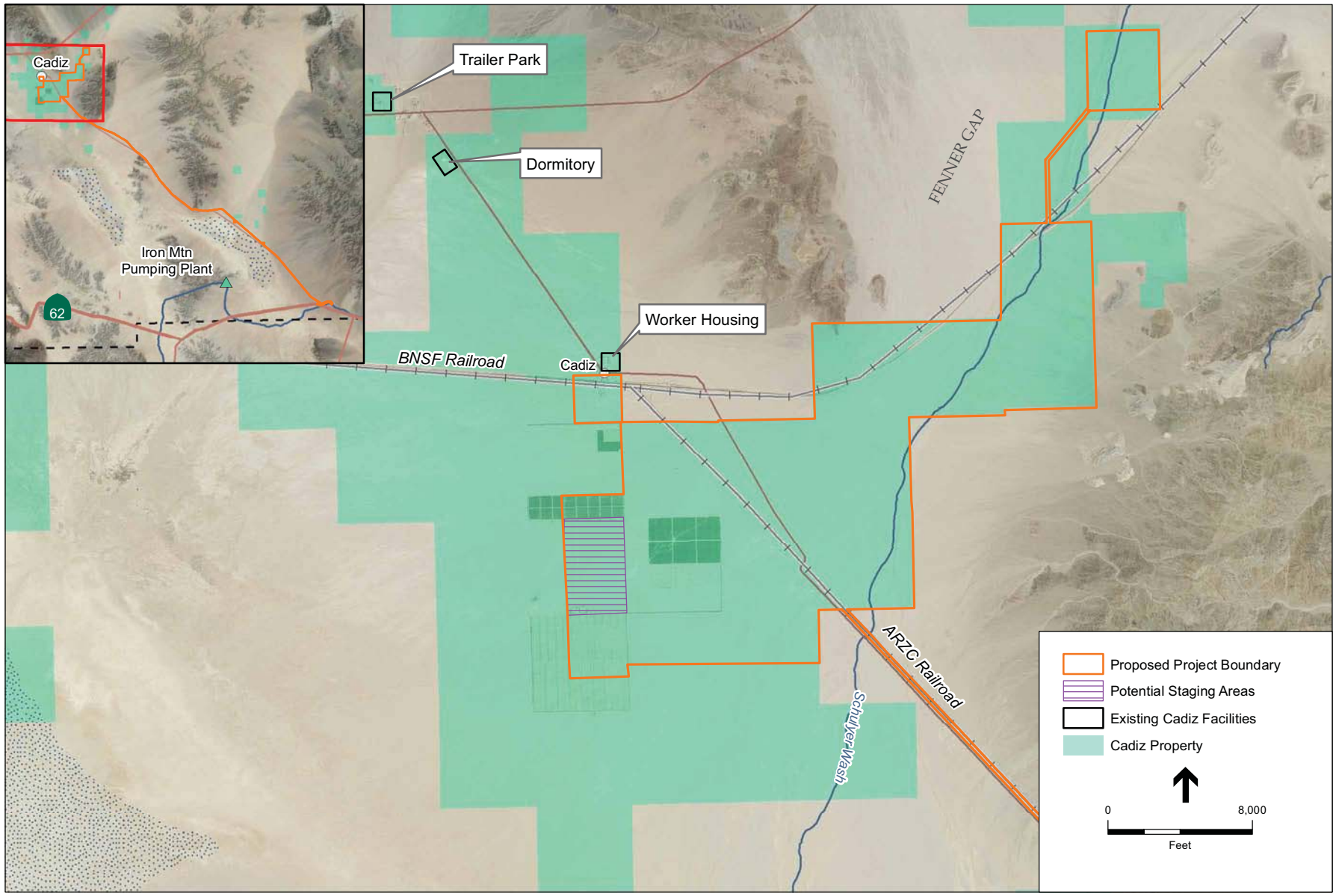
[18] Memorandum of Lease Agreement between Cadiz Real Estate, LLC and Arizona & California Railroad Company, dated September 17, 2008, page 1.

[19] Cadiz Inc., *Communication entitled "Cadiz RE pipeline project"* to RailAmerica Inc., September 17, 2008.

SOURCE: CCWD, 2008.

Cadiz Valley Water Conservation, Recovery, and Storage Project

Figure 3-9
Example of Typical
Air Relief Valve Structure

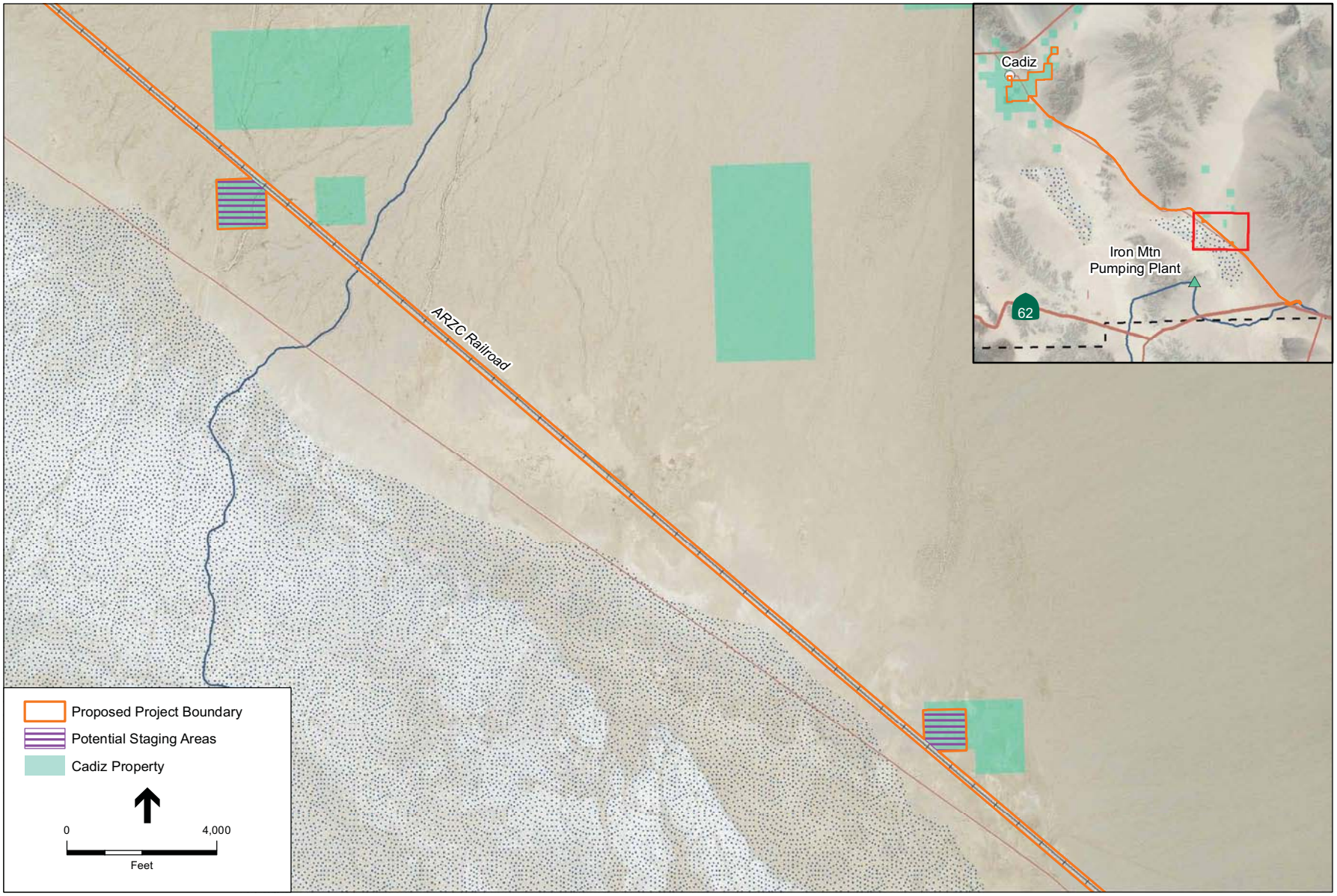


SOURCE: USDA, 2009; Bing Maps, 2011; ESRI, 2010; Tetra Tech, 2008; Cadiz Inc., 2011; and ESA, 2011

