Appendix A

Notice of Preparation and Scoping Report

ESA

CADIZ VALLEY WATER CONSERVATION, RECOVERY, AND STORAGE PROJECT

Scoping Report

Introduction

The Santa Margarita Water District is the Lead Agency for the proposed Cadiz Valley Water Conservation, Recovery, and Storage Project (Project) that would be constructed in the Cadiz and Fenner Valleys in the eastern Mojave Desert portion of San Bernardino County, California. SMWD, along with other participating water agencies acting as Responsible Agencies, is proposing to implement the Project in partnership with Cadiz Inc. (Cadiz), a Delaware Corporation that owns approximately 34,000 contiguous acres of land in the Cadiz and Fenner Valleys (Cadiz Property), and the Fenner Mutual Water Company (FMWC), a non-profit California mutual water company formed to deliver water at cost to its shareholders that are comprised of public water systems that purchase water from the Project. Cadiz would make available its land, easements, and appurtenant rights for the operation of the Project.

Substantial quantities of percolating groundwater underlie the Cadiz property. The groundwater naturally flows to the Bristol and Cadiz Dry Lakes and is lost to evaporation. The total volume of groundwater in storage in the Watersheds has been estimated to be more than 20 million acre-feet (MAF).

In the Project area, the depth to water is consistently more than 180 feet below ground surface (bgs), reaching over 400 feet bgs in some areas. In parts of the Watersheds the groundwater extends to depths of nearly 2,000 feet bgs. The proposed Project would be executed in two phases, each of which is described in more detail below. The entire Project would be operated under two guiding principles: to optimize the reasonable and beneficial use of water and to do so without causing harm to the environment.

Notice of Preparation

On March 1, 2011, a Notice of Preparation (NOP) for the proposed Project was submitted to the California Office of Planning and Research (State Clearinghouse and Planning Unit) and distributed to Responsible and Trustee Agencies, County Clerks, and other interested parties for a 30-day review period that ended March 30, 2011 (see Attachment 1). A Notice of Completion (NOC) was also prepared by SMWD and sent to the State Clearinghouse (see Attachment 2). The NOP was mailed to approximately 120 interested parties, including local, state, and federal agencies and groups or individuals who had expressed interest in the Project. The NOP was distributed via certified mail or FedEx delivery (see Attachment 3). Copies of the NOP were made available for public review on the SMWD website (http://www.SMWD.com), at the SMWD offices located at 26111 Antonio Parkway, Rancho Santa Margarita, CA 92688, and at the following libraries.

- San Bernardino County Library, 104 W. 4th Street, San Bernardino, CA 92415
- Rancho Santa Margarita Public Library, 30902 La Promesa Drive, Rancho Santa Margarita, CA 92688
- Twentynine Palms Library, 6078 Adobe Rd. Twentynine Palms, CA 92277
- City of Barstow Library, 304 E. Buena Vista St., Barstow, CA 92311
- City of Needles Library, 1111 Bailey, Needles, CA 92363
- Joshua Tree Library, 6465 Park Blvd., Joshua Tree, CA 92252

Scoping Meetings

The 30-day project scoping period, which began with the distribution of the NOP on March 1, 2011, remained open through March 30, 2011. SMWD held two public scoping meetings during the 30-day public scoping period. On March 16, 2011, SMWD held a meeting at their District Boardroom on 26111 Antonio Parkway, Rancho Santa Margarita, CA 92688. On March 24, 2011, SMWD held a meeting at the Joshua Tree Community Center at 6171 Sunburst Street, Joshua Tree, CA 92252. The District placed public notices advertising the scoping meetings and announcing the availability of the NOP in the following newspapers on the following dates (see Attachment 4):

- The Press-Enterprise: Sunday March 13 and Sunday March 20.
- The Orange County Register: Sunday March 13 and Sunday March 20.
- Desert Trail: Thursday March 17.
- Hi Desert Star: Saturday March 12 and Saturday March 19.

The next formal opportunity for the public to comment on the proposed Project will occur when the Draft Environmental Impact Report is distributed for a 45-day review period, which is currently anticipated to occur sometime in early fall 2011.

NOP Comments

During the scoping period, SMWD received **25** comment letters via mail, e-mail or facsimile (see Attachment 5) and received verbal and written comments at the public scoping meetings (see Attachment 6). Table A-1 lists the comments that were received via mail and email. Table A-2 shows dates of oral comments received during the public scoping meetings.

TABLE A-1
NOP COMMENTS RECEIVED VIA MAIL AND EMAIL

	Agency/Affiliation	Name of Individual	Date of Comment Received
Federal Agencies			
1	US Department of Interior – National Park Service	Christine Lehnertz	March 29, 2011 (via mail)
2	United States Marine Corps	B.R. Norquist	March 29, 2011 (via mail)
State Agencies			
3	Office of Planning and Research (State Clearinghouse)	Scott Morgan	March 1, 2011 (via mail)
4	Department of Toxic Substances Control	Leonard Robinson	March 21 2011 (via mail)
5	Native American Heritage Commission	Dave Singleton	March 21, 2011 (via mail)
6	California Department of Fish and Game	Michael Flores	March 30, 2011 (via mail)
Organizations			
7	Mojave Desert Air Quality Management District	Alan De Salvio	March 2, 2011 (via mail)
8	East Mojave Land Owners Association	Richard MacPherson	March 21, 2011 (via mail)

	Agency/Affiliation	Name of Individual	Date of Comment Received
9	San Bernardino County Public Works Department	Annesley Ignatius	March 23, 2011 (via mail)
10	Center for Biological Diversity	Ileene Anderson	March 28, 2011 (via mail)
11	Mojave Preserve Land Owners Association	Richard MacPherson (2)	March 28, 2011 (via email)
12	Defenders of Wildlife	Jeff Aardahl	March 29, 2011 (via mail)
13	National Parks Conservation Association	Seth Shteir	March 29, 2011 (via mail)
14	Metropolitan Water District	John Shamma	March 30, 2011 (via mail)
15	Mojave Desert Heritage and Cultural Association	Chris Ervin	March 30, 2011 (via mail)
16	San Bernardino County Land Use Services Department	Christine Kelly	March 30, 2011 (via mail)
Individuals			
17	Public commenter	Joe Ross	March 12, 2011 (via email)
18	Public commenter	Russel and Marilyn Woodruff	March 23, 2011 (via mail)
19	Public commenter	Brenden Hughes	March 25, 2011 (via email)
20	Public commenter	Valerie Finstad	March 25, 2011 (via mail)
21	Public commenter	Chris Brown	March 28, 2011 (via email)
22	Public commenter	Elden Hughes	March 28, 2011 (via email)
23	Public commenter	Helena Bongartz	March 28, 2011 (via email)
24	Public commenter	Helena Bongartz (2)	March 29, 2011 (via email)
25	Public commenter	Chris Ervin	March 30, 2011 (via mail)

TABLE A-2
NOP COMMENTS RECEIVED AT SCOPING MEETINGS

Agency/Affiliation	Meeting Date, Location
Oral public comments	March 16, 2011, District Boardroom, Rancho Santa Margarita
Oral public comments	March 24, 2011, Joshua Tree Community Center

Contents of this Report

This Scoping Report contains documents pertinent to the scoping process. The following items are included:

Attachment 1: Notice of Preparation
Attachment 2: Notice of Completion
Attachment 3: NOP Distribution List
Attachment 4: Proof of Publication of Public Notices
Attachment 5: Comment Letters Received by SMWD
Attachment 6: Scoping Meeting Comments
Attachment 7: Matrix of Comments
Attachment 8: Matrix of Alternative Suggestions

Attachment 1
Notice of Preparation

Santa Margarita Water District

NOTICE OF PREPARATION OF A DRAFT EIR AND PUBLIC SCOPING MEETING NOTICE

Cadiz Valley Water Conservation, Recovery, and Storage Project

To: California Office of Planning and Research; Responsible and Trustee Agencies; County Clerks; and Other Interested Parties

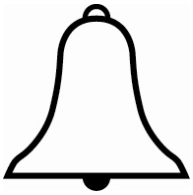
Subject: Notice of Preparation of an Environmental Impact Report and Public Scoping Meeting Notice

Project: Cadiz Valley Water Conservation, Recovery, and Storage Project

Lead Agency: Santa Margarita Water District

This Notice of Preparation (NOP) has been prepared to notify agencies and interested parties that the Santa Margarita Water District (SMWD) as the Lead Agency is beginning preparation of an Environmental Impact Report (EIR) pursuant to the California Environmental Quality Act (CEQA) for the proposed Cadiz Valley Water Conservation, Recovery, and Storage Project (Project). SMWD, along with other participating water agencies acting as Responsible Agencies, is proposing to implement the Project in partnership with Cadiz Inc. (Cadiz), which owns approximately 34,000 acres of land located in the Cadiz and Fenner Valleys of San Bernardino County, and the Fenner Mutual Water Company (FMWC), a non-profit California mutual water company formed to deliver water at cost to its shareholders that are public water systems that purchase water from the Project.

Substantial quantities of percolating groundwater underlie the Cadiz property. The groundwater naturally flows to the Bristol and Cadiz Dry Lakes (Dry Lakes) and is lost to evaporation. The proposed Project would be executed in two phases: the first phase of the Project is the Conservation and Recovery Component, and the second phase is the Imported Water Storage Component. In the first phase, the Conservation and Recovery Component would be constructed to capture and conserve the average annual natural recharge in the Fenner and northern Bristol Valleys that would otherwise discharge to the Bristol and Cadiz Dry Lakes. The Project would construct extraction wells (wellfield) on the Cadiz property and a 42-mile underground water conveyance pipeline within an active railroad right-of-way that intersects the Colorado River Aqueduct (CRA). The



Project would extract the amount of water that would otherwise flow to the Dry Lakes plus the amount needed to maintain hydraulic control in the vicinity of the wellfield. The pipeline would be sized to convey an annual average of 50,000 acre-feet per year (AFY) of water from the Fenner Valley groundwater basin to SMWD and other participating water agencies, for a period of 50 years.

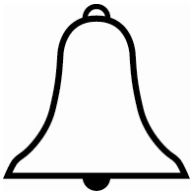
A second phase of the Project, the Imported Water Storage Component, would make available up to one million acre-feet (MAF) of groundwater storage space to be used as part of a conjunctive use project, which is consistent with State policy favoring and supporting conjunctive use projects (Cal. Water Code § 79170 et seq.). Under the Imported Water Storage Component, Colorado River water would be conveyed to recharge basins in the Fenner Valley to percolate into the ground for storage and future withdrawal as a dry-year supply. Because the Imported Water Storage Component would be implemented at a later date, it will be evaluated in the EIR on a programmatic basis. Prior to implementing the Imported Water Storage Component, it will undergo appropriate further environmental review consistent with CEQA.

SMWD is acting as Lead Agency as the first public agency with a discretionary decision regarding the Project and because the Project will be owned in part and operated by SMWD. SMWD is soliciting the views of interested persons and agencies as to the scope and content of the environmental information to be studied in the EIR. In accordance with CEQA, agencies are requested to review the Project description provided in this NOP and provide comments on environmental issues related to the statutory responsibilities of the agency. The EIR will be used by SMWD and other Responsible Agencies when considering approval of the Project. Other confirmed participating water providers include Three Valleys Municipal Water District, Suburban Water Systems, and Golden State Water Company.

In accordance with the time limits mandated by CEQA, comments on the NOP must be received by SMWD no later than 30 days after publication of this Notice. We request that comments on this NOP be received no later than March 30, 2011. Please send your comments, including a return address and contact name, via mail to this address:

c/o Tom Barnes, ESA
626 Wilshire Boulevard, Ste. 1100
Los Angeles, CA 90017
Telephone: 213-599-4300
FAX: 213-599-4301

Or by email to: cadizproject@esassoc.com



Public meetings will be held to receive public comments and suggestions on the Project. One scoping meeting will be held in San Bernardino County and a second scoping meeting will be held within SMWD's service area. The scoping meetings will be open to the public on the following dates and in the following locations:

Wednesday, March 16, 2011, 4 p.m.
Santa Margarita Water District
26111 Antonio Parkway
Rancho Santa Margarita, CA

Thursday, March 24, 2011, 6 p.m.
Joshua Tree Community Center
6171 Sunburst Street
Joshua Tree, CA

PROJECT LOCATION AND SETTING

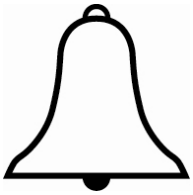
The Project proposes active management of the groundwater basin underlying Cadiz Inc. property in the Cadiz and Fenner Valleys located in the eastern Mojave Desert, San Bernardino County, California (**Figure 1**). The purpose of the Project is to develop a new, reliable water supply and storage facility for SMWD and other participating water providers. The Project would be operated by FMWC, which is comprised of shareholders that are public water systems.

The Project area is located at the confluence of the Fenner Valley and Orange Blossom Watersheds (Watersheds), which span nearly 1,300 square miles and contain an estimated total volume of groundwater in storage of more than 20 MAF. The Project area is underlain by an aquifer system composed of saturated alluvial materials, limestone-carbonates, and granitic rocks with a depth to groundwater of consistently more than 180 feet below ground surface (bgs) and reaching over 400 feet bgs in many areas.

PROJECT DESCRIPTION

The Project would be implemented in two phases:

> The first phase, referred to as the **Conservation and Recovery Component**, would employ a strategy to lower water levels beneath Cadiz property in the vicinity of the proposed Project wellfield to establish hydraulic control and intercept groundwater presently migrating to the Bristol and Cadiz Dry Lakes and being lost to evaporation. Facilities that would be constructed under the first



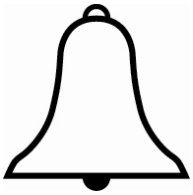
phase include a Project wellfield, water conveyance facilities, tie-in to the Colorado River Aqueduct (CRA), access roads, and power supply and distribution facilities.

- The second phase, referred to as the **Imported Water Storage Component**, would use the established hydraulic control for the importation, storage and recovery of imported developed water made available from the CRA. Facilities that would be constructed under the second phase include a Project wellfield expansion, extension of the water conveyance facilities, CRA diversion structure and pump station, access roads, expansion of the power supply and distribution facilities, and spreading basins.

A. Conservation and Recovery Component

As part of the Conservation and Recovery Component, native groundwater currently being lost annually to evaporation at the Bristol and Cadiz Dry Lakes from the aquifer system underlying the Project area would be captured and conserved through the active management of the groundwater basin. Wells would be constructed within the Fenner Gap portion of the Watersheds to withdraw the amount of groundwater necessary to achieve an optimal level to create a natural hydraulic barrier. The hydraulic barrier would allow for the recovery of groundwater that otherwise would be lost to evaporation. The proposed wells would be constructed on Cadiz property, and a 42-mile underground pipeline would be installed within the privately-owned railroad right-of-way (ROW) that connects the Project wellfield to the CRA. The recovered groundwater would be conveyed to SMWD and other participating water providers through the CRA delivery system owned and operated by the Metropolitan Water District of Southern California (Metropolitan). The Draft EIR will include a detailed project description showing facility locations and access points. **Figure 2** shows the proposed Project, including the following components:

- wellfield area
  - groundwater wells
  - interconnecting pipelines
  - natural gas distribution system
- 42-mile water conveyance pipeline
- CRA tie-in
- equalization storage reservoir and pump station near CRA (if necessary)

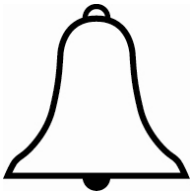


Only the quantity of water that is equal to (a) the amount required to attain an optimal groundwater level, plus (b) the amount of long-term average recoverable recharge, would be extracted from the groundwater basin under the Conservation and Recovery Component. The specific quantity and schedule for groundwater recovery that is required to achieve this objective will be determined by an operations plan. However, the Project would operate under a self-imposed limit so that the total quantity of native groundwater that would be recovered and conveyed to the CRA would not exceed an annual average of 50,000 AFY over the life of the Project, which is considered to be 50 years. During that period, the Project would conserve and recover the sustainable yield that would otherwise have evaporated from the Dry Lakes. The sustainable yield from the Watersheds has been estimated to be approximately 32,500 AFY. As described above, to maintain access to this sustainable yield, the groundwater within the wellfield area would be dewatered to an optimal level. The drawdown would create a groundwater trough that would modify groundwater flow by creating a hydraulic control mechanism. To maintain hydraulic control, an annualized surplus of approximately 17,500 AFY averaged over the life of the Project would be extracted and conveyed to the CRA. This water would be available for delivery to participating water providers, bringing the annual average delivery capacity of the Project to 50,000 AFY.

In certain wet years, participants may opt to decrease or forego their contracted annual groundwater deliveries and instead store that water in the aquifer system at the Project site. This stored water, or "carry-over water," could then be conveyed to Project participants in a future dry year as a supplement to their contracted annual supply. The capacity of the pipeline would be sized to accommodate 75,000 AFY so that carry-over storage water in addition to the contracted annual supply could be accommodated. This would not alter the long-term average annual withdrawal of 50,000 AFY over the 50-year term of the Project.

B. Imported Water Storage Component

The second phase of the Project, the Imported Water Storage Component, would allow for storage of imported surface water from the CRA into the aquifer system. When water is available by direct delivery or exchange, such as surplus water in wet years, a Project participant could convey surplus from the CRA to the Project site via the pipeline. The Project participants for the second phase may include Colorado River rights holders, located in southern California. This water would be recharged into the aquifer system via spreading basins proposed to be constructed on Cadiz property. When needed, participants could extract previously stored surface water from the aquifer system, and it would be conveyed to the CRA and delivered through the CRA delivery system to Project participants. The storage capacity of the aquifer system is estimated to be more than 1 MAF. The second phase would benefit from established hydraulic control. The creation of hydraulic control will allow project participants to store water from year-to-



year without losing the water to evaporation because lowering the water table in the wellfield will also change the gradient and intercept groundwater flowing beneath the surface into the wellfield. Accordingly, the groundwater pumping will act as a barrier to outflow from the groundwater basin into the Dry Lakes where it presently evaporates.

In the event that imported water from the Colorado River is subsequently stored in the Project, the existence of hydraulic control will also allow the imported water to be held in storage for longer periods of time without suffering losses.

The potential quantity and schedule for spreading, storage, and extraction will be explored at the programmatic level in this EIR, pursuant to CEQA Guidelines Section 15168 (14 Cal. Code Regs. § 15168.). Further appropriate environmental review would be conducted as required under CEQA and when specific Project participants are identified and express an interest in accessing the storage space. For example, additional information regarding the specific location and design of the proposed wellfield expansion could be necessary to fully evaluate groundwater quality impacts associated with the Imported Water Storage Component.

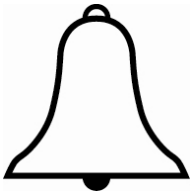
PROJECT APPROVALS

Implementation of the proposed Project will require the following approvals:

- US Fish and Wildlife Service, Endangered Species Act Section 7
- US Army Corps of Engineers, Clean Water Act Section 404
- California Department of Fish and Game, California Fish and Game Code Section 2081 and California Fish and Game Code Section 1602
- Regional Water Quality Control Board, Clean Water Act Section 401; Storm Water Pollution Prevention Plan; Waste Discharge Requirements for spreading basins; and Anti-Degradation Analysis
- Metropolitan Water District of Southern California, Approval to modify CRA and Wheeling Agreement
- Mojave Desert Air Quality Management District, Natural gas engine emissions permits

PROJECT HISTORY

In the early 1990s, Cadiz recognized the potential for developing a groundwater storage and transfer project on its properties and partnered with Metropolitan. Metropolitan, as the lead agency, evaluated the feasibility of operating the project, referred to as the "Cadiz Groundwater Storage and Dry-Year Supply Program" (Program). An EIR/EIS (Environmental Impact Statement) was prepared for the Program, which would have involved transporting surplus Colorado River water to the Program site, recharging it



through a series of recharge basins, storing the water, and then extracting the stored water during times of drought. A pipeline was proposed to be constructed on federal Bureau of Land Management (BLM) land to convey water from the CRA to the Program site. In August 2002, the United States Department of Interior issued a right-of-way grant for the pipeline.[1] However, although the feasibility studies completed under the partnership demonstrated a significant potential for water supply development, Metropolitan decided not to pursue the Program in October 2002.[2]

Since 2002, Cadiz has continued to pursue partnerships to develop a revised water supply project different than the Program previously contemplated with Metropolitan. Because water supply to Southern California from the State Water Project and Colorado River is often either unreliable or unpredictable, and future costs of supply are uncertain, SMWD and other Southern California water purveyors have partnered with Cadiz to augment their current water supply with the new Project, as proposed.

The new proposed Project is distinct from the prior Program because:

a) A conservation component has been added to recover native groundwater currently being lost to evaporation, which was not part of the prior Program;

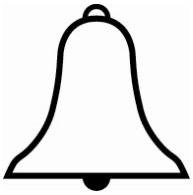
b) The proposed water conveyance pipeline would be constructed within a privately-owned railroad right-of-way, under a 99-year lease agreement, and not on public lands, as was previously proposed;

c) End users have been identified as project participants, as opposed to the prior Program, which only identified one public agency. In addition to SMWD, other confirmed Project participants include Three Valleys Municipal Water District, Suburban Water Systems, and Golden State Water Company.

d) The imported water storage component is not part of the initial project approval. Accordingly, the groundwater extraction facilities have been sized to accommodate the annual variations in the delivery of conserved, recovered and stored indigenous water.

1 U.S. Dept. of the Interior, Bureau of Land Management, Record of Decision for California Desert Conservation Area Plan Amendment and Right-of-Way Grant/Temporary Use Permit, August 29, 2002.

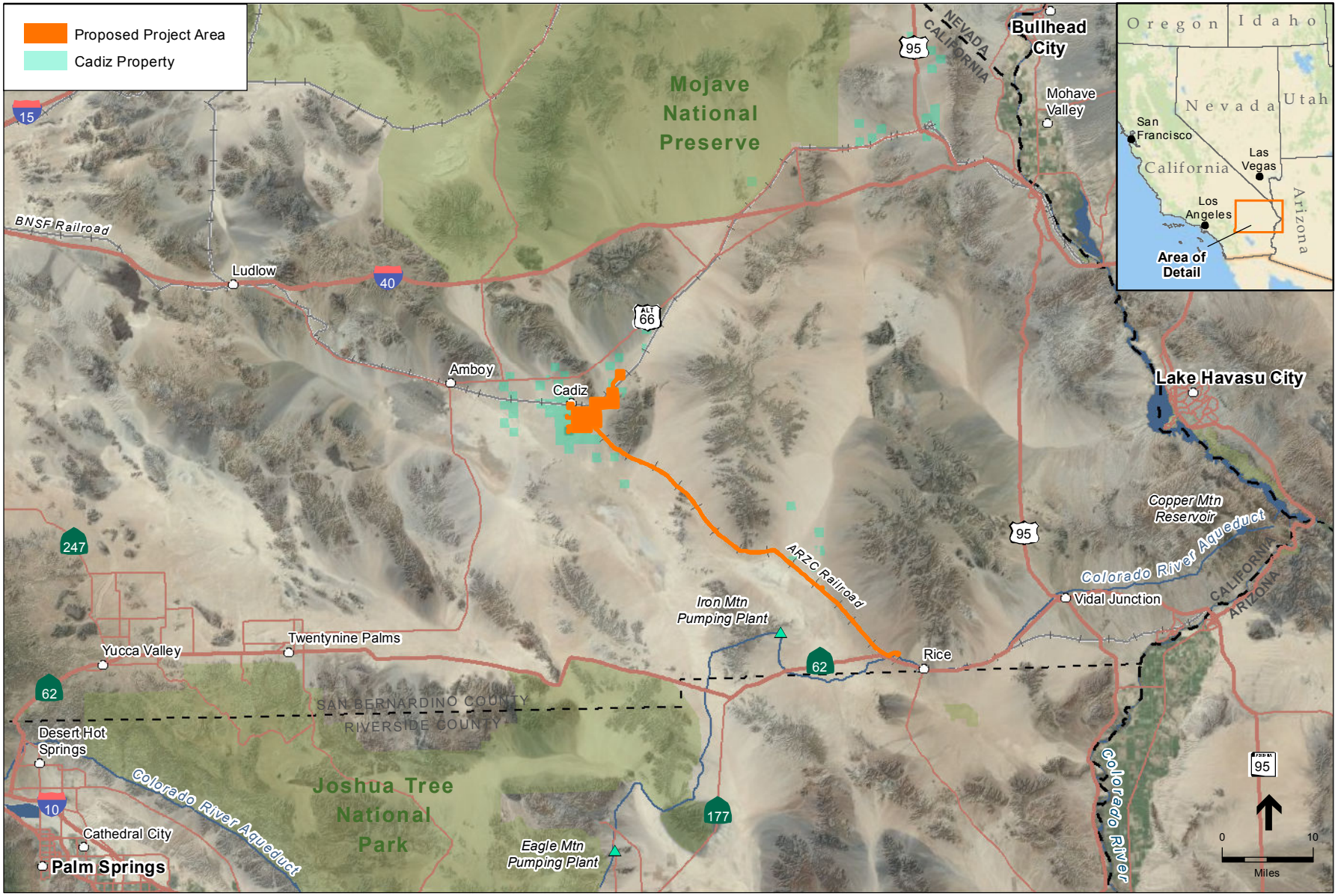
2 Final Environmental Impact Report/Environmental Impact Statement, Cadiz Groundwater Storage and Dry-Year Supply Program, SCH. No. 99021039, Sept. 2001.



DISCUSSION OF POTENTIAL ENVIRONMENTAL IMPACTS

The EIR will address all topics listed in Appendix G of the CEQA Guidelines, regardless of whether the potential impact may be significant, so that information regarding this project is available in a single document to facilitate public review. The content of the EIR will also be subject to input received during the NOP comment period. Where necessary, the EIR will identify mitigation measures to minimize potentially significant impacts of the proposed Project. The EIR will evaluate the following environmental resource issues in addition to CEQA-mandated topics such as cumulative impacts, growth inducement, and Project alternatives:

- Aesthetics
- Agriculture and Forestry Resources
- Air Quality and Greenhouse Gas Emissions
- Biological Resources
- Cultural Resources
- Geology, Soils, Faulting and Seismicity
- Hazards and Hazardous Materials
- Hydrology, Water Quality, and Groundwater
- Land Use and Planning
- Population and Housing
- Mineral Resources
- Noise
- Public Services
- Recreation
- Traffic and Circulation
- Utilities & Service Systems / Water Supply

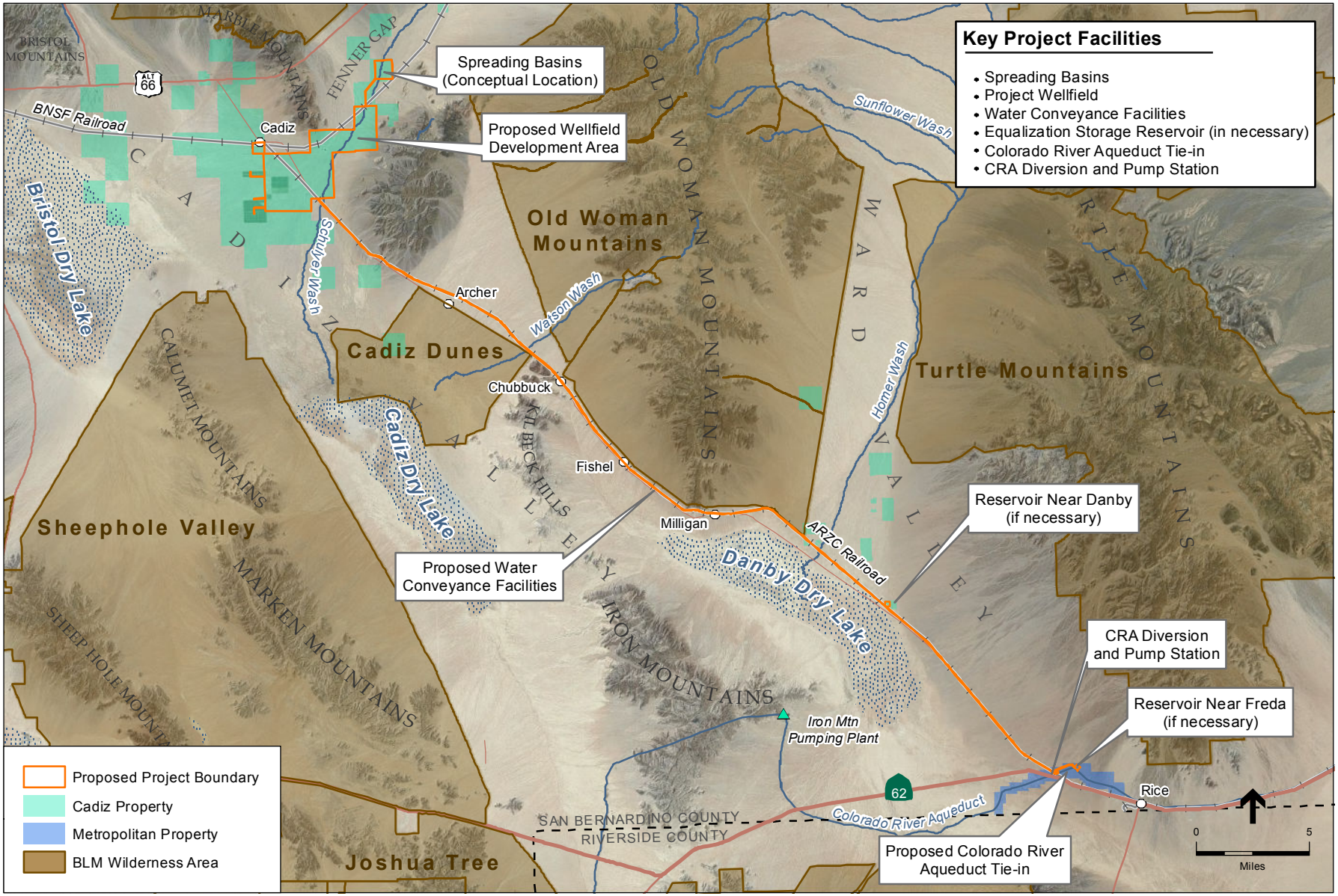


SOURCE: Bing Maps, 2011; ESRI, 2010; DeLorme, 2011; Cadiz Inc., 2011; and ESA, 2011

Cadiz Valley Water Conservation, Recovery, and Storage Project . 210324

Figure 1

Regional Location



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

Cadiz Valley Water Conservation, Recovery, and Storage Project . 210324

Figure 2

Key Project Facilities

Attachment 2
Notice of Completion

Notice of Completion & Environmental Document Transmittal

Mail to: State Clearinghouse, P.O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613
For Hand Delivery/Street Address: 1400 Tenth Street, Sacramento, CA 95814

SCH #

Project Title: Cadiz Valley Water Conservation, Recovery, and Storage Project

Lead Agency: Santa Margarita Water District | Contact Person: Tom Barnes

Mailing Address: 626 Wilshire Blvd., Suite 1100 | Phone: 213 599 4300

City: Los Angeles | Zip: 90017 | County: Los Angeles

Project Location: County: San Bernardino | City/Nearest Community: Cadiz

Cross Streets: Cadiz Road & National Trails Hwy | Zip Code: 92304

Longitude/Latitude (degrees, minutes and seconds): 34 ° 18 ′ 38 ″ N / -115 ° 14 ′ 21 ″ W | Total Acres:

Assessor's Parcel No.: | Section: 36 | Twp.: 5N | Range: 14E | Base: SBB&M

Within 2 Miles: State Hwy #: Highway 62 | Waterways: Colorado River Aqueduct (CRA)

Airports: | Railways: ARZC; BNSF | Schools:

Document Type:

CEQA: ☑ NOP ☐ Draft EIR | NEPA: ☐ NOI | Other: ☐ Joint Document
☐ Early Cons ☐ Supplement/Subsequent EIR | ☐ EA | ☐ Final Document
☐ Neg Dec (Prior SCH No.) | ☐ Draft EIS | ☐ Other:
☐ Mit Neg Dec ☐ Other: | ☐ FONSI

Local Action Type:

☐ General Plan Update	☐ Specific Plan	☐ Rezone	☐ Annexation
☐ General Plan Amendment	☐ Master Plan	☐ Prezone	☐ Redevelopment
☐ General Plan Element	☐ Planned Unit Development	☐ Use Permit	☐ Coastal Permit
☐ Community Plan	☐ Site Plan	☐ Land Division (Subdivision, etc.)	☑ Other: Water Supply

Development Type:

☐ Residential: Units	Acres		
☐ Office: Sq.ft.	Acres	Employees	☐ Transportation: Type
☐ Commercial: Sq.ft.	Acres	Employees	☐ Mining: Mineral
☐ Industrial: Sq.ft.	Acres	Employees	☐ Power: Type MW
☐ Educational:			☐ Waste Treatment: Type MGD
☐ Recreational:			☐ Hazardous Waste: Type
☑ Water Facilities: Type Conserve/Store	MGD 75-150		☐ Other:

Project Issues Discussed in Document:

☑ Aesthetic/Visual	☐ Fiscal	☑ Recreation/Parks	☑ Vegetation
☑ Agricultural Land	☑ Flood Plain/Flooding	☑ Schools/Universities	☑ Water Quality
☑ Air Quality	☑ Forest Land/Fire Hazard	☐ Septic Systems	☑ Water Supply/Groundwater
☑ Archeological/Historical	☑ Geologic/Seismic	☐ Sewer Capacity	☑ Wetland/Riparian
☑ Biological Resources	☑ Minerals	☑ Soil Erosion/Compaction/Grading	☑ Growth Inducement
☐ Coastal Zone	☑ Noise	☑ Solid Waste	☑ Land Use
☑ Drainage/Absorption	☑ Population/Housing Balance	☑ Toxic/Hazardous	☑ Cumulative Effects
☐ Economic/Jobs	☑ Public Services/Facilities	☑ Traffic/Circulation	☑ Other: GHG/climate chng.