Cadiz Valley Water Conservation, Recovery and Storage Project

Figure 3-10a

Potential Staging Areas: Near the Proposed Wellfield Area

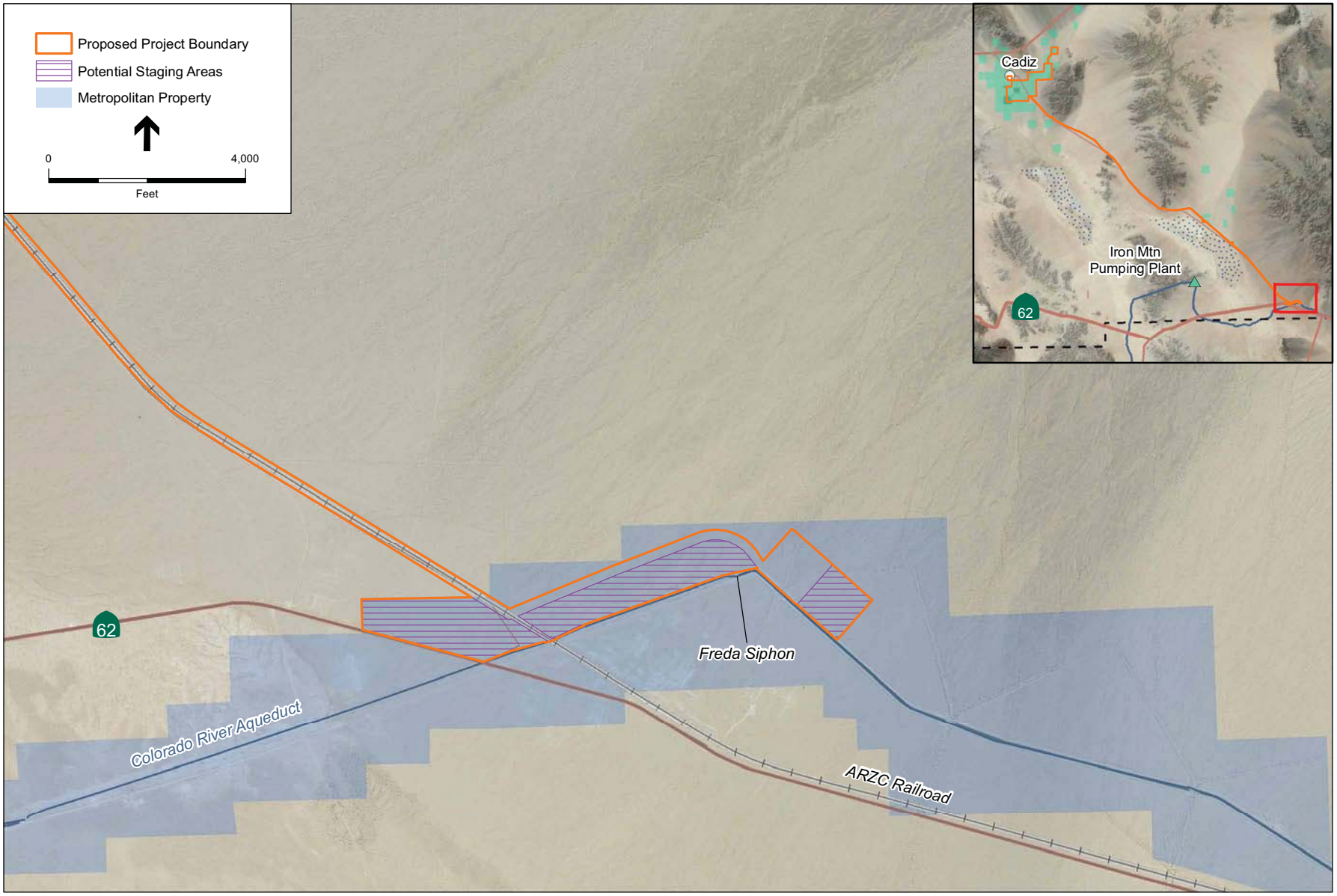


SOURCE: USDA, 2009; Bing Maps, 2011; ESRI, 2010; Tetra Tech, 2008; Cadiz Inc., 2011; and ESA, 2011

Cadiz Valley Water Conservation, Recovery and Storage Project

Figure 3-10b

Potential Staging Areas: Along the ARZC Railroad



SOURCE: USDA, 2009; Bing Maps, 2011; ESRI, 2010; Tetra Tech, 2008; Cadiz Inc., 2011; and ESA, 2011

Cadiz Valley Water Conservation, Recovery and Storage Project

Figure 3-10c

Potential Staging Areas: Near the CRA Tie-In

Colorado River Aqueduct Tie-in

The water conveyance pipeline would terminate at the CRA, a 242-mile water conveyance facility that delivers water from the Colorado River at Parker Dam to water suppliers in Southern California. The CRA is owned and operated by Metropolitan. Operation of the CRA is complex; it involves advance annual planning of water deliveries from the Colorado River and continuous changes in the operation of the facilities along the aqueduct in order to convey water to terminal storage at Lake Mathews. In general, water can be introduced into the CRA in increments of 215 cfs to 235 cfs to account for the CRA's pumping capabilities, although some flexibility may exist and would be determined by Metropolitan.[20]

This Draft EIR evaluates two CRA tie-in options, Option 1 and Option 2, each containing sub-options. Under Option 1, a direct tie-in to the CRA would be constructed at the intersection of the water conveyance pipeline and the CRA. Various operational strategies could be employed to deliver water to the CRA.

CRA Tie-in Option 1

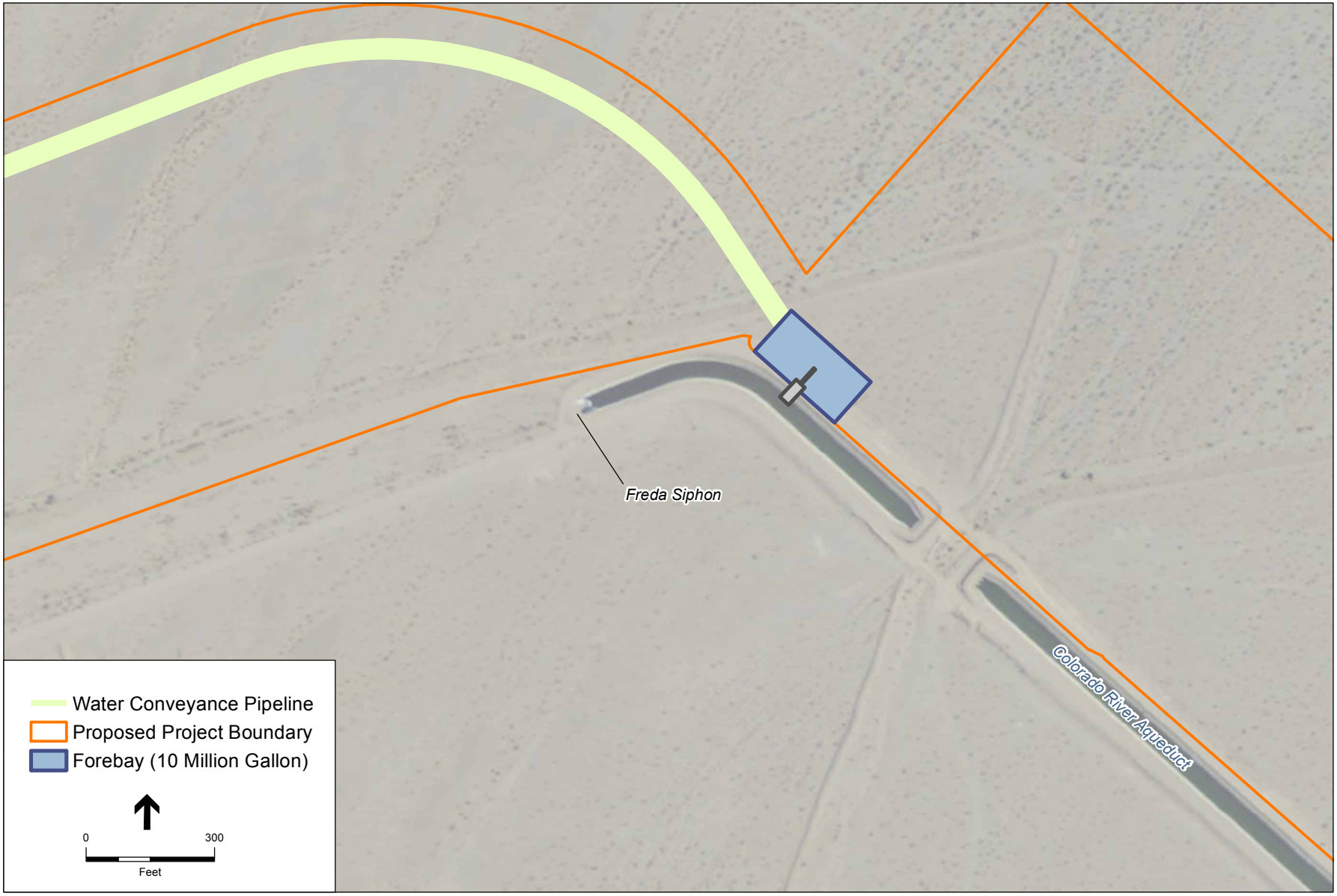
Under CRA Tie-in Option 1, a small 5,000-square-foot structure (forebay) would be constructed at the intersection of the water conveyance pipeline and the CRA to stabilize and meter flows into the CRA (see **Figure 3-11**). The forebay would be a trapezoidal reservoir, Hypalon-lined, with 3 to 1 side slopes and a flat floor with a volume of approximately 10.7 million gallons. It would be sized to hold two hours of the 250 cfs flow. The exact configuration of the forebay would be refined during final design. The forebay would have inlet and outlet facilities to connect the water conveyance pipeline to the CRA with automated gates.

The water conveyance pipeline would connect to the CRA sidewall and discharge directly into the Aqueduct. Water would be conveyed using the well head pumps; no additional pump stations or regulating storage along the pipeline route would be required. To implement this preferred tie-in option, one of the following CRA operational scenarios would be employed by Metropolitan:

A) *Option 1a - Copper Basin Inflow Reduction*. Under Option 1a, Copper Basin Inflow Reduction, Metropolitan would adjust the discharge into the CRA from Copper Mountain Reservoir in order to accommodate the Project's pump-in volume. Since there are no pump stations between Copper Mountain Reservoir and the Project tie-in, Metropolitan would not have to modify pumping operations at any of the down-stream pump stations. This is the preferred option.

B) *Option 1b - Pump Discharge Gates Throttle*. Under Option 1b, Pump Discharge Gates Throttle, the Project tie-in would require modification to accommodate the operation of each of the down-stream pump stations (Iron Mountain, Eagle Mountain, and Hinds Pump Stations). Metropolitan would throttle the pump discharge gates to allow pumps to match incoming flow from Project. This would increase energy use and would result in more frequent repair and replacement of pump equipment.

[20] CH2M Hill, *Cadiz Groundwater Conservation Project – Conceptual Engineering and Opinions of Probable Cost Technical Memorandum*, December 2010, pages 1-12.



SOURCE: USDA, 2009; Bing Maps, 2011; ESRI, 2010; Tetra Tech, 2008; Cadiz Inc., 2011; and ESA, 2011

Cadiz Valley Water Conservation, Recovery and Storage Project

Figure 3-11

Proposed CRA Tie-In Option 1

C) *Option 1c - Variable Frequency (Speed) Drive Pumps at Three Metropolitan Pump Stations*. Under Option 1c, Variable Frequency, Metropolitan would install variable frequency drives at each of the downstream pumps that would allow for adjustment of the pumping rate at one of their pumps in each pump station (Iron Mountain, Eagle Mountain, and Hinds Pump Stations) in order to accommodate the flow input from the Project.

CRA Tie-In Option 2

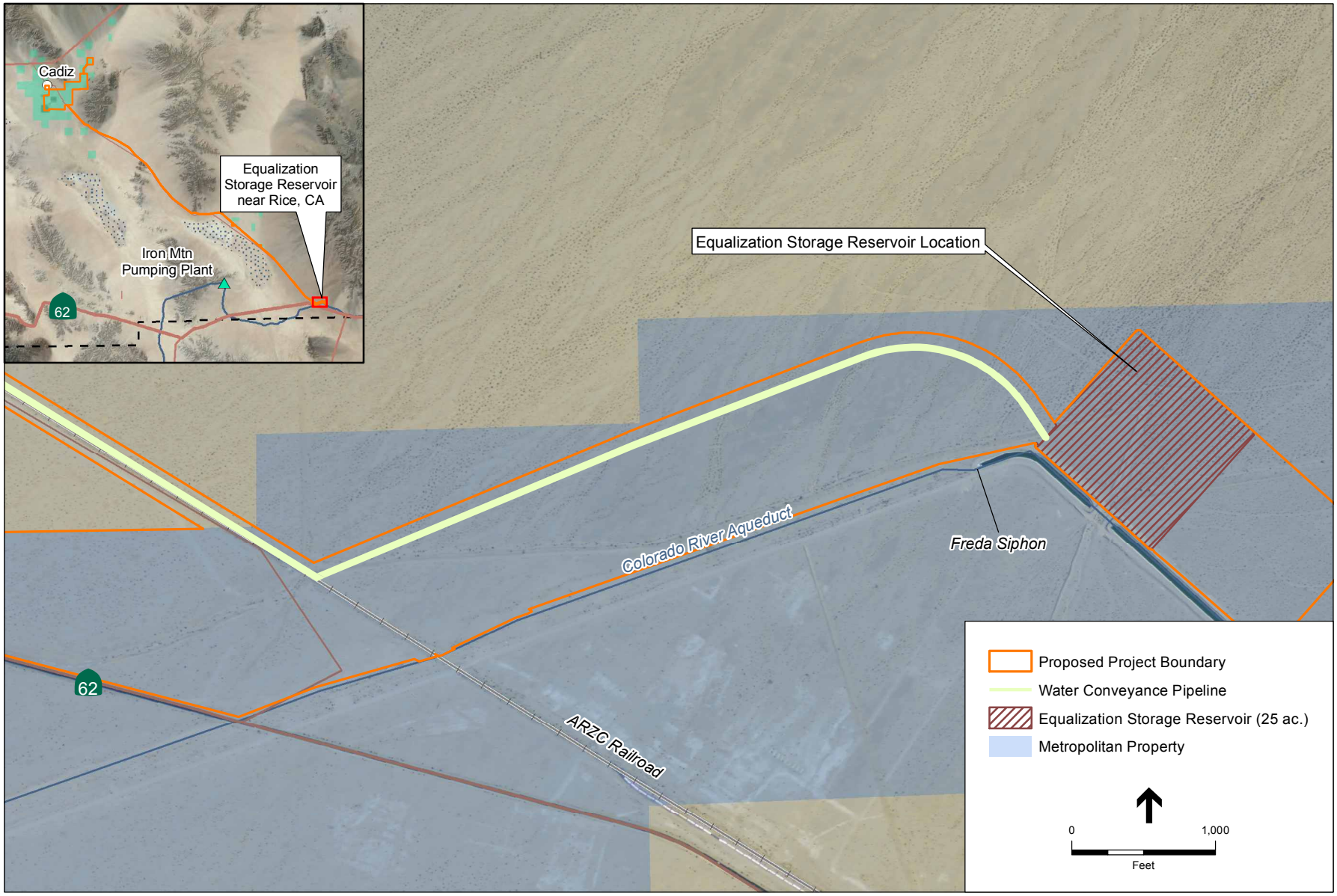
Under Option 2, an equalization storage reservoir would be constructed at one of two possible locations. Under Option 2a, the equalization storage reservoir would be constructed near Rice, California, on Metropolitan-owned land (see **Figure 3-12a**). Under Option 2b, an equalization storage reservoir and intermediate pump station would be constructed on Cadiz Property adjacent to the ARZC ROW located near Danby Dry Lake and Milligan, California (see **Figure 3-12b**).

The equalization storage reservoir would encompass approximately 25 acres with a storage capacity of 32.8 AF, sized to hold two hours of the 250 cfs flow. The exact configuration of the equalization storage reservoir would be refined during final design to optimize depth-to-surface-area ratio. The equalization storage reservoir would have inlet and outlet facilities to connect the Project to the CRA using automated gates. There are two potential locations for the equalization storage reservoir, as follows:

A) *Option 2a – Equalization Storage Reservoir near Rice, California:* Under Option 2a, an equalization storage reservoir would be constructed adjacent to the CRA on Metropolitan-owned land near Rice, California, as shown in Figure 3-12a. No intermediate pump station or forebay would be required under Option 2a; rather, Option 2a combines the forebay and equalization storage into one facility.