Present Land Use/Zoning/General Plan Designation:

Agriculture, Resource Conservation

Project Description: *(please use a separate page if necessary)*

The proposed project would be executed in two phases: the first phase, the Conservation and Recovery Component (project level evaluation), would capture and conserve the annual natural recharge in the Fenner and northern Bristol Valleys that would otherwise discharge to the Bristol and Cadiz Dry Lakes. The second phase is the Imported Water Storage Component (program level evaluation), and would make up to one million acre-feet of groundwater storage space available, to store water for future withdrawal.

Note: The State Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.

Reviewing Agencies Checklist

Lead Agencies may recommend State Clearinghouse distribution by marking agencies below with and "**X**".
If you have already sent your document to the agency please denote that with an "**S**".

x	Air Resources Board	x	Office of Emergency Services
	Boating & Waterways, Department of	x	Office of Historic Preservation
x	California Highway Patrol		Office of Public School Construction
x	Caltrans District # 8	x	Parks & Recreation, Department of
	Caltrans Division of Aeronautics		Pesticide Regulation, Department of
x	Caltrans Planning	x	Public Utilities Commission
	Central Valley Flood Protection Board	x	Regional WQCB # 7
	Coachella Valley Mtns. Conservancy	x	Resources Agency
	Coastal Commission		S.F. Bay Conservation & Development Comm.
x	Colorado River Board		San Gabriel & Lower L.A. Rivers & Mtns. Conservancy
x	Conservation, Department of		San Joaquin River Conservancy
	Corrections, Department of		Santa Monica Mtns. Conservancy
	Delta Protection Commission		State Lands Commission
	Education, Department of		SWRCB: Clean Water Grants
x	Energy Commission	x	SWRCB: Water Quality
x	Fish & Game Region # 6	x	SWRCB: Water Rights
x	Food & Agriculture, Department of		Tahoe Regional Planning Agency
x	Forestry and Fire Protection, Department of	x	Toxic Substances Control, Department of
	General Services, Department of	x	Water Resources, Department of
x	Health Services, Department of		
x	Housing & Community Development		Other:
x	Integrated Waste Management Board		Other:
x	Native American Heritage Commission		

Local Public Review Period (to be filled in by lead agency)

Starting Date March 1, 2011 Ending Date March 31, 2011

Lead Agency (Complete if applicable):

Consulting Firm: Environmental Science Associates
Address: 626 Wilshire Blvd. Suite 1100
City/State/Zip: Los Angeles, CA 90017
Contact: Tom Barnes
Phone: 213 599 4300

Applicant: Santa Margarita Water District
Address: 26111 Antonio Parkway
City/State/Zip: Rancho Santa Margarita, CA 92688
Phone: 949 459 6400

Signature of Lead Agency Representative: _____ **Date:** March 1, 2011

Authority cited: Section 21083, Public Resources Code. Reference: Section 21161, Public Resources Code.

Attachment 3
NOP Distribution List

Reason	Fedex	Certified	First Name	Last Name	Title	Organization	Division	Address	City	State	ZIP	NOP Copies
NEWSPAPERS												
LIBRARIES												
Agency Outreach	X		Linda	Muller	Librarian	City of Twentynine Palms Library		6078 Adobe Rd	Twentynine Palms	CA	92277-2354	1
Agency Outreach	X		Debbie	Medina	Branch manager Librarian	City of Barstow Library	Barstow Library	304 E. Buena Vista St.	Barstow	CA	92311	1
Agency Outreach	X					City of Needles Library	Needles Branch Library	1111 Bailey	Needles	CA	92363	1
Agency Outreach	X				Branch manager Librarian	Rancho Santa Margarita Water District		30902 La Promesa	Rancho Santa Margarita	CA	92688	1
Agency Outreach	X		Leonard	Hernandez	County Librarian	San Bernardino County Library	Library Administration	104 W. 4th Street	San Bernardino	CA	92415	1
Agency Outreach	X		Pat	Gowland	President	Town of Joshua Tree Library	Joshua Tree Branch	6465 Park Blvd	Joshua Tree	CA	92252	1
FEDERAL AGENCIES												
Agency Outreach	X		Robert A.	Johnson		29 Palms Marine Base		G-5, USMC	Twentynine Palms	CA	92277	1
Agency Outreach	X		Jared	Blumenfeld	Regional Administrator	Environmental Protection Agency	Region 9	75 Hawthorne Street	San Francisco	CA	94105	1
Agency Outreach	X		Christine	Lehnertz	Regional Director	National Park Service		1111 Jackson Street, Suite 700	Oakland	CA	94607	1
Agency Outreach	X		Dianne	Feinstein	Senator	Senate		331 Hart Senate Office Building	Washington	DC	20510	1
Agency Outreach	X		Barbara	Boxer	Senator	Senate		112 Hart Senate Office Building	Washington	DC	20510	1
Agency Outreach	X				Regional Manager	Southern California Agency - Bureau of Indian Affairs	Southern California	2038 Iowa Avenue, Suite 101	Riverside	CA	92507	1
Statutory		X	Brian	Moore	Deputy District Engineer	US Army Corps of Engineers	Los Angeles District	PO Box 532711	Los Angeles	CA	90053	1
Agency Outreach	X					US Bureau of Indian Affairs	Office of Public Affairs	1849 C Street NW	Washington	DC	20240-0001	1
Statutory	X		Jeff	Krauss	Division Chief	US Bureau of Land Management	National Public Affairs	1620 L Street NW, Rm. 401	Washington	DC	20036	1
Agency Outreach	X		JoAnn	Schiffer-Burdett		US Bureau of Land Management	California Desert District - Riverside	6221 Box Springs Blvd	Riverside	CA	92507	1
Agency Outreach	X		Rusty	Lee	Field Manager	US Bureau of Land Management	Needles Field Office	1303 S. Hwy 95	Needles	CA	92363	1
Agency Outreach	X		John	Kalish	Field Manager	US Bureau of Land Management	Palm Springs - South Coast Field Office	1201 Bird Center Drive	Palm Springs	CA	92262	1
Agency Outreach		X	Lorri	Gray-Lee	Regional Director	US Bureau of Reclamation	Lower Colorado Region	PO Box 61470	Boulder City	NV	89006	1
Agency Outreach	X					US Department of Agriculture	Natural Resources Conservation Service	14393 Park Ave Sute 200	Victorville	CA	92392	1
Agency Outreach	X		Ken	Salazar	Secretary	US Department of the Interior	Secretary Office	1849 C Street, N.W.	Washington	DC	20240	1
Statutory	X		Robyn	Thorson	Regional Director	US Fish and Wildlife Service	Pacific Region	911 NE 11th Ave	Portland	Oregon	97232	1
Agency Outreach	X		Kara	Capelli	Water	USGS Water Resources Division - Federal Building	California Water Science Center	6000 J Street	Sacramento	CA	95819	1
STATE AGENCIES (SENT BY STATE CLEARING HOUSE AS INDICATED ON NOC)												
Agency Outreach	N/A	N/A	Richard	Corey	Division Chief	California Air Resources Board	Stationary Source Division	PO Box 2815	Sacramento	CA	95812	x
Agency Outreach	N/A	N/A				California Highway Patrol		PO Box 942898	Sacramento	CA	94298	x
Statutory	N/A	N/A	John	Chrisholm	District Coordinator	California Department of Transportation - District 8	District 8	464 W. 4th Street	San Bernardino	CA	92401	x
Agency Outreach	N/A	N/A	Chris	Ratekin	Interim Chief	Caltrans Planning		PO Box 942874	Sacramento	CA	95274	x
Agency Outreach	N/A	N/A	Christopher	Harris	Acting Executive Director	Colorado River Board of California		770 Fairmont Ave Suite 100	Glendale	CA	91203	x
Agency Outreach	N/A	N/A	Tom	Gibbs	Deputy Director	California Department of Conservation		801 K Street, MS 24-01	Sacramento	CA	95814	x
Agency Outreach	N/A	N/A	Erick	Solorio	Project Manager	California Energy Commission	Siting, Transmission, and Environmental Protection	1516 Ninth Street, MS-15	Sacramento	CA	95814	x
Agency Outreach	N/A	N/A			Regional Manager	California Department of Fish and Game	Inland Deserts Region - 6	3602 Inland Empire Boulevard	Ontario	CA	91764	x
Agency Outreach	N/A	N/A	Karen	Ross	Secretary	California Department of Food and Agriculture		1220 N Street	Sacramento	CA	95814	x
Agency Outreach	N/A	N/A	Patti	Cox	Staff Service Analyst	California Department of Forestry		PO Box 944246	Sacramento	CA	94244	x

Agency Outreach	N/A	N/A	Jean	Lacino	Special Assistant to the Director	California Department of Public Health		1615 Capitol Avenue	Sacramento	CA	95815	x
Agency Outreach	N/A	N/A				California Department of Housing and Community Development		1800 Third Street	Sacramento	CA	95811	x
Agency Outreach	N/A	N/A	Alicia	McGee	Assistant Director	California Integrated Waste Management Board	Office of Public Affairs	801 K Street, MS 19-01	Sacramento	CA	95814	x
Agency Outreach	N/A	N/A	Larry	Myers	Executive Secretary	Native American Heritage Commission		915 Capitol Mall, Room 364	Sacramento	CA	95814	x
Agency Outreach	N/A	N/A				California Emergency Management Agency		3650 Schriever Ave	Mather	CA	95655	x
Agency Outreach	N/A	N/A	Milford	Donaldson	State Historic Preservation Officer	Office of Historic Preservation	Sacramento Office	1725 23rd Street, Suite 100	Sacramento	CA	95816	x
Agency Outreach	N/A	N/A	Ruth	Coleman	Director	California Department of Parks and Recreation		PO Box 942896	Sacramento	CA	95814	x
Agency Outreach	N/A	N/A				California Public Utilities Commission		505 Van Ness Avenue	San Francisco	CA	94102	x
Agency Outreach	N/A	N/A	Robert	Perdue	Executive Officer	Colorado River Regional Water Quality Control Board		73-720 Fred Waring Drive, Suite 100	Palm Desert	CA	92260	x
Agency Outreach	N/A	N/A	John	Laird	Secretary	California Resources Agency		1416 Ninth Street, Suite 1311	Sacramento	CA	95814	x
Agency Outreach	N/A	N/A				State Water Resources Control Board	Division of Water Rights	P.O. Box 100	Sacramento	CA	95812	x
Agency Outreach	N/A	N/A				State Water Resources Control Board	Division of Water Quality	P.O. Box 100	Sacramento	CA	95812	x
Agency Outreach	N/A	N/A	L.	Robinson	Director	Calif. Dept. of Toxic Substances Control	Headquarters	PO Box 806	Sacramento	CA	95812	x
Agency Outreach	N/A	N/A			Director	California Dept of Water Resources	Southern District	770 Fairmont Ave Suite 102	Glendale	CA	91203	x
STATE AGENCIES												
Statutory	X		Ryan	Broodrick	Director	California Department of Fish and Game	Headquarter Office	1416 9th Street. 12th Floor	Sacramento	CA	95814	1
Agency Outreach		X	David	Schaub		California Department of Parks and Recreation	Natural Heritage Section	PO Box 942896	Sacramento	CA	94296-0001	1
Agency Outreach		X	Veda	Lewis		California Department of Transportation	Environmental Analysis	PO Box 942874	Sacramento	CA	94274	1
Agency Outreach	X		Linda	Adams	Environmental Protection	California Environmental Protection Agency	Executive Management	1001 I Street P.O. Box 2815	Sacramento	CA	95812	1
Agency Outreach		X				State Clearing House	Office of Planning and Research	1400 Tenth Street	Sacramento	CA	95814	1
Agency Outreach	X		Cy	Oggins	Division Chief Environmental Planning	State Lands Commission	Sacramento Office	100 Howe Ave Suite 100 South	Sacramento	CA	95825-8202	1
LOCAL / REGIONAL AGENCIES												
Agency Outreach	X		Marina	West	General Manager	Bighorn-Desert View Water Agency		622 South Jemez Trail	Yucca Valley	CA	92284	1
Agency Outreach	X		Curt	Mitchell	City Manager	City of Barstow		220 E Mountain View St #A	Barstow	CA	92311	1
Agency Outreach	X		David G.	Brownlee	Acting City Manager	City of Needles		817 Third Street	Needles	CA	92363	1
Agency Outreach	X		John	Tooker	Interim City Manager	City of Twentynine Palms		6136 Adobe Road	Twentynine Palms	CA	92277	1
Agency Outreach	X				Regional Director	Golden State Water Company		630 E. Foothill Blvd	San Dimas	CA	91773	1
Agency Outreach	X		Martha	Ostrander	Associate Engineer	Hi-Desert Water District	Engineering Department	55439 29 Palms Highway	Yucca Valley	CA	92284	1
Agency Outreach	X		William	Brunet	Director of Public Works	Imperial County	Public Works	155 South 11th Street	El Centro	CA	92243	1
Agency Outreach		X			Board of Directors	Imperial Irrigation District		PO Box 937	Imperial	CA	92251	1
Agency Outreach		X			Office Manger	Inland Empire Utilities Agency		P.O. Box 9020	Chino Hills	CA	91709	1
Agency Outreach	X		Richard	Bruckner	Director of Planning	Los Angeles County	Regional Planning	320 West Temple Street, 13th Floor	Los Angeles	CA	90012	1
Agency Outreach	X		Stephen	Jenkins	Lead Air Quality Specialist	Mojave Desert Air Quality Management District	Compliance Department	14306 Park Ave	Victorville	CA	92392	1
Agency Outreach	X		Steve	Mongrain	President	Mojave Desert Heritage and Cultural Association		37198 Lanfair Road G-15	Essex	CA	92332	1
Agency Outreach	X		JoAnn	Finnegan	President	Municipal Water District of Orange County	Board of Directors	18700 Ward Street	Fountain Valley	CA	92708	1
Agency Outreach		X			Office Manager	Orange County	Community Developemt	PO Box 4048	Santa Ana	CA	92702	1
Agency Outreach		X	Mark	Esslinger		Orange County Public Works	Community Developemt	PO Box 4048	Santa Ana	CA	92702	1
Agency Outreach	X				General Manager	Palo Verde Irrigation District	Water Department	180 W. 14th Ave	Blythe	CA	92225	1

Agency Outreach	X				Director	Riverside County	Planning Department - Desert Office	38686 El Cerrito Road	Palm Desert	CA	92211	1
Agency Outreach	X		Warren	Williams	Chief Engineer	Riverside County Flood Control and Water Conservation District		1995 Market Street	Riverside	CA	92501	1
Agency Outreach	X		Ed	Layaye	Agricultural Commissioner	San Bernardino Agricultural Commission		777 E. Rialto Ave	San Bernardino	CA	92415	1
Agency Outreach	X		Ty	Schuiling	Director of Planning	San Bernardino Associated Governments		1170 W. 3rd Street, 2nd Floor	San Bernardino	CA	92410-1715	1
Agency Outreach	X		Laura	Welch	Clerk of the Board	San Bernardino County	Board of Supervisors	385 N. Arrowhead Ave, 2nd Floor	San Bernardino	CA	92415	1
Agency Outreach	X		Christine	Kelly	Director	San Bernardino County	Land Use Services Department	385 N. Arrowhard Avenue - 1st Floor	San Bernardino	CA	92415	1
Agency Outreach	X		Brad	Mitzelfelt	First District Supervisor	San Bernardino County	Board of Supervisors	385 N. Arrowhard Avenue - 5th Floor	San Bernardino	CA	92415	1
Agency Outreach	X		Janice	Rutherford	Second District Supervisor	San Bernardino County	Board of Supervisors	385 N. Arrowhard Avenue - 5th Floor	San Bernardino	CA	92415	1
Agency Outreach	X		Neil	Derry	Third District Supervisor	San Bernardino County	Board of Supervisors	385 N. Arrowhard Avenue - 5th Floor	San Bernardino	CA	92415	1
Agency Outreach	X		Gary	Ovitt	Fourth District Supervisor	San Bernardino County	Board of Supervisors	385 N. Arrowhard Avenue - 5th Floor	San Bernardino	CA	92415	1
Agency Outreach	X		Josie	Gonzales	Fifth District Supervisor	San Bernardino County	Board of Supervisors	385 N. Arrowhard Avenue - 5th Floor	San Bernardino	CA	92415	1
Agency Outreach	X		Randy	Coleman	Supervisor	San Bernardino County	1st District - Planning Commission	385 N. Arrowhard Avenue - 5th Floor	San Bernardino	CA	92415	1
Agency Outreach	X		Raymond	Allard	Supervisor	San Bernardino County	2nd District - Planning Commission	385 N. Arrowhard Avenue - 5th Floor	San Bernardino	CA	92415	1
Agency Outreach	X		Bill	Collazo	Supervisor	San Bernardino County	3rd District - Planning Commission	385 N. Arrowhard Avenue - 5th Floor	San Bernardino	CA	92415	1
Agency Outreach	X		Elizabeth	Rider	Supervisor	San Bernardino County	4th District - Planning Commission	385 N. Arrowhard Avenue - 5th Floor	San Bernardino	CA	92415	1
Agency Outreach	X		Audrey	Mathews	Supervisor	San Bernardino County	5th District - Planning Commission	385 N. Arrowhard Avenue - 5th Floor	San Bernardino	CA	92415	1
Agency Outreach	X		Granville	Bowman	Flood Control Engineer	San Bernardino County	Flood Control District	825 E 3rd Street	San Bernardino	CA	92415	1
Agency Outreach	X		Wes	Reeder	San Bernardino County Geologist	San Bernardino County	Building and Safety Division	385 North Arrowhead Avenue	San Bernardino	CA	92415	1
Agency Outreach	X				Office Manager	San Bernardino County	Building and Safety Division	385 North Arrowhead Avenue	San Bernardino	CA	92415	1
Agency Outreach	X		Greg	Devereaux	CAO	San Bernardino County	County Administrative Office	385 N. Arrowhead Ave	San Bernardino	CA	92415	1
Agency Outreach	X				Office Manager	San Bernardino County Environmental Health	Land Use Services Department	385 North Arrowhead Avenue #2	San Bernardino	CA	92415	1
Agency Outreach	X		Dan	Wurl	Fire Chief	San Bernardino County Fire Department		157 W. 5th Street, 2nd Floor	San Bernardino	CA	92415	1
Agency Outreach	X		Kathleen	Springer	Senior Curator, Geological Science	San Bernardino County Museum		2024 Orange Tree Lane	Redlands	CA	92374	1
Agency Outreach	X		Robert	McKernan	Director	San Bernardino County Museum		2024 Orange Tree Lane	Redlands	CA	92517	1
Agency Outreach	X				Office Manager	San Bernardino County Regional Parks Department		777 E. Rialto Ave	San Bernardino	CA	92415	1
Agency Outreach	X		Josie	Gonzales	Supervisor	San Bernardino International Airport		294 S Leland Norton Way	San Bernardino	CA	92408	1
Agency Outreach	X					San Bernardino Valley Municipal Water District		380 East Vanderbilt Way	San Bernardino	CA	92408	1
Agency Outreach	X				Office Manager	San Diego County	Planning and Land Use	5201 Ruffin Road, Suite B	San Diego	CA	92123	1
Agency Outreach			John	Schatz	General Manager	Santa Margarita Water District		26111 Antonio Parkway	Rancho Santa Margarita	CA	92688	1
Agency Outreach			Joanne	Drabek	Office Manager	Sierra Club		85 Second Street, 2nd Floor	San Francisco	CA	94105	1
Agency Outreach	X		Elden	Hughes		Sierra Club	San Gorgonio Chapter	4079 Mission Inn Avenue	Riverside	CA	92501	1
Agency Outreach	X		Floyd	Wicks	Chief Executive Officer	Suburban Water Systems		1211 E Center Court Drive	Covina	CA	91724	1
Agency Outreach	X					The Nature Conservancy	International Headquarters	4245 North Fairfax Drive, Suite 100	Arlington	VA	22203-1606	1
Agency Outreach	X		Bob	Kuhn	President	Three Valleys Municipal Water District		1021 E Miramar Ave	Claremont	CA	91711	1
Agency Outreach	X		Mark	Nuaimi	Town Manager	Town of Yucca Valley	Town Hall	57090 Twentynine Palms Highway	Yucca Valley	CA	92284	1
Agency Outreach	X				Office Manager	Ventura County	Planning Division	800 South Victoria Ave L-1740	Ventura	CA	93009	1

Organizations

Requested by NAHC		X	Linda	Otero	Direct	AhaMaKav Cultural Society, Mojave Indian		PO Box 5990	Mohave valley	AZ	92346	1
Requested by NAHC		X	Preston	Arrow-weed		Ah-Mut-Pipa Foundation		PO Box 160	Bard	CA	92236	1
Requested by NAHC	X		Tanya	Cecil	General Manager	Arizona and California Railroad		1301 California Ave	Parker	AZ	92363	1
Requested by NAHC	X		Mathew	Rose	Chairman and Chief Executive Officer	Burlington Northern Santa Fe Corporation	Headquarter Office	2650 Lou Menk Drive	Fort Worth	TX	86440	1
Agency Outreach	X		Mike	Winn	Preident	California Building Industry Association		1215 K Street, Suite 1200	Sacramento	CA	95814	1
Agency Outreach	X		Tara	Hansen	Executive Director	California Native Plant Society		2707 K Street, Suite 1	Sacramento	CA	92346	1
by written request		X	Joe	Benitez	Tribal Elder	Chemehueve Indian Tribe		PO Box 1829	Indio	CA	92363	1
Requested by NAHC		X	Charles	Wood	Chairman	Chemehuevi Reservation		PO Box 1976	Chemehuevi Valley	CA	92363	1
Agency Outreach	X		Justin	Nakano	Environmental Specialist	Chino Basin Watermaster		9641 San Bernardino Road	Rancho Cucamonga	CA	91730	1
Agency Outreach		X	Steve	Robbins	General Manager	Coachella Valley Water District		PO Box 1058	Coachella	CA	92222	1
Agency Outreach	X		Christopher	Harris	Acting Executive Director	Colorado River Board		770 Fairmont Avenue, Suite 100	Glendale	CA	92220	1
Requested by NAHC	X		Ginger	Scott	Acting Cultural Contact	Colorado River Reservation		26600 Mojave Road	Parker	AZ	89025	1
Agency Outreach		X	Crystal	Thompson	Contact	Colorado River Water Users Association		PO Box 1058	Coachella	CA	92236	1
Agency Outreach	X		David	Luker	General Manager	Desert Water Agency		1200 Gene Autry Trail	Palm Springs	CA	93263	1
Agency Outreach		X			Office Manager	El Paso Natural Gas Company		PO Box 1087	Colorado Springs	CO	80944	1
Requested by NAHC	X		Tim	Williams	Chairman	Fort Mojave Indian Tribe		500 Merriman Ave	Needles	CA	93555	1
Requested by NAHC	X		Nora	McDowell	Cultural Resources Coordinator	Fort Mojave Indian Tribe		500 Merriman Ave	Needles	CA	92363	1
Requested by NAHC	X		Esadora	Evanston	Environmental Coordinator	Fort Mojave Indian Tribe		500 Merriman Ave	Needles	CA	90048	1
Requested by NAHC	X					Las Vegas Paiut Tribe - Cultural Resources Dept.		1 Paiute Drive	Las Vegas	NV	94105	1
Agency Outreach		X	John	Shamma	Senior Engineer	Metropolitan Water District		PO Box 54153	Los Angeles	CA	90054	1
Agency Outreach		X	Jeff	Kightlinger	General Manager	Metropolitan Water District		PO Box 54153	Los Angeles	CA	90054	1
Requested by NAHC		X				MOAPA Paiute Band of the Moapa Reservation - Cultural Resources Dept.		PO Box 340	Moapa	NV	94612	1
Agency Outreach	X				President	Mojave Desert Heritage and Cultural Association		37198 Landfair Road G-15	Essex	CA	92332	1
Agency Outreach	X		Jackie	Lindgren	District Coordinator	Mojave Desert Resource Conservation District		14393 Park Ave, #200	Victorville	CA	94105	1
Agency Outreach	X				President	Mojave Pipeline Operating Company, Inc		5401 E. Brundage Lane	Bakersfield	CA	90401	1
Agency Outreach	X		Kirby	Brill	General Manager	Mojave Water Agency		22450 Headquarters Drive	Apple Valley	CA	92521	1
Requested by NAHC	X		Michael	Contreras	Cultural Heritage Program	Morongo Band of Mission Indians		12700 Pumarra Road	Banning	CA	92220	1
Requested by NAHC	X		Ernest	Siva		Morongo Band of Mission Indians		9570 Mias Canyon Road	Banning	CA	93307	1
Agency Outreach		X	Laraine	Turk	President	Morongo Basin Desert Conservation Association		PO Box 24	Joshua Tree	CA	92392	1
Agency Outreach	X				Manager	National Chloride Company of America		Amboy Road	Amboy	CA	92277	1
Agency Outreach	X		Tom	Kiernan	President	National Parks Conservation Association		777 6th Street NW Suite 700	Washington	DC	20001	1
Requested by NAHC	X				Regional Manager	Pacific Gas & Electric Company		530 S China Lake Blvd	Ridgecrest	CA	92264	1
Agency Outreach	X		Dr. Peter	Gleick	President	Pacific Institute for Development, Environmental & Security Preservation Park	California Office	654 13th Street, Preservation Park	Oakland	CA	92236	1
Requested by NAHC		X	Joseph	Hamilton	Chairman	Ramona Band of Cahuilla Mission Indians		PO Box 391670	Anza	CA	94612	1
Requested by NAHC	X		James	Ramon	Chairman	San Manuel Band of Mission Indians		26569 Community Center Drive	Highland	CA	91030	1
Requested by NAHC	X		Ann	Brierty	Cultural Resources Department	San Manuel Band of Mission Indians		28669 Community Center Drive	Highland	CA	94945	1
Requested by NAHC		X	Goldie	Walker		Serrano Nation of Indians		PO Box 343	Patton	CA	90401	1

Attachment 4

Proof of Publication of Public Notices

Advertising Receipt

Hi-Desert Publishing
P.O. Box 880
Yucca Valley, CA 92286
Phone: (760)365-3315
Fax: (760)365-8686

Star Legals
PUBLIC NOTICE

YUCCA VALLEY, CA 92284

Cust#: 02101386 000
Ad#: 01548155
Phone: (760)365-3725
Date: 03/14/11

Ad taker: BE **Salesperson:** **Classification:** 999

Description	Start	Stop	Ins.	Cost/Day	Surcharges	Total
03 The Desert Trail	03/17/11	03/17/11	1	173.85		173.85

Payment Reference:

Total:	173.85
Tax:	0.00
Net:	173.85
Prepaid:	173.85
Total Due	0.00

Notice of Preparation of a Draft Environmental Impact Report and Public Scoping Meeting for the Cadiz Valley Water Conservation, Recovery, and Storage Project (Cadiz, California)

Santa Margarita Water District (SMWD) as the Lead Agency is beginning preparation of an Environmental Impact Report (EIR) pursuant to the California Environmental Quality Act (CEQA) for the proposed Cadiz Valley Water Conservation, Recovery, and Storage Project (proposed Project). The Project would be designed and implemented in partnership with other Southern California water providers ("Project Participants") to actively manage the groundwater basin underlying a portion of the Cadiz and Fenner Valleys located in the eastern Mojave Desert portion of San Bernardino County, California. These Project Participants include Golden State Water Company, Three Valleys Water Company and Suburban Water Company.

The purpose of the Project is to capture water that would otherwise evaporate from the local dry lakes, and convey it to SMWD and other Project Participants as a new reliable water supply. The Project would construct extraction wells (wellfield) on the Cadiz property and a 44-mile underground water conveyance pipeline within an active ARZC railway right-of-way that intersects with the

PROOF OF PUBLICATION
(2015.5 C.C.P.)

STATE OF CALIFORNIA
County of San Bernardino

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years, and not a party to or interested in the above-entitled matter. I am the principal clerk of the printer of the:

DESERT TRAIL

a newspaper of general circulation, printed and published WEEKLY in the City of TWENTYNINE PALMS County of San Bernardino, and which newspaper has been adjudged a newspaper of general circulation by the Superior Court of the County of San Bernardino, State of California,

under the date of 11/17 19 38

Case Number 43099; that the notice, of which the annexed is a printed copy (set in type not smaller than nonpareil), has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates, to-wit:

3/17

all in the year 2011.

I certify (or declare) under penalty of perjury that the foregoing is true and correct.

Dated at : TWENTYNINE PALMS

California, this **17th.** day of **March,2011**

Bekie Edelbrock

Signature
Bekie Edelbrock

This space is for the County Clerk's Filing Stamp

Proof of Publication

NOTICE OF PREPARATION OF A DRAFT ENVIRONMENTAL IMPACT REPORT

Notice of Preparation of a Draft Environmental Impact Report and Public Scoping Meeting for the Cadiz Valley Water Conservation, Recovery, and Storage Project (Cadiz, California)

Santa Margarita Water District (SMWD) as the Lead Agency is beginning preparation of an Environmental Impact Report (EIR) pursuant to the California Environmental Quality Act (CEQA) for the proposed Cadiz Valley Water Conservation, Recovery, and Storage Project (proposed Project). The Project would be designed and implemented in partnership with other Southern California water providers ("Project Participants") to actively manage the groundwater basin underlying a portion of the Cadiz and Fenner Valleys located in the eastern Mojave Desert portion of San Bernardino County, California. These Project Participants include Golden State Water Company, Three Valleys Water Company and Suburban Water Company.

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Thursday, March 24, 2011
6 p.m.
Joshua Tree Community Center
6171 Sunburst Street
Joshua Tree, CA

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c/o Tom Barnes, Environmental Science Associates
626 Wilshire Boulevard, Ste 1100
Los Angeles, CA 90017
cadizproject@esassoc.com

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- Twentynine Palms Library, 6078 Adobe Rd. Twentynine Palms, CA 92277

Please submit your comments by March 30, 2011.
(PUB: T. 3/17/2011)

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PAYMENT RECEIPT

Friday, March 11, 2011

Transaction Type: **Payment**
Ad Number: **0009346436**
Apply to Current Order: **Yes**
Payment Method: **Credit Card**
Bad Debt: -
Credit Card Number: **XXXXXXXXXXXX7128 - Mastercard**
Credit Card Expire Date: **February 2012**
Payment Amount: **$796.00**
Amount Due: **$0.00**
Reference Number:
Charge to Company: **OCRC**
Category: **Classified**
redit to Transaction Numbe
Invoice Text:
Invoice Notes:

attn: Pecalle

Customer Type: **Small Business**
Customer Category:
Customer Status: **Active**
Customer Group:
Customer Trade:
Account Number: **1001034169**
Phone Number: **8187038600**
Company / Individual: **Company**
Customer Name: **ESA/WATER**

Customer Address: **21650 OXNARD STREET**

WOODLAND HILLS, CA 91367 USA

Check Number:
Routing Number:

FREEDOM

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Orange County Home • Coast • Preferred Destinations • OC Kids

PAYMENT RECEIPT

Friday, March 11, 2011

Transaction Type:	**Payment**
Ad Number:	**0009346432**
Apply to Current Order:	**Yes**
Payment Method:	**Credit Card**
Bad Debt:	-
Credit Card Number:	**XXXXXXXXXXXX7128 - Mastercard**
Credit Card Expire Date:	**February 2012**
Payment Amount:	**$868.00**
Amount Due:	**$0.00**
Reference Number:	
Charge to Company:	**OCRC**
Category:	**Classified**
redit to Transaction Numbe	
Invoice Text:	
Invoice Notes:	

attn: Nicole

Customer Type:	**Small Business**
Customer Category:	
Customer Status:	**Active**
Customer Group:	
Customer Trade:	
Account Number:	**1001034169**
Phone Number:	**8187038600**
Company / Individual:	**Company**
Customer Name:	**ESA/WATER**
Customer Address:	**21650 OXNARD STREET**
	WOODLAND HILLS, CA 91367 USA
Check Number:	
Routing Number:	

attn: Priscilla
$196.00

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Please submit your comments by March 30, 2011.