B) *Option 2b – Equalization Storage Reservoir and Intermediate Pump Station near Danby Dry Lake:* Option 2b would construct an equalization storage reservoir on Cadiz Property near Danby Dry Lake approximately eight miles northwest of the intersection of the ARZC ROW and the CRA (Figure 3-12b). Under Option 2b, an intermediate pump station would also be constructed at the equalization storage reservoir site to convey water from the equalization storage reservoir to the CRA. The intermediate pump station would be approximately 6,000 square feet, with a total footprint of about 1.5 acres, including ingress/egress facilities and other structures. The pump station would operate 8 hours a day, 365 days a year, at 125-220 cfs. A small, 5,000-square-foot forebay structure would also be constructed at the intersection of the water conveyance pipeline and the CRA to stabilize and meter flows into the CRA. Power for the intermediate pump station would be determined during final design; currently the options include natural gas engines, electricity from solar power, and/or delivery of power via an existing power line or solar turbine generators.

The CRA tie-in Option 1 is the simplest and preferred tie-in option. The final decision is subject to agreement with Metropolitan. Once in the CRA, the groundwater would be subject to Metropolitan's rules, regulations, and fees concerning the transportation of water to its member agencies and retail service providers.

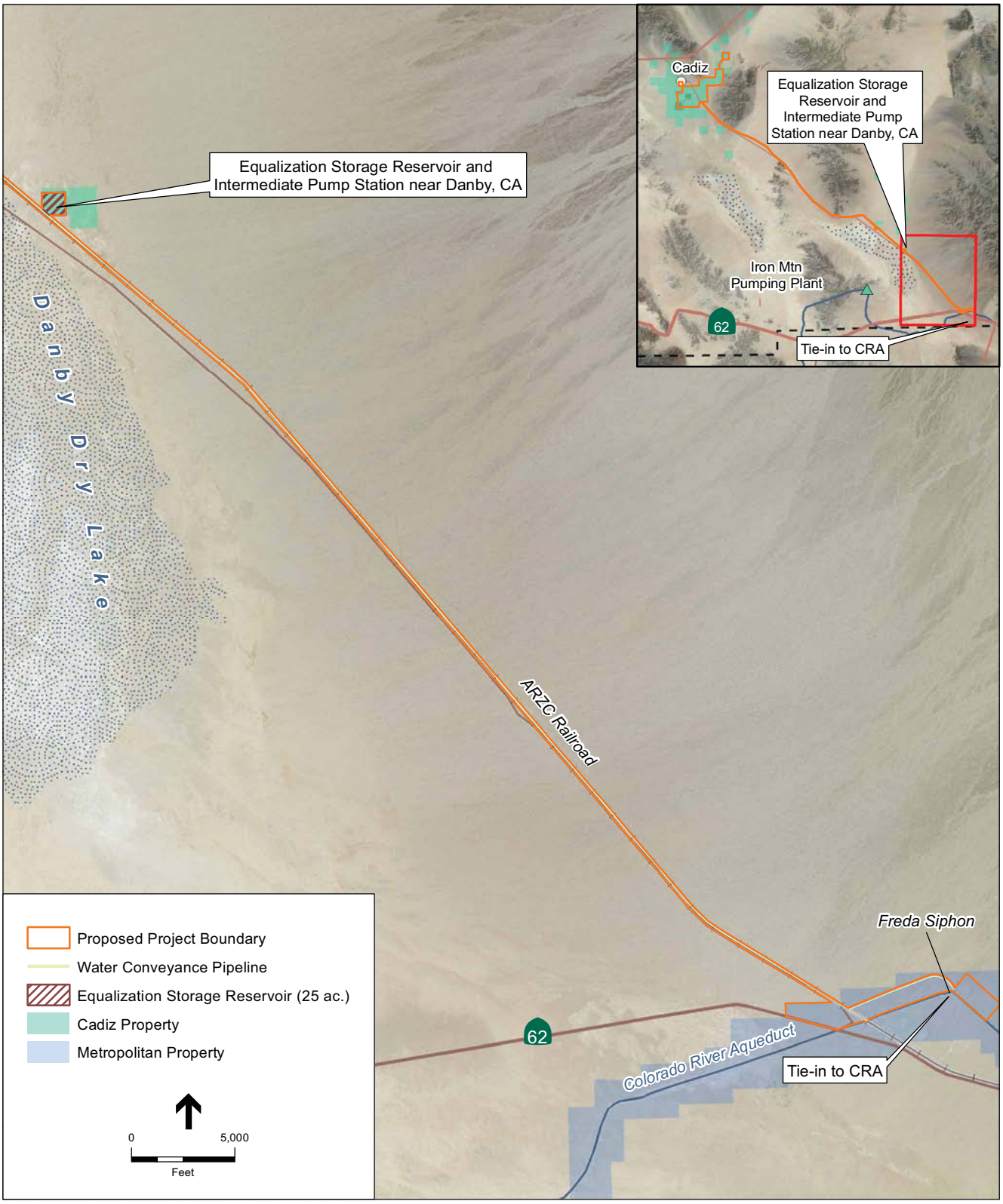


SOURCE: USDA, 2009; Bing Maps, 2011; ESRI, 2010; Tetra Tech, 2008; Cadiz Inc., 2011; and ESA, 2011

Cadiz Valley Water Conservation, Recovery and Storage Project

Figure 3-12a

Proposed CRA Tie-in Option 2a,
Equalization Storage Reservoir Location



SOURCE: USDA, 2009; Bing Maps, 2011; ESRI, 2010; Tetra Tech, 2008; Cadiz Inc., 2011; and ESA, 2011

Cadiz Valley Water Conservation, Recovery and Storage Project

Figure 3-12b

Proposed CRA Tie-in Option 2b, Equalization Storage Reservoir Location

Power Supply and Distribution

Power requirements for the Groundwater Conservation and Recovery Component are summarized in **Tables 3-2** and **3-3**. It is anticipated that approximately 50.7 million killowatt hours (kWh) per year of power would be needed to operate the Groundwater Conservation and Recovery Component at maximum capacity. The Intermediate Pump Station, required only for the CRA tie-in Option 2b, would require an additional 22 million kWh per year. This would comprise all the energy needed to operate the Project.

TABLE 3-2
CADIZ WELLFIELD POWER REQUIREMENTS
GROUNDWATER CONSERVATION AND RECOVERY COMPONENT

Wellfield Production	Average Power Requirement[a]		Annual Power Requirement[b]
Afy	hp	kW	kWh
50,000	4,250	3,160	30,800,000
75,000	7,000	5,200	50,700,000

[a] Average power requirement based on 85% pump efficiency.
[b] Annual power requirement based on 90% motor transfer efficiency, 24hrs/day, 365 days/yr.

SOURCE: RBF Consulting, *Power Requirements Analysis Technical Memorandum, Cadiz Groundwater Conservation and Storage Project, San Bernardino County, California, Phase* 1, November 2010.

TABLE 3-3
INTERMEDIATE PUMP STATION POWER REQUIREMENTS
GROUNDWATER CONSERVATION AND RECOVERY COMPONENT
CRA TIE-IN OPTION 2B

Flow rate		TDH	Average Power Requirement[a]		Annual Power Requirement[b]
Cfs	mgd	ft	hp	kW	kWh
220	142	310	9,100	6,800	22,000,000

[a] Average power requirement based on 85% pump efficiency.
[b] Annual power requirement based on 90% motor transfer efficiency, 24hrs/day, 365 days/yr.

SOURCE: RBF Consulting, *Power Requirements Analysis Technical Memorandum, Cadiz Groundwater Conservation and Storage Project, San Bernardino County, California, Phase* 1, November 2010.

Three power options are being examined to provide pumping capacity at the wellfield. The first option uses all natural gas and would install a centralized natural gas-fueled turbine generator that would provide electric power to engines located at each well. Gas would be accessed from an existing natural gas line which is located near the proposed wellfield and runs across Cadiz Property. The gas line has ample capacity to supply all well pumping power.

The second option is to utilize combination of a centralized natural-gas-fueled turbine generator and a solar powered generator to power electric motors located at the well pumps. The solar power would come from solar panels located at the wellfield.

The third option would be to supply electric-motor-driven well pumps. This option would require Southern California Edison (SCE) to upgrade their existing electrical lines that run in the area and to run them 30 miles to the wellfield.

Power would be distributed to the well pads either underground or on 30-foot overhead power poles.The intermediate pump station required for the CRA tie-in option 2b is anticipated to be driven by natural gas engines only since electrical power is not readily available in the area and turbine generators are not appropriate for this site.

ARZC Fire Suppression Facilities

To provide for fire suppression along the ARZC rail corridor, fire hydrants would be installed at several locations along the railroad ROW, primarily at the trestle bridge locations. The specific number and location of fire hydrants would be determined during the Project final design phase in consultation with ARZC.

As part of the Project, ARZC would be granted use of certain Project facilities including the Project access road(s), which would be developed or maintained for the Project for the purpose of providing access to and along the conveyance pipeline within the railroad alignment, as well as the power facilities located along the railroad that would be installed as part of the Project.

ARZC has reserved rights for the use of water from the Project for other designated railroad purposes, including for washing railcars, controlling vegetation, serving its offices and other improvements and future operations, such as a steam-powered excursion locomotive, new warehouses (if any), bulk transfer facilities or other railroad related facilities on the line. Each of these additional uses would be subject to additional environmental review as they are developed.

Monitoring Features

The GMMMP includes a network of monitoring features to monitor the effects of the Project. The following sections describe these facilities.

Observation Wells

Fifteen existing observation wells would be used to monitor the groundwater. The wells would be accessed from existing roads or paths and sampled periodically according to the protocols established in the GMMMP. Two new observation wells would be located outside the Watersheds —one within the neighboring Piute Wash Watershed that is tributary to the Colorado River, and one in Ward Valley to the southeast of the wellfield. Both wells would be located on Cadiz Property. Figures 3-6a and 3-6b identify the location of these wells. An access road would be constructed from the existing roads in the area. Both new observation wells would be drilled to up to 1,000 feet total depth.

Four additional observation well clusters would be constructed. The well clusters would consist of multiple observation wells near the wellfield area, at the edge of Bristol Dry Lake, and on the Bristol Dry Lake. An additional monitoring cluster would be located just north of Cadiz Dry Lake. All wells would be located on Cadiz Property except the well cluster on Bristol Dry Lake that would be located on other private property. The well clusters would consist of two wells screened at different depths in close proximity. Wells would be accessed periodically and monitored for water depth, and water quality. Electric down-hole geophysical logs would be collected at one well for each cluster.

Bench Marks and Extensometers

A network of approximately 20 benchmarks would be installed to establish a baseline land surface elevation. These benchmarks would be monitored periodically according to protocols in the GMMMP. In addition, three extensometers would be installed (1) near the railroad, (2) within Fenner Gap and, (3) at Bristol Dry Lake to continuously monitor land compaction.

3.6.2 Imported Water Storage Component

The Imported Water Storage Component would utilize the facilities described above for the Groundwater Conservation and Recovery Component but also expand these facilities as needed and add certain additional facilities necessary to support the import of surface water, groundwater recharge and recovery, and delivery back to participants. The Imported Water Storage Component would include the following new and expanded facilities:

- CRA Diversion structure and pump station.
- Extension of the water conveyance pipeline.
- Potential State Water Project intertie using existing idle pipeline(s) in Project region.
- Spreading basins.
- Expanded wellfield.
- Expanded interconnecting access roads with underground utilities.
- Expanded power distribution system.

CRA Diversion Structure and Pump Station

As part of the Imported Water Storage Component, a diversion structure would be installed within the CRA at the tie-in location to take surface water out of the aqueduct for import to the Project area. A pump station would be constructed on approximately five acres adjacent to the CRA, on Metropolitan property or within Cadiz-owned property near the edge of Danby Dry Lake. The pump station would consist of a concrete building approximately 10,000 square feet in size; it would pump water from the CRA to the Project spreading basins located northeast of the Fenner Gap. Power to the pump station would be provided by natural gas or from the nearest transmission lines.

Water Conveyance from State Water Project Using Existing Pipelines

There are existing unused pipelines (formerly used for oil and natural gas) in the Project vicinity that may provide an opportunity to connect the Storage component of the Project to the SWP

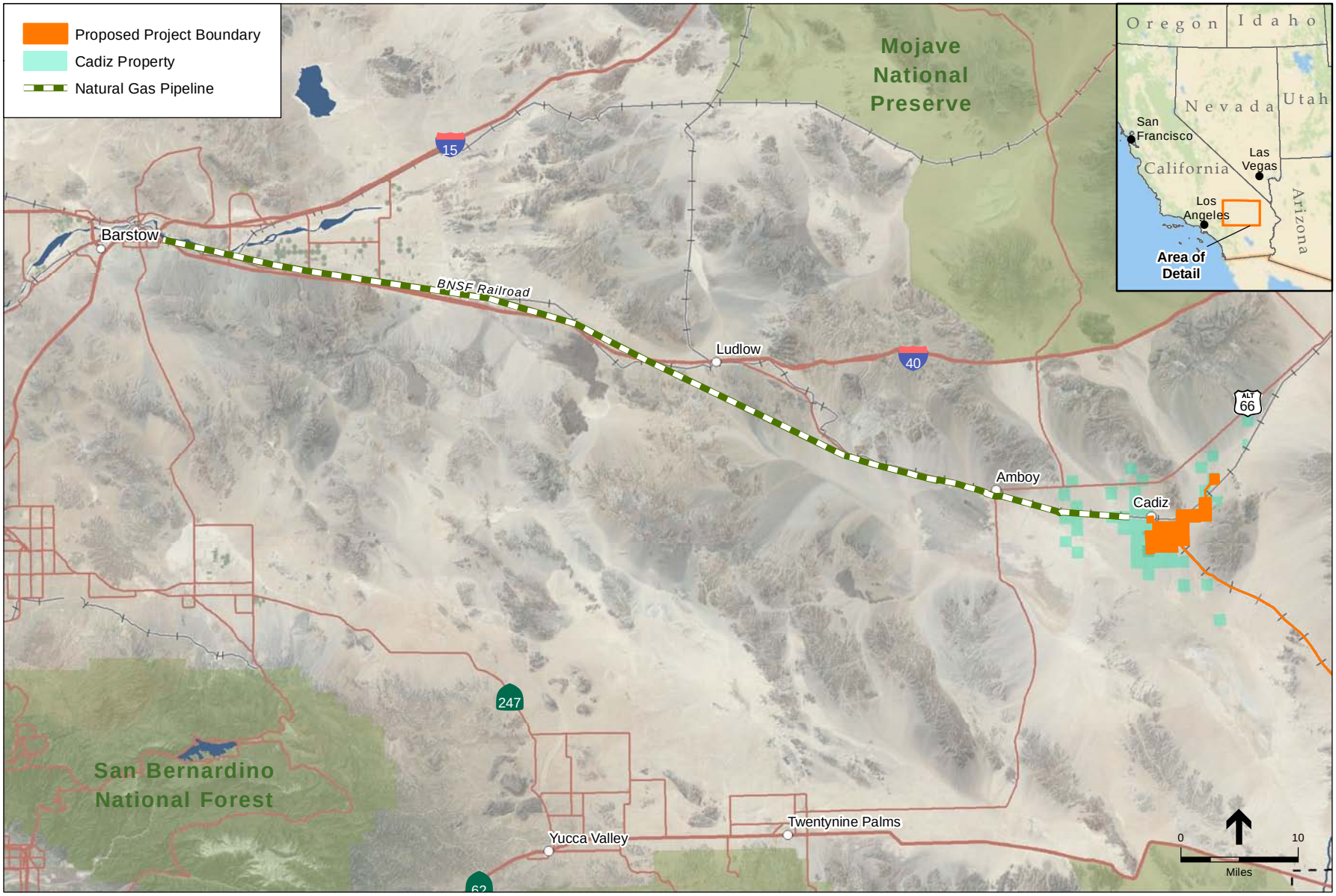
system. **Figure 3-13** shows the approximate route of a potential existing pipeline. Connecting with the SWP would expand the sources of water that could be imported for storage and also broaden the range of potential participants to include those connected not only to the Colorado River system, but also to the SWP system. One existing unused pipeline extends northwest from near the Cadiz Property to Kern County and could be converted for water conveyance to intertie with the SWP. Other existing unused pipelines in the region may offer similar intertie opportunities. Use of an existing unused pipeline for water conveyance is analyzed in this Draft EIR as a potential additional water conveyance option that could be incorporated into the Storage component.

Use of one or more of the existing idle pipelines would involve installation of pump stations and air valves. Development of each pump station would require up to two acres of area. Air valves/blow-off valves also would be installed along the pipeline. Blow-off valves and air valves are permanent release valves for water and air, respectively, used during pipeline filling and draining and during routine operations.