Publish: Orange County Register March 20, 2011 R-386

attn: Nicolee

$868.00

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Please submit your comments by March 30, 2011.

Publish: Orange County Register March 13, 2011 R-385

THE PRESS-ENTERPRISE

CLASSIFIED ADVERTISING RECEIPT

Printed by: **Gribbin, Kristin** Ad #: **10581908**
at: **2:46 pm**
on: **Thursday, Mar 10, 2011**

3450 Fourteenth St.
Riverside, CA 92501-3878
1-800-880-0345
951-684-1200
951-368-9018 Fax

Payment Information

Date	Payment #	Type	Card Holder	Exp.	Approval	Amount
03-10-11	2752113	MasterCard	NICOLLE IANELLI-STEINER	2/12	33049Z	405.00
					Total payments:	$ 405.00

Note: Advertising may be subject to credit approval.

Account Information

Phone #: (818) 703-8600
Name: ESA WATER
Address: 21650 OXNARD STREET
SUITE 1680
WOODLAND HILLS CA 91367

Acct #:
Client:
Placed by: Nicolle Ianelli Steiner
Fax #: (951)

Ad Information

Classification: Legals
Publications: Press-Enterprise

Start date: **03-13-11**
Stop date: **03-13-11**
Insertions: 1

Rate code: LE-Open
Ad type: Ad Liner
Taken by: Gribbin, Kristin

Size: 2x112.260
Bill size: 225.00x 5.14 agate lines

Gross price:	$ 405.00
Net price:	$ 405.00
Total payments:	$ 405.00
Amount Due:	**$ 0.00**

Ad Copy:

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Please submit your comments by March 30, 2011. 3/13

Advertising Receipt

Hi-Desert Publishing
P.O. Box 880
Yucca Valley, CA 92286
Phone: (760)365-3315
Fax: (760)365-8686

Star Legals
PUBLIC NOTICE

YUCCA VALLEY, CA 92284

Cust#: 02101386 000
Ad#: 01548142
Phone: (760)365-3725
Date: 03/11/11

Ad taker: BE **Salesperson:** **Classification:** 999

Description	Start	Stop	Ins.	Cost/Day	Surcharges	Total
01 Hi-Desert Star	03/19/11	03/19/11	1	173.85		173.85

Payment Reference:

Total:	173.85
Tax:	0.00
Net:	173.85
Prepaid:	0.00
Total Due	173.85

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PROOF OF PUBLICATION
(2015.5 C.C.P.)

STATE OF CALIFORNIA
County of San Bernardino

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years, and not a party to or interested in the above-entitled matter. I am the principal clerk of the printer of the:

HI-DESERT STAR

a newspaper of general circulation, printed and

published BI-WEEKLY

in the City of YUCCA VALLEY County of San Bernardino, and which news- paper has been adjudged a newspaper of general circulation by the Superior Court of the County of San Bernardino, State of California,

under the date of 11/27 19 61

Case Number 107762 : that the notice, of which the annexed is a printed copy (set in type not smaller than nonpareil), has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates, to-wit:

3/19

all in the years 2011

I certify (or declare) under penalty of perjury that the foregoing is true and correct.

Dated at: YUCCA VALLEY, California,
this **19th.** day **March 2011**

Bekie Edelbrock

Signature
Bekie Edelbrock

This space is for the County Clerk's Filing Stamp

Proof of Publication

NOTICE OF PREPARATION OF A DRAFT ENVIRONMENTAL IMAPCT REPORT

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(PUB: S. 3/19/2011)

Attachment 5

Comment Letters Received by SMWD

United States Department of the Interior

NATIONAL PARK SERVICE
Pacific West Region
1111 Jackson Street, Suite 700
Oakland, California 94607-4807

IN REPLY REFER TO:

L7619 (PWR-P)

29 MAR 2011

Tom Barnes, ESA
626 Wilshire Blvd., Ste. 1100
Los Angeles, CA 90017

Re: *Scoping Comments Responding to Notice of Preparation of Draft Environmental Impact Report for the Cadiz Valley Water Conservation, Recovery and Storage Project*

Dear Mr. Barnes:

By Notice of Preparation (NPO) dated March 1, 2011, the Santa Margarita Water District (SMWD), as the Lead Agency, informed interested parties of its intent to begin preparation of an Environmental Impact Report (EIR) pursuant to the California Environmental Quality Act (CEQA) for the *Cadiz Valley Water Conservation, Recovery, and Storage Project* (Project), and invited scoping comments on the EIR to be submitted by March 30, 2011. SMWD, along with other participating water agencies acting as Responsible Agencies, is proposing to implement the Project in partnership with Cadiz Inc. (Cadiz), which owns approximately 34,000 acres of land located in the Cadiz and Fenner Valleys of San Bernardino County, and the Fenner Mutual Water Company (FMWC), a non-profit California mutual water company formed to deliver water at cost to its shareholders that are public water systems that purchase water from the Project. The following letter and attachments constitute the complete set of comments of the National Park Service (NPS) and the Mojave National Preserve (Preserve).

Mojave National Preserve and the Water Resources Division of the National Park Service were involved in the preparation of the preceding draft and final EIR/EIS for the *Cadiz Groundwater Storage and Dry-Year Supply Program* as a cooperating agency and, as a result, have some familiarity with this proposed project, now headed by the Santa Margarita Water District renamed the Cadiz Valley Water Conservation, Recovery and Storage Project. From the project description posted on the Santa Margarita Water District website it appears that the proposed hydrology is very similar to the previous project, with a planned annual extraction of native groundwater at a rate of 50,000 acre-feet per year but with the major difference being the planned route of the water conveyance infrastructure.

Our comments regarding this NOP revolve around two primary issues: the sustainability of the proposed pumping rate and the use of the Arizona & California Railroad Company right-of-way from Cadiz to the Colorado River Aqueduct.

The NOP describes the Arizona & California Railroad Company right-of-way as a privately owned railroad right-of-way, not on public lands, and identifies the US Fish and Wildlife Service and the US Army Corps of Engineers as the only two federal agencies involved. The Project proponents need to demonstrate that the proposed path of the water conveyance infrastructure is entirely on privately owned land and not on a right-of-way that includes portions of public land. If the property in the path of the water conveyance infrastructure is entirely on private land then the NOP misidentifies the role of the US Fish and Wildlife Service. This would not be consultation under §7 of the Endangered Species Act but instead would be §10. If the route of the proposed water conveyance infrastructure crosses any land held by the federal government, this would trigger the National Environmental Policy Act, involve federal land management agencies, and involve the US Fish and Wildlife Service for consultation under §7 of the Endangered Species Act, as the NOP notes.

In addition, the Project proponent should provide confirmation that a right is held, or will be transferred, to use the Arizona & California Railroad Company right-of-way for the express purpose as will be stated in the draft EIR. The NPS is aware of cases in which rights-of-way granted to a railroad or utility foreclose third party or non-railroad/utility use, at risk of reversion to the original grantor, typically the United States or the original railroad. It is noted that an Arizona & California Railroad Company request to abandon portions of the rail line within California has been filed (Surface Transportation Board Decision Document, Docket Number AB_1022_1_X). However, abandoned or not, in the EIR the Project proponent should prove acquisition of needed rights from the legal holder of the right-of-way.

The Project is proposed to be executed in two phases. The first phase is the Conservation and Recovery Component, which would be constructed to capture the average annual natural recharge in the Fenner and northern Bristol Valleys that would otherwise discharge to the Bristol and Cadiz Dry Lakes. In this phase of the Project, extraction wells (well field) would be constructed on the Cadiz property and a 42-mile underground water conveyance pipeline would be constructed within an active, railroad right-of-way that will allow the indigenous groundwater to be conveyed to the Colorado River Aqueduct and southern California for use.

The second phase is the Imported Water Storage Component, which would make available up to one million acre-feet of groundwater storage space to be used as part of a conjunctive use project. In the second phase of the Project, water from the Colorado River would be conveyed to recharge basins in the Fenner Valley to percolate into the ground for temporary storage and future withdrawal and conveyance to southern California as a dry-year water supply. Since the second phase begins at a future date, it is anticipated to be evaluated in the EIR on a programmatic basis. As a result, prior to implementing the second phase of the Project, additional environmental review consistent with CEQA would be necessary.

Water Resource Concerns

The NPS is not averse to the concept of recovering groundwater that naturally discharges to the atmosphere or the concept of using an aquifer to store surplus surface water supplies and extracting these stored supplies during dry years, as long as (1) the Project adopts and adheres

to a hydrologic sustainable yield concept, and (2) the Project does not directly or indirectly affect water resources, water-dependent resources and other natural and cultural resources within NPS park units.

Given proximity of the Project to Mojave National Preserve and considering the fact that most of the natural groundwater recharge to the Fenner Valley originates in the mountains located in the Preserve, the NPS and the Preserve are concerned that groundwater withdrawals associated with the Project have the potential for affecting water resources within the Preserve. Many of the water features in the Preserve are critical to supporting rare and threatened species and vegetation, and therefore, could be adversely impacted if effects from Project pumping significantly alter the groundwater flow regime throughout the Fenner Valley. As a result, the NPS and the Preserve asks that the Lead Agency and the other Responsible Agencies be guided by sound peer-reviewed science in the development and preparation of the EIR for the Project.

The EIR should recognize that most of the groundwater recharge studies conducted in the study area indicate that natural recharge to the Fenner and Bristol Valleys ranges from 2,000 to 11,000 acre-feet per year and that the Project's recharge estimate is 3 to 120 time too high.

The NPS's greatest concern with respect to the Project is related to potential pumping impacts on the water resources within the Fenner Valley and Bristol Valley watersheds. Past groundwater studies in these two valleys and under the former Cadiz Project suggest that most of the water recharging these two valleys originates in the higher mountainous areas located within the Mojave National Preserve, which is managed by the NPS. Given the amount of recoverable groundwater that the Project proponent is seeking to extract from these two watersheds, the NPS is concerned that the proponent is substantially overestimating the amount of natural precipitation recharging the groundwater basins in these two valleys. If this proves to be correct, the Project not only will violate the sustainable yield, but there could also be impacts to the Preserve's water resources under the first phase of the Cadiz Project and possibly under the second phase of the project.

The preponderance of previous study results indicates that annual groundwater recharge to Fenner and Cadiz valleys ranges from 270 to 11,200 acre-feet per year (ac-ft/yr), with average and median values of 4,210 ac-ft/yr and 3,700 ac-ft/yr, respectively. This range of values is based on a summary table of recharge study results for these two valleys presented in earlier revised EIS comments submitted by Dr. John Bredehoeft, Ph.D, (HydroDynamics Group, 2001), one of the preeminent groundwater hydrologists in the country. This table is recreated below for reference. NPS is attaching the August 2001 revised EIS comments (Attachment A) submitted by the Dr. Bredehoeft, and incorporates his comments and concerns by reference as part of our submittal of scoping comments and concerns that should be considered and addressed in the Project EIR.

Methodology/Author	Estimate (ac-ft/yr)
1. Watershed Runoff Model – MWD & BLM (1999)	20,000 – 70,000
GeoScience Groundwater Model	50,000
2. Maxey/Eakin Method	
USGS (2000)	2,550 -11,200
Durbin (2000)	5,000
3. Fenner Gap Groundwater Flow	
Friewald (1984 – USGS)	270
LaMoreaux (1995)	3,700

USGS (2000)	2,600 – 4,300
4. Chloride Method (correctly applied)	
USGS (2000)	1,700 – 9,000
Durbin (2000)	2,000
5. Drawdown Associated with Cadiz Co. pumping	
Boyle Engineering (1996)	4,000

In contrast, the Project proponent previously estimated that groundwater recharge to these two groundwater basins ranged from 20,000 to 70,000 ac-ft/yr (see table above). Under the current version of the Project, the proponent has revised the annual recharge estimate to 32,500 ac-ft/yr. In both cases, the Project proponent is still proposing to pump 50,000 ac-ft/yr, so the magnitude of potential impacts has not changed. The current recharge estimate for the Project is approximately 3 to 120 times greater than all previous estimates of groundwater recharge for this area.

In order to evaluate and resolve this wide disparity in the groundwater recharge estimates reported for the study area, the NPS requests that the EIR address the following issues and questions:

- Provide a thorough discussion of all previous hydrologic investigations related to quantifying the amount of water entering, moving through and discharging from the groundwater system(s) beneath the study area or in other proximal valleys. As the lead agency in preparing the EIR, SMWD is required to utilize all available peer-reviewed science to critically evaluate the possible impacts to water resources in these basins posed by the Project. If there are wide disparities between previous and current estimates of groundwater recharge, underflow and discharge, the major findings of the previous and current studies should be presented in the EIR for fair and equal consideration. If there is disagreement with the results of previous or current studies such that one set of the results are eliminated from further consideration, then a thorough discussion should be presented stating the technical reasons for the disagreement. This will lay the foundation for critically evaluating the Project study results against previous study results.

- The current estimate of annual groundwater recharge for the Project should be supported by several independent lines of analysis. The EIR should thoroughly discuss the different methodologies used to analyze the annual recharge, the data and information supporting each methodology, and the analysis results for each methodology. In cases where the analysis method is similar to a method utilized by a previous investigator in the area and the results vary significantly, the discussion should attempt to ascertain why the results vary (e.g., the analysis method was improperly applied) between the previous and current studies and which set results were ultimately utilized in the EIR.

- If a watershed model is used in the EIR to calculate the recoverable water in the basin, the model should account for bedrock permeability when estimating the amount of recharge to the groundwater system. The model should also incorporate routines to route water through the

surface drainage network and estimate downstream flows and subsequent percolation. The USGS noted these deficiencies as flaws with the watershed model developed for the former Cadiz Project.

- If a chloride mass balance approach is used in the EIR to support groundwater recharge estimates, it should be properly applied to the study area. In the opinion of the USGS, the project proponent misapplied their chloride mass balance approach under the former Cadiz Project in estimating the amount of recharge to the flow system, as they assumed a much higher chloride concentration of precipitation than values used by other previous investigators in the area.

- If isotopic data are used in the EIR to support groundwater recharge estimates, proper data should be collected so that reliable groundwater age determinations can be made or estimated. In their previous attempt to use carbon-14 data to date the groundwater under the former Cadiz Project, the project proponent reported apparent groundwater ages ranging from 11,500 to 14,000 years before present, but suggested that rock-water reactions had occurred and as a result, groundwater ages were younger than the apparent ages indicated. This deficiency can be corrected by (1) collecting aquifer material samples and analyzing for carbon-13/carbon-14 content so that site specific age corrections can be made, or (2) estimating corrected carbon-14 ages for the groundwater using data and rock-water reactions interpreted from other studies. The USGS attempted the latter as part of its previous review and noted that corrected carbon-14 ages ranged from 5,500 to 10,600 years before present, which suggests a very low current-day recharge rate.

- Estimate of annual groundwater discharge from the groundwater flow system should be supported by several independent lines of analysis. Under the former Cadiz Project, USGS in its technical review suggested that discharge estimates by soil evaporation from the Bristol and Cadiz dry lakes were not supported by physical soil evaporation measurements at these sites and groundwater level measurements beneath the dry lakes. Additionally, the project proponent was encouraged by the USGS to utilize existing study results from around the region which have attempted to quantify soil evaporation rates off of similar salt encrusted dry lakes (e.g., USGS study in Death Valley) in order to ascertain the likely amount of groundwater discharge from the flow system. The USGS also recommended that contribution to soil evaporation from the dry lakes due to surface water runoff not be neglected, as it was under the former Cadiz Project. The Project proponent must demonstrate through physical measurements of water loss from the dry lake areas and through measurement of groundwater depths beneath the dry lake areas that groundwater discharge is actively occurring at these dry lake areas. The USGS noted in their previous review that the project proponent's discharge estimate in their groundwater flow model (50,000 ac-ft/yr) was unreasonable on the basis of the depth to water (estimated to be 10 feet or greater) and soil characteristics beneath the dry lake areas. The USGS recommended installation of multiple depth monitoring wells to determine the depth of water

beneath the dry lakes, and the use of energy-budget methods or salt crust accumulation methods to better quantify the water loss off of the dry lakes. Quantification of water loss off of these two dry lakes is extremely important - this is the limiting factor on the amount of recharge entering the flow system and how much recoverable water is available for the project. If it is shown that the amount of soil evaporation occurring at the dry lake areas is small or negligible, then the Project's claim to being sustainable must be re-evaluated.

The lead agency should consider seeking an impartial technical review of the EIR's water resource impact analysis from the US Geological Survey.

Given the sensitivities associated with a regional groundwater exportation project on the scale of the Project and the fact that the Lead Agency, SMWD, is also one of the entities that stands to benefit from this project, the NPS recommends that the SMWD seek an impartial technical review of the Project proponent's water resource impact analysis from the USGS to assess the technical soundness of the hydrologic analysis. Such a commitment may help to alleviate potential concerns by the public related to perceptions of a conflict of interest by SMWD and the other participating water agencies acting as Responsible Agencies, and better inform all interested parties as to whether or not the Project is economically and environmentally feasible, as proposed. An outside technical review by the USGS will help to provide another level of due diligence to the project, which may have value in alleviating concerns that the participating water agencies' water users and investors might have about the Project.

Retaining the USGS to conduct a technical review is consistent with the history of the Cadiz Project. In its previous incarnation as the Cadiz Groundwater Storage and Dry-Year Supply Program (former Cadiz Project), the USGS was asked by the Bureau of Land Management (BLM) to conduct a technical review of the *Draft Environmental Planning Technical Report, Groundwater Resources, Volumes I and II (Draft Report)* to assess the technical soundness of the water resource impact analysis. At that time, it was the opinion of the USGS review team that the Project proponent's regional watershed model, water balance studies, and groundwater flow and transport models were used without adequate data to support the results and conclusions presented in the Draft Report. Their opinion appears to be largely predicated on concerns with an overestimation of natural recharge (and discharge) from the groundwater flow system in the study area by the project proponent. The NPS agreed with most of the USGS's original concerns about characterization of the water resource impacts associated with the former Cadiz Project. Accordingly, the NPS is attaching the February 2000 technical memorandum (Attachment B) submitted by the USGS outlining their concerns with the Draft Report, and incorporates the USGS concerns by reference as part of our submittal of scoping comments and concerns that should be considered and addressed in the Project EIR.

Presumably, in the decade that has passed since this technical review was conducted, the Project proponent has had time to consider and address many of the technical concerns presented by the USGS leading up to the current proposal. Given the USGS's familiarity with the water resource conditions in the Mojave Desert region and with the former Cadiz Project in general, it would be advantageous to all to have the USGS perform another technical review of the revised Project to assess whether or not the USGS's original concerns have been addressed, and if there are new concerns with the analysis that should be addressed. The NPS is concerned that the Project proponent continues to have an overly optimistic view of the amount of recoverable groundwater in the Fenner Valley and Bristol Valley, which would preliminarily indicate that many of the USGS's original concerns have not been

addressed in the interim. If this is the case, the NPS believes that the lead agency should use the USGS's previous technical review as a starting point from which to formulate and evaluate the water resource impact analysis for the current EIR.

The EIR should thoroughly evaluate and discuss the potential impacts associated with the various elements of the Conservation and Recovery Component of the Project.

In general, the NPS is not averse to the concept of recovering groundwater that naturally discharges to the atmosphere, as long as total annual withdrawals do not exceed the annual sustainable yield of the groundwater basin, and given any project pumping does not directly or indirectly affect water resources, water-dependent resources, and other natural and cultural resources within units of the NPS. After reviewing the description of the first phase of the Project (i.e., Conservation and Recovery Component) in the NOP, the NPS has identified the following initial concerns with some of the proposed elements that should be addressed in the EIR:

- The EIR should clearly demonstrate the Project's need for the groundwater stored in the Bristol and Fenner Valleys. Information on current and future water demands within the service areas of the participating water districts should be presented and thoroughly discussed. Information on current and future water demands for existing water users in these two valleys should also be presented and discussed so that potential economic and environmental impacts to the users of the indigenous water supply can be evaluated. What other measures are being taken to conserve the participating water districts' current water supplies and have other sources of supplemental water supplies been assessed?

- How is the first phase of the Project going to conserve or be sustainable when it is proposing to extract an amount equal to the long-term average annual recoverable recharge in the watersheds plus an additional amount required to attain an optimal groundwater level needed to maintain hydraulic control? The description of this phase of the Project in the NOP states that the Project will extract 32,500 ac-ft/yr (the project proponent's estimated sustainable yield of the watersheds) plus an additional 17,500 ac-ft/yr of groundwater to maintain hydraulic control of the groundwater flow system in the Fenner Gap area. These totals account for the Project's self-imposed annual operational limit of 50,000 ac-ft/yr, all of which will be conveyed out of the watershed to the Colorado River Aqueduct. Based on this description, the Project discloses that it will be mining an additional 17,500 ac-ft/yr of groundwater beyond an already optimistic estimate of the sustainable yield. If the proposed Project is truly striving to be environmentally sustainable and part of a larger holistic approach to water supply development as is states on its project web site, then it should strive to maintain its total groundwater pumping within the sustainable yield of the watersheds. What has not been accounted for in the description of the first phase of the Project is the amount of existing pumping that is occurring within these watersheds, which is already utilizing some of the sustainable yield. This presumably includes agricultural pumping by the project proponent (previously estimated to be 4,000 – 5,000 ac-ft/yr) and other agricultural, industrial, municipal and domestic pumping in the watersheds.

Once these existing groundwater withdrawal totals are determined, the Project should only be allowed to develop what sustainable yield remains, if any, in order to remain sustainable.

- In the planning and operational phases, how does the Project propose to confirm that groundwater levels beneath the Bristol and Cadiz Dry Lakes have been lowered sufficiently by Project pumping to cause natural evaporation to cease? If the premise of the Project is to capture or recover groundwater destined for natural evaporation from these dry lake areas, then the Project should be required to demonstrate that soil evaporation is actively occurring from the dry lakes and that their pumping will lower groundwater beneath the dry lake discharge areas to a level that prevents the natural evaporation from occurring during the life of the Project. If this cannot be demonstrated and the Project is allowed to proceed, then the Project will effectively mine upwards of 50,000 ac-ft/yr of groundwater from the groundwater basin, while as much of 32,500 ac-ft/yr of natural evaporative discharge is allowed to continue from the groundwater basin. This could have substantial effects on groundwater levels and spring discharges throughout the groundwater basin over the life of the project.

- The meaning of "hydraulic control" must be addressed in presenting Phase I of the proposed Project. Does hydraulic control only relate to establishing a sufficient area of drawdown in the vicinity of the Fenner Gap to intercept groundwater moving through that area, or does it also apply to lowering the groundwater levels in the area enough to cause natural evaporation to cease from the dry lake areas (see previous comment)? Does hydraulic control also include groundwater injection to help prevent the possible migration of highly saline groundwater beneath the dry lake area toward the project well field? A figure prepared by CH2M Hill (see Attachment C) and posted on the home page of the Cadiz Project web site conceptually illustrates an injection well located downgradient between the conceptual project well field and a dry lake, suggesting that groundwater injection will be utilized to prevent migration of highly saline groundwater toward the Project well field. If groundwater injection is envisioned as part of establishing hydraulic control for the Project, then the EIR should thoroughly discuss and demonstrate the effectiveness of this approach. As part of the discussion, the EIR should identify how much additional groundwater is needed for injection to achieve the desired hydraulic control, where this water will come from, the potential effects on the groundwater flow system resulting from pumping this water from the groundwater basin, and whether sufficient lowering of groundwater levels beneath the dry lake areas can still be achieved to prevent natural evaporation from occurring in these areas (see previous comment).

- The EIR should address in detail whether California statutes allow for the banking of unused groundwater rights (i.e., carry-over groundwater) for use in future years, and if so, how this banking of carry-over groundwater will be managed under Phase I and Phase II of the Project, when surplus Colorado River water supplies also may be stored in the aquifer. Additionally, please describe how this carry-over management will be factored into groundwater modeling scenarios conducted as part of the EIR assessment. Conceptually, please describe whether the

plan is to withdraw unused groundwater in wet years and artificially recharge it back into the aquifer for future use, or to cease pumping in wet years and pump an additional amount of groundwater in a dry year equal to the unused wet year allotment plus the dry year allotment. The EIR should clearly demonstrate through worst-case and best-case scenario modeling of reasonable expectations for dry and wet year occurrences whether or not the Project's claim that management of this carry-over water would not alter the long-term average annual withdrawal and associated impacts over the 50-year term of the Project.

- The EIR should provide a thorough evaluation and discussion of reasonable alternatives to the Proposed Action. The NPS would like to recommend that one of the alternatives include an evaluation of the Project under a lower recharge setting that is in line with previous recharge study results in the area. As noted in an earlier scoping comment, the preponderance of available information on recharge estimates for watersheds in this part of the Mojave Desert indicates a likely annual recharge on the order of 5,000 ac-ft/yr. If the wide disparity between estimates of annual recharge in this area cannot be resolved, then it is also reasonable for a similar project alternative formulated under lower recharge conditions to be considered and evaluated as part of the EIR. Also recommended is that the "environmentally preferred" alternative be identified in the EIR.

- The EIR should utilize groundwater flow modeling to simulate the potential impacts to water resources in the project area watersheds resulting from groundwater extraction during Phase I of the Project, and artificial recharge and groundwater extraction during Phase II of the Project. Modeling simulations should be conducted for the Proposed Action and all of the alternative actions evaluated under the EIR. In its review of the Draft Report submitted under the former Cadiz Project, the USGS noted several deficiencies in the groundwater flow modeling effort conducted at that time and provided recommendations for improving the groundwater flow model's predictive capabilities. The NPS agrees with most of the USGS's assessment and suggests that any groundwater flow model developed under this EIR address the following concerns, many of which were identified from the previous modeling effort:

    - The groundwater flow model should be calibrated to lower estimates of recharge and discharge for the flow system. The USGS noted in its previous review that the former groundwater flow model was incorrectly calibrated as a result of overestimation of natural recharge and discharge in the model. The consequence of an incorrectly calibrated model was inaccurate simulations of steady-state and transient conditions and unreasonable predictions of water levels and fluxes in response to the proposed put/take scenarios.

    - A properly calibrated groundwater flow model should be used to simulate the long-term effects (100 to 1,000 years) of the currently proposed Project on groundwater levels and groundwater discharge to the Bristol and Cadiz Dry Lake areas. To accommodate this

simulation, the USGS recommended expanding the model grid to evaluate the long-term impact of withdrawals on spring discharge and water levels in the Fenner Valley.

- A density-dependent solute transport model is needed to accurately simulate the movement of the highly saline brine beneath the dry lake areas. Under the former Cadiz Project, a nondensity-dependent model, MT3D, was used to simulate the brine movement. The USGS correctly noted that use of a nondensity-dependent model calls into question any results and conclusions regarding the water levels and movement of brine near the dry lakes.

- The conceptualization and development of the groundwater flow model should take into consideration the presence and potential effects that faults might have on the groundwater flow system. The USGS noted in their previous review that several major fault structures were ignored in the conceptualization of the previous model that have the possibility of acting as barriers and/or conduits for flow. Additional hydrogeologic studies may be needed to assess the hydrologic nature of these faults and how they should be addressed in the model.

- The groundwater flow model should utilize realistic estimates of aquifer parameters that can be substantiated either through direct field measurement/testing or published estimates of parameter properties for similar hydrogeologic materials and settings. Under the former Cadiz Project, the USGS noted in their review that the hydraulic conductivity and transmissivity values were too high in the groundwater flow model, which allowed the optimistically high flux rates that were assumed in the previous modeling attempt. Another area of concern noted by the USGS was the use of an excessively deep extinction depth (100 feet) for the bare soil evaporation occurring at the dry lake areas in the model, which allowed much more flux (discharge) to leave the flow system. The USGS review noted that existing studies of bare soil evaporation at that time indicated evaporation extinction depths should be 10 feet or less. The USGS concluded from their review of the former groundwater modeling attempt that the model could not transmit the excessively high inflows (recharge) without increasing the simulated hydraulic gradient beyond the observed hydraulic gradient, even when using unreasonably high transmissivity values, and without having an unreasonable evaporation extinction depth.

- Water level recovery simulations should be conducted as part of the EIR to assess how long it would take for groundwater levels to recover to their original levels under different operating scenarios. This exercise has utility in evaluating whether or not monitoring and mitigation measures such as placement of early warning monitoring systems, a reduction in project pumping, or redistribution of project pumping can be effective measures in avoiding or minimizing possible pumping-related impacts to

water resources in the project watersheds. The NPS's concern is that even after complete cessation of pumping, drawdown affects can continue to propagate throughout the aquifer for a time before water levels start to recover under natural recharge conditions. This was effectively demonstrated in earlier EIS comments submitted by Dr. John Bredehoeft, Ph.D, (see Attachment A) related to the former Cadiz Project. At least two recovery simulations should be conducted for the Proposed Action and for all alternative actions to evaluate water level recovery after the project is shutdown after 50 years of Phase I operations and after 50 years of combined Phase 1 and Phase II operations, so that the range of post-operational water level recovery effects for the proposed project can be evaluated for each action.

The EIR should thoroughly discuss the potential impacts associated with the various programmatic elements of the Imported Water Storage Component of the project.

In general, the NPS is not averse to the concept of using an aquifer to store surplus surface water supplies and extracting these stored supplies during dry years, as long as total annual withdrawals from the aquifer do not exceed the combined annual sustainable yield of the groundwater basin and the amount of surplus water supplies stored in the aquifer, and the project pumping and artificial recharge does not directly or indirectly affect water resources, water-dependent resources and other natural and cultural resources within NPS park units. After reviewing the description of the second phase of the Project (i.e., Imported Water Storage Component) in the NOP, the NPS has identified the following initial concerns with some of the proposed elements that should be addressed in the EIR:

- Please describe in detail the likely availability of surplus Colorado River water supplies that might be stored in the aquifer system during the 50-year life of the Project. Discussion in the NOP notes that water supply to Southern California from the State Water Project and Colorado River is often either unreliable or unpredictable. Given that reality, what effect do the recently negotiated changes to the Colorado River Compact have on future availability of surplus water to participating water agencies? The programmatic evaluation should clearly demonstrate through worst-case and best-case scenario modeling the reasonably expected range of annual surplus water volumes that might be available for storage in the aquifer. This analysis should also factor in potential impacts to Colorado River water supply availability due to potential climate change effects and future water demand projections in the Colorado River Basin.

- The programmatic evaluation of Phase II of the proposed Project should include preliminary modeling of potential impacts to the groundwater flow system resulting from the artificial recharging and subsequent pumping of surplus water supplies that might be stored in the aquifer. Assuming a properly calibrated groundwater flow and transport model is developed to assess the potential pumping impacts related to Phase I of the Project, this same groundwater model should be utilized to estimate both incremental and cumulative effects to the local aquifer resulting from the storage and withdrawal of imported surplus surface water supplies. Modeling simulations should evaluate the potential impacts associated with just Phase II

operations and with combined Phase I and Phase II operations so that incremental and cumulative impacts can be adequately assessed.

- The programmatic evaluation of Phase II of the proposed Project should discuss the potential effects on groundwater levels resulting from storage of surplus surface water supplies in the aquifer. With the stated possibility of storing upward of 1,000,000 ac-ft of surplus water in the aquifer plus additional carry-over groundwater from Phase I of the Project, is there a potential for groundwater levels to rise close enough to land surface, so as to create areas where artificial evaporative (or evapotranspiration) losses could occur? Is there a possibility that the stated hydraulic control could be overwhelmed by the stored surplus water and carry-over groundwater?

- The programmatic evaluation of Phase II of the proposed Project should discuss the expected evaporative losses from the spreading basins that will be used to artificially recharge the aquifer. If evaporative losses are expected, the total volume of stored surplus water to be extracted should be reduced by the estimated volumetric losses due to evaporation from the spreading basins.

If potential adverse impacts to water resources are determined to be significant enough to warrant implementation of mitigation measures, the EIR should first consider the relevancy of the mitigation measures that were developed and proposed under the former Cadiz Project. Given that many of the previous impact concerns are likely to be expressed and evaluated in this EIR, it makes sense to revisit the mitigation measures that were being proposed and developed under the EIS prepared for the former Cadiz Project and determine which measures might have utility to this EIR. Great effort was expended in developing these measures, so they should not be discounted nor neglected if it is determined under this EIR that mitigation measures will be necessary to protect against adverse impacts to the water resources in the Fenner Valley and Bristol Valley. It is possible that some of these measures may need to be adjusted if impact conditions change under the current EIR analysis.

Under no circumstances should monitoring by itself be construed as an acceptable mitigation measure, though it is a necessary activity in determining successful implementation of the Project. Mitigation measures are typically defined as measures that avoid, minimize, reduce and/or eliminate adverse impacts. The EIR should also demonstrate the likely effectiveness of any proposed mitigation measure. Use of a properly calibrated groundwater model can be quite useful in demonstrating the effectiveness of monitoring and mitigation measures such as the placement of an early warning monitoring well system and establishment of trigger levels, a reduction in Project pumping, or a redistribution of Project pumping.