Blow-off valves and air valves are installed at low points and high points, respectively. The actual locations of these valves would depend on the pipeline alignment; however, for purposes of this analysis, it is assumed that either a blow off or air valve would be installed approximately every \one-half mile. The valve structures have a small concrete base pad (approximately 12 square feet) with a medium diameter pipe extending about 2 feet above the base for a total height of about 2 to 4 feet above the ground. Prior to use for water conveyance, the existing pipeline(s) would be inspected to assess their condition and lining may be proposed in some sections to address or protect against corrosion. In the alternative, sequestering chemicals may be used. Lining an existing pipeline would involve limited excavation at regular intervals along the pipeline alignment to allow the insertion of lining equipment and materials. Once the lining is installed, the pipeline trench would be filled and the pipeline fully re-buried.

Water Conveyance Pipeline Extension to Spreading Basins

Under the Imported Water Storage Component, the water would be conveyed from the CRA to the spreading basins via the pipeline constructed under the Groundwater Conservation and Recovery Component. A new segment of this pipeline would be constructed from the wellfield to the spreading basins as shown in **Figure 3-14**. The water conveyance facility would terminate at the Project spreading basins and discharge Colorado River water for percolation into the ground, where it would be stored for future use. The underground conveyance extension would be installed entirely on Cadiz Property. The pipeline would cross the ARZC rail line using jack and bore construction methods. The Intermediate Pump Station located near the CRA would provide the energy to convey water from the CRA to the spreading basins. Access to the spreading basin would be provided using existing under-crossings. No new grade crossings would be required.

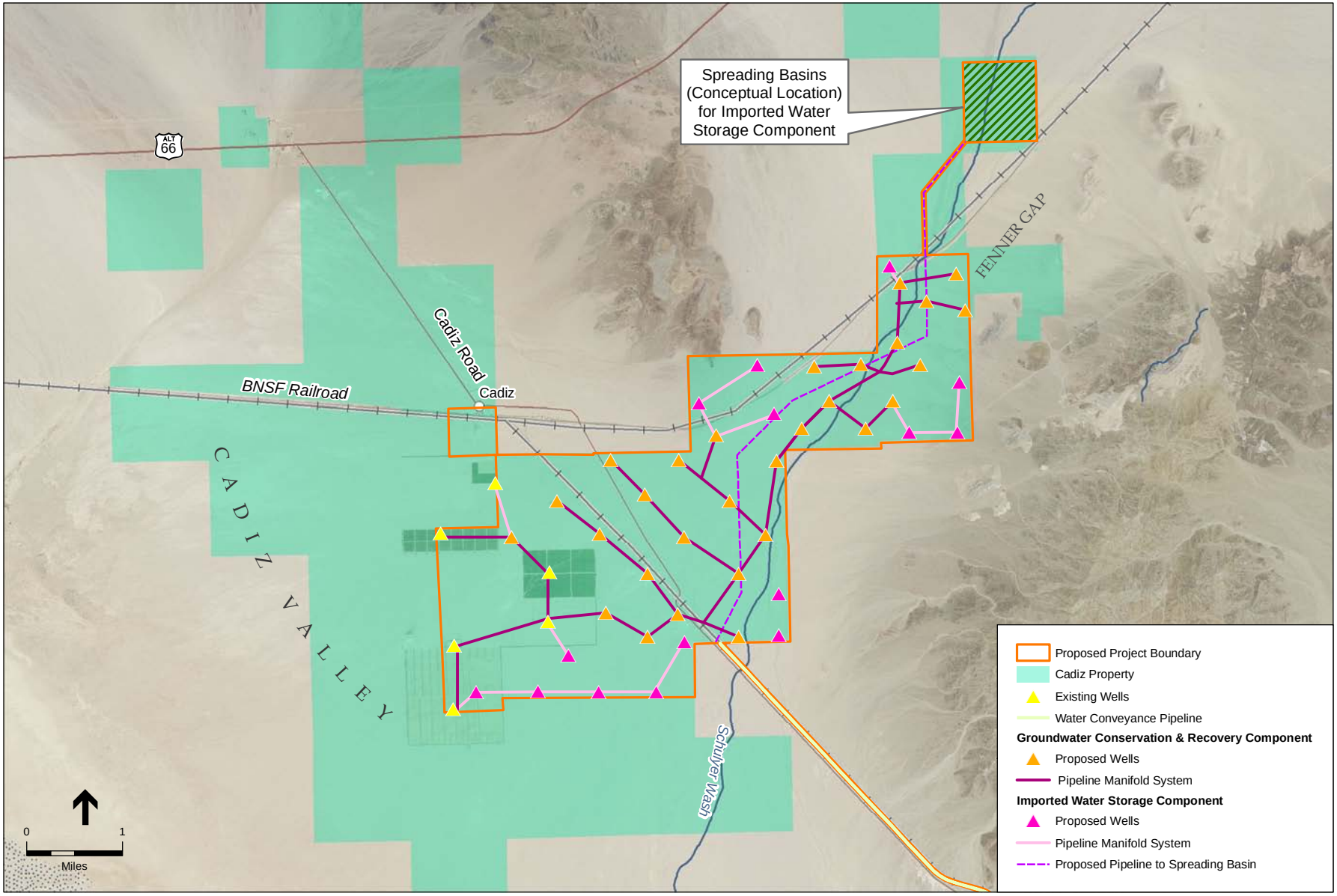


SOURCE: Bing Maps, 2011; ESRI, 2010; DeLorme, 2011; Cadiz Inc., 2011; and ESA, 2011

Cadiz Valley Water Conservation, Recovery, and Storage Project

Figure 3-13

Existing Natural Gas Pipeline



SOURCE: USDA, 2009; ESRI, 2010; Cadiz Inc., 2011; San Bernardino Co., 2010; and ESA, 2011

Cadiz Valley Water Conservation, Recovery, and Storage Project

Figure 3-14

Expanded Wellfield
Imported Water Storage Component

Spreading Basins

As part of the Imported Water Storage Component, spreading basins would be constructed on Cadiz Property northeast of the Fenner Gap. Figure 3-14 shows a conceptual location for the proposed spreading basins, which would encompass up to 400 acres. Each individual basin would range from 10 to 15 acres in size, surrounded by fencing. Individual basins would be about 400 feet wide and would range from 1,700 to 2,100 feet long. Water would flow by gravity through the basins in succession. An access road would be constructed from the wellfield to the basins.

The basins would be constructed with earthen berms using from 3:1 to 6:1 (horizontal:vertical) side slopes. Structures associated with the basins would include control structures, inlet structures, flow control structures, and overflow structures. Control structures would control and divert water from the transmission pipeline to the inlet structure.

Flow control structures would be used to cascade flow from upstream basin cells to downstream basin cells. The flow control structures would consist of reinforced concrete structures with wingwalls, weir guides and supports, weir boards, piping handrails, and riprap at the inlet and outlet. Spreading basin operations would occur when water is available for diversion from the CRA under executed contracts.

It is anticipated that spreading basins would be full for up to several weeks at a time and otherwise dry much of the year. The spreading basins would be cleaned periodically depending on the sediment load of the imported water. Cleaning would require scraping the floor of the basins and disposing of the silts at an on-site location. The basin floors would be scarified to improve percolation.

Wellfield Expansion

Under the Imported Water Storage Component, additional wells would be constructed, as needed, to increase capacity. A conceptual wellfield expansion area for the Imported Water Storage Component is depicted in Figure 3-14. An additional 10 to 15 wells may be needed to accommodate the Imported Water Storage Component. Wells would be similar to those constructed for the Groundwater Conservation and Recovery Component.

The power distribution system installed for the Groundwater Conservation and Recovery Component would be expanded to accommodate the expanded wellfield. Energy consumption would be increased by 75 million kWh per year as summarized in **Table 3-4**.

TABLE 3-4
CADIZ WELLFIELD POWER REQUIREMENTS
IMPORTED WATER STORAGE COMPONENT

Wellfield Production	TDH	Average Power Requirement[a]		Annual Power Requirement[b]
Afy	ft	hp	Kw	kWh
100,000	565	10,400	7,800	75,600,000

[a] Average power requirement based on 85% pump efficiency.
[b] Annual power requirement based on 90% motor transfer efficiency, 24hrs/day, 365 days/yr.

SOURCE: RBF Consulting, *Power Requirements Analysis Technical Memorandum, Cadiz Groundwater Conservation and Storage Project, San Bernardino County, California, Phase* 1, November 2010.

3.7 Project Construction

3.7.1 Groundwater Conservation and Recovery Component

Project Wellfield

The first construction activity would be to stake the location of the access roads to the wells and the well pads for the drillers. The staked locations would be cleared and a bladed access provided to the drilling sites. Drilling pads would be graded, including a “mud” pit for drilling fluids. The drill rig would be mobilized to the site and drilling operations would commence. Upon completion, the well would be developed, the well pad completed, pump and motor set, and power and control panels constructed. The drill rig would then mobilize to another site. Piping and other utilities, such as power, would be installed to the main wellfield collector, and the access road to the well site would be completed. As wells and well piping are completed, the wellfield main collector would be constructed within previously cleared areas and connected to individual well pipes. Construction related activities would take place entirely on Cadiz Property. Approximately 0.25 to 0.5 acre of land would be kept clear around each well location for construction, staging, and ongoing maintenance.

Well drilling would be accomplished with drill rigs using the reverse rotary drill method. Each well would be approximately 1,000 feet Total Depth. A crane would lower the well casing and screens into the borehole. The annular space between the well casing and borehole would be filled with a mixture of soil and rock filter pack to ensure that fine-grained material from the formation surrounding the well is not pumped through the well during operation. Well screens would be installed within the water bearing formations at depths between 400 to 900 feet. A concrete seal would be placed at the top 50 feet of the annular space to provide a sanitary seal for the well. Figure 3-7 illustrates a typical well cross section. As wells are developed, pumped water would be conveyed to detention basins to percolate into the ground until the Project is ready to begin operations. Water quality data would be collected as part of the well development process. Each well would be equipped with internal pumps and sensors. Pressure gages and valves would be installed at the surface to control pressure. The well pumps would provide enough power to lift water in the well and convey it all the way to the CRA through the conveyance pipeline.

A backhoe would excavate pipe trenches for the Project wellfield distribution system that would carry water to the conveyance pipeline leading to the CRA. A crane would be used to lower pipe segments into the trench. The pipe trench would be backfilled by a loader and the backfill compacted to ensure pipe integrity. A separate trench would be excavated to install the Project wellfield electrical power and SCADA control systems. A maintenance road along the entire well network would be constructed to provide access to each Project well site and the collector pipeline. Construction of the Project power supply and distribution facilities would occur concurrently with the construction of the Project wellfield.

Water Conveyance Facility

For the conveyance pipeline, the first construction activity would be to stake the construction limits. Following staking, best management practices to control sediment discharges would be installed, such as silt fencing, erosion control blankets, etc. This activity would be in coordination with the clearing of the construction limits, including stockpiling topsoil to use in surface restoration. Construction equipment would be mobilized at the site to start trench excavation, pipe installation, and backfilling, including installation of cathodic protection test stations. Following pipe installation, additional crews would follow behind to install appurtenances, such as air valves and blow offs. A surface restoration crew would follow the appurtenance crew to perform fine grading, place stockpiled topsoil, and perform revegetation and erosion control. Washes and training dikes that are impacted by construction would be returned to their pre-construction condition in coordination with ARZC operators.

Upon completion of the pipe laying operation, the pipe would be filled with water and hydrostatically tested. Hydrostatic testing may be performed in sections. Upon acceptance, the pipeline would be placed in service. Grading operations associated with regulating storage or forebays would be performed following site clearing and staking. Storage facilities would be excavated and surfaces restored. If an intermediate pump station is required in the final Project configuration it would be constructed as follows: Site clearing and staking; excavation of foundation; construction of foundation; construction of walls and roof (if a structure is required); installation of equipment; performance of functional testing; and startup and performance testing.

Figure 3-8 depicts a typical pipe trench. The conveyance pipeline would be installed underground using open-trench construction methods at a depth of 15 feet bgs. The pipeline would be installed more than 50 feet from the centerline of the existing track. The pipeline may cross under the railroad tracks in a few places to avoid sensitive areas or geologic constraints, to be determined during final design. Such crossings would be subject to written approval by ARZC and installed, maintained, renewed, and repaired at a depth of not less than five feet below the base of the rail. Railroad undercrossings would use bore and jack methods or directional drilling. Blasting may be required in some areas. There are approximately 70 road and wash crossings. These wash crossings, from the wellfield to the spreading basins, would be constructed with at least five feet of cover and may require reinforcing with concrete casing or pads at least five feet below the surface.

It is assumed that no import or export of soil would be required for construction of the pipeline. Pipe segments would be delivered to the Cadiz Inc. agricultural operation (Cadiz Ranch) via the

BNSF railroad where it intersects with the ARZC on Cadiz Property. Pipe would then be delivered to the construction sites using either the existing ARZC rail system or by truck. The pipe-laying work area would be within the railroad ROW. The ARZC rail line would remain operational for the duration of the construction. The pipeline may be installed within multiple locations simultaneously, requiring a second or third crew and equipment.

Monitoring Features

Observation wells, benchmarks, and extensometers would be installed as required in the GMMMP prior to Project operation. The observation wells would be drilled in a similar fashion to the production wells, but the well diameters would be much smaller, between 2 and 3 inches. Well pad disturbance areas would be smaller than those used for the production wells due to the smaller size of the wells and the lack of surface appurtenances needed. Access roads would be graded to each new well. Bench marks and extensometers would be placed near roads or existing structures, resulting in minimal disturbance.

Construction Equipment

Construction equipment that would be required during construction of the Groundwater Conservation and Recovery Component is shown below in **Table 3-5**.

Workers

Approximately 240 workers would be employed at any given time at the Project site.[21] On-site workers would reside within the existing housing areas on Cadiz Property. These existing worker housing areas support the agricultural activities and are sized to house over 300 workers at peak harvest season. These areas are expandable if necessary, within the footprint of the existing disturbed areas. Worker commutes would include individuals arriving at and leaving the worker housing areas once a week (typically arriving on Monday mornings and leaving on Friday nights). During the week, commutes would consist of van pools from the worker housing areas to the work zones.

Staging Areas

Staging areas would be required for the temporary storage of equipment and materials during construction of the Project. Preparation of these staging areas would consist of flattening vegetation in place or blading the site in a manner that would allow native vegetation to recover from rootstock.

[21] Economics & Politics, Inc., *Economic Impact of the Proposed Cadiz Valley Conservation, Recovery and Imported Water Storage Project*, April 2011, pages 5-7, 11-13 and Executive Summary. (Project would create more than 1,200 direct and indirect jobs over the two phases of the Project. Jobs include the following: construction material production or planning; engineering; and firms assisting those operations; fabricated pipe and pipe fitting manufacturing; management, scientific and technical consulting.)

TABLE 3-5
CONSTRUCTION EQUIPMENT REQUIRED FOR THE GROUNDWATER CONSERVATION AND RECOVERY COMPONENT

Description	Wellfield Installation[a]	Conveyance Pipeline	Storage Reservoir/Pump Stations	CRA Tie-in Facility
Grader	1	1	3	1
Dozer	1	1	2	2
¾ ton Pickup Truck	6	6	10	-
End Dump Truck, 12 cy	2	2	4	1
Crane	2	1	1	1
Air Compressor	2	1	1	2
Tractor / Lowboy Hauling Rig	2	2	-	2
3 cy Rubber Tire Loader	1	3	3	2
Backhoe	-	3	3	1
Highway Water Truck	1	2	2	1
Truck Crane	1	2	1	1
Concrete Truck[b]	2	1	2	1
Well Drill Rig	4	-	-	-
Directional Drill Rig	-	1	-	-
Workers	60	100	40	40
Mobilization Maximum Daily Miles Travelled[c]	100	2,500	1,000	1,000
Commute to Cadiz once per week Maximum Daily Miles Travelled (200 miles per worker per one way trip).	12,000	20,000	8,000	8,000

[a] per header. Assumes Project would be constructed with two headers simultaneously
[b] daily average
[c] assumes workers stay at Cadiz Property five days per week. Miles traveled shown here are mobilization miles from Cadiz worker housing area to work site. Assumes four workers per car.

NOTE: The types and quantities of equipment are approximate and intended only for estimating construction related impacts. Actual equipment types and quantity may vary.

SOURCE: ESA, 2011.

As described above, Cadiz Inc. owns and operates housing facilities in the northern portion of the Project area that would be utilized to house employees throughout the construction period (see Figure 3-10a). Residential facilities include a trailer park with 50 available mobile home/RV hook-ups, a dormitory which sleeps 150 people, and a worker housing facility with beds for an additional 150 people. The worker housing area includes a kitchen facility large enough to provide meals to the entire workforce.