The EIR should provide a thorough discussion on closure plans associated with the Project. Given the 50-year operating period envisioned for the Project, please provide details on closure activities that will be implemented by the Project participants, following shut down of the Project. The discussion should include activities and measures that might be implemented to address remnant impacts to water resources within the project area watersheds.

Thank you for the opportunity to provide scoping comments on this NOP. For any clarification or follow up regarding our comments, please contact Lawrence J. Whalon, Acting Superintendent, Mojave National Preserve at (760)252-6109.

Sincerely,

Patricia L. Neubacher

for

Christine S. Lehnertz
Regional Director

Attachments:3

Cc:
MOJA-S
NPS-WRD

ATTACHMENT A

Revised Comments
Cadiz Groundwater Storage Project
Cadiz and Fenner Valleys
San Bernardino County, California

Prepared by Dr. John Bredehoeft, Ph.D, HydroDynamics Group
for the Western Environmental Law Center
August 2001

THE HYDRODYNAMICS GROUP
Studies in mass & energy transport in the earth

REVISED COMMENTS

CADIZ GROUNDWATER STORAGE PROJECT
CADIZ AND FENNER VALLEYS
SAN BERNARDINO COUNTY, CALIFORNIA

PREPARED FOR: WESTERN ENVIRONMENTAL LAW CENTER
TAOS, NEW MEXICO

JOHN BREDEHOEFT, PH.D.
AUGUST 2001

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OVERVIEW

I have prepared this supplemental comment in an effort to both clarify and elaborate on points made in made in my earlier report on the proposed Cadiz Water Project. This comment specifically responds 1) to assertions made by the project proponents, 2) to measures that are reportedly being considered by the Agencies responsible for reviewing the project as means of addressing, or avoiding, the concerns raised in my earlier report, and 3) the critiques of other technical reviewers.

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For example, it has been suggested the inefficacy of the monitoring system that I addressed in my earlier report can be remedied by 1) better placement of the observation wells, 2) by lowering the threshold at which a response would be triggered, and/or 3) or by adjusting the models that are to be used to predict the future response of the groundwater system. While this approach sounds superficially appealing, as I explain below, it does not address the fundamental problem that the recharge is undetermined. It does not address the fact that early warning signals will be subtle, and will be obscured by the operations of recharge and pumping, and by natural fluctuations in water levels. Monitoring for response and control has little chance of being effective.

In addition there is reportedly a proposal to treat the first five years of project life as a pilot project, or trial period, to observe how the groundwater system is responding to project operations. The idea is that magnitude of future extractions of native groundwater would be based upon the aquifer response during the five-year pilot period. As explained below this suggestion, while superficially appealing, is also fraught with problems and as a practical matter probably unworkable.

In this revised comment I conclude:

1. The magnitude of the recharge is an order of magnitude smaller than that suggested by the proponents of the project. The weight of evidence indicates it is approximately 5,000 acre-feet annually (ac-ft/yr) rather than 50,000 ac-ft/yr as the proponents suggest.
2. Monitoring for the purpose of avoiding undesired impacts and controlling the project is unlikely to work because the early warning signals of impending problems are both subtle and small, and will be obscured by the signals associated with the operations along with natural water level fluctuations. The threshold levels of what constitutes an early warning signal of adverse impacts are left unspecified by the project. The remedial measures to stop adverse consequences are also left unspecified.
3. The major uncertainty in assessing the long-term life of the project is the magnitude of the recharge. A pilot project, or trial period, must stress the aquifer sufficiently so as to give an indication of the impact of the long-term pumping of large quantities of native groundwater. The pumping in order to be definitive must be approximately an order of magnitude larger than the current Cadiz Company pumping for agriculture—currently the pumping is approximately 5,000 ac-ft/yr. Pumping 50,000 ac-ft/yr of native groundwater in the first five years of the project is in conflict with the practical consideration that surplus

water from the Colorado River may only be available during the first decade or so of project.

4. A ***sustainable*** Cadiz project is one in which the pumping of native groundwater is restricted to the current rate of pumping by the Cadiz Company for agriculture—approximately 5,000 ac-ft/yr. In a sustainable project the current agriculture pumping would be acquired by the project. ***I recommend a sustainable project in which the pumping of native groundwater is restricted to an average of 5,000 ac-ft/yr.***

INTRODUCTION

Before embarking on the analysis, a brief recap of the principal features of the Cadiz Water Project is in order.

The Cadiz Valley Groundwater Storage Project is proposed to serve three functions: 1) store water from the Colorado River Aqueduct during periods when water is available, 2) pump the water stored, and 3) pump a significant quantity of indigenous native groundwater from the Cadiz and Fenner Valleys when Colorado River water is deficient.

The project facilities consist of a pipeline (approximately 35 miles long) through Cadiz Valley from the Colorado River Aqueduct, at least one pumping station for the pipeline, recharge ponds, and a well field. The recharge ponds are used to infiltrate Colorado River water into the underlying alluvial aquifer where it is stored. The well field is used both to pump out stored water as well as the native groundwater in the area. The facilities are designed to recharge as much 145,000 acre-feet of water per year (ac-ft/yr). Similarly the well field is designed to pump 145,000 ac-ft/yr of groundwater.

The project is proposed both to store water and pump groundwater. The proposal is to extract more groundwater than that which is stored. One scenario of development indicates the project will extract 1,700,000 acre-feet of groundwater in excess of the amount stored during a 50-year period. Under this scenario 1,100,000 acre-feet of Colorado River water will be stored during the 50-year period; however, the total groundwater extracted will be 2,800,000 acre-feet during the period.

The argument put forward in the Draft EIR/EIS is that the 1,700,000 acre-feet of indigenous groundwater pumped is somewhat less than the cumulative recharge to the aquifers in the area during the 50-year period of project operation, and therefore will have no adverse impacts on the groundwater system. The Draft EIR/EIS indicates that the annual recharge is in the range of 40,000 to 50,000 acre-feet per year. It is on this basis that the report suggests little or no adverse impact on the groundwater system. It is the analysis of the impacts of pumping the native groundwater that creates great concern.

In my earlier report (Bredehoeft, 2000) I indicated that:

1. the estimate of annual recharge used in the Draft EIR/EIS is an order of magnitude too high—it is probably only 5,000-6,000 ac-ft/yr;

2. using a more realistic recharge rate there will be adverse impacts to the groundwater system and the environment; and
3. once development has proceeded for a period of several decades simply stopping the pumping of native groundwater, as implied in the Supplemental EIR/EIR, will not halt the adverse environmental impacts—in other words, the groundwater system once perturbed has sufficient persistence that adverse impacts will persist well beyond 100 years, even though the project is stopped after 50 year or earlier.

In this comment I wish to elaborate on some of the points made earlier. In order that the document stands by itself I am restating some of my earlier arguments.

THE GEOGRAPHIC/GEOLOGICAL SETTING

The Cadiz and Fenner Valleys are typical valleys within the Great Basin geographical province. The valleys are situated between mountain ranges. The mountain ranges are composed of older bedrock that ranges in age from PreCambrian through Mesozoic. The mountain ranges were uplifted by the basin and range tectonics of the region. The valleys are underlain by alluvial material that was eroded from the mountain ranges. Often the alluvial valley fill is quite thick, commonly in the more open parts of the valleys several thousand feet thick. The alluvial deposits beneath the valleys are good aquifers.

The valleys and surrounding mountain ranges are often closed topographic basins; the closed topographic basins form closed watersheds. Precipitation that falls in the watershed remains in the watershed. The discharge of water from these closed watersheds occurs either as evaporation or as plant transpiration. This is a desert; the precipitation ranges from a low of the 3 to 4 inches per year in Cadiz Valley to a high of 11 to 12 inches in the higher parts of the Granite Mountains west of Fenner Valley.

Commonly a playa forms in the lowest parts of the valleys in the area. These playas are ephemeral lakes. During periods of unusually high rainfall the runoff from the surrounding area is sufficient that the playas become lakes for a period; however, these events are infrequent. Most times runoff from the surrounding mountains is insufficient to reach the playa. Typically the runoff from winter snowfall and from summer thunderstorms 1) evaporates, 2) is held in the shallow soil where the plants transpire the moisture, or 3) infiltrates to the underlying groundwater table (the ***water table***).

Freshwater is supplied to the playas either as surface runoff in infrequent runoff events, or by underlying groundwater flow. The water evaporates from the playa; as it evaporates it leaves behind dissolved salts. The salts buildup naturally over time in the groundwater associated with the playas. There is highly saline groundwater underlying both Bristol Lake Playa and Cadiz Lake Playa; under Bristol Lake the groundwater is 7 times higher in dissolved salt than seawater. There are commercial salt works associated with both these playas.

The Hydrology of Valleys in the Basin and Range

Under natural conditions the alluvial aquifers that underlie the valleys are full of groundwater. These systems have existed for geologic time. There were periods of higher rainfall in the area during the Pliestocene ice ages. Under natural (virgin) conditions before any development the recharge to the aquifers is balanced by the discharge from the aquifers, or:

Recharge = Discharge (under virgin conditions)

As suggested above, the discharge from the aquifers occurs in many of the closed valleys in the Basin and Range as either evaporation from the playa, or by transpiration from plants in the lower parts of the valleys that draw their water from the water table. (Plants that draw water from the water table are referred to as ***phreatophytes.***) Common plants that draw groundwater from the water table are creosote bush, giant sage, and rabbit brush. Very few of these plants are present in Cadiz Valley; groundwater in this area is thought to discharge, before development, as evaporation from the local playas.

Pumping groundwater in one of these valleys constitutes an additional withdrawal from a system that was in a natural state of balance under virgin conditions. In order for such a groundwater system to reach a new equilibrium (a state of indefinite ***sustainability***) two things must occur: 1) the pumping must increase the recharge, and/or 2) the pumping must decrease the discharge. Usually groundwater pumping has no impact on the recharge; recharge is determined by climatic conditions—precipitation, etc. On the other hand the pumping can decrease the discharge. For example, in Cadiz Valley pumping groundwater can lower the water table beneath Bristol Lake playa and either reduce or eliminate groundwater discharge as evaporation there.

In the parlance of the hydrogeologist, pumping can capture groundwater discharge. *In order for a groundwater system to be indefinitely* ***sustainable*** *the pumping must be balanced by an equal capture of discharge.* If the pumping exceeds the total amount of the natural discharge from the system the system cannot be brought into a new balanced state; in other words one will be mining groundwater—such a system is not indefinitely sustainable.

One rarely hears the discussion of groundwater sustainability put in terms of the capture of virgin discharge. The usual statement is that *pumping must not exceed the recharge (in order for the system to be sustainable).* In the discussion above I made the point that the virgin rate of discharge in these systems equals the virgin rate of recharge. The statement *pumping must not exceed recharge* is a round about way of saying that the pumping must not exceed the virgin discharge—the presumption is that all the virgin discharge can be captured by the pumping.

Nevada Groundwater Law

The Cadiz and Fenner Valleys are comparable to the closed Basin and Range Valleys in Nevada; they are dissimilar to much of the rest of California. For this reason it is worth looking at how Nevada treats groundwater in similar valleys.

Nevada recognized in the early1900s that the water supply for many of the valleys within the state would have to come totally from groundwater. The Nevada decision was to attempt to make that the groundwater supply within these valleys sustainable. The discharge in many of the valleys in Nevada is similar to Cadiz Valley where the groundwater discharge is by evaporation from the playas and from plants that tap the water table—the phreatophytic plants mentioned above. Nevada was willing to let the groundwater pumping capture both the evaporation and the groundwater that went to support the phreatophytic plants. This thinking led to the Nevada doctrine *that groundwater pumping must not exceed the recharge.*

As an aside, it has been difficult for the water managers in Nevada to administer this doctrine in places of heavy urbanization such as Las Vegas, even though Nevada law codified the doctrine.

Nevada has systematically surveyed the entire state in an effort to investigate the recharge in each of its many valleys. Many of the techniques of estimating recharge in the Basin and Range Province have stemmed from efforts in Nevada. One of the widely used methods of estimating recharge is the Maxey/Eakin Method. This is an empirical procedure devised by Burke Maxey and Tom Eakin (1949) working for the U.S. Geological Survey (USGS) in cooperation with the state of Nevada.

Even though the Maxey/Eakin Method is more than 50 years old it is still in widespread use. It applicability has been evaluated in recent years. Avon and Durbin (1994) published an evaluation of the method in which they showed that it gave good estimates of recharge for valleys in the Basin and Range. The Maxey/Eakin Method, along with other methods, indicates a much lower rate of recharge for Cadiz and Fenner Valleys than the method that was used in the Draft EIR/EIS. The method used in the Draft EIR/EIS continues to serve as the basis for overly optimistic projections of the quantity of native groundwater that can be extracted on a sustained basis from the Cadiz-Fenner groundwater system

As discussed above, whether a groundwater system can be brought into a state of indefinite sustainability depends upon whether the system can ultimately capture sufficient natural discharge to balance the pumping. I indicated that under virgin conditions, before development, in these systems the recharge is balanced by an equal amount of discharge. If a proposed development is much larger than the amount of potential discharge that can be captured the system will never be brought into a new equilibrium—one will be continuing to mine groundwater. In other words one will be draining the groundwater system.

Let's state these ideas in another way. Remember the virgin recharge equals the virgin

discharge. If the proposed development is much larger than the recharge (or in other words the virgin discharge since it is equal) one can never capture sufficient natural discharge to bring the system to a new balance. Therefore, one hears the common statement the *development must not exceed the recharge if the development is to be sustainable.*

The estimate of recharge becomes critical in any analysis of how a groundwater system will perform. If the estimate of recharge is in error then predictions of system performance will also be in error. Thus, one cannot make accurate predictions of future performance without a good estimate of the natural recharge. One cannot make a defensible judgment about the impacts of withdrawing native groundwater without a good estimate of recharge. I wish to examine the various estimates of recharge for the Fenner and Cadiz Valleys that were referenced in my earlier report.

Summary of the Recharge Estimates

Table 1 summarizes the various estimates of recharge to the Fenner/Cadiz Valleys.

Table 1. A summary of the recharge estimates.

Methodology/Author	**Estimate (ac-ft/yr)**
1. Watershed Runoff Model—MWD & BLM (1999)	20,000-70,000
GeoScience Groundwater Model	50,000
2. Maxey/Eakin Method	
USGS (2000)	2,550-11,200
Durbin (2000)	5,000
3. Fenner Gap Groundwater Flow	
Friewald (1984—USGS)	270
LaMoreaux (1995)	3,700
USGS (2000)	2,600-4,300
4. Chloride Method (correctly applied)	
USGS (2000)	1,700-9,000
Durbin (2000)	2,000
5. Drawdown Associated with Cadiz Co. pumping	
Boyle Engineering (1996)	4,000

Looking at Table 1, the only investigator that estimated the recharge as high as 50,000 acre-feet per year was GeoScience in their work reported in the Draft EIR/EIS Report. This estimate was commissioned by the Cadiz Company and done in support of the project. The other eight estimates performed using a variety of proven methods indicated that the annual recharge is less than approximately 10,000 ac-ft/yr. While there is a range in the estimates the most probable value for the annual recharge is 5,000 acre-feet per year—an order of magnitude lower than that used in the Draft EIR/EIS.

The Boyle Engineering (1996) report indicated that Cadiz Company was pumping

approximately 4,000 ac-ft/yr for irrigation in 1996. Boyle noted small, continued declines in the groundwater levels of approximately 1 foot per year; they suggested that the recharge was less than the 4,000 ac-ft/yr pumped in 1996. The Cadiz agricultural pumping has, or will capture the natural discharge that is thought to have occurred as evaporation from the dry lakes under virgin conditions. The pumping for irrigation, now approximately 5,000 ac-ft/yr, appears to have had little, or no significant adverse impacts to date. The Cadiz Company has approval from San Bernardino County to continue their pumping for irrigation.

Apart from the GeoScience report there has been one other minority voice among the technical reviewers of the Cadiz Project. Lee Davisson, a scientist at Lawrence Livermore Laboratory, wrote a short letter that endorses the quantity of recharge indicated by GeoScience. The Davisson letter suggested that his support for the GeoScience estimate was based upon isotopic studies of the native groundwater. It is difficult to assess the Davisson suggestion since his letter is brief; it does not contain the usual scientific information—his method of analysis, his assumptions, his data, or his results.

The Supplemental EIR/EIS did not address the issue of how large is the recharge to the local groundwater system. It sidestepped the issue of the recharge by proposing a monitoring and control scheme. The idea is that the project operations would be carefully monitored and modified to control adverse impacts as they were observed. This proposal has two fatal flaws:

1. The future impacts of the project cannot be projected at all accurately without an up-front estimate of the recharge.
2. By the time an adverse impact is detected by the monitoring the groundwater system will be sufficiently perturbed that even completely stopping the pumping of native groundwater will not ameliorate the impacts.

The bottom line is that if a large quantity of native groundwater in mined from the Fenner-Cadiz system it will cause water levels to drop below the dry lakebeds. This in turn will result in an increase in dust from the two associated playas. An increase in dust from a similar dry lakebed in Owens Valley has been a difficult and expensive problem to attempt to ameliorate. In addition, saline water will move out from beneath the playas and invade parts of the aquifer that currently contain freshwater. Springs in the nearby mountains may be caused to dry up.

The connection between the springs in the nearby mountains and the pumping in the valley is undetermined. The proponents of the project argue there is no connection. However, there is insufficient understanding or empirical data to know what will happen to the springs. If the springs do dry up as a result of the local pumping it will have a severe impact on a local herd of Desert Bighorn Sheep.

The Cadiz Company does not seem to be concerned about these impacts. Once a large public investment is made in the project, the pressure will mount to continue the project including the mining of native groundwater.

INFEASIBILITY OF MONITORING & CONTROL

The Cadiz project entails a substantial investment of public funds to build the facilities—pipeline, pumping station, recharge basin, and well field. Monitoring the groundwater system by observing water levels and water quality might reveal that the project operation is creating adverse environmental impacts. However, the early warning signs will be subtle, at best. The signals will be obscured by effects of the project operations, both storage and pumping, and other natural water-level fluctuations

The Supplemental EIR/EIS—Monitoring and Control

A number of individuals, in commenting on the Draft EIR/EIS suggested that the recharge indicated the Draft Report was much too large—approximately an order of magnitude too large. The Supplemental Draft EIR/EIS did not address this issue directly; a different tack was taken. The Supplemental Report proposed extensive monitoring with the idea that adjustments could be made to the project operation that would ameliorate adverse impacts.

The idea put forward in the Supplemental EIR/EIS is that early signs of adverse impacts will trigger modifications in the project operations. Exactly how the operations will be changed is not specified. Nor is it specified what constitutes an early warning sign of an adverse impact—what is the signal that triggers a modification of the project. The trigger signals that indicate adverse impacts are also left unspecified.

The problem with this idea is that once the project has operated for several decades the groundwater system will be sufficiently perturbed that stopping the pumping of native groundwater by the project will not stop the adverse impacts. Entirely stopping the pumping of native groundwater is probably the most drastic corrective action that can be taken. Clear signs of an overdraft of native groundwater will not occur until the project has operated for some time. In the early stages of operation it will be easy to discount early warning signs of adverse impacts as the result of project operations (storing water and pumping stored water) or natural groundwater fluctuations

Once the groundwater system is perturbed, that perturbation will work its way through the system at a rate dictated by the response time of the groundwater system. It is much like a freight train put into motion; once it has started moving it will be difficult, if not impossible, to stop the system from responding.

The traditional method of analyzing the impact of stopping pumping in a groundwater system is:

1. to analyze the aquifer as if the pumping is continued; and
2. to superimpose a recharge well of opposite but equal magnitude at the site of the pumping well.

This has the effect that the impacts of the pumping continue to migrate through the aquifer even though the pumping has ceased. It takes some time for the impact of the

superimposed recharge well to catch up with the impact of the pumping. The rule of thumb is that the impact of the pumping after it is stopped persists for a time approximately equal to the time of pumping. For example if one pumps for a year and then stops, the impact of the pumping will persist for approximately another year—it takes a year for the aquifer to recover. Therein lies the difficulty for monitoring; adverse impacts persist within the system even after pumping ceases.

The problem of recovery of the system is compounded if a large quantity of groundwater is mined. I made the point above that a number of investigators suggested that the recharge to the aquifer in the area is probably 5,000 acre-feet annually (ac-ft/yr). This estimate is an order of magnitude lower than the estimate presented in the Draft EIR/EIS for the Cadiz Project; the project estimate was 50,000 to 60,000 ac-ft/yr. Let's assume for the sake of argument that the project is operated based upon the higher estimate of 50,000 ac-ft/yr. Let's further assume that in 10 years of operation:

pumping indigenous groundwater	10 years @ 50,000 ac-ft/yr	500,000 ac-ft
recharge	10 years @ 5,000 ac-ft/yr	50,000 ac-ft
overdraft (groundwater mined)		450,000 ac-ft

Even if we stopped pumping indigenous groundwater after 10 years of operation we have created an overdraft that will take at least 90 years to refill at a recharge rate of 5,000 ac-ft/yr. This is without any other natural discharge from the system. Of course there will be continued natural discharge or other extractions that the project operators will not be able to control. By extension, if the project extracts groundwater at the proposed rate for two or three decades as seems likely, an overdraft will be created that takes more than a century or two to replenish.

If one is sufficiently alert there will be subtle early warning signs of trouble ahead. However, the early warning will be sufficiently obscure as to not halt the mining of native groundwater. As suggested above, once the project has operated for several decades it will be impossible to halt the adverse impacts even if the pumping of native groundwater is stopped. Let me try to illustrate my point further with results from the earlier modeling.

Water Levels in Selected Observation Wells

Using a groundwater flow model I projected the drawdown at several observation wells to illustrate the point about the difficulty associated with monitoring and control of the Cadiz Project. In order to do the modeling one has to assume some schedule of project operations. My assumed schedule of recharge and pumping is shown in Figure 1. Figure 2 is a map showing selected hypothetical observation well locations. Figure 3 shows the model-projected hydrographs for the three hypothetical well locations.

Consider for example the drawdown in Fenner Valley as observed in the observation well near Danby—see Figures 2 and 3. This well has almost no drawdown in 40 years of project operation. The drawdown is approximately 3 feet in 50 years, but this is only the beginning. The drawdown is 10 feet in 100 years, 50 years after the project was shut

down, and the drawdown at Danby is continuing to decline. At 100 years the drawdown is continuing to migrate up Fenner Valley to the north even though the pumping was totally stopped 50 years earlier.

The monitoring situation is a bit clearer beneath Bristol Lake—see Figure 3. There is no decline in the water table beneath the center of the lake out to 20 years. By 30 years the drawdown is approximately 7 feet and by 50 years it is approximately 12 feet. Again this is only the beginning, the drawdown goes to 20 feet in 80 years and remains at 20 feet to 100 years. Even though the project was stopped after year 50, there is no recovery in water levels beneath the lake in 100 years.

Water Quality in Observation Well SCE 5

I ran a groundwater transport model to simulate the movement of the brine beneath Bristol Lake. Observation well SCE 5 is situated approximately halfway from the proposed project and Bristol Lake playa—see Figure 2. The total dissolved solids, as observed in this observation well, are plotted in Figure 4. Notice that the dissolved solids start to increase slightly in year 30. By year 45 it increases to 1,000 milligrams per liter (mg/l); by year 50 the concentration is 1,300 mg/l. This water is still useable; but again this is only the beginning. The concentration increases to more than 7,500 mg/l by 100 years, and it is still increasing—again the project was halted 50 years earlier.

The point shown especially by the brine movement is that we would have to halt the pumping of native groundwater very early on in order for there not to be a significant degradation in water quality at this location. I selected only one location to make my point, but this is not an isolated location; the degradation in water quality between Bristol Lake and the project will be widespread and continuing out to at least 100 years. The groundwater flow into the cone of depression will still be significant at 100 years. The groundwater flow from the region of Bristol Lake will bring with it brine from beneath the lake. The outward flow of brine will render the groundwater unusable without costly treatment. The modeling suggests an area more than 10 square miles will be impacted.

To make my point that adverse impacts persist I stopped the project after 50 years of operation. To the reader this may suggest a worst-case scenario analysis. However, as suggested above the same point can be made after a much shorter period. As indicated above after a one-year period of pumping at any rate (for example 5,000 ac-ft/yr), pumping impacts will exist in the system for approximately another year; after a decade they will persist for approximately another decade; and so forth. The magnitude of the drawdown created is a direct function of the pumping rate; for example, the drawdown from pumping at 50,000 ac-ft/yr is ten times larger than drawdown from pumping at 5,000 ac-ft/yr. However, the rate at which the impacts migrate outward from the well through the groundwater system are the same for both pumping rates.

Modeling as an Integral Part of Monitoring

Modeling is one of the tools that hydrogeologists use to assess impacts of development—in this case recharge and withdrawal. Models have the ability to project the impacts into

the future. The procedure in using a model is to fit the model output to empirical data. This procedure is referred to as ***calibration***, or in the petroleum industry ***history matching***. Once the model fits the observed data it is referred to as calibrated. The calibrated model is then used to make predictions of the future response of the system.

Models are routinely calibrated based upon limited data sets. A steady-state model can be calibrated using either a high or a low estimate of recharge. Usually the aquifer permeability is adjusted to compensate for the high or low estimate of recharge. It will take a period of sustained high pumping from the aquifer before the impact of the recharge rate will be felt and a better estimate of the recharge provided by the modeling or other analyses. The bottom line is that the long-term behavior of the aquifer cannot be accurately estimated without a good upfront estimate of recharge.

During calibration what constitutes a good fit to the observed data is a matter of judgment on the part of the modeler. Compounding the calibration is the fact that the data is never sufficient to provide a unique model. The modeler adjusts the model parameters until an adequate fit to the observations is achieved. However, the non-uniqueness arises from the fact that another set of different model parameters could provide a similar fit to the observations. In colloquial terms, there are too many knobs to adjust in the model to be sure that the model is unique. Even so, once the model is calibrated it is used to make predictions of aquifer response.

This leads to the fact that analysis of the future response using models, or other analytical tools, has an inherent uncertainty associated with the prediction. The question is: in a situation where one is controlling one's actions based upon model predictions that are uncertain, ***how seriously will the model results be taken?*** This question becomes more important as the investment in the project increases.

Model uncertainty is likely to be used as an excuse for not taking warning signs predicted by the model seriously. This is especially likely in a project like Cadiz where a very substantial initial investment is made in the project before the model begins predicting problems. The likelihood of discounting the early warning signs of a model prediction are even greater where the decision to take remedial action is controlled by parties having a direct financial stake in the production of native groundwater.

A FIVE-YEAR PILOT PROJECT

It has been suggested that concerns associated with the long-term impact of pumping native groundwater can be resolved by using the first five years of the project as a pilot project or trial period. Such a pilot project might give an indication of the potential long-term impacts of pumping groundwater; however, five years is a short period to reveal how the long-term pumping of large quantities of native groundwater will impact the system. In order to be at all definitive the pumping rate must be much larger than the current Cadiz Company pumping for agriculture. There is an additional practical problem; water for storage from the Colorado River is probably only available during the

first decade of project operation. This consideration will probably preclude pumping large quantities of native groundwater during the first five years.

The major uncertainty in pumping native groundwater by the Cadiz Project is the recharge—is it 50,000 or some larger figure, or is it 5,000 ac-ft/yr? A five-year project in which a large amount of indigenous groundwater is pumped may provide an indication of whether the proposed pumping is sustainable. The Cadiz Company is reportedly currently pumping approximately 5,000 ac-ft/yr and has been doing so for more than a decade. The impacts of the current pumping appear to be acceptable

At issue is what happens if the pumping of indigenous groundwater is increased dramatically—up to the 50,000 ac-ft/yr of the projected recharge in the Draft EIR/EIS. Unless the pumping in the pilot project is much larger than the current level of pumping by the Cadiz Company, the pilot project will be inconclusive at best, and possibly misleading. The pilot project pumping needs to approach the larger estimate of annual recharge to be meaningful

A pilot project that calls for pumping so large a level of native groundwater is inconsistent with the proposal to store large amounts of Colorado River water in the first decade of the project when it is anticipated surplus water will be available from the Colorado River. Beyond 2015 surplus water from the Colorado River may be quite limited.

A SUSTAINABLE PROJECT

Many of the objections to the Cadiz Project are based upon the analysis that the project as proposed will mine a large quantity of indigenous groundwater. Given our current understanding of the groundwater system in the area, only a project that pumped a smaller quantity of local groundwater while storing Colorado River water could be sustainable indefinitely.

As suggested above, the recharge to the Cadiz/Fenner valley aquifers is probably of the order of 5,000 ac-ft/yr. This is approximately equal to the quantity of groundwater being pumped for irrigation by the Cadiz Company. The current agricultural pumping has, or will capture the natural discharge that probably occurred as evaporation from the dry lakes under virgin conditions. The agricultural pumping been going on for more than decade and appears to have little, or no significant adverse impacts.

A Cadiz Project in which the quantity of groundwater pumped currently for irrigation is acquired by the project, and not exceeded, is probably sustainable. This would be pumping by the project instead of for agriculture—the irrigation by the Cadiz Company would cease.

Accordingly, I recommend a sustainable Cadiz Project in which the total pumping of native groundwater from the Cadiz/Fenner Valleys be restricted to an average of 5,000 ac-ft/yr.

CONCLUSIONS AND RECOMMENDATION

From my analysis I reached the following conclusions:

1. Valley aquifers is of the order of 5,000 ac-ft/yr, not 50,000 ac-ft/yr as suggested in the Draft EIR/EIS.
2. Water table groundwater systems respond slowly to perturbations. Impacts occur at long times into the future. This poses a challenge for monitoring and control. The delayed reaction of the groundwater system combined with the fact that the subtle indications of overdraft tend to be masked or easily confused with fluctuations due to other causes will profoundly undermine the early warning system that has been proposed The weight of evidence indicates that the recharge to the Cadiz/Fenner for the project. Furthermore, trigger levels of what constitutes an early warning sign of adverse consequences have not been specified. One is left with only verbal assurances that careful monitoring will inform the project staff when bad consequences are anticipated. What triggers a response and what the response will be is left unspecified.
3. Models are useful tools in the monitoring. They can be used to assess long-term impacts. However, future predictions made using models carry a degree of uncertainty inherent in the analysis. Given 1) the fact that a model analysis indicates an unwanted future adverse impact, and 2) the uncertainty inherent in the analysis, the question arises ***will such an analysis be sufficiently persuasive to modify or halt the mining of native groundwater—especially given the project investment?***
4. A five-year pilot project is a short time in which to collect sufficient data to evaluate the long-term viability of the project. The major uncertainty is the magnitude of the recharge. The Cadiz Company currently pumps approximately 5,000 ac-ft/yr without apparent adverse impacts. In order to assess the recharge issue the pumping must be much larger than the current Cadiz Company pumping. To be definitive the five-year pilot period must involve pumping an order of magnitude greater than the current pumping; even at the higher pumping rate the results may not be definitive. To assess the recharge the pilot project must entail mostly pumping indigenous groundwater during its five-year life. This appears to be in conflict with the availability of surplus water for storage from the Colorado River.
5. The Cadiz Project could probably be sustainable if one limited the magnitude of pumping of native groundwater to approximately the current rate of pumping by the Cadiz Company—5,000 ac-ft/yr. In a sustainable mode the project would acquire the irrigation pumping of the Cadiz Company—irrigation in the area would cease. This rate of pumping of native groundwater is equal to 250,000 ac-ft over the 50-year life of the project. ***It is my recommendation that the project be made sustainable with the pumping of native groundwater restricted to an average rate of 5,000 ac-ft/yr.***

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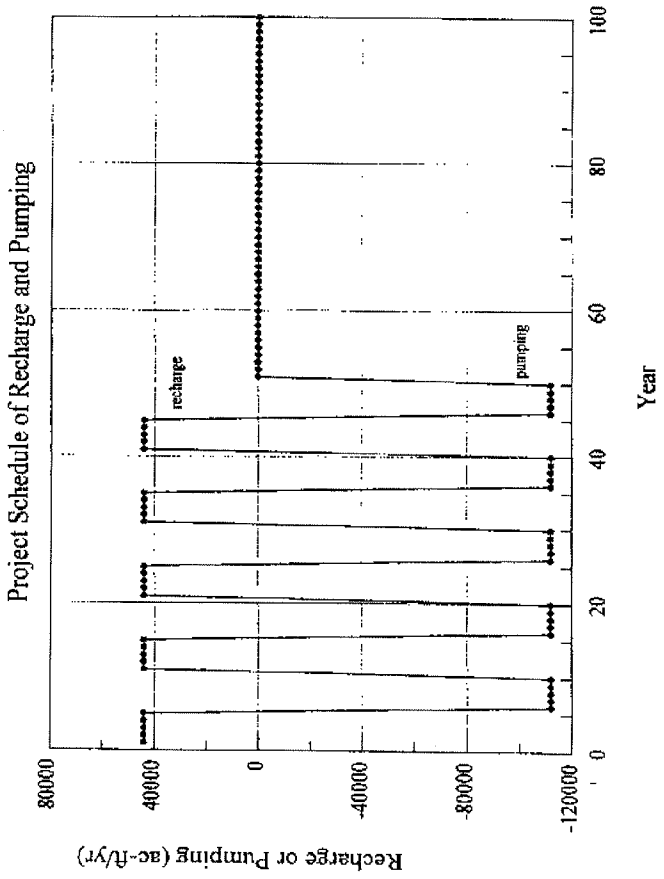

Figure 1. Hypothetical schedule of pumping and recharge.