Depending on the construction contractor, a second worker housing facility may be established within the staging area footprints at the south end of the proposed pipeline alignment. If established, these housing facilities would be rustic in nature, relying on portable sanitation, portable generators, and tents. No new permanent structures would be constructed in these areas.

Site Access

It is assumed that access to the construction site would be either from the north at SR 66 or south from SR 62. Workers and equipment could access SR 66 from Amboy Road, which connects with SR 62 at Twentynine Palms. From SR 66, construction traffic would turn south at Cadiz Road and utilize the existing at-grade rail crossing to enter Cadiz Property. Staging areas and worker housing facilities would be established near the Cadiz Ranch. Access from the south would be from SR 62 at Rice. Construction traffic would cross the CRA within the ARZC easement over the Frieda Siphon.

Workers would access work zones from worker housing facilities along the Project access roads either by van or truck. It may be possible to utilize high-rail trucks as well with pre-approval from ARZC. Material deliveries could come from trucks or rail.

Construction Schedule

It is assumed that construction of the Groundwater Conservation and Recovery Component would begin immediately following certification of the EIR and acquisition of necessary permits, completion of final designs, and Project bidding process. For planning purposes, this permitting process is expected to take from six months to a year. Installation of the wellfield would require approximately 10 to 11 months thereafter; it is expected to take approximately 1 to 2 months to drill each well, with multiple wells being drilled simultaneously. The drilling operation would be continuous, 24 hours per day.

The pipeline, including the CRA connection, would be installed within a 12-month period, assuming construction would occur 12 hours a day, five days a week, with approximately 7,000 feet of pipeline constructed each week. Actual work schedules may include work on the weekends as well. It is anticipated that two pipeline crews would work to lay pipe simultaneously, with restoration crews following to re-vegetate in the wake of the backfill. During the hot, dry summers, it is likely that construction would occur predominantly during the pre-dawn and early mornings or in the evening and nighttime hours when it is cooler. Wells and possibly portions of the pipeline would be constructed 24-hours per day. Construction for the entire Project is expected to last approximately 18 months, potentially beginning in 2012 and concluding in 2014.

3.7.2 Imported Water Storage Component

The Imported Water Storage Component is being evaluated at a programmatic level. Because of potential synergies and economies of scale, the Imported Water Storage Component would be ripe for further analysis upon approval of the Groundwater Conservation and Recovery Project. Although the storage and recovery of imported water was examined extensively in the 2002 EIR/EIS a substantial quantity of new data has been obtained and new modeling undertaken since 2002. The earlier analysis must be updated to account for this as well as the new hydrologic conditions that exist on the Colorado River and the SWP among other things. Consequently, the Imported Water Storage Component would be constructed only after additional appropriate CEQA analysis is conducted, as appropriate, in accordance with *CEQA Guidelines* §15168.

Wellfield Expansion

Construction of the expanded Project wellfield would be similar to the Project wellfield. Approximately 10 to 15 additional wells would be constructed. Well-pads, connector pipeline routes, and access roads would be cleared. Approximately 0.25 to 0.5 acre of land would be kept clear around each well location for construction, staging, and ongoing maintenance.

CRA Diversion Structure and Pump Station

A diversion structure would be installed within the CRA. A pump station would be constructed to pump water from the CRA to the Project spreading basins. Site grading and excavation would be conducted to establish a foundation for the structure. Approximately 10,000 cubic yards of soil would be excavated and spread near the site. No soil would be hauled off site. A concrete building approximately 25 feet tall, encompassing approximately 10,000 square feet would be constructed. Pumps would be installed within the pump station.

Water Conveyance Extension

Construction methods for the conveyance pipeline extension would be similar to those used for installing the pipeline to the CRA. The entire pipeline extension would be installed underground using open-trench construction methods at a depth of 15 feet bgs. Utility and railroad crossings would require jack and bore installation techniques.

Project Spreading Basins

Construction activities for the spreading basins would include excavation, embankment or berm construction, gate and valve installation, and appurtenant construction. All construction-related activities would take place on Cadiz Property. Construction equipment that would be required for the Imported Water Storage Component is shown below in **Table 3-6**.

Staging Areas

Staging areas would be required for the temporary storage of equipment and materials needed during construction of the Imported Water Storage Component. Preparation of these staging areas would consist of flattening vegetation in place or blading the site in manner that would allow native vegetation to recover from rootstock.

Construction Schedule

Construction of the spreading basins, pipeline extension, and expanded wellfield for the Imported Water Storage Component would only begin following appropriate CEQA compliance review and compliance with any additional permitting requirements. Once approved for construction, the Imported Water Storage Project would be completed in approximately 12 months.

TABLE 3-6
CONSTRUCTION EQUIPMENT REQUIRED FOR THE IMPORTED WATER STORAGE COMPONENT

Description	Diversion Structure/ Pump Station	Wellfield Expansion	Spreading Basins
Grader	3	1	4
Dozer	2	1	4
Scraper	-	-	2
¾ ton Pickup Truck	10	6	6
End Dump Truck, 12 cy	4	2	2
Crane	1	2	-
Air Compressor	1	2	1
Tractor / Lowboy Hauling Rig	-	2	2
3 CY Rubber Tire Loader	3	1	3
Backhoe	3	-	2
Highway Water Truck	2	1	2
Truck Crane	1	1	1
Concrete Truck[a]	2	2	1
Well Drill Rig	-	4	-
Workers	60	60	60
Mobilization Maximum Daily Miles Travelled[b]	1,500	100	100
Commute to Cadiz once per week Maximum Daily Miles Travelled (200 miles per worker per one way trip).	12,000	12,000	12,000

[a] daily average

[b] assumes workers stay at Cadiz Property five days per week. Miles traveled shown here are mobilization miles from Cadiz to work site. Assumes four workers per car.

NOTE: The types and quantities of equipment are approximate and intended only for estimating construction related impacts. Actual equipment types and quantity may vary.

SOURCE: ESA, 2011.

3.8 Agreements, Permits, and Approvals

Implementation of the proposed Project may require the following agreements, permits, and approvals:

Santa Margarita Water District	Project Approval/CEQA	A Project Participant and CEQA Responsible Agency pursuant to California Public Resources Code section 21069, SMWD would evaluate potential environmental impacts within its boundaries and has discretion to approve or reject its participation in the proposed Project
Three Valleys Municipal Water District	Project Participation Approval/CEQA	A Project Participant and CEQA Responsible Agency pursuant to California Public Resources Code section 21069, Three Valleys would evaluate potential environmental impacts within its boundaries and has discretion to approve or reject its participation in the proposed Project
Jurupa Community Services District	Project Participation Approval/CEQA	A Project Participant and CEQA Responsible Agency pursuant to California Public Resources Code section 21069, JCSD would evaluate potential environmental impacts within its boundaries and has discretion to approve or reject its participation in the proposed Project
Arizona California Railroad	Agreement of right of way easement	Needed to utilize railroad right of way
	Project Participation Approval	A Project Participant. Has discretion to approve or reject its participation in the proposed Project
California Public Utilities Commission	CPUC Approval	Regulatory authority over Golden State and Suburban, the CPUC has approval authority over Golden State's and Suburban Water's agreements if rates are affected
US Fish and Wildlife Service	Endangered Species Act Section 7	Needed due to presence of desert tortoise

US Army Corps of Engineers	Clean Water Act Section 404	Needed for Piute Wash observation well
	Commitment to remove unexploded ordnance	Needed if unexploded ordnance removal is necessary
California Department of Fish and Game	California Fish and Game Code Section 2081	Needed due to presence of desert tortoise
	California Fish and Game Code Section 1602	Needed for effects to streambeds
California Department of Transportation	Encroachment Permit	Needed for lane closures if necessary on SR62 and SR66
Regional Water Quality Control Board	Clean Water Act Section 401	Needed for effects to waters of the US
	WDRs for waters of the state	Needed to cross washes as waters of the state;
	Storm Water Pollution Prevention Plan	Needed for construction activities
	Waste Discharge Requirements	Needed for land discharges including spreading basins, well completion discharges, and blow-off discharges
	Anti-Degradation Analysis for storage recharge	Needed per Basin Plan to protect groundwater
Metropolitan Water District of Southern California	Approval to modify CRA for the proposed intertie and diversion structures	Needed for use of CRA
	Agreement to convey water through the CRA	
Mojave Desert Air Quality Management District	Natural gas engine emissions permits	Needed for well pumps and Intermediate Pump Station
San Bernardino County	Groundwater Management, Monitoring and Mitigation Plan pursuant to County MOU	Needed to comply with County MOU