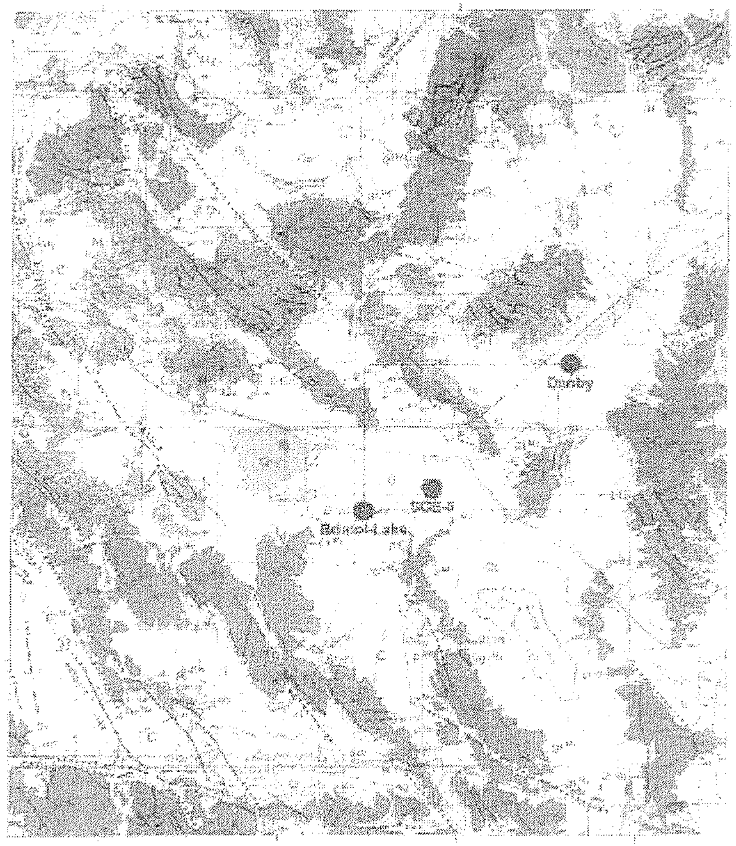

Figure 2
Location map of three
hypothetical observation wells

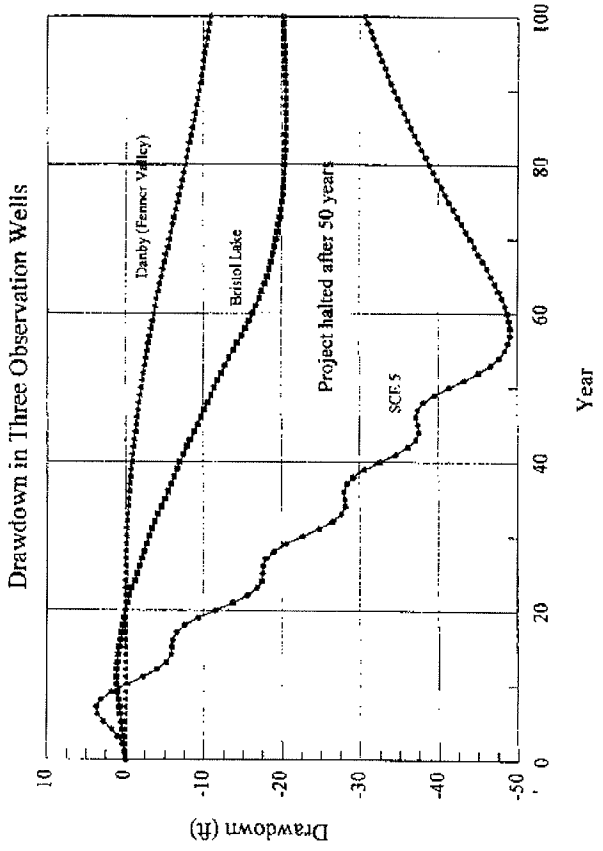

Figure 3. Computed drawdown in three hypothetical observation wells.

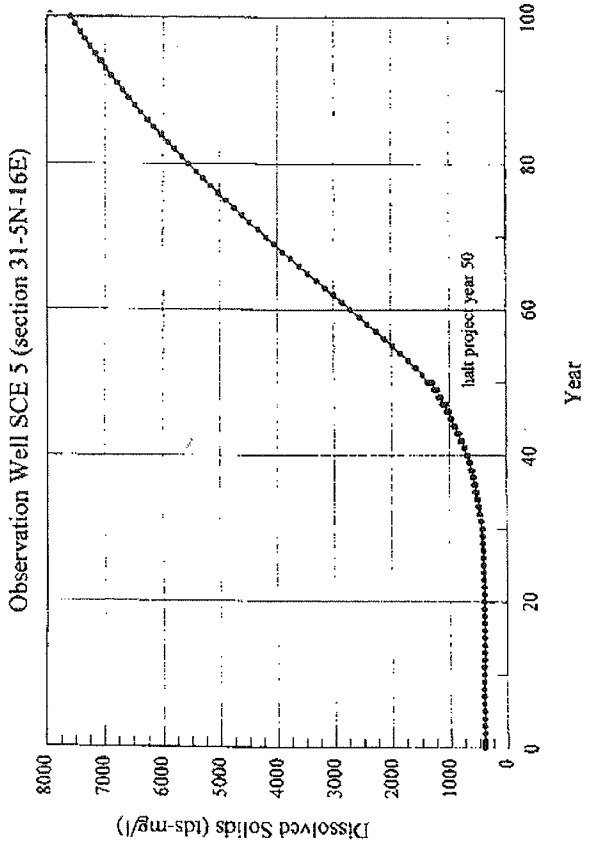

Figure 4. Computed plot of TDS in observation well SCE 5.

ATTACHMENT B

Review of the Cadiz Groundwater Storage and Dry-Year Supply Program Draft Environmental Planning Technical Report, Groundwater Resources, Volumes I and II

Technical Memorandum

Prepared by the United States Geological Survey

for the U.S. Department of the Interior, Bureau of Land Management

February 23, 2000

In Reply Refer To:
Mail Stop 423

Feb. 23, 2000

MEMORANDUM

To: Molly S. Brady, Field Manager
Bureau of Land Management, Needles, California

From: James F. Devine */Signed/*
Senior Advisor for Science Applications

Subject: Review of the Cadiz Groundwater Storage and Dry-Year Supply Program Draft Environmental Planning Technical Report, Groundwater Resources, Volumes I and II.

As requested by the U.S. Department of the Interior, Bureau of Land Management, the U.S. Geological Survey has reviewed the subject draft report. This draft report was written in support of the Cadiz Groundwater Storage and Dry-Year Supply Program Draft Environmental Impact Report/Draft Environmental Impact Statement/SCH. No. 99021039 (referred to as Draft Report in this review). This memorandum presents USGS comments.

GENERAL COMMENTS:

The Metropolitan Water District of Southern California has proposed a water storage project known as the Cadiz Groundwater Storage and Dry-Year Supply Program (Cadiz Project). The aim of the Cadiz Project is to ensure the reliability of Southern California's existing water supply via the Colorado River Aqueduct by storing Colorado River water in the Fenner, Bristol, and Cadiz watersheds during wet years and withdrawing stored water along with indigenous ground water during dry years. The proposed project would utilize the ground-water basin underlying the Cadiz and Fenner valleys for storage of part of Metropolitan's Colorado River supplies during wet years for later recovery and use during dry years. One of the stated project objectives is to provide up to 2.0 million acre-feet (maf) of indigenous ground water for transfer out of the watershed. In the Draft Report, indigenous ground water is defined as water that naturally recharges the ground-water system on a long-term average. A watershed model and water balance calculations, developed as part of the Draft Report, estimated that the quantity of indigenous water ranges from 20,000 to 71,000 acre-feet per year. A ground-water flow model was used to evaluate the impacts of the proposed project; the model assumed that the annual recharge to the Fenner, Bristol, and Cadiz watersheds was 50,000 acre-feet per year. The review of the Draft Report shows that the watershed model and water-balance studies presented in the Draft Report overestimate the natural recharge to the basin by 5 to 25 times the values estimated

by this review team using similar methods. It is the opinion of the review team that the regional watershed model, water-balance studies, and ground-water flow and transport models were used without adequate data to support the results and the conclusions presented in the Draft Report. The assumptions and methods applied in the development and calibration of both the watershed and ground-water flow models, which are essential for predicting the environmental impacts of the proposed project, are not defensible. The ground-water flow model was developed using an overestimate of natural recharge. This calls into question the usefulness of using the results of the ground-water flow model for predicting the environmental impact of this project. Until more appropriate fluxes and boundary conditions are used, the environmental impact of this study is yet unknown. The following discussion highlights the analysis and rationale for the above statements.

A watershed model was used to calculate "recoverable water" in the basin. Recoverable water was defined in the Draft Report as the total amount of surface runoff and infiltrating water that reaches the regional water table (ground-water recharge or indigenous ground water). The Draft Report estimates that the total amount of recoverable water for the entire watershed ranges from 20,000 to 58,000 acre-feet per year, with a median value of 39,000 acre-feet per year. The watershed model is a detailed daily water budget model: daily precipitation, infiltration, runoff, vegetation interception, evapotranspiration, soil moisture, and percolation are addressed. However, the model does not address bedrock permeability, and this may become an important factor for upland areas, such as the Providence Mountains, where low permeability granitic and metamorphic rocks underlie shallow soils. The model simulates the greatest amount of percolation in these areas; however, the bedrock permeability may be less than the simulated percolation rates. If this is the case, the model should be simulating runoff instead of percolation. Another major problem is that the model does not incorporate any routines to route water through the surface drainage network and estimate downstream flows and subsequent percolation. The fact that runoff occurs does not imply that the water will percolate farther downstream in the basin and eventually become recharge. Vegetation in desert environments is very efficient at extracting soil water from great depths. For example, creosote has been reported to extract water from depths as great as 18 feet below land surface. The model will overestimate the recoverable water (annual recharge) to the watershed because the watershed model does not address bedrock permeability and assumes that all runoff from a soil area becomes recharge.

Two types of data were used in the Draft Report to support the watershed model results: chloride mass balance data and isotopic data. The chloride mass balance approach was not properly applied and greatly overestimates water availability in the basin. In the Draft Report, the total area of the Fenner watershed was assumed to contribute recharge; however, studies by Prudic (1994) and Izbicki et al. (1998) indicate that recharge has not occurred on the valley floors of the neighboring Ward Valley and Mojave River basin for thousands of years. Dettinger (1989) estimated that some recharge might occur in alluvial basins in Nevada as a result of precipitation, runoff, and infiltration at elevations in excess of 4,000 feet. If one assumes that recharge only occurs at elevations in excess of 4,000 feet in the Fenner watershed, this would reduce the area of potential recharge from 718,000 acres to 126,000 acres. Another problem with the chloride mass balance approach, as applied in the Draft Report, is that the assumed chloride concentration of precipitation (3.5 milligrams per liter) is much higher than the values used by other investigators (0.4 to 0.8 milligram per liter) (Dettinger, 1989; Prudic, 1994). If one assumes that

only the area of the watershed with elevations in excess of 4,000 feet can contribute recharge and that the chloride concentration of precipitation is 0.8 milligram per liter (Prudic, 1994), then the estimated recharge for the Fenner watershed, using the chloride mass-balance approach, is 1,710 acre-feet per year. This value is more than 20 times less than the value of 40,000 acre-feet per year estimated in the Draft Report.

The occurrence of active ground–water recharge in the Fenner, Bristol, and Cadiz watersheds is reported in the Draft Report to be supported by isotopic evidence of geologically "recent" (Holocene) age of ground water. Carbon-14 data from observation wells in Fenner Gap range from 18 to 25 percent modern carbon and have apparent ages ranging from 11,500 to 14,000 years before present. The Draft Report suggests that water-rock reactions have occurred and ground-water ages are younger than the apparent ages indicate. On the basis of carbon-13 data provided as part of the Draft Report, it is apparent that reactions have occurred between ground water and aquifer materials; however, it is still possible to interpret the carbon-14 data. A complete interpretation of possible rock-water reactions and resulting corrections in carbon-14 data was beyond the scope of this review; however, an estimate of corrected carbon-14 ages for the Fenner Gap samples was made on the basis of data and rock-water reactions interpreted from other studies. As described in the review comments for section 9.3, the corrected carbon-14 ages range from 5,500 to 10,600 years before present. As a group, the isotopic data show that there is limited recharge under present-day climatic conditions and that ground water sampled at Fenner Gap was recharged thousands of years ago.

The USGS, as part of this review, estimated recharge in the Fenner, Bristol, and Cadiz watersheds using a modified Maxey-Eakin model (1949). The model assumptions and results are included as an attachment to this review. The USGS completed two models for the region. The first model used an elevation-precipitation correlation based on a network of 114 precipitation stations in the Great Basin and the Mojave Desert and represents the regional elevation-precipitation correlation. The second model used an elevation-precipitation correlation for four stations in or near the Cadiz watershed. This model provides unrealistically high estimates of precipitation for elevations of 5,000 feet and higher and does not correctly represent the relation of precipitation with elevation on a regional basis (see attachment). Recharge estimates obtained using the first model provided reasonable estimates of spatially distributed recharge based on a comparison of recharge estimates obtained for various locations throughout the southern Nevada and south-central Great Basin regions. The estimates obtained from the first model were consistent with previous estimates of recharge in the Mojave Desert region, and were more than one order of magnitude less than the recharge estimates obtained from the Draft Report for the three watersheds included in the Cadiz study area. For example, the Draft Report estimated median value of 39,077 acre-feet per year for the three Cadiz area watersheds is 15 times greater than the USGS model (model 1) estimate of 2,550 acre-feet per year. Recharge estimates obtained using the second model were based on unjustifiably high maximum precipitation rates of 500 to 750 millimeters per year for the higher elevations of approximately 6,500 to 7,500 feet. Although precipitation estimates obtained using the second model can be considered reasonable for elevations of approximately 4,000 feet and less, the relatively high precipitation estimates obtained for the summit areas of the Granite and New York Mountains are more representative of expected precipitation rates for elevations of 10,000 feet and higher in the southern Basin and Range Province. Even when using the very unrealistic precipitation rate

for the Cadiz area, the total basin recharge estimated by the second model is still approximately 5 times less than the total basin recharge simulated in the ground-water flow model developed for this Draft Report. This result indicates that the modified Maxey-Eakin model cannot provide the recharge magnitudes indicated in the Draft Report, even when attempts are made to account for uncertainty in precipitation estimates (the original Maxey-Eakin model would estimate even less recharge). In summary, the median recharge rates estimated by the Draft Report watershed model are most likely 15 times higher than the values estimated by the preliminary Maxey-Eakin models developed by the USGS.

The water-balance studies in the Draft Report estimated long-term recharge by estimating discharge by soil evaporation on the Bristol and Cadiz dry lakes. Prior to ground-water development in the watershed, natural ground-water recharge was equal to natural ground-water discharge or, in this case, soil evaporation from Bristol and Cadiz dry lakes. The Report multiplied an assumed soil evaporation rate by the area of the dry lakes. This method assumes evaporation occurs over the entire area of the lakebed (41,600 acres for Bristol and 29,788 acres for Cadiz) and neglects any contribution by surface-water runoff on the lakebed. The total evaporation estimated in the report ranged from 20,000 to 71,000 acre-feet per year. The final value used in the ground-water model developed for the Draft Report was 50,000 acre-feet per year; therefore, the average evaporation rate used in the Draft Report was 0.7 foot per year. As part of this review, the USGS measured the area of the lakebeds to be 58,457 acres, about 13,000 acres less than the Draft Report value. Water-level data from wells constructed on the lakebed indicate that the depth to water exceeds 10 feet throughout most of Bristol dry lake (Moyle, 1967). Kunkel and Chase (1969) estimated that the annual rate of evaporation from bare soil on China Lake in Indian Wells Valley decreased to negligible amounts at water-level depths of more than 7 feet below land surface. An ongoing study by the USGS in Death Valley has measured rates of about 0.17 feet/year on a salt playa (salt crust) where the depth to water was less than 1 foot (Guy DeMeo, USGS, WRD, Las Vegas, Nevada, written communication, 2000). If one uses the Death Valley number for the evaporation rate (0.17 foot per year), and multiplies that by the area of dry lake playa surface digitized from the geologic map (58,457 acres), the estimated evaporation is 9,900 acre-feet per year. This value probably overestimates the evaporation, because it uses the total area of the lakebeds and ignores any contribution from surface runoff. The total evaporation used in the ground-water flow model (50,000 acre-feet per year) is unreasonable on the basis of depth to water and soil characteristics, and needs to be significantly reduced. Multiple depth monitoring wells are needed on the dry lakes to determine the depth to water. The evaporation from the lakebeds needs to be measured using energy-budget methods (Laczniak et al., 1999) or salt crust accumulation methods (Feth and Brown, 1962) to better quantify this water loss.

As has been stated above, the quantity of natural ground-water recharge to the Fenner, Bristol, and Cadiz watersheds and discharge (evapotranspiration) from Bristol and Cadiz dry lakes has been grossly overestimated. A direct result of these overestimates of recharge and discharge is that the ground-water flow model developed as part of the Draft Report is incorrect because it was calibrated using overestimated recharge and evapotranspiration values. Specifically, the aquifer parameters (e.g., hydraulic conductivity, transmissivity, and the extinction depth for soil evaporation from the dry lakebeds) are overestimated. In general, the consequences of an incorrect model are inaccurate simulations of steady-state and transient conditions (water levels

and simulated fluxes) and unreasonable predictions of water levels and fluxes in response to the proposed put/take scenarios. The model needs to be recalibrated before it can be used to predict water-level changes, solute movement, and land subsidence resulting from the planned recharge/pumpage operation. The operating scenarios described for the Cadiz Project's 50-year term of operations indicate a transfer of 1.3 to 2.0 million acre-feet of indigenous ground water out of the watershed. The Draft Report assumes that 2.5 million acre-feet of natural ground water will recharge the watershed over the 50-year term of the project; therefore, the Draft Report predicts that there will be no long-term ground-water-level declines. However, if the natural recharge is less than the quantity of indigenous ground water transferred out of the watershed, water-level declines will be greater than currently simulated by the model. The ground-water flow model needs to be recalibrated with lower values of natural ground-water recharge. After the model has been recalibrated, the model needs to simulate the long-term effects (100 to1,000 years) of the proposed project on water levels and ground-water discharge to Bristol and Cadiz dry lakes. The model grid will need to be expanded to evaluate the long-term impact of ground-water withdrawls on spring discharge and water levels in Fenner Valley.

The brines present beneath the dry lakes have a greater density than freshwater. Consequently, a density-dependent solute transport model is needed to accurately simulate the movement of the brine. A nondensity-dependent model, MT3D, was used to simulate the brine movement for this Draft Report. This model cannot simulate a density-dependent solute transport problem and, therefore, any results and conclusions regarding the water levels and movement of brine near the dry lakes are questionable.

In summary, the results of the watershed model, chloride mass-balance studies, isotopic data, water balance (evaporation at the dry lakes), and ground-water flow and solute transport models presented in the Draft Report greatly overestimate natural ground-water recharge and discharge. Data presented in the Draft Report and all previous studies done in the area are consistent with small amounts of recharge to desert basins. The 50,000 acre-feet per year of natural ground-water recharge to the Fenner, Bristol, and Cadiz watersheds is 5 to 25 times the values estimated by the review team. Such a large error in such an important component of the model invalidates the flow and solute model results and predictions. No matter what the actual recharge value is, if the project pumps more water than it recharges, there will be less ground-water discharge at the dry lakes. Over the long-term, this will cause water levels beneath the dry lakes to decline. A density-dependent solute-transport model is needed to evaluate the long-term impacts of the project on the brine levels. The Draft Report does not address how water-level declines will impact the dry lakes. With a decrease in ground-water discharge, will the mining operation at the dry lakes be impacted? Will lower water levels cause the upper sediments to dry out and result in a dust problem? The failure of the model to simulate the water levels beneath dry lakes invalidates the model's ability to predict any impacts resulting from the recharge/pumping operation on water levels and solute transport beneath the dry lakes. With less recharge in the model, water-level declines resulting from the pumping phase of the project will be greater than currently estimated. This will undoubtedly cause the high salinity water beneath Bristol dry lake to move towards the pumping wells, assuming there does not exist a ground-water barrier between the well field and Bristol dry lake. If ground-water pumpage of indigenous ground water exceeds the natural recharge to the watershed, there will be long-term impacts on water

levels and natural ground-water discharge (evaporation and spring discharge) from the watershed.

As part of this review, the U.S. Geological Survey was requested to recommend ground-water monitoring and management strategies for the Cadiz Project. Preliminary recommendations are included in this summary and throughout the review document. Following are some of the more significant recommendations. Prior to the initiation of this project, better estimates of natural recharge and discharge need to be made. Infiltration of precipitation and streamflow should be quantified by collecting soil-moisture, chemical, and isotopic data in areas of potential recharge. A long-term ground-water-level and quality monitoring network needs to be established to help determine the impacts from the project. The network should include multiple-well monitoring sites to monitor water levels and water quality with depth. Monitor wells will be needed on the dry lakes to determine if the lakes are hydraulically connected to the regional aquifer. Monitor wells will be needed above the current water table to sample the recharge water during the put phase of the project, when water levels will rise in response to the artificial recharge. Wells will also be needed about 100, 250, and 500 feet below the current water table to monitor the movement of the recharge water. Microgravity measurements could be collected to estimate water levels in areas where well data are sparse. A revised ground-water flow model could be used to optimally locate the monitor well sites. Springs within the predicted long-term (100-year) drawdown cone should be monitored for flow and water quality. Velocity logs and downhole sampling should be completed on the production wells to help determine the principal zones contributing water to the wells. This information will be important for recalibrating the ground-water flow model and designing the proposed well field. Soil evaporation from Bristol and Cadiz dry lakes should be measured using energy-budget or salt accumulation methods prior to and during the proposed project to help determine the impact of the project on the dry lakes. Interferometric synthetic aperture radar (INSAR) could be used to monitor land movement (inflation or subsidence) that may occur as a result of the proposed project (Galloway et al., 1998). The INSAR images could be used to help locate potential barriers or changes in aquifer properties.

SPECIFIC COMMENTS:

2.0--INTRODUCTION

Page 15, 2.2, Purpose and Scope. Is this the purpose and scope for the entire project or just for the pilot study? In this part of the report one would expect the purpose and scope for the entire project. Much of the material that follows has to do with determining the hydrogeology of the area. The pilot test study is a small part of Volumes I and II.

Page 16, 2.4, Previous Investigations. The authors list previous investigations but do not list the major findings of the reports. For example, Friewald (1984) estimated underflow through Fenner Gap to be 300 acre-feet per year, significantly less than the value of 30,000 acre-feet per year presented in the Draft Report. The report states that Prudic (1994) estimated percolation rates and ages of water in the unsaturated sediments in the Mojave Desert. The Draft Report neglects to report that Prudic (1994) estimated that the age of water at the depth of 10 meters is between 16,000 and 33,000 years. In addition, percolation rates below a depth of 10 meters at

the Ward Valley site (the basin directly east of Fenner Valley) were on the order of 3 to 5 centimeters per 1,000 years. Prudic's results indicate that there is no recent recharge at the sites that he studied. The Draft Report presents a list of companies involved with investigations in the Bristol and Cadiz dry lake areas but does not discuss the findings of these studies. The reports by P.E. LaMoreaux & Associates, Inc. (1995) and Boyle Engineering Corporation (1996) question the quantity of ground-water underflow reported by Cadiz Land Company, Inc. (20,000 acre-feet per year) and suggest that the quantity of underflow is significantly less (3,000-4,000 acre-feet per year). The results of these studies need to be presented and evaluated.

Page 19, 2.5, Data Sources. The Draft Report states that it used data from Moyle (1967), but later in the Draft Report, Moyle's (1967) measurements of depth to water beneath the dry lakes were not used in the computation of evaporation from the dry lakes. The report utilizes data by Shafer (1964) later in the Draft Report to substantiate paleo river channels. This report is not readily available; therefore, it would be beneficial to reproduce some of the key elements of the Shafer (1964) report in this document.

3.0--DESCRIPTION OF AREA

Page 29, 3.2, Drainage Boundaries and Surface Stream System. The Draft Report considers Bristol, Cadiz, and Fenner one drainage system because all surface and ground water are reported to drain to a central location. However, it should be noted that the surface-water drainages of Bristol and Cadiz are separated by the coalesced alluvial fans of the Calumet Mountains to the south and the Marble Mountains to the north. Rosen (1992) reports that both basins have completely separate internal drainage. The ground-water basins are not well defined; however, northwest-southwest regional faulting may separate the Bristol and Cadiz ground-water systems. Sparse water-level data from Moyle (1967) suggest that there may be a barrier to ground-water flow on the eastern end of Bristol Dry Lake. Additional data are needed to better define the ground-water flow system. Data are not presented in the report to show that Bristol and Cadiz basins are closed ground-water basins.

The Draft Report includes the southern third of Lanfair Valley in the Fenner watershed. The southern third of Lanfair Valley is indeed part of the surface-water drainage system; however, it is probably not part of the Fenner ground-water basin. Friewald (1984) includes the southern third of the Lanfair Valley as part of the Lanfair ground-water basin. Ground water that recharges at the flanks of the New York Mountains moves to the east in Lanfair Valley and discharges at Piute Spring on the eastern part of the valley (Friewald, 1984). The Woods and Hackberry Mountains and the Vontrigger Hills form the southern boundary to the Lanfair ground-water basin. Surface-water drainage occurs along the Watson Wash; however, available data do not indicate that ground water follows the same drainage. Geophysical data or well data are needed to define the thickness of the basin-fill deposits beneath the Watson Wash to determine if ground water can move through the narrow gap between the Woods and Hackberry Mountains. The Draft Report references a study by Viceroy Gold Corporation (1990) as a basis for including the southern third of Lanfair Valley in the Fenner ground-water basin. Because this reference is not readily available, the data presented in the Viceroy (1990) study should be included in the Draft Report to substantiate including the southwestern third of Lanfair Valley in the Fenner ground-water basin. In any case, the quantity of ground-water discharge from Lanfair

Valley to Fenner Valley must be small because of the limited extent of the aquifer in the mountain gaps.

The Draft Report cites Izbicki et al. (1998) to imply that infiltration from washes during storm events is a source of recharge to Fenner basin. The work described in that paper was done in the western part of the Mojave Desert in washes that drain the Cajon Pass area. This area is far wetter than the Fenner watershed. In addition, the wash studied has some unique geologic features that may not be applicable to the washes draining the Fenner Basin. Furthermore, Izbicki et al. (1998) indicate that the quantity of flow and the amount of recharge from the wash are small and that travel times through the thick unsaturated zone are as long as several hundred years.

Page 30, 3.3, Climate.

Page 31, 3.3.2, Precipitation.

Page 34, 3.3.6, Evaporation. Please show graph of monthly evaporation rates.

4.0--GEOLOGY

Page 35, 4.1, Regional Geologic Setting. The depression that forms the Bristol watershed is believed to be the result of regional movement along the fault (Rosen, 1989). What is the age of these faults and do they cut the water-bearing deposits?

Page 35, 4.2, Stratigraphy. Grouping the geologic formations into only three groups (bedrock, loose alluvial sediments, and fine-grained sediments underlying Bristol and Cadiz dry lakes) is an oversimplification. Inspection of the geologic and geophysical logs presented in the Draft Report indicates that the alluvial sediments become more fine-grained and indurated with depth. Most of the loose alluvial sediments as described in the Draft Report lie above the water table. The Draft Report presents figure 17 showing the estimated bedrock elevations of the Bristol, Cadiz, and Fenner watersheds and cites Maas (1994) as the source of the data. How were these bedrock elevations determined? What geophysical techniques were utilized? Borehole data, showing the elevation where bedrock was encountered, should be included on figure 17. Figure 19 in the Draft Report shows the estimated depth to bedrock in the Fenner Gap area. This map does not contour the depth to bedrock correctly in the areas where well data are available. For example wells MW-7 encountered bedrock at a depth of about 500 feet. Figure 19 has a contour of 1,500 feet passing near this well. Figure 19 overestimates the depth to bedrock in Fenner Gap and the map is incorrectly contoured. Well data need to be shown on the map. Symbols shown on the map need to be included in the explanation. The data used to construct the simplified seismic cross section (figure 20) should be included with the Draft Report.

The statement that most of the sediment is Holocene is questionable. Numerous studies have shown that Pleistocene soils are widespread and common at the surface in the Mojave Desert, and where they are not present at the surface they are commonly present just a few meters beneath Holocene alluvial fan sediment. See McDonald et al. (1995) for one of many nearby examples. Several photographs in Volume 1 nicely illustrate the argillic and calcic horizons in

the area, and the section on paleontology describes calcic materials in the area of the well field. Unpublished geologic mapping by USGS identifies widespread Pleistocene soils in the area. For example, much of the valley between the Marble and Clipper Mountains is underlain by stage IV calcic horizons within one meter of the surface. Argillic horizons are important hydrologically, and their presence is hinted at by the non-linear rate of percolation in the percolation pond experiments.

Page 37, 4.3, Structure. The Draft Report states that more than a dozen faults (figure18) is evidence of Quaternary movement in the Fenner watershed. How do these faults affect the movement of ground water? Why weren't these faults considered in the development of the ground-water model described later in the Draft Report? Rosen (1989) is cited as saying that subsidence of the Bristol dry lake continues to the present. This would suggest that the faults cut the aquifer system, and are potential barriers to ground-water flow. These faults could have a major impact on the storage and recovery operation if they are barriers or partial barriers to ground-water flow.

Figure 18 does not include the Iron Mountains Fault, which may connect to the northwest with the Bristol-Granite Mountains Fault and thereby pass near the well field at Cadiz. In addition, this figure is incorrectly ascribed to the reference by Miller and Howard (1985); that paper included the Iron Mountains Fault and did not show many of the connections of faults across the Bristol-Danby trough. The faults shown in figure 18 must correctly reflect the cited source, which shows the Iron Mountains fault as Quaternary. The steep slope on the buried basement surface under the proposed well field could be support for a connection of the Iron Mountains and Bristol-Granite Mountains faults. The well field accordingly may straddle a buried fault only a few meters beneath the surface, which may have hydrologic implications and seismic hazard implications.

The Draft Report cites geothermal heating (up to 90°F) in the Fenner Gap and suggests that the heating may be caused by convection of ground water with a zone of brecciated bedrock in the Fenner Gap. What is the flowpath for the ground water to move into the brecciated bedrock? The presence of the geothermal water would preclude a significant quantity of underflow of ground water through the alluvial deposits in Fenner Gap. If there were a significant quantity of underflow through the gap, one would expect cooler temperatures associated with winter recharge of precipitation and runoff (around 60°F).

5.0--GEOHYDROLOGY

Page 39, 5.1, Groundwater Basins. The Draft Report assumes that Bristol, Cadiz, and Fenner basins are closed; however, hydrologic data are not presented in the report to substantiate this statement. Does ground water move from Dale dry lake to Cadiz or from Cadiz ground-water basin to the southern part of Ward Valley? Water-level and geologic data are needed to support the statement that the basins are closed.

The Draft Report assumes that the topographic divides form the margins of the ground-water basins. This assumption will result in the overestimation of the size of the ground-water basins, because most of the margins of the basin consist of nonwater-bearing consolidated rocks. The

ground-water basins should be defined by the contact of the consolidated rocks and the saturated basin fill.

Page 39, 5.2, Aquifer Systems. Sediments in the basins may, and almost certatinly does, include the early Miocene volcanic rocks and associated sediments, which are shown on the geologic maps and described in the geologic history, but ignored in the treatment of materials in the basins. Volcanic rocks dip northeast from the Marble Mountains and roughly north from the Ship Mountains. It seems likely that some of this section is present in deeper parts of the ground-water basin.

The upper alluvial unit is unlikely to be just Quaternary sediments as defined. Quaternary sediments have accumulated at rates of a few meters per ten thousand years, and even in sites of rapid deposition are unlikely to be 800 feet thick, as described in the Draft Report. Regardless of their exact thickness, numerous buried soil horizons are to be expected within a thick Quaternary section.

The Draft Report divides the basin into an upper alluvial aquifer, lower alluvial aquifer, and a bedrock aquifer. It is unclear how the upper and lower alluvial aquifers were delineated. The report states that the average thickness of the upper aquifer is 500 feet. Does this thickness include the unsaturated alluvium? Inspection of the geophysical and lithologic logs presented in the Draft Report indicates that the deposits become poorly sorted with a higher percentage of fine grained deposits at about 300 to 400 feet below land surface in the Fenner Gap (MW-3, MW-6, and MW-7). Inspection of the short- and long-normal resistivity logs indicates that there is little separation between the logs. The lack of separation suggests that the sediments are fine-grained or indurated. The spontaneous potential log also shifts at this point in the borehole, indicating a change in water chemistry or sediments. This change in character on the logs is probably the contact between the upper alluvial sediments and the lower alluvial sediments. The long-normal resistivity averages about 40 ohm-m above the contact and less than 20 ohm-m below the contact. The water table is about 300 feet below land surface in the Fenner Gap; therefore, the saturated thickness of the upper alluvial aquifer is on the order of only 100 feet in the Fenner Gap. The lower aquifer would then extend from 400 feet below land surface to the top of the bedrock. As indicated on the lithologic logs and shown on plate 3 of Draft Report, these lower sediments contain high percentages of silt and clay and are less permeable than the overlying deposits.

The Draft Report states that the upper aquifer is very permeable. This statement is based on pumping well PW-1. Well PW-1 is located downgradient of the Fenner Gap, and is probably in the Bristol Trough as described by Jachens et al. (1992). Inspection of the lithologic and geophysical logs for PW-1 indicates that well encountered relatively permeable deposits to a depth of 650 feet. Inspection of the short and long normal resistivity logs shows significant separation to this depth, suggesting permeable deposits. Below 650 feet the logs merge together and decrease in resistivity, suggesting less permeable deposits. The long normal resistivity decreases from about 50 ohm-m above 650 feet below land surface to less than 30 ohm-m below 650 feet. The water table at PW-1 is about 275 feet below land surface. These interpretations indicate that the saturated thickness of the upper alluvial aquifer is about 375 feet at well PW-1 compared with 120 feet at well MW-3.

The lower alluvial aquifer is reported to yield water freely to wells. This statement is supported in the Draft Report by the statement that the "Cadiz agricultural wells are screened primarily in the lower alluvial aquifer and typically yield 1,000 to 2,000 gallons per minute." The Draft Report needs to present the lithologic and geophysical logs, well-construction information, and specific-capacity data to support this statement. As indicated later in the water-quality section of this review, the water chemistry of the Cadiz agricultural wells is significantly different than the chemistry in the Fenner Gap wells, suggesting that the Cadiz wells are pumping water from the upper alluvial aquifer.

The Draft Report indicates that the recent drilling in Fenner Gap indicates that the Paleozoic rocks that underlie the Fenner Gap comprise a third aquifer unit. The data that support this statement need to be presented in the Draft Report. Well CI-2 is perforated in the "bedrock aquifer." What is the specific capacity of this well?

5.3 Groundwater Recharge, Flow Direction, and Flow Rate

Page 40, 5.3.1, Groundwater Recharge. See comments regarding the infiltration from washes inferred from Izbicki et al. (1998) in the section 3.2 comments. The report cites several references as reporting that the principal recharge to Bristol and Cadiz dry lakes is seepage of ground water into the lakebed sediments from adjacent alluvial deposits. Did these references estimate the quantity of ground-water seepage?

The Draft Report states that the occurrence of active ground-water replenishment within the Bristol, Cadiz, and Fenner watersheds is supported by (1) the existence of a regionally consistent hydraulic gradient, (2) isotopic evidence for a geologically "recent" age of the ground water, and (3) stable ground-water elevation recorded in wells located between Fenner Gap and Bristol dry lake despite continuous ground-water pumping by Cadiz agricultural operations for more than 15 years. What does a regionally consistent hydraulic gradient indicate? The gradient is dependent on the aquifer hydraulic conductivity and the quantity of ground-water flow. If the hydraulic conductivity is poorly defined, then the gradient doesn't indicate the quantity of flow. Please refer to the comments about isotopic evidence for geologically "recent" (Holocene) age for ground water in comments for Section 9.33. It is stated that the ground-water elevations have been "stable"; however, data indicate predevelopment water-level elevations of about 600-625 feet while figs. X-4 to X-15 show current water-level elevations of about 580 feet or less. This indicates there has been drawdown in the area under relatively low pumping rates. The report by Boyle Engineering Corporation (1996) states that the measured drawdowns in the Cadiz wells indicate that the perennial yield of the basin is less than 4,000 acre-feet per year.

The estimated average amount of recoverable water (surface runoff and ground-water recharge) available to Project area is reported to range from 15,000 to 37,000 acre-feet per year. What is the breakdown of quantities of surface runoff and ground-water recharge? How was the surface water routed from Fenner Gap to Bristol and Cadiz dry lakes? Was the surface-water drainage divide between Bristol and Cadiz dry lakes considered? The validity of these numbers will be discussed in the review of Section 6.0. Based on model results presented in Section 8, the amount of ground water available to the Project area on an annual basis is estimated to be 30,000

acre-feet per year. The validity of this number will be discussed in the review of Section 8. These numbers should not be presented in this part of the Draft Report.

Page 41, 5.3.2, Groundwater Flow Direction. The data used to construct the water-level elevation map (figure 21) needs to be included in the Draft Report. The data points need to be presented on the map. Does the map represent water levels collected at the same time or is it a collection of different time periods? The map does not accurately represent the water levels measured in the Fenner Gap area. For example the water level reported for the Siam well 5N/15E-4X1 is 641 feet but the map indicates a water level of 670 feet. Well 6N/15E-29Q has a measured water level of about 690 feet; however, on the map the water level is about 750 feet. These are just two examples of many problems on the contour map. With the scarcity of data, many of the contour lines should be queried. What impacts do the faults have on the ground-water flow direction? One would think that the northwest/southeast trending faults might be barriers to flow. In addition, geothermal heating (presented in Section 4.3) indicates that the faults are impacting the flow system. The Draft Report states that ground water flows through Fenner Gap and then migrates to Bristol and Cadiz dry lakes. If the water levels for the Cadiz agricultural wells (presented in the Draft Report) are plotted on the map, there is a water-level depression related to the 15 years of agricultural pumping (water-level elevations range from 590 feet on the north end of the agricultural fields to 530 feet on the south end of the fields. How has this agricultural pumping changed the predevelopment movement of ground water? Water levels beneath the fields are currently lower than historical water-level measurements beneath Bristol dry lake (Moyle, 1967), indicating that ground water moving southward through Fenner Gap will be captured by the irrigation wells.

The Draft Report refers to a "paleowash" identified by a seismic survey in the vicinity of Danby (Shafer, 1964). The seismic data should be presented in the Draft Report. How deep was the "paleowash"? The Draft Report states that water levels support a "paleowash." The water-level data simply indicate the direction of ground-water movement. Fenner Gap is a discharge point from Fenner Valley, therefore, ground water is moving towards this discharge point. How was it determined that no ground water moves through Skeleton Pass? Are there any water-level or geologic data to support this statement? The water-level contour map (figure 21) indicates that ground water moves through Skeleton Pass.

Page 42, 5.3.3, Groundwater Flow Rate. How were the ground-water flow rates determined? Supporting data need to be presented. These data should be presented in chapter 9.

5.4 Groundwater Discharge

Page 42, 5.4.1, Evaporation. Ground-water levels along the east end of Bristol dry lake are as much as 50 feet below land surface (Moyle, 1967; and this Draft Report). Surface evaporation from these depths would be very small. This suggests that ground-water discharge from Fenner Valley also is small. The evaporation estimates are discussed in great detail in the review of s Section 6.6.2.

Page 43, 5.4.2, Ground-water Pumping in Area. The volume of water pumped by Cadiz agricultural operations cited in the second and third paragraphs appears to be contradictory.

Page 44, 5.5, Ground-water Storage. Ground-water storage values are presented here without supporting documentation. These values should not be presented until the method is discussed. These values will be discussed in the review of Section 6.4.

Page 44, 5.6, Ground-water Quality. The Draft Report states that the quality of fresh ground water varies only minimally throughout the Bristol, Cadiz, and Fenner watersheds. Inspection of data presented in the Draft Report and the USGS database indicate that there is more variation than is indicated in the Draft Report. For example, there is even a large variation in water chemistry of wells in Fenner Gap (table 20), ranging from a total dissolved solids (TDS) of 267 nilligrams per liter (mg/L) in well CI-1 to 1,040 mg/L in well MW-3. The total dissolved-solids map (figure 23) needs to have the data (well and TDS values) plotted on the map. The data as plotted on the map indicate that the TDS upgradient of Fenner Gap has a higher concentration (350-400 mg/L) than downgradient of the gap (300 mg/L). If underflow from Fenner Valley is the main source of recharge to the Cadiz agricultural wells, how can the TDS be higher in the recharge water than in the Cadiz wells (less than 300 mg/L in table 3)? The presence of the high TDS values at the dry lakes would indicate that there should be springs along the freshwater/saltwater interface. This conceptual model can be observed at Death Valley. Are springs present around the dry lakes?

Page 45, 5.7, Interrelationship of Bristol, Cadiz and Fenner Watersheds with Other Groundwater Basins. As stated previously in this review, water-level and geologic data are needed to support the statement in the Draft Report that the basins are closed.

6.0--EVALUATION OF WATER RESOURCES

Page 46, 6.1, Evaluation of Recoverable Water Using a Watershed Model. The watershed model is reviewed below by section. In addition, we have presented some recharge estimates for the watershed using alternative modeling approaches. A description of these alternative models and the model results are presented as an attachment to this review.

General comments on approach--A watershed model was used to calculate "recoverable water" in the basin. Recoverable water is defined in the Draft Report as the total amount of surface runoff and infiltrating water that reaches the ground-water surface. The two terms were not discussed separately in the text of the Draft Report; however, they were separated in model results presented in Appendix F.

The watershed model incorporates the Thornthwaite equation to estimate daily potential evapotranspiration and an additional routine to estimate soil infiltration. The Thornthwaite equations yields estimates of potential evapotranspiration that are smaller than estimates produced using other approaches (Dingman, 1994) and, as a result, this model will tend to overestimate infiltration and runoff when compared to other methods. The model then calculates infiltration by subtracting surface runoff and vegetation interception from daily precipitation. The model does not account for soil water storage and subsequent withdrawal by plants. Vegetation in desert environments is very efficient at extracting soil water from great depths. For example, creosote has been reported to extract water from depths as great as 6 meters below

land surface. Numerous studies show that infiltration to depths below this thick root zone does not occur in desert basins--and soluble salts such as chloride accumulate just below the root zone (Phillips, 1994; Prudic, 1994; Izbicki et al., 1998). The amount of infiltrating water that reaches the water table approaches zero in most of the basin and water-potential data from other studies in desert basins suggest that water (in the form of vapor) may move upward from the water table to the root zone in many areas (Prudic, 1994). No field data or other evidence supporting infiltration to depths below the root zone for any of the soil groups is presented in the Draft Report. These issues are discussed in greater depth in the review of Section 6.7 --'"Estimates of ground-water recharge using a chloride mass balance approach."

A small amount of infiltration and subsequent recharge may occur in desert basins where water accumulates in topographic depressions. These areas include natural topographic depressions, such as certain playas (Osterkamp and Wood, 1987), man-made depressions, such as bomb-blast craters at the Nevada Test Site (Tyler et al., 1992; Pohl, 1996), and intermittent streams (Scanlon, 1994; Izbicki et al., 1998; Nimmo, 1999). As a group, these studies uniformly conclude that infiltration and subsequent ground-water recharge from these areas is small. The model does not incorporate any routines to route water through the surface drainage network and estimate downstream flows and subsequent infiltration. The existence of runoff does not imply that that water will infiltrate farther downstream in the basin. Although isotopic data are cited in the Draft Report as evidence of infiltration from washes, review of Section 9.3.3 "Evaluation of Groundwater Age Using Isotopes," suggests that the isotopic data presented in the Draft Report actually show that the amount of water from infiltration of surface flows is small. No other field data or evidence of infiltration from washes is presented in the Draft Report. An estimate of the "recoverable water" in the basin using data from the Draft Report and data from studies in similar areas is presented in the "Conclusion" section of this review.

The watershed model is a detailed daily water budget model: daily precipitation, infiltration, runoff, vegetation interception, evapotranspiration, soil moisture, and percolation are addressed. The model results provide an estimate of the recoverable water. It appears that the model does not account for bedrock permeability, and this may become an important factor for upland areas with shallow soils underlain by low permeability granites and metamorphics. For example, soil unit D defines an important watershed modeling unit that is used to subdivide the watershed model into areas of similar characteristics. For soil unit D, these are predominantly upland areas with shallow soils and thus the permeability of the underlying bedrock may have an important effect. It may be incorrect to assume that the hydrologic response for soil unit D will be similar for all locations covered by this soil type (even if the soil area is subdivided on the basis of the isohyets). There may be important differences in the hydrologic response of this model unit between areas underlain by low permeability bedrock and areas underlain by high permeability bedrock. It would be important to incorporate these differences into the watershed model, at least for soil unit D, because the model unit defined by this soil class on average has the highest computed recharge rates.

Page 47, 6.2, Description of the Bristol, Cadiz and Fenner Watershed Model. Each of the three basins is subdivided into hydrologic or modeling response units. For the Fenner watershed, five sub-areas are defined on the basis of soil types (A, B, C, and D) and an additional subdivision based on precipitation isohyets for subdivision for D. The long-term isohyetal map

is based on precipitation records from Twentynine Palms, Amboy, Needles, Mitchell Caverns, Mountain Pass, Kelso, and Yucca Grove. There are additional stations in the region surrounding the Cadiz study area that could have been used in the watershed modeling to obtain a more accurate representation of daily precipitation (e.g., Iron Mountain, Searchlight, Joshua Tree, Baker, Eagle Mountaint, and Parker).

Page 49, 6.2.1, Delineation of Model Subareas. The Bristol, Cadiz, and Fenner watersheds define the total watershed model area. A total of 11 subareas are defined for the three watershed areas. How were topographic effects such as differences in slope, aspect, and drainage characteristics, taken into consideration in the subarea boundaries?

Most recharge is simulated in the watershed model as occurring in soil group D. These soils should have limited rates of percolation (recharge) and high rates of runoff because of the impervious bedrock that underlies this soil type. If these soils have high runoff potential and are underlain by low-permeability bedrock, why are the highest recharge rates occurring at these locations (according to the watershed model)? There is no justification in the report for all the recharge occurring in the bedrock areas.

6.3 Model Parameter Determination

Page 52, 6.3.2, Soil Curve Number and Surface Runoff. No comments.

Page 54, 6.3.3, Temperature and Evapotranspiration. Thornthwaite's formula is cited but no reference is given. There is no way to know if this equation considers the lack of vegetation. The alpha coefficient (ratio of soil moisture to field capacity) is not the appropriate function for soil evapotranspiration. The method selected comes from Thornthwaite and Mather (see Hanks and Ashcroft, 1980, fig 4.6, pg. 115). A more appropriate function for the Mojave region is the modified Priestley-Taylor function (Flint and Childs, 1990), but only when vegetative cover is accounted for (Stannard, 1993). The assumptions in the Draft Report would underestimate evapotranspiration and therefore overestimate recharge.

Page 56, 6.3.4, Infiltration, Vegetation Interception, Soil Moisture, and Percolation. The estimates of potential evapotranspiration, 0.12 to 0.434 inches per day, seem high. The assumption that if soil moisture exceeds field capacity precipitation will percolate downward to replenish ground-water storage is questionable without accounting for the bedrock permeability under shallow soils, which is where most of the model calculated recharge comes from. Low-permeability bedrock holds excess soil moisture in the root zone where it may be removed by evapotranspiration processes. The rate of recharge in these situations is limited to the permeability of the bedrock and must be accounted for. Also see the equation for percolation on p. 57, which needs to account for bedrock permeability.

Page 57, 6.3.5, Assumption for Soil Thickness, Initial Soil Moisture, Field Capacity, and Apparent Specific Gravity. The estimates of field capacity are below the range that would be calculated from the STATSGO database, 13 to 17% for soil type D in the Providence Mountains area. For the same general area as soil type D, estimates using the STATSGO database would be 17--24%. The soil thickness for the shallow soils seems reasonable, but the soil thickness for the

deeper soils is in error. Although taxonomically the soils may be less than 2 meters (6 feet), the rooting depth, and therefore the evapotranspiration depth is much deeper, perhaps as much as 6 meters (20 feet). This is particularly important for channels.

6.4 Sensitivity and Uncertainty of Model Parameters. The model sensitivity analysis does not test the entire reasonable range of field capacity and soil thickness. These are two of the most sensitive parameters. If the true range of these two parameters were tested, the model would show a larger range and significantly less water would be simulated as being recharged.

6.5 Validation of Watershed Model Methodology. This section is much too brief. There needs to be more information provided on the Big Sandy Valley watershed so that basin characteristics can be compared. Western Arizona has a much different climate characteristic than southeastern California because of an increase in average elevations eastward towards Arizona and increased moisture input from the Gulf of Mexico, primarily during the Southwestern Summer Monsoon. In general, the climate is wetter and cooler, with more precipitation occurring as snow and a higher frequency of intense storms during the monsoon season. These differences in precipitation characteristics must be understood and accounted for before a model that is calibrated in Big Sandy Valley can be assumed to be a calibrated model in the Cadiz study area. In addition to differences in climate, differences in basin characteristics, such as topography, vegetation, soils, and geology, may cause non-transferability of a calibrated model. In general, there is an important transition from granitics and metamorphic rocks in southeastern California to sedimentary and volcanic rocks moving eastward onto the Colorado Plateau. Also, there is an increase in vegetation density with an increase in coniferous vegetation type and also in grasses moving eastward onto the Colorado Plateau.

The comparison of a recoverable water estimate between average simulated and measured watershed outflow is not very meaningful in terms of model calibration, especially when calibrating a model to be used in a different basin. The best way to determine if the hydrologic characteristics and processes in a watershed have been adequately represented by a model is to compare the hydrographs of simulated and measured daily watershed outflow because the timing, duration, and intensity of runoff events are much more indicative of watershed characteristics than mean outflow rates.

6.6 Water Balance for the Bristol, Cadiz, and Fenner Watersheds. How was it determined that the basins are closed basins? Show data that supports that there is no inflow or outflow from upgradient and downgradient basins.

Page 59, 6.6.1, Outflow Terms-Groundwater Pumping. Agricultural pumping is estimated at 5,026 acre-feet per year. Were return flows considered in the budget or are the fields drained?

Page 60, 6.6.2, Evaporation Loss from Dry Lakes. The Draft Report states that a wide range of methods are used for determining evapotranspiration rates in playa settings. Because of the importance of accurately determining this number, there should have been an effort to use an energy balance (Czarnecki, 1997; Laczniak and others, 1999) or salt scraping method (Lines, 1979, described below) to estimate the evaporation from the playa.

Page 60, 6.6.2.1, Determination of Evaporation Area. The Draft Report assumes that evaporation occurs over the entire surface area of Bristol and Cadiz dry lakes on the basis of the assumption of shallow depths to water. The report references Moyle (1967) as support for "shallow" depths to water. Plotting the water levels presented in Moyle (1967) indicates that the depth to water exceeds 10 feet throughout most of Bristol dry lake. Water levels beneath the eastern third of the dry lake range from 30 to 54 feet below land surface. Kunkel and Chase (1969) revised estimates of Lee (1913) for bare-soil evaporation from different depths to ground water in Indian Wells Valley, California. In their study they estimated that the annual rate of evaporation from bare soil decreased to negligible amounts at water-level depths of more than 7 feet below land surface. The Draft Report sites "puffy" soil as evidence of capillary movement of shallow water. How did this study differentiate between shallow perched water (remnant from local runoff--see Volume 1, figure 10--Photograph of Bristol Dry Lake during Flood Conditions) and regional ground-water evaporation? The total area of Bristol and Cadiz dry lakes is reported to be 41,600 and 29,788 acres, respectively (table 8, Volume1). However, the value calculated utilizing the geologic data presented by the Department of Defense (1998) and digitizing the geologic map of Kupfer and Bassett (1962) is 40,972 acres for Bristol and 17,485 acres for Cadiz. What is the reason for the large discrepancy in values for Cadiz dry lake? In any case, on the basis of the water-level data presented in Moyle (1967) the area used to calculate the evaporation is too large. Also it should be determined if there is a perched water body at the lakebed. If the water body is perched, then the evaporation from the lakebed can not be used to calculate discharge from the regional aquifer.

Page 60, 6.6.2.1, Estimated Evapotranspiration Loss. The Draft Report neglects to account for direct recharge of precipitation and runoff on the dry lakes, and assumes all the evaporation is from ground water that has originated north of Fenner Gap. As shown on figure 10 of Volume 1 (Photograph of Bristol Dry Lake During Flood Conditions), the dry lakebeds become lakes during rainfall events. In a study of the Bonneville Salt Flats, Turk (1973, p. 73) found that infiltration rates ranged from 2.5 to 4.0 feet per day on the salt crust and from 0.4 to 1.4 feet per day in areas of clay and silt. Clearly the infiltration of ponded water on the lakebeds needs to be addressed in the water balance. The Draft Report references Todd (1980) for the evapotranspiration rates used in table 8 to calculate total evapotranspiration. Todd (1980) states that for water tables within 1 meter of ground surface, evaporation is largely controlled by atmospheric conditions; but below this depth, soil properties become limiting and the rate decreases markedly with depth. Todd (1980) presents data only to about 7 feet below land surface (about 2% of pan evaporation). As stated above, Moyle's (1967) data indicate that the depth to water beneath most of Bristol dry lake exceeds 10 feet. Therefore, one should use values less than 2% (0.26 feet per year) to estimate the total evaporation. As stated in Todd (1980), evaporation is limited by soil properties at depths greater than 3 feet. The presence of a salt crust further limits the evaporation.

In a study of the Bonneville Salt Flats, Lines (1979) scraped halite (NaCl) that had accumulated on the surface of the dry lakebed sediments to determine the evaporation of ground water from the barren surface. Lines (1979, p. 86-89) estimated that the evaporation during May-December 1976 ranged from about 0.0025 to 0.00042 inch per day. The estimates were made using the weight of halite that had accumulated at land surface on 2 square-foot plots and the concentration of NaCl in the evaporating shallow brine, which averaged about 295 grams per liter. Ground-

water levels at the study plots declined during the summer and fall, but ranged from 0.21 to 2.21 feet below land surface. Similarly, Feth and Brown (1962, p. 100-101) scraped salt from dry mudflats near the edge of the Great Salt Lake during the summer of 1954, and they determined that ground-water evaporation rates at land surface averaged about 0.003 inch per day. Assuming an average evaporation rate of 0.003 inch per day from the surface of Bristol and Cadiz dry lakes (total of 71,388 acres from table 8 or 58,457 acres from the Mojave Desert Ecosystem Program (1998)) and that evaporation is negligible during the winter (December through February), evaporation of ground water from the two dry lakes could be no more than about 6,500 to 5,300 acre-feet per year depending on what value is used for the lakebed area. An ongoing study by the USGS in Death Valley has measured rates of about 0.17 feet per year on a salt playa (salt crust) where the depth to water was less than 1 foot and 0.27 feet per year on a bare soil with some salt mix where the depth to water was 1 to 2 feet (Guy DeMeo, USGS, WRD, Las Vegas, Nevada, written communication, 2000).

Clearly the values for evaporation and areas of potential evaporation are too large as presented in table 8. If one uses the Death Valley number for the evaporation rate (0.17 feet per year) and multiplies that by the area of the dry lake playa surface digitized from the Kupfer and Basset (1962) geologic map (58,457 acres), the estimate evaporation is 9,900 acre-feet per year. The evaporation rate estimated in the report (20,000 to 71,000 acre-feet per year) is unreasonable on the basis of depth to water and soil characteristics, and needs to be significantly reduced. The area of potential evaporation also needs to be reduced significantly.

Page 61, 6.6.3, Total Outflow. The total outflow is stated to be 76,000 acre-feet per year. As stated above, the estimate of evaporation from the dry lakes is too high and needs to be recalculated using lower evaporation rates and smaller areas of potential evaporation. Therefore, this estimate for total outflow is too large. If there was in fact this much ground-water discharge at the dry lakes, one would expect to see springs and vegetation similar to Ash Meadows in Nevada (see Laczniak and others, 1999). To put things in perspective, the estimated evapotranspiration along the entire reach of the Mojave River (Victorville to Afton Canyon) is about 17,000 acre-feet per year (Lines and Bilhorn, 1996). The Mojave River area has areas of perennial flow and riparian habitat.

6.7 Estimates of Groundwater Recharge Using a Chloride Mass Balance Approach. The chloride mass balance approach and associated equations presented in this section are derived from regional recharge studies of the High Plains aquifer (Wood and Sanford, 1995). This is a much different environment than Bristol, Cadiz, or Fenner basins. Although semi-arid, the High Plains receive between 13 and 22 inches per year of precipitation, areal recharge occurs through the unsaturated zone. In contrast, precipitation in the study area is about 7 inches per year and the assumptions associated with the approach as described in the Draft Report are not valid (Wood, 1999). Violation of these assumptions is discussed in the Draft Report; however, this is not a matter of using an approach, violating a few assumptions and qualifying the results--it is a matter of using a completely wrong approach.

There is an alternative chloride mass-balance approach for arid regions where assumptions needed to use the Wood and Sanford (1995) approach are not valid. In contrast to estimates of recharge described in the Draft Report, when properly applied the chloride mass-balance

approach is used to estimate the time since recharge has last occurred. Phillips (1994) described the use of the chloride mass balance approach for alluvial basins in the arid portions of the Southwestern United States. In the Mojave Desert, the approach has been applied near the study site at Ward Valley (Prudic, 1994; National Research Council, 1995), at the Nevada Test Site (Tyler et al., 1995), and in the western part of the Mojave Desert (Izbicki et al., 1998). Although the hydrology at specific sites differ, the general conclusions from these studies is that chloride has been accumulating in the unsaturated zones for 13,000 years in western part of the Mojave Desert (Izbicki et al., 1998) to as long as 58,000 years in Ward Valley adjacent to Fenner Valley. This is a different result than the 40,000 acre-feet of annual recharge estimated using the chloride mass-balance approach for Fenner Valley in this Draft Report.

Although the data needed to calculate the time since recharge were not collected as part of this study, the report indicates that chloride and other soluble salts have accumulated in the unsaturated zone beneath Fenner Valley. On the basis of increased dissolved solids and chloride concentrations as high as 933 mg/L measured in monitoring wells after water from the test recharge basins in Fenner Gap through the unsaturated zone to the water table, a large amount of chloride has accumulated in the unsaturated zone at the test site and it has been a long time since recharge has occurred through the unsaturated zone at this location. Data from this Draft Report, and from all other studies done in the Mojave Desert, are consistent and indicate that only negligible recharge occurs on the alluvial valley floors of desert basins. In addition, there is a large body of literature from other parts of the American Southwest, Australia, and arid zones throughout the world that supports this conclusion.

Dettinger (1989) estimated that some recharge may occur to alluvial basins in Nevada as a result of precipitation, runoff, and infiltration at higher altitudes. The chloride mass-balance approach described by Wood (1999) may (with great uncertainty) be applied to these areas to estimate an upper limit on recharge to Fenner basin. Assuming that recharge in the Fenner basin only occurs from precipitation at altitudes greater than 4,000 feet (Dettinger, 1989), recharge to Fenner basin is about 1,710 acre-feet per year. This value was estimated using the chloride mass balance approach as follows:

$$Q = [(P^{*}Cl_p) / Cl_{gw}] A_{4000}$$

where P is average annual precipitation about 10 inches per year (0.83 feet per year) (this Draft Report);
Cl_p is the chloride concentration in precipitation from the Mojave Desert, about 0.8 mg/L;
Cl_{gw} is the chloride concentration in ground water from Fenner Gap monitoring wells, about 49 mg/L. This value excludes low chloride concentrations in water from agricultural wells operated by Cadiz Inc. (this Draft Report); and
A_{4000} is the area of the basin above 4,000 feet, about 126,000 acres.

The average chloride concentration used in this calculation is subject to uncertainty. The value used in these calculations is the value used for bulk precipitation in chloride mass-balance calculations for Ward Valley (Prudic, 1994). This value is higher than the volume-weighted mean chloride concentration measured in precipitation at National Atmospheric Deposition

Program (NADP) site at Red Rock, Nevada. This site has been operated for 14 years and is the best data for the region. However, data from the NADP sites are wet-fall only (rain, snow, etc.); these data do not include dry-fall (dust, particulates, ect.). This value also is higher than the chloride concentration for bulk precipitation of 0.4 mg/L measured for precipitation by Dettinger (1989) to estimate ground water recharge in 16 basins in Nevada. This value is lower than the chloride concentration of 3.5 mg/L used in this Draft Report to estimate recharge in Fenner Valley.

At best, recharge estimates calculated using the chloride mass balance approach described by Wood and Sanford (1995) provide an upper limit on ground-water recharge from higher altitudes in the Fenner basin. Dettinger's (1989) work was for basins farther north in Nevada and may not be directly transferable to Fenner Valley. For example, there may not be large quantities of recharge at altitudes greater than 4,000 feet in the southern California Desert and chloride may be accumulating in the unsaturated zone in that part of the basin. No data are provided in the Draft Report to demonstrate that infiltration to depths below the root zone and subsequent ground-water recharge occur in the study area at altitudes greater than 4,000 feet.

If the chloride mass-balance method is applied but the deposition rate is 0.8 mg/L, which is what has been recommended for Ward Valley, and if you assume that all the recharge comes from soil type D then the method alone would calculate a recharge of 3,000 acre-feet per yearr. Even if you use the entire Fenner watershed area, rather that soil type D, the recharge would be 9,000 acre-feet per year. The 3.5 mg/L accumulation number used is much higher than most other researchers would use.

6.8 Groundwater Storage Estimates

Page 64, 6.8.1, Groundwater Storage Estimates for the Fenner Watershed. Estimates of ground-water storage using this methodology are misleading. Although there are large amounts of ground water in storage, much of this water is difficult to extract owing to decreased permeability with depth. In addition, the water chemistry of the deeper sediments in most desert basins contains high concentrations of fluoride, arsenic, and other trace elements.

Page 64, 6.8.1.1, Procedure. As stated earlier in the review, there appears to be a problem with the depth to bedrock map. Where checked with borehole data presented in the Draft Report, the depth to bedrock map overestimated the depth to bedrock. The specific yield values will decrease with depth in the aquifer, because of cementation and compaction of the sediments.

Page 65, 6.8.1.2, Parameters Used for Storage Calculation. Same comments as above.

Page 66, 6.8.1.3, Results. Need a statement indicating that not all of this could be extracted economically and the water chemistry of this water may be greater than drinking-water standards for some constituents.

Page 67, 6.8.2, Groundwater Storage Estimates for the Project Area. The estimate is based on the depth to bedrock map presented in the Draft Report (figure 17). As stated above, this map appears to overestimate the depth to bedrock.

7.0--FENNER GAP PILOT INFILTRATION TEST

Overall the largest weakness with this section is the lack of a numerical model. A pre-experiment model, using the soil parameters estimated from field and laboratory analysis, should have been conducted. This step is a critical part to any large-scale field experiment. The results would demonstrate the adequacy (or inadequacy) of the estimated parameters. Modeling of the unsaturated zone is a much more difficult part of the study than modeling of the saturated zone. The non-linearity of the relation between water content and water potential is critical in understanding the response of the system to continual ponding. The hydrologic characterization of the unsaturated (vadose) zone is still a critical part of site characterization. The demonstration of adequate data and understanding are needed to show how the system will respond to long-term ponding (and infiltration) and pumping. Post-experiment modeling (history matching) would help to further develop the hydrologic properties of the unsaturated zone using standard inverse methods.

7.1 Pilot Spreading Basin. What is the rationale for requiring 200 feet of a saturated alluvial aquifer? Should not the requirement be for a specified unsaturated alluvial thickness because the artificial recharge and mounding will occur above the water table? Again a model would be helpful in defending, or providing rationale for assessing, the thickness required for the saturated or unsaturated zone.

7.3 Pilot Test Field Testing. Report should include plots of the pumping-test data. Show the type-curve matches for determining aquifer characteristics (Ttansmissivity and Storage). How were the gypsum blocks isolated in the boreholes? Were bentonite seals placed in the holes to prevent preferential flow through the borehole?

Page 76, 7.3.4.1, Principle of Operation. The resistance between the two probes is calculated from voltage measurements made in the gypsum blocks. The resistance is converted to water potential using a calibration equation. This section incorrectly states that the sensors measure water potential which is converted to Kohms (this appears to be just a misstatement). Heat dissipation probes, which are a much better measures of water potential, should have been used. They would provide data necessary for modeling.

Page 77, 7.4, Eight-Month Infiltration Test Monitoring. Was the model used to simulate the drawdown at the pumping well and the mounding beneath the ponds? This would be useful to help calibrate the model on a local scale. The model could then be used to predict water-level changes resulting from the larger scale project.

Page 77, 7.4.1, Climatological Data. What is the "evapotranspiration monitor" on the weatherstation and why were solar radiation measurements, the driving force for evapotranspiration, not measured during the study period?

Page 77, 7.4.4.2, Single-Ring Infiltrometer Field Tests. Is the reference to Bouwer (1998) the 1989 reference? The method employed is not as straight forward as other infiltrometer methods.

A long-term measurement (greater than 6 hours), where lateral flow is less important, would give a better measure of the expected conditions in the similar, but larger, ponded area.

7.5 Water Quality Monitoring

Page 83, 7.5.2, Sampling Procedure. Some wells may not have been completely purged prior to sample collection using the procedure described in the Draft Report. For example, monitoring well CI-1 is 420 feet deep and the depth to water is about 300 feet. Given a casing diameter of 2 inches, about 19 gallons of water are in the casing. According to procedures described in the Draft Report, only 6 liters of water (about 1.5 gallons) were removed from each well prior to sample collection. The sampling procedure increases uncertainty associated with the interpretation of chemical and isotopic data presented in the Draft Report.

Page 85, 7.5.3.2, Baseline Analyses-General Suite. Comments for this section also include comments on results of chemical analyses presented in table 12 and Appendix U.

Results of chemical analyses show that background water quality from the Fenner Gap monitoring wells has a relatively wide range in dissolved solids from 267 to 1,040 mg/L. On the basis of Stiff diagrams presented in Appendix U most water is sodium bicarbonate or sodium bicarbonate-sulfate in chemical composition. No baseline water-quality samples from monitoring wells in Fenner Gap had a calcium bicarbonate composition and high pH (greater than 9.0) that would be expected for water from Schuyler Wash that infiltrated through a thick unsaturated zone to recharge the underlying ground water. As a result, chemical data are not consistent with large amounts of infiltration from the wash as interpreted in the Draft Report. It is interesting to note that after water from the test recharge ponds infiltrated through the unsaturated zone to the water table, water from the monitoring wells became increasing calcium bicarbonate in chemical composition (table 22).

Page 85, 7.5.3.3, Baseline Analyses-Isotopes. Comments for this section are included in comments for section 9.3.3 "Evaluation of groundwater age using isotopes."

8.0--CADIZ GROUNDWATER MODEL

8.1 Model Development. Please clearly explain for what purpose the models were developed.

Page 94, 8.1.1, Conceptual Model. The conceptualizations of model layers 2 and 3 are not clear. Semiconfined is insufficient information. In MODFLOW, are these layers confined or confined/unconfined (LAYCON=2 or 3)? On the basis of Plate 3, there may be continuous clay layers; you choose to assume them to be discontinuous.

Page 95, 8.1.2.1, MODFLOW Model. Please clearly explain and defend the nonuse of the fault (HFB) package given the high degree of faulting in the study area. The northwest/southeast trending faults may be barriers to ground-water flow and should be incorporated into the model.

Page 97, 8.1.2.2, MT3D Model. Please clearly explain and defend the use of MT3D, a nondensity-dependent transport model, to model brine transport. Water with high TDS

concentrations (about 300,000 mg/L beneath Bristol dry lake) has a greater density than freshwater. This greater density will affect the physics of the flow system; therefore, in order to estimate the potential impact of the proposed project on the movement of the high-density brine one must use a density-dependent ground-water flow and transport model. To determine the potential impacts of the proposed project on the salt playas, a density-dependent transport model is needed.

Page 98, 8.1.2.3, Pre- and Post-Processors. No comments

Page 98, 8.1.3, Model Size, Grid Geometry and Boundary Conditions. Please show a typical model cross-section.

8.1.4 Flow Model Aquifer Parameters

Page 99, 8.1.4.1, General. Please use specific yield instead of effective porosity (effective porosity is used later in the report as a porosity). It is stated much later in the report that layer 2 is confined/unconfined; therefore, the top elevation of this layer is required. I assume that layer 3 is confined, although it is never stated. Define "mathematically superimposing" and "appropriate gridding algorithm."

Page 100, 8.1.4.2, Elevations of Aquifer Boundaries. Move this section to Section 8.1.3. How were the elevations determined? As stated earlier in the review, the bottom elevation of the upper aquifer in Fenner Gap is too low.

Page 100, 8.1.4.4, Hydraulic Conductivity and Transmissivity. Note that Jacob's method is valid only for confined aquifers; therefore, is not applicable to layer 1 data. The use of the screened interval to calculate K can overestimate the K value. The well efficiency is not normally used to estimate T from specific capacity data (see Driscoll, 1987) and will overestimate T. Please provide a reference for the E-log sequential method and show example calculations. How were K-values adjusted using clay percentages and what is the basis for this adjustment? Give specific clay percentages used in table 14. Show point estimates of hydraulic conductivity and transmissivity on contour maps (figures 61-64) for comparison. Overlaying figures 60, 62 and 63, the hydraulic conductivity and transmissivity contours do not appear to be consistent. A map with the model grid and associated parameter values for all layers needs to be presented in the Draft Report.

Data for the aquifer tests presented in table 14 need to be presented in the Draft Report or be in a published document. The USGS logged well 5N/14E-13 shown in the table 14. Inspection of the geologic log for this well indicated that the sediments were poorly sorted, gravelly sand and silt with increasing silt content with depth. On the basis of this lithologic description, it is difficult to justify an average hydraulic conductivity of 699 gallons per day per foot squared ($gpd/ft^{2)}$. An average value of 100 gpd/ft^2 would be the highest that one would expect for these materials. What was the pumping rate for this test? Also, why is this well assigned to layer 2 when the well is perforated at the water table? According to Plate 3, most of this well is perforated in layer 1. The upper estimate of the layer-2 transmissivity seems too high. From your description of the layer-2 materials, the hydraulic conductivity values may be in the range

of 1 to 10 gpd/ft^2 (Freeze and Cherry, 1979). The layer-3 transmissivity values are too high. For sandstone the transmissivity values should range between 0.4-4000 gallons per day per foot (gpd/ft) and for carbonate rocks the transmissivity values should range between 4-4000 gpd/ft (Freeze and Cherry, 1979).

In general, the hydraulic conductivity and transmissivity values are too high, which allows the high flux rates that are assumed in the model. The pumping-test data presented in the Draft Report for well PW-1 (Appendix M) indicate a specific capacity of about 200 gpm/ft. The empirical equation used to estimate transmissivity from specific capacity in a unconfined aquifer is to multiply the specific capacity (gallons per minute per foot) by 1,500 to give transmissivity (gpd/ft) (Driscoll, 1987, p. 1021). Using this equation for the well PW-1 data indicates that the transmissivity of the aquifer near well PW-1 is 300,000 gpd/ft. Dividing this estimated transmissivity by the perforated interval of the well (500 feet) will give an estimate of the average hydraulic conductivity--in this case 600 gpd/ft^2. This value is about 70% of the value estimated on table 14 (851 gpd/ft^2). On table 14, it is assumed that well PW-1 is only perforated in 36 feet of layer 1. On plate 3 of the Draft Report it appears that layer has been placed at an elevation of 300 feet, which would indicate that well PW-1 is perforated in about 300 feet of layer 1. In table 14, the hydraulic conductivity of layer 1 is assumed to be 2.7 times the hydraulic conductivity of layer 2. Assuming this ratio is correct, the estimated hydraulic conductivity values at PW-1 are 800 and 300 gpd/ft^2 for layers 1 and 2; respectively. It is clear that the adjusted hydraulic conductivities estimated for this well in table 14 (1,835 gpd/ft^2 for layer 1 and 680 gpd/ft^2 for layer 2) are too large. Using lower values would decrease the allowable flux rate.

Page 103, 8.1.4.5, Vertical Leakance. Vertical leakance (VCONT) is calculated using vertical K values not horizontal K values. Assuming anisotropies of 1 to 2 orders of magnitude may greatly reduce the calculated VCONT values. Lower VCONT values can lead to greater stratified flow than is currently being modeled.

8.1.5 MT3D Model Aquifer Parameters

Page 104, 8.1.5.2, Aquifer Thickness. Thickness of aquifer units in the Fenner Gap needs to be reduced.

Page 105, 8.1.5.3, Longitudinal and Transverse Dispersivity. The longitudinal dispersivity value of 50 feet seems small. Gelhar et al. (1992) report that at the field scale (greater than 1,000 meters), longitudinal dispersivity values of about 100 meters (greater than 300 feet). Anecdotally, other researchers have used longitudinal dispersivity values on the order of their grid spacing. The use of small dispersivity values will sharpen the solute front and allow less spreading than would a larger value.

Page 105, 8.1.5.4, Total Dissolved Solids Concentrations. Review of the data in table 22 shows that prior to artificial recharge in the Fenner Gap area dissolved solids concentrations in some wells were as high as 1,040 mg/L. This is higher than the 300 to 400 mg/L reported in the Draft Report. It is not clear from the Draft Report why wells having high dissolved-solids water

were sampled only one time or why this water was not analyzed for stable isotope or carbon-14 activity.

8.1.6 Recharge and Discharge

Page 106, 8.1.6.2, Subsurface Inflow. Show locations of injection wells on a figure. Into which layer was water injected?

Page 106, 8.1.6.3, Areal Recharge. Show recharge cells on a figure.

Page 106, 8.1.6.4, Ground-water Pumping. Pumping information does not match data presented on page 43.

Page 107, 8.1.6.5, Evapotranspiration. Show the ET cells on a figure. Justify the use of an extinction depth of 100 feet; this value seems to be much too large; it should be less than 10 feet for bare-soil evaporation. Using a too large extinction depth allows much more flux to leave the system than if a smaller value were used. State the values of the ET surface and the maximum ET used in the model.

8.2 Model Calibration

Page 107, 8.2.1, Selection of Calibration Period. The discussion of the calibration period makes no sense. Why is the precipitation record important? It seems that the pumping record would have a greater impact on the ground-water system. How is 1958-85 a steady-state condition? How is this implemented in the model? Compare the simulated steady-state water levels with measured, predevelopment water levels.

Page 108, 8.2.2, Discussion of Calibration Process. What do you mean by "Therefore, for the purposes of this model, the model-generated water levels beneath Bristol and Cadiz dry lakes were not used and were considered boundary conditions"? If the simulated water levels beneath the lakes are 40 to 80 feet below measured water levels, this indicates that the simulated initial conditions are much too low and the model should be recalibrated. Note that most of the calibrated water levels in the northern part of the model area (e.g., figures X-13 and X-15) are 20 to 40 feet higher than measured water levels. This information, coupled with the lower-than-measured lake water levels, indicates a simulated gradient greater than measured conditions. This implies that even though overestimated T values are used in the model, the model could not transmit the estimated inflows without increasing the simulated hydraulic gradient.

Page 109, 8.2.3, Discussion of Model Calculated Recharge and Discharge. The report states that the model simulated recharge term (50,000 acre-feet per year) is supported by the stable water level trends. As described below, the water levels were not stable. The model could not simulate 50,000 acre-feet per year discharge without having an unreasonable evaporation extinction depth (100 feet) and the resulting simulated water levels at the dry lakes were 50 feet too low. In addition, the simulated water-level gradient through the Fenner Gap was greater than the measured gradient, even using unreasonably high transmissivity values. The model results indicate that the conceptual model is incorrect.

Page 110, 8.2.4, Discussion of Model-Generated Water Levels. Show the simulated steady-state water levels. Published data indicate that steady-state water levels were about 600-625 feet around the project area; these data are 40 or more feet higher than the initial water levels shown in figures X-4 to X-15. This indicates that the steady-state water levels were underestimated throughout the model domain. Show measured water levels on simulated water-level contour figures. The model underestimates the water-level declines at the Cadiz agricultural well field. The model fit appears reasonable at the scale plotted; however, if the measured data ranges only on the order of 25 feet for the period of simulation, one should not plot it on a scale that has a range of 400 feet. The model results need to be replotted on a reasonable scale and consideration should be given to predevelopment water-level measurements in the area (Moyle, 1967). As stated previously, the model does a poor job of simulating the water-level gradient north of Fenner Gap.

The model needs to be recalibrated, starting with steady-state conditions. The model needs to be able to simulate the observed water levels and gradients. Matching the water levels at Cadiz and Bristol dry lakes will be an important element of the calibration process. Initial calibration might include using the MODFLOW drain function to simulate discharge at the dry lakes.

8.2.5 Discussion of Water Budget

Page 112, 8.2.5.1, Water Balance Analysis. The water budget is meaningless because the model does not correctly simulate the water levels beneath the dry lakes.

Page 113, 8.2.5.2, Natural Recharge to the Cadiz Project Wellfield. The value of 30,000 acre-feet per year of recharge is based on an invalid model. As stated above, the gradient simulated by the model is too high through the Fenner Gap, even using unreasonably high transmissivity values. Earlier in the report it is stated that all the recharge originates from the mountains in Fenner Valley. If 30,000 acre-feet per year is simulated as moving through Fenner Gap, where does the model simulate the remaining 20,000 acre-feet per year recharge to the system?

8.3 Evaluation of Project Operational Scenarios Using the Cadiz Groundwater Model. The following sections discussing the operational scenarios (Sections 8.3.1-8.3.6) were not reviewed, because the model needs to be recalibrated before using it to predict future scenarios.

8.4 Evaluation of Subsidence

Page 116, 8.4.2, Description of Subsidence Simulation Model. As most readers will not be familiar with Helm's model, please present the model with all assumptions.

Page 116, 8.4.3, Model Input Data Parameters. Were the proposed spreading basins included as one of the modeled sites? The overburden of the water may cause increased subsidence. Please show sites where model was applied on a figure.

Page 117, 8.4.3.1, Idealized Lithologic Log Development. What is an "idealized lithologic log"? Please show one.

Page 117, 8.4.3.2, Water levels. Where in the column are the boundary conditions defined?

Page 118, 8.4.3.5, Preconsolidation Stress. State the value of preconsolidation head used in the subsidence model. Compaction occurs after the head drops below the preconsolidation head; therefore, the timing of compaction is affected by the choice of this value.

Page 119, 8.4.4, Model Output. Please show the time varying subsidence for all 19 sites.

SECTION 9.0--RESULTS

9.1 Results of Evaluation of Water Resources

Page 120, 9.1.1, Results of Watershed Model. The Draft Report estimates that the total amount of recoverable water for the entire watershed ranges from 20,000 to 58,000 acre-feet per year, with a median value of 39,000 acre-feet per year. As discussed in great detail in the review of Section 6.0, there are major problems with the watershed model assumptions and results. The watershed model is a detailed daily water-budget model: daily precipitation, infiltration, runoff, vegetation interception, evapotranspiration, soil moisture, and percolation are addressed. However, the model does not address bedrock permeability, and this may become an important factor for upland areas with shallow soils underlain by low-permeability granites and metamorphics. For example, soil unit D defines an important watershed modeling unit that is used to subdivide the watershed model into areas of similar characteristics. For soil unit D, these are predominantly upland areas with shallow soils and thus the permeability of the underlying bedrock may have an important effect. The estimates of field capacity used in the model (13 to 17 %) are below the range that would be calculated from the STATSGO database for soil unit D in the Providence Mountains area. Estimates using the STATSGO database, for the same general area as soil unit D, would be 17 to 24 %. The soil thickness for the shallow soils seems reasonable, but the soil thickness for the deeper soils is in error. Although taxonomically the soils may be less than 2 meters, the rooting depth, and therefore the evapotranspiration depth, is much deeper. As shown in figure 26 of the Draft Report, field capacity and soil thickness are very sensitive parameters for the watershed model. Increasing the field capacity and/or the soil thickness will reduce the model-calculated recharge. Therefore, the range of recoverable water calculated by the watershed model used in the Draft Report would be larger (the low end would be lower and the high end would remain the same) and the resulting median value would be lower.

To test the reasonableness of the recharge values simulated by the Draft Report watershed model, the USGS developed two Maxey-Eakin water-balance models. The model development and model results are included as an attachment to this review. The median recharge rate estimated by the watershed model (39,077 acre-feet per year) is 3 to 15 times higher than the values estimated by the preliminary Maxey-Eakin models developed by the USGS (2,550 to 11,800 acre-feet per year). The quantity of recharge estimated with the watershed model appears to be an overestimate of the recharge and, therefore, the recharge rates should be reevaluated.

Page 121, 9.1.1.4, Groundwater Storage Capacity. This value is misleading in that it assumes that all of the water can be removed and that all of the water is of suitable quality. Table 10b of the Draft Report overestimates the thickness of layer 2 and overestimates the specific yield of the bedrock aquifer.

Page 121, 9.2, Geology of Fenner Gap. There are inconsistencies in the measured thickness of alluvium and the values and the depth to bedrock contour map presented in the Draft Report (figure 19). As indicated in the Draft Report, the difference in bedrock elevation between wells 5/14-13 and CI-2 suggest the presence of a fault. This fault and other faults in the area should be studied to determine if they are barriers or partial barriers to ground-water flow. These faults may compartmentalize the proposed recharge and change the proposed recharge/pumpage operation.

9.3 Geohydrology of Fenner Gap

Page 125, 9.3.1, Bedrock Aquifer. It is unclear from the data presented in the Draft Report that there is a bedrock aquifer in the study area. Additional geohydrologic and geochemical data need to be collected to determine the significance of the bedrock aquifer.

9.3.2 Alluvium

Page 129, 9.3.2.1, Geohydrologic Characteristics. The Draft Report presents results of a pumping test conducted for well PW-1. It is apparent from inspection of the data that water levels are being affected by leakage. Water levels made during the test indicate that actual drawdowns are less than those predicted by the Theis curve at larger values of time. This type of deviation generally reflects the presence of a lateral recharge boundary or a leaky aquifer. Because there are no apparent recharge boundaries, the departure from the curve probably is the result of leakage of ground water from overlying or underlying sediments. The transmissivity and storage coefficient of an aquifer affected by leakage may be solved by conventional methods of analysis on the basis of the Theis equation if the data are collected at or close to the pumped well. In general, drawdown data collected early in an aquifer test are affected by leakage to a lesser degree than data collected at a later time (Neuman and Witherspoon, 1972, p. 1291). Analysis of drawdown data collected from wells at a distance from the pumped well, and at later times tends to overestimate the transmissivity of the aquifer. Therefore, early time data (in this case 0.1 to 10 minutes after commencement of pumping) should be analyzed from the pumping well and close observation well. Data collected during the recovery phase will be affected by leakage and will overestimate the transmissivity.

Page 130, 9.3.2.2, Baseline Water Quality. Inspection of the trilinear diagram of water-quality samples for wells in the Fenner Gap indicate that there is a wide range of water quality in the gap. The Draft Report states that the difference is the result of development problems. However, when one inspects the data a definite pattern appears. Most of the wells in the gap are perforated only 100 feet below the water table. In general, these wells are sampling the upper alluvial aquifer. Wells in the southeastern part of the gap (wells MW-3, 5, and 6) have TDS values in excess of 500 mg/L and have high percentages of sodium. These wells may be

influenced from poor quality water from the underlying and surrounding bedrock. The thermal water sampled in Fenner Gap indicates upward flow from the underlying bedrock, possibly along fault zones. The two deepest wells (5/14-13 and PW-1) have the lowest TDS values (328 to 294 mg/L) of the wells sampled. These wells also have similar water chemistry, having a higher percentage of sulfate and calcium then samples from the other wells. As stated in the Draft Report, these wells appear to be on the downthrown (southwestern) side of a northwest-southeast trending fault. Wells CI-3 and MW-2 are probably also on the southwestern side of the fault; however, they have similar chemistry to the wells on the upthrown (northeastern) side of the fault. In addition, these wells are screened only in the upper 100 to 200 feet of the aquifer. This suggests that wells PW-1 and 5/14-13, which are perforated 500 to 300 feet beneath the water table, yield a large percentage of their water from the water-bearing deposits that are more than 100 feet below the water table. A velocity log and downhole sampling should be completed in these wells to identify the major water-bearing zones. In Fenner Gap, apon the northeastern side of the fault, water-bearing deposits are not as prevalent at depths of more than 100 feet below the water table. As shown on plate 3 of the Draft Report, a silt and clay layer is present at about 150 feet below the water table at wells PW-1 and CI-3. This fine-grained layer must separate the two types of water. It is interesting to note that the hydraulic head in well PW-1 is about 5 feet higher than the head in the nearby CI-3 well. The land-surface elevations should be resurveyed to verify this difference.

The source of water to the upper aquifer on the downgradient side of the fault probably is underflow through the Fenner Gap in the permeable deposits directly beneath the water table because the TDS and water types are similar. However, the source of water to the lower aquifer on the downgradient side of the fault cannot be solely underflow from Fenner Gap. The lower aquifer downgradient of the fault contains lower TDS and has different chemistry compared with upgradient wells in the Fenner Gap (see figure 80 in the Draft Report). Recharge along the Orange Blossom Wash may be the source of this water. Additional geochemical and isotopic data are needed from the deep wells to help answer this complex hydrologic puzzle.

Page 133, 9.3.3, Evaluation of Groundwater Age Using Isotopes. Comments presented for this section also include comments for isotopic data and correspondence from M. Lee Davisson of Lawrence Livermore National Laboratory from Appendix T.

General Comments--A number of controversial land uses have been proposed for the study area and adjacent basins--including the Bolo Landfill (RailCycle) and the low-level radioactive waste disposal site at Ward Valley. Because of the high profile of these proposed sites, the region has been extensively studied and there are a large amount of isotopic data collected in the study area and adjacent basins. Much of this previous work concluded that recharge in the area is small. Although data from these studies are readily available, it does not appear in the Draft Report. These data are important and have been included as part of this review (figure 1).

Comments on interpretation of oxygen-18 and deuterium data--The ∂D and ∂^{18}O isotopic compositions of precipitation collected by Friedman et al. (1992) at Mitchell Caverns and at Amboy (near Bristol dry lake and closer to the study site) are different. Data from Mitchell Caverns plots on the meteoric water line. Data from Amboy plot on a line parallel to, but below, the meteoric water line. The isotopic composition of precipitation data at Amboy relative to the

meteoric water line is typical of precipitation in summer-dominated precipitation regimes of the Mojave Desert and across much of the arid southwestern United States. The isotopic composition of water from Mitchell Caverns is typical of water from cooler, higher altitude sites. The similarity in isotopic composition (both in absolute magnitude and position relative to the meteoric water line) of ground water sampled as part of the Draft Report in the Fenner Gap areas to precipitation at Mitchell Caverns suggests that the ground water originated as recharge from precipitation that fell at a higher altitude rather than from locally derived precipitation. This is consistent with the interpretation presented in the Draft Report and is not consistent with infiltration from Schulyer Wash. Mitchell Caverns and other higher altitude locations are many miles from the study site and ground-water flow paths through alluvial aquifers are long.

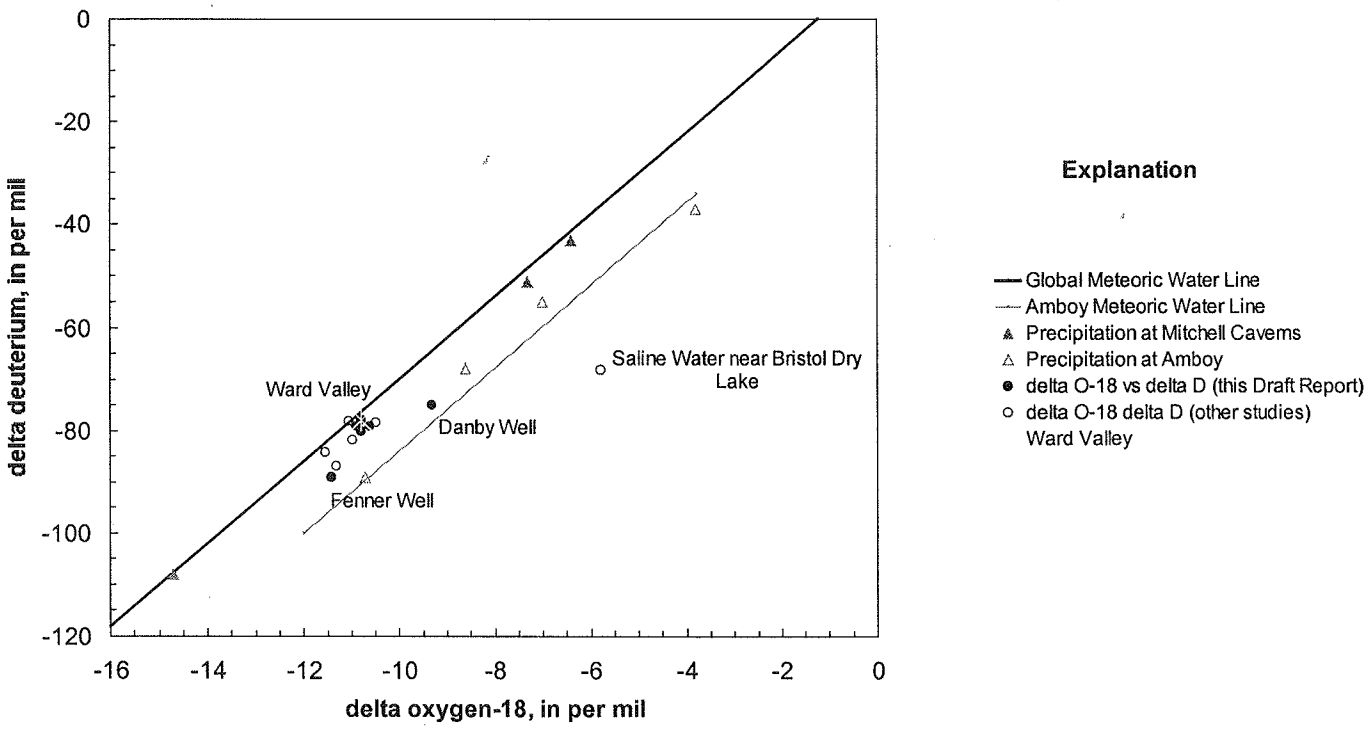

Figure 1.--Delta oxygen-18 and delta deuterium data from Fenner Valley and vicinity.

Water from the Danby well (this Draft Report) plots below the meteoric water line along the local meteoric water line at Amboy. Its position along the Amboy meteoric water line suggests a locally derived origin for water from this well. This is consistent with the interpretation presented in the Draft Report and the ∂D and $\partial^{18}O$ composition of water from the Danby well is cited as evidence of infiltration from washes that drain Fenner Valley. However, if infiltration is occurring along the wash, why is there no isotopic or chemical evidence of water from this source in the Fenner Gap wells? Similarly, data from an upgradient well along the wash at Essex

(LaMoreaux & Associates, 1995) show no evidence of infiltration from the wash. Friewald (1984) described several wells in Danby were that drilled for the railroad between 1901 and 1927. One the basis of water-level data collected by Friewald (1984), the depth to water at this site is about 250 below land surface. At that time, at least one of these wells yielded water from above the regional water table and could not be representative of water from the regional aquifer. It is possible that the Danby well sampled as part of this Draft Report is old, its casing has failed, and water from the well is not representative of the aquifer. Izbicki (1998) estimates that several hundred years are required for water from washes to infiltrate through thick unsaturated zones and reach the water table. Tritium would not be expected in ground water at this site regardless of its source. A failed casing and leakage of surface water into the well also would explain the presence of tritium in water from the Danby well sampled as part of this Draft Report. The Danby well may not be representative of water from the aquifer. Because of the uncertainty of the validity of this sample, the data should not be used as evidence of infiltration from the wash and should not be considered as part of the interpretations in this Draft Report. Proper identification of the well, inspection of the well, and inspection of the integrity of its casing are required to verify or reject this sample.

The Draft Report claims that the natural variability in the isotopic composition of water in the Fenner Gap area is small and consistent with one large source of ground-water recharge. However, on the basis of the large variability in chemical quality of water from wells, this variability has not been adequately addressed with samples collected as part of the Draft Report. Water-chemistry data indicate large differences in the chemical quality of water even in the small area near the recharge site. These large differences in chemistry would not be expected near a large source of ground-water recharge. They are in fact consistent with water from a number of smaller sources converging at a single location. It is not clear from the Draft Report why wells with high dissolved-solids water were sampled only one time or why this water was not analyzed for stable isotope or carbon-14 activity.

As a group the data from wells that were sampled in Fenner Gap are isotopically similar to data collected at the Ward Valley (National Research Council, 1995) and near the proposed Bolo Landfill (LaMoreaux & Associates, 1995). The most negative (lightest) samples are from a well along the eastern edge of Fenner Valley, sampled by Gleason et al. (1984). This sample plots along the local meteoric water line at Amboy and, on the basis of its location, would not be expected to receive recharge from the higher altitudes in the Providence Mountains near Mitchell Caverns. Saline water from a well near Bristol dry lake plots farthest from the meteoric water line as a result of evaporation. These data give an estimate of variations in the natural isotopic composition of water from wells in the study area--additional data are required for further interpretation.

The similarity of the ∂D and ∂^{18}O isotopic compositions of water from wells to present-day precipitation is interpreted in the Draft Report as evidence of recharge during present-day climatic conditions. Given the wide range and seasonality in the ∂D and ∂^{18}O composition of present-day precipitation measured by Friedman et al. (1992), care must be used when interpreting changes in ∂D and ∂^{18}O isotopic compositions of water in terms of paleoclimatic signals. Unlike many other areas of the world, in the western part of the Mojave Desert (Izbicki et al., 1995) and in parts of coastal California (Izbicki et al., 1992), correlations between carbon-

14 ages and the ∂D and $\partial^{18}O$ isotopic composition of ground water do not show a large shift toward more negative values (lighter) with increasing age. The reasons for this are unclear but may be related to the marine influence on climate and precipitation in southern California. Paleoclimatic studies have shown that, unlike most of the world, the temperature of the Pacific Ocean off the California coast during the Pleistocene (CLIMAP, 1976) was similar to present-day temperatures (Pisias, 1979).

Comments on the interpretation of tritium data--On the basis of data collected at Santa Maria and correlation with samples collected at Ottawa Canada (International Atomic Energy Agency, 1981), tritium in present-day precipitation in coastal California is expected to be about about 2 tritium units (TU) or about 6.4 picoCurries per liter (pCi/L) (Izbicki, 1992; Michel, 1989). Tritium in precipitation increases with increasing distance from the ocean; Michel (1989) estimated tritium concentrations in southern California to be about 3.3 TU in 1983. On the basis of samples of stormflow runoff collected at different sites in the Mojave Desert (U.S. Geological Survey, unpublished data), tritium in present-day precipitation in the Mojave Desert may be about 6 TU, slightly higher than Michel's estimate and slightly lower than the estimate in this Draft Report. Tritium in precipitation at Santa Maria reached a peak concentration of about 1,200 TU in 1962. Correcting for radioactive decay to the present time (about 3 half-lives) produces an estimate of about 150 TU. This is lower than the value reported in this Draft Report. The actual tritium concentrations in precipitation at the site probably are between the decay-corrected Santa Maria value and the value presented in the Draft Report. However, even after allowing for radioactive decay, tritium is readily measurable in environmental samples if the proper analytical techniques are used.

The tritium data for the Danby well (Stephens & Associates, 1992) has significant error associated with the measurement. The precision of the tritium analysis for this well is poor and the analytical techniques used were not intended for environmental studies of recharge processes. Analytical techniques that incorporate gas scintilation, electrolytic enrichment, or the recently developed helium-ingrowth procedures allow for detection limits of 0.2 TU or lower. The Draft Report interprets data from the Danby well as recently recharged water, and the ∂D and $\partial^{18}O$ isotope data suggest that the water is locally derived. Unfortunately, the well sampled is not identified by State well number. There are several old wells in the Danby area; water-level data (Friewald, 1984) suggest that at least some of the wells do not measure water representative of the aquifer. As previously discussed, Izbicki (1998) estimated that several hundred years are required for water from washes to infiltrate through thick unsaturated zones and reach the water table. Tritium would not be expected in ground water at the Danby well regardless of its source. Data from this well should not be considered as part of the interpretations in this Draft Report unless the sampled well is identified and the integrity of its casing verified.

Comments on the interpretation of carbon-14 data--Carbon-14 data from observation wells in Fenner Gap range from 18 to 25 percent modern carbon and have an apparent ages ranging from 11,500 to 14,000 years before present. In Appendix T, M. Lee Davisson suggests that water-rock reactions have occurred and that ground-water ages are younger than apparent ages indicate. However, he still believes that the ground-water age is early Holocene to late Pleistocene. The Draft Report dismissed the carbon-14 data and interpretations provided by M. Lee Davisson and suggested that carbon-14 data are not interpretable because reaction between ground water and

aquifer materials (primarily dissolution of carbonate minerals) during recharge and subsequent movement through the aquifer have altered the carbon-14 activity of the ground water.

In areas where the recharge rate is small and infiltrating water passes through a thick unsaturated zone prior to ground-water recharge, the Draft Report is correct in stating that carbon-14 activities are altered and may not be interpretable. However, in areas where large amounts of recharge occurs, the unsaturated zone is leached of chloride and other soluble salts, and carbonate minerals have not accumulated. The estimates of recharge presented in the Draft Report are large and, if correct, would leach soluble salts and, therefore, extensive accumulations of carbonate minerals would not be present in the unsaturated zone in these area. These conditions allow interpretation of rock-water reactions and their effect on carbon-14 activities.

On the basis of carbon-13 data provided as part of the Draft Report, reactions have occurred between ground water and aquifer materials. However, it is possible to interpret carbon-14 data and correct ground-water ages to account for the dissolution of carbon from aquifer materials that do not contain carbon-14. Numerous studies in the literature demonstrate corrections for rock-water interactions and the application of carbon-14 data to ground-water recharge studies. A complete interpretation of possible rock-water reactions and resulting corrections in carbon-14 data is beyond the scope of this review. However, an estimate of corrected carbon-14 ages for water from wells sampled in Fenner Gap can be made on the basis of data and rock-water reactions interpreted from other studies. Given the following,

1. Organic carbon typically has $\partial^{13}C$ compositions ranging from -21 to -28 per mil, depending on the source. Ground water in most desert aquifers contains dissolved oxygen. As a result, sulfate reduction and oxidation of organic material to bicarbonate cannot occur and contributions from organic material in the aquifer are limited.

2. Inorganic carbon in carbonate minerals present as caleche or as cement in desert aquifers typically has a $\partial^{13}C$ of about -4 per mil in areas where marine limestones are present the $\partial^{13}C$ of inorganic carbon may be as low as 0 per mil (Izbicki et al., 1995). For the purposes of calculations presented in this review, dissolution or isotopic exchange between ground water and carbonate minerals is the primary source of carbon that does not contain carbon-14 to ground water in desert aquifers. This assumption is consistent with the geochemical framework presented in the Draft Report.

3. Detailed sample collection and geochemical modeling studies done along flowpaths in the western part of the Mojave Desert show that the $\partial^{13}C$ composition of infiltrating water in active recharge areas is close to equilibrium with atmospheric $\partial^{13}C$ and has a value near -13 per mil (Izbicki et al.,, 1995) at the time of recharge. For the purposes of calculations presented in this review, the carbon-14 value of infiltrating water at the time of recharge is assumed to be 100 percent modern carbon. Carbon-14 activities in surface runoff and recently recharge water in the Mojave Desert is actually between 95 and 90 percent modern carbon (La Mareaux & Associates, 1995; Izbicki et al., 1995). Lower initial carbon-14 activities will result in older corrected ground-water ages.

Assuming a closed system and conservation of mass, a calculation can be made to estimate the fraction of the dissolved inorganic carbon dissolved from aquifer materials using the following equation:

$$C_m f_m = C_r f_r + C_w f_w$$

where: C_m is the measured $\partial^{13}C$ composition of the ground water. When using this approach, the fraction carbon measured in the ground water, f_m, is 1;
C_r is the $\partial^{13}C$ composition of the rock--assumed to be -4 per mil;
f_r is the fraction of the dissolved inorganic carbon from the rock;
C_w is the initial $\partial^{13}C$ composition of ground water at the time of recharge--assumed to be -13 per mil;
f_w is the fraction of the dissolved inorganic carbon from the recharge water. (To solve the equation f_w is written as $f_w = f_r - 1$).

Once the fraction of carbon from the aquifer materials is known, the corrected carbon-14 activity can be calculated using the following equation:

$$^{14}C_m = {}^{14}C_r f_r + {}^{14}C_w f_w$$

where: $^{14}C_m$ is the measured carbon-14 activity of the water. The fraction of carbon measured in the water is 1.
$^{14}C_r$ is the carbon-14 activity of the rock--assumed to be 0 because the rock has great age.
$^{14}C_w$ is the carbon-14 activity of the water corrected for mineralogical reactions. The fraction of the carbon-14 from the recharge water was calculated from the previous equation.

Results of these calculations are summarized in table 1.

Although subject to considerable discussion and additional interpretation if more data were available, the fraction of dissolved inorganic carbon from rock dissolution and corrected carbon-14 numbers are consistent with interpretations presented in the Draft Report by M. Lee Davisson of Lawrence Livermore National Laboratory. Corrected carbon-14 ages presented in table 1 also are consistent with corrected carbon-14 ages between 9,300 and 12,700 years before present estimated for the proposed Bolo Station Landfill Site (La Moreaux & Associates, 1995) in Cadiz Valley to the south of the study area and with corrected carbon-14 ages between 4,500 and 22,000 years before present estimated for Ward Valley east of the study area (National Research Council, 1995). Younger water, recharged 2,300 years before present, was sampled in parts of Cadiz Valley upgradient from the proposed landfill near the mountain front.

Mixing of younger ground water infiltrated from washes with older ground water also is cited as a source of error associated with carbon-14 measurements. In the Draft Report, the $\partial^{18}O$ and ∂D composition of water infiltrated from washes is believed to be characterized by samples from the Danby well. Water from this well has a unique ∂D and $\partial^{18}O$ isotopic composition and plots along the local meteoric water line for Amboy. If the Draft Report is correct in its interpretation,

∂D and $\partial^{18}O$ data suggest that water infiltrated from wash must be only a small component of the water sampled from wells at Fenner Gap. If a mixture is present, the Draft Report is correct in stating that carbon-14 measurements in water from wells represent an average age of the water; therefore, if even a small amount of comparatively young water from the wash infiltrated to the water table it would mix with ground water that would have to be even older than the corrected ages shown in table 1.

Summary--As a group isotopic data from this Draft Report and from studies in adjacent areas are consistent and show there is limited recharge under present-day climatic conditions and that ground water in desert basins was recharged thousands of years ago.

Table 1--Carbon-14 activities and ages for ground water from wells in the Fenner Gap.

Well number	Measured carbon-14 activity (pmc)	Measured carbon-13 (per mil)	Uncorrected Carbon-14 age (years before present)	Fraction DIC from rock (f_r)	Corrected carbon-14 activity (pmc)	Corrected carbon-14 age (years before present)
Assuming a carbon-13 composition of -4 per mil for rock dissolution						
CI-1	19	-7.8	13,600	0.58	45	5,500
CI-2	18	-8.4	14,000	0.51	37	8,300
CI-3	24	-9.4	11,900	0.40	40	7,600
MW-7	25	-10	11,500	0.33	38	8,100
Assuming a carbon-13 composition of 0 per mil for rock dissolution						
CI-1	19	-7.8	13,600	0.40	32	9,500
CI-2	18	-8.4	14,000	0.35	28	10,600
CI-3	24	-9.4	11,900	0.28	33	9,100
MW-7	25	-10	11,500	0.23	32	9,200

9.5 Infiltration

Page 139, 9.5.3, Groundwater Mounding. Was the ground-water model described in Section 8.0 used to simulate the water-level drawdown resulting from the pumping during the test and water-level mounding resulting from the recharge operation? The measured results of this test (figures 103 and 108) would provide excellent data to calibrate the ground-water flow model on a local scale. How were the drawdown and recharge mound figures constructed in such detail (figures 103-108)? The measured data from the wells are too sparse to construct the figures. The symmetry of the drawdown and mounding could be useful for identifying changes in lithology and potential barriers to flow. As postulated in the Draft Report and in this review, a northwest-southeast trending fault lies almost directly beneath the recharge ponds. Since the production well is perforated in the upper and lower aquifers, and the extent of the lower aquifer is limited by the fault to the northeast, one would expect to see a barrier affect in the measured

drawdown. Unfortunately, there are no wells perforated opposite the lower aquifer between the production well and the recharge ponds. A better monitoring network would be needed to define the drawdown and mounding. Microgravity would be a good technique to apply to fill in the gaps during a follow-up recharge activity. The calibrated model could then be used with more confidence, then the poorly calibrated regional model, to help manage the large-scale recharge operation. In addition, a two-dimensional unsaturated zone model could be calibrated with the measured data, to provide information on the unsaturated zone properties.

Page 140, 9.5.4, Water Quality Changes (Includes comments for 9.5.4.1 and 9.5.4.2). Water-quality changes observed in monitoring wells after water infiltrated through the thick unsaturated zone beneath the recharge basins are consistent with leaching of chloride and other soluble salts from the unsaturated zone. As described in previous comments from Section 6.7, accumulation of chloride and other soluble salts is consistent with the lack of recharge in desert basins. The relatively high chloride concentrations measured in observation wells suggest that the salt accumulation was large and that the length of time since recharge has occurred at that site must be long.

The Draft Report does not discuss what happens with this high TDS water. Was the solute-transport model described in Section 8 used to simulate the movement of this TDS plume? It is interesting to note that the TDS contours do not agree with the water-level contours. What are the implications of this high TDS water for the large-scale operation? What will be done with this high TDS during the pump-back operation? Wells CI-3 and MW-2 should have been sampled to determine the transport of the TDS plume.

9.9 Analysis of Project Impacts Using the Groundwater Model

Page 148, 9.9.1, Project Area Water Level Changes. As described in great detail in the review of the model in Section 8.0, the model does not accurately simulate current water levels. Water levels are too high in Area A and too low near the dry lakes. The simulated gradient through the Fenner Gap is higher than the gradient measured in the gap, even using unreasonably high hydraulic conductivity values (in excess on 1,000 gpd/ft^2). Too much recharge is being simulated in the model; therefore, the gradient is too high and an unreasonable evapotranspiration rate is being simulated in the model. The simulation of soil evaporation from the dry lakes using a 100-foot extinction depth is unreasonable. The model needs to be recalibrated before it can be used to predict water-level changes resulting from the planned recharge/pumpage operation.

Water-level contours and drawdown contours need to be presented for each scenario. These contours are needed to show the areal extent of mounding during recharge operations and drawdown during the pumping operation. In addition to simulating scenarios 5 and 6, please make two long-term simulations considering the recovery of the aquifers after the 50-year put/take operations cease. The length of these simulations should be long enough such that there is little change in head between subsequent stress periods. Note that steady-state simulations will not suffice because density-dependent flow and transport takes many years to equilibrate. These simulations are needed to show the long-term affects of the recharge and pumping

operations. If more water is withdrawn than is recharged, it will take many years for the drawdown cone to stabilize, especially if realistic recharge rates are simulated in the model.

Page 148, 9.9.2, Groundwater Supply to Bristol and Cadiz Dry Lakes. Results of the watershed model, chloride mass balance studies, isotopic data, and water balance (evaporation at the dry lakes) presented in the Draft Report greatly overestimate natural ground-water recharge. Data presented in the Draft Report and all previous studies done in the area are consistent with small amounts of recharge to desert basins. The 1,150,000 acre-feet of ground water projected as discharge to Bristol dry lake, under existingl conditions, over a 50-year period is not correct. The actual number is much smaller. Such a large error in such an important component of the model almost certainly invalidates the flow and solute model results and predictions.

As a check on the simulated underflow through Fenner Gap, a simple Darcy's Law calculation was completed using the data presented in the Draft Report. Friewald (1984) and P.E. La Moreaux & Associates (1995) performed similar calculations. Darcy's Law states that Q = KIA where Q is equal to the rate of underflow; K is equal to the hydraulic conductivity, and A is equal to the cross-sectional area. The gradient (I) was determined by measuring the water-level distance between wells MW-7 and MW-1 (612.72-602.47=10.25 feet) and dividing by the measured distance between the wells (5,950 feet; measured on plate 3 of the Draft Report). The resulting gradient is 0.0017 feet per feet. The cross-sectional area was measured along the cross-section D-D' on plate 3. Two areas were measured: the first area (A1) is the area of the saturated unconsolidated deposits from the water table to 100 feet below the water table, and the second area (A2) is the area of the saturated unconsolidated deposits from 100 feet below the water table to the contact with the underlying bedrock. This was done because inspection of the geophysical and lithologic logs indicated that there was a change in the hydraulic properties of the unconsolidated deposits at about 100 feet below the water table. The resulting areas were approximately 486,000 ft^2 for A1 and 3,300,000 ft^2 for A2. If we assume the hydraulic conductivity values estimated for the upper and lower alluvial aquifers, presented earlier in this review (see review comments for Section 8.1.4.4), are representative of the two aquifers (800 gpd/ft^2 for the upper aquifer and 300 gpd/ft^2 for the lower aquifer), we can estimate the underflow through the Fenner Gap. Note that these hydraulic conductivity values were estimated from well PW-1 that is downgradient of a postulated fault, and this well penetrates deposits that are not present in the gap. The calculated underflows are about 740 acre-ft/yr and 1,887 acre-ft/yr for A1 and A2, respectively. Therefore, the combined estimated underflow through the Fenner Gap is about 2,627 acre-feet per year. If one assumes that the hydraulic conductivity estimated from the specific capacity data of well PW-1 is representative for the entire cross sectional area (600 gpd/ft^2; see review comments for Section 8.1.4.4), then the total estimated underflow would be about 4,330 acre-feet per year. These estimates are higher than the 270 acre-feet per year estimated by Friewald (1984) lower or slightly higher than the 3,720 acre-feet per year estimated by P.E La Moreaux & Associates (1995), and significantly less than the 30,0000 acre-feet per year estimated in the Draft Report. The Draft Report must reevaluate the recharge and hydraulic conductivity estimates used in the ground-water flow model.

Regardless of the recharge value, if the project pumps more water than is recharged, there will be less ground-water discharge at the dry lakes. Over the long term, this will cause water levels beneath the dry lakes to decline. A density-dependent solute-transport model is needed to

evaluate the long-term impacts of the project on the brine levels. The Draft Report does not address how water-level declines will impact the dry lakes. With a decrease in ground-water discharge, will the mining operation at the dry lakes be impacted? Will lower water levels cause the upper sediments to dry out and result in a dust problem? As stated previously in this review, the failure of the model to simulate the water levels beneath the playas invalidates the models ability to predict any impacts resulting from the recharge/pumping operation on water levels and solute transport beneath the playas. With less recharge in the model, water-level declines resulting from the pumping phase of the project will be greater, which will undoubtedly cause the high salinity water to move from the Bristol dry lake area towards the pumping wells if there is not a ground-water barrier between the well field and Bristol dry lake.

Page 150, 9.10, Subsidence and Hydrocompaction. As stated previously in the review, the water-level changes predicted by the ground-water model are based on an incorrectly calibrated model; therefore, the predicted subsidence values will also be in error.

Page 151, 9.11, Project Spreading Basins. The entire project should be reevaluated after recalibrating the ground-water flow and solute-transport models.

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Attachment

Copy To: **Willie Taylor, Director, Office of Environmental Policy and Compliance**
Mike Shulters, District Chief, California
A. Holley, DO, Reston, Virginia

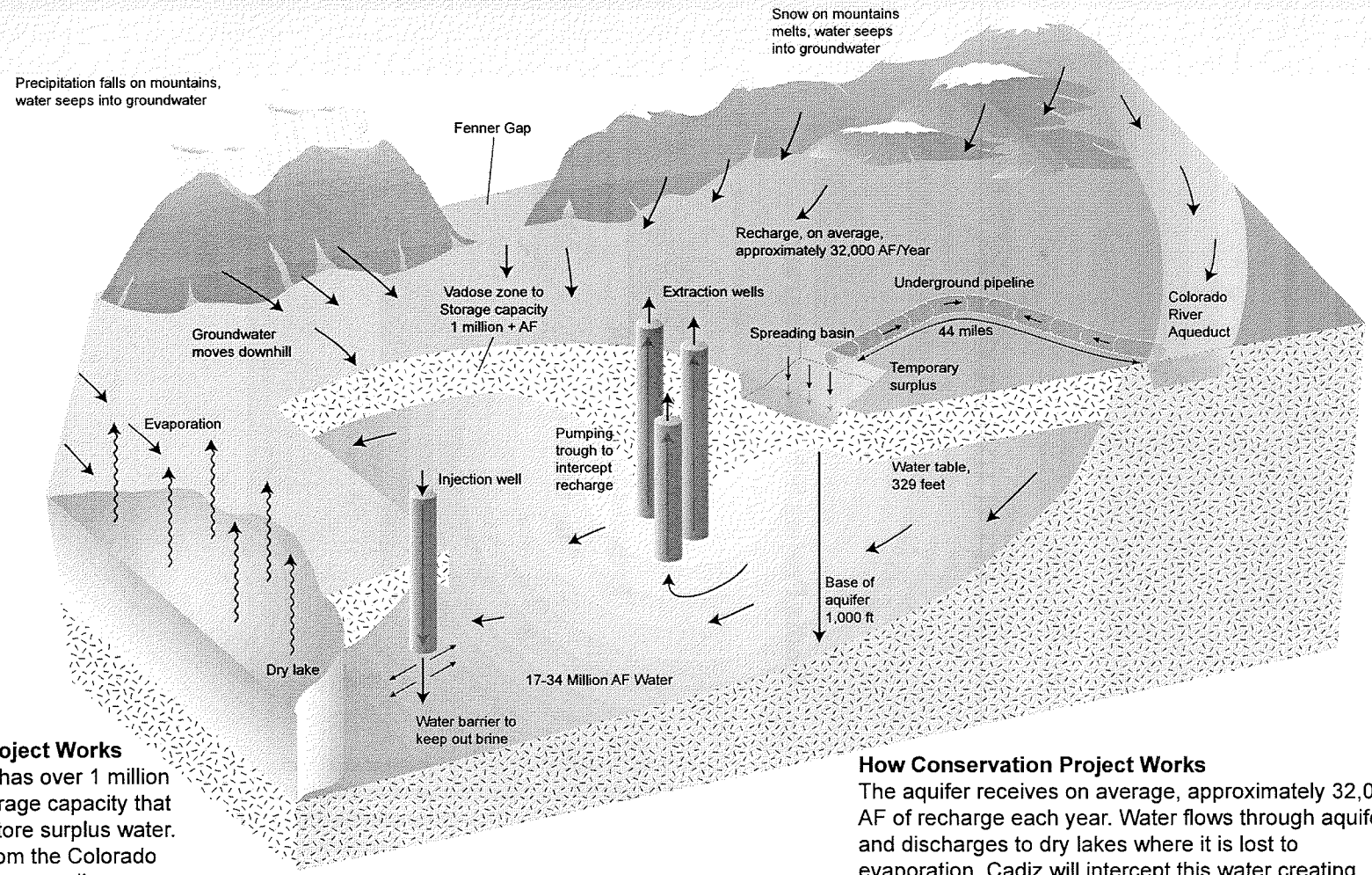
ATTACHMENT C

Cadiz Project Schematic Diagram

Prepared by CH2M Hill

for Cadiz, Inc.

CADIZ WATER CONSERVATION AND STORAGE PROJECT



How Storage Project Works

The aquifer also has over 1 million AF of excess storage capacity that can be used to store surplus water. Water is piped from the Colorado River Aqueduct to spreading basins where it infiltrates through the vadose zone and is stored safely in the aquifer, with negligible evaporative losses.

How Conservation Project Works

The aquifer receives on average, approximately 32,000 AF of recharge each year. Water flows through aquifer and discharges to dry lakes where it is lost to evaporation. Cadiz will intercept this water creating conserved groundwater for local supply. This water can also be piped to the Colorado River Aqueduct. Over a 50-year project duration, more than 1.5 million AF of water will be conserved, water that otherwise would be lost to evaporation forever.

CH2MHILL

UNITED STATES MARINE CORPS
MARINE AIR GROUND TASK FORCE TRAINING COMMAND
MARINE CORPS AIR GROUND COMBAT CENTER
BOX 788100
TWENTYNINE PALMS, CALIFORNIA 92278-8100

IN REPLY REFER TO:
5800
G-4
March 29, 2011

Mr. Tom Barnes, ESA
Santa Margarita Water District
626 Wilshire Blvd., Ste. 1100
Los Angeles, CA 90017

SUBJECT: CADIZ VALLEY WATER CONSERVATION, RECOVERY, AND STORAGE PROJECT

The Marine Corps Air Ground Combat Center, Twentynine Palms, California, takes this opportunity to submit comments on the Notice of Preparation of a Draft EIR for the above-referenced project. As a neighboring land owner, we are very interested in the potential impacts of this project.

As you may know, the Marine Corps is considering an expansion of the Combat Center and the establishment of new special use airspace to support any such expansion. A Draft Environmental Impact Statement for the Twentynine Palms Land Acquisition and Airspace Establishment project is currently out for public review and comment (the comment period runs from February 25, 2011, to May 26, 2011). A Final EIS is expected by the end of 2011, with a Record of Decision being issued in April 2012. Any acquisition of land must then be approved by Congress.

While the designated Preferred Alternative for the Twentynine Palms Land Acquisition and Airspace Establishment project does not include lands to the east of the current Combat Center boundaries, one alternative still under active consideration (Alternative 3) does include a portion of the Cadiz Inc. held lands. Even though our Alternative 3 does not appear to include the Cadiz Valley Water project's proposed well fields or spreading basins, it does include large amounts of adjacent lands. Therefore, the Marine Corps encourages the EIR to fully consider the land use and other impacts of the Twentynine Palms Land Acquisition and Airspace Establishment project on the Cadiz Valley Water project.

Thank you for the opportunity to comment. Please continue to consider the Combat Center as an interested party to your project.

Sincerely,

B. R. Norquist
Lieutenant Colonel, USMC
Assistant Chief of Staff, G-4

Copy to: Office of General Counsel

STATE OF CALIFORNIA

GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH

STATE CLEARINGHOUSE AND PLANNING UNIT

JERRY BROWN
GOVERNOR

Notice of Preparation

March 1, 2011

To: Reviewing Agencies

Re: Cadiz Valley Water Conservation, Recovery, and Storage Project
SCH# 2011031002

Attached for your review and comment is the Notice of Preparation (NOP) for the Cadiz Valley Water Conservation, Recovery, and Storage Project draft Environmental Impact Report (EIR).

Responsible agencies must transmit their comments on the scope and content of the NOP, focusing on specific information related to their own statutory responsibility, within 30 days of receipt of the NOP from the Lead Agency. This is a courtesy notice provided by the State Clearinghouse with a reminder for you to comment in a timely manner. We encourage other agencies to also respond to this notice and express their concerns early in the environmental review process.

Please direct your comments to:

Tom Barnes
Santa Margarita Water District
626 Wilshire Blvd., Suite 1100
Los Angeles, CA 90017

with a copy to the State Clearinghouse in the Office of Planning and Research. Please refer to the SCH number noted above in all correspondence concerning this project.

If you have any questions about the environmental document review process, please call the State Clearinghouse at (916) 445-0613.

Sincerely,

Scott Morgan
Director, State Clearinghouse

Attachments
cc: Lead Agency

1400 10th Street P.O. Box 3044 Sacramento, California 95812-3044
(916) 445-0613 FAX (916) 323-3018 www.opr.ca.gov

Document Details Report
State Clearinghouse Data Base

SCH# 2011031002
Project Title Cadiz Valley Water Conservation, Recovery, and Storage Project
Lead Agency Santa Margarita Water District

Type NOP Notice of Preparation

Description The proposed project would be executed in two phases: the first phase, the Conservation and Recovery Component (project level evaluation), would capture and conserve the annual natural recharge in the Fenner and northern Bristol Valleys that would otherwise discharge to the Bristol and Cadiz Dry Lakes. The second phase is the Imported Water Storage Component (program level evaluation), and would make up to one million acre-feet of groundwater storage space available, to store water for future withdrawal.

Lead Agency Contact

Name Tom Barnes
Agency Santa Margarita Water District
Phone 213 599-4300 **Fax** 213-599-4301
email cadizproject@esassoc.com
Address 626 Wilshire Blvd., Suite 1100
City Los Angeles **State** CA **Zip** 90017

Project Location

County San Bernardino
City
Region
Cross Streets Cadiz Road and National Trails Hwy
Lat / Long 34° 18' 38" N / 115° 14' 21" W
Parcel No.
Township 5N **Range** 14E **Section** 36 **Base** SBB&M

Proximity to:

Highways Hwy 62
Airports
Railways ARZC; BNSF
Waterways Coloardo River Aqueduct (CRA)
Schools
Land Use Agriculture, Resource Conservation

Project Issues Aesthetic/Visual; Agricultural Land; Air Quality; Archaeologic-Historic; Biological Resources; Drainage/Absorption; Flood Plain/Flooding; Forest Land/Fire Hazard; Geologic/Seismic; Minerals; Noise; Population/Housing Balance; Public Services; Recreation/Parks; Schools/Universities; Soil Erosion/Compaction/Grading; Solid Waste; Toxic/Hazardous; Traffic/Circulation; Vegetation; Water Quality; Water Supply; Wetland/Riparian; Growth Inducing; Landuse; Cumulative Effects; Other Issues

Reviewing Agencies Resources Agency; Colorado River Board; Department of Conservation; California Energy Commission; Cal Fire; Office of Historic Preservation; Department of Parks and Recreation; Resources, Recycling and Recovery; Department of Water Resources; Department of Fish and Game, Region 6; CA Department of Public Health; Office of Emergency Management Agency, California; Native American Heritage Commission; Public Utilities Commission; State Lands Commission; California Highway Patrol; Department of Housing and Community Development; Caltrans, District 8; State Water Resources Control Board, Divison of Financial Assistance; State Water Resources Control Board, Division of Water Quality; State Water Resources Control Board, Division of Water Rights; Department of Toxic Substances Control; Regional Water Quality Control Board, Region 7

Date Received 02/28/2011 **Start of Review** 03/01/2011 **End of Review** 03/30/2011

Note: Blanks in data fields result from insufficient information provided by lead agency.

NOP Distribution List

County: San Bernardino SCH# 2011031002

Resources Agency

- [■] **Resources Agency** Nadell Gayou
- [ ] **Dept. of Boating & Waterways** Mike Sotelo
- [ ] **California Coastal Commission** Elizabeth A. Fuchs
- [ ] **Colorado River Board** Gerald R. Zimmerman
- [ ] **Dept. of Conservation** Jonathan Martis
- [ ] **California Energy Commission** Eric Knight
- [ ] **Cal Fire** Allen Robertson
- [ ] **Central Valley Flood Protection Board** James Herota
- [ ] **Office of Historic Preservation** Ron Parsons
- [■] **Dept of Parks & Recreation** Environmental Stewardship Section
- [ ] **California Department of Resources, Recycling & Recovery** Sue O'Leary
- [ ] **S.F. Bay Conservation & Dev't. Comm.** Steve McAdam
- [ ] **Dept. of Water Resources** Resources Agency Nadell Gayou
- [ ] _____ Conservancy

Fish and Game

- [ ] **Depart. of Fish & Game** Scott Flint Environmental Services Division
- [ ] **Fish & Game Region 1** Donald Koch
- [ ] **Fish & Game Region 1E** Laurie Harnsberger
- [ ] **Fish & Game Region 2** Jeff Drongesen
- [ ] **Fish & Game Region 3** Charles Armor
- [ ] **Fish & Game Region 4** Julie Vance
- [ ] **Fish & Game Region 5** Don Chadwick Habitat Conservation Program
- [ ] **Fish & Game Region 6** Gabrina Gatchel Habitat Conservation Program
- [ ] **Fish & Game Region 6 I/M** Brad Henderson Inyo/Mono, Habitat Conservation Program
- [ ] **Dept. of Fish & Game M** George Isaac Marine Region

Other Departments

- [ ] **Food & Agriculture** Steve Shaffer Dept. of Food and Agriculture
- [ ] **Depart. of General Services** Public School Construction
- [ ] **Dept. of General Services** Anna Garbeff Environmental Services Section
- [ ] **Dept. of Public Health** Bridgette Binning Dept. of Health/Drinking Water

Independent Commissions,Boards

- [ ] **Delta Protection Commission** Linda Flack
- [ ] **Cal EMA (Emergency Management Agency)** Dennis Castrillo
- [ ] **Governor's Office of Planning & Research** State Clearinghouse
- [■] **Native American Heritage Comm.** Debbie Treadway
- [ ] **Public Utilities Commission** Leo Wong
- [ ] **Santa Monica Bay Restoration** Guangyu Wang
- [ ] **State Lands Commission** Marina Brand
- [ ] **Tahoe Regional Planning Agency (TRPA)** Cherry Jacques

Business, Trans & Housing

- [ ] **Caltrans - Division of Aeronautics** Sandy Hesnard
- [ ] **Caltrans - Planning** Terri Pencovic
- [ ] **California Highway Patrol** Scott Loetscher Office of Special Projects
- [ ] **Housing & Community Development** CEQA Coordinator Housing Policy Division

Dept. of Transportation

- [ ] **Caltrans, District 1** Rex Jackman
- [ ] **Caltrans, District 2** Marcelino Gonzalez
- [ ] **Caltrans, District 3** Bruce de Terra
- [ ] **Caltrans, District 4** Lisa Carboni
- [ ] **Caltrans, District 5** David Murray
- [ ] **Caltrans, District 6** Michael Navarro
- [ ] **Caltrans, District 7** Elmer Alvarez
- [ ] **Caltrans, District 8** Dan Kopulsky
- [ ] **Caltrans, District 9** Gayle Rosander
- [ ] **Caltrans, District 10** Tom Dumas
- [ ] **Caltrans, District 11** Jacob Armstrong
- [ ] **Caltrans, District 12** Chris Herre

Cal EPA

Air Resources Board

- [ ] Airport Projects Jim Lerner
- [ ] Transportation Projects Douglas Ito
- [ ] Industrial Projects Mike Tollstrup
- [ ] **State Water Resources Control Board** Regional Programs Unit Division of Financial Assistance
- [ ] **State Water Resources Control Board** Student Intern, 401 Water Quality Certification Unit Division of Water Quality
- [ ] **State Water Resouces Control Board** Phil Crader Division of Water Rights
- [ ] **Dept. of Toxic Substances Control** CEQA Tracking Center
- [ ] **Department of Pesticide Regulation** CEQA Coordinator

Regional Water Quality Control Board (RWQCB)

- [ ] **RWQCB 1** Cathleen Hudson North Coast Region (1)
- [ ] **RWQCB 2** Environmental Document Coordinator San Francisco Bay Region (2)
- [ ] **RWQCB 3** Central Coast Region (3)
- [ ] **RWQCB 4** Teresa Rodgers Los Angeles Region (4)
- [ ] **RWQCB 5S** Central Valley Region (5)
  - [ ] **RWQCB 5F** Central Valley Region (5) Fresno Branch Office
  - [ ] **RWQCB 5R** Central Valley Region (5) Redding Branch Office
- [ ] **RWQCB 6** Lahontan Region (6)
  - [ ] **RWQCB 6V** Lahontan Region (6) Victorville Branch Office
- [ ] **RWQCB 7** Colorado River Basin Region (7)
- [ ] **RWQCB 8** Santa Ana Region (8)
- [ ] **RWQCB 9** San Diego Region (9)

- [ ] Other _____

Last Updated 218/11

Department of Toxic Substances Control

Linda S. Adams
Acting Secretary for
Environmental Protection

Leonard E. Robinson
Acting Director
5796 Corporate Avenue
Cypress, California 90630

Edmund G. Brown Jr.
Governor

March 21, 2011

Mr. Tom Barnes
Santa Margarita Water District
626 Wilshire Boulevard, Suite 1100
Los Angeles, California 90017

NOTICE OF PREPARATION (NOP) OF A DRAFT ENVIRONMENTAL IMPACT REPORT FOR THE CADIZ WATER CONSERVATION, RECOVERY, AND STORAGE PROJECT (SCH# 2011031002), SAN BERNARDINO COUNTY

Dear Mr. Barnes:

The Department of Toxic Substances Control (DTSC) has received your submitted Notice of Preparation for a draft Environmental Impact Report (EIR) for the above-mentioned project. The following project description is stated in your document: "The Project proposes active management of the groundwater basin underlying Cadiz Inc. property in the Cadiz and Fenner Valleys located in the eastern Mojave Desert, San Bernardino County, California. As part of the Conservation and Recovery Component, native groundwater currently being lost annually to evaporation at the Bristol and Cadiz Lakes from the aquifer system underlying the Project area would be captured and conserved through the active management of the groundwater basin. The project would construct extraction wells (wellfield) on the Cadiz property and a 42-mile underground water conveyance pipeline within an active railroad right-of-way that intersects the Colorado River Aqueduct (CRA). The proposed Project would be executed in two phases: the first phase of the Project is the Conservation and Recovery Component, and the second phase is the Imported Water Storage Component".

Based on the review of the submitted document DTSC has the following comments:

1. The EIR should evaluate whether conditions within the Project area may pose a threat to human health or the environment. Following are the databases of some of the regulatory agencies:

- National Priorities List (NPL): A list maintained by the United States Environmental Protection Agency (U.S.EPA).

- Envirostor (formerly CalSites): A Database primarily used by the California Department of Toxic Substances Control, accessible through DTSC's website (see below).

- Resource Conservation and Recovery Information System (RCRIS): A database of RCRA facilities that is maintained by U.S. EPA.

- Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS): A database of CERCLA sites that is maintained by U.S.EPA.

- Solid Waste Information System (SWIS): A database provided by the California Integrated Waste Management Board which consists of both open as well as closed and inactive solid waste disposal facilities and transfer stations.

- GeoTracker: A List that is maintained by Regional Water Quality Control Boards.

- Local Counties and Cities maintain lists for hazardous substances cleanup sites and leaking underground storage tanks.

- The United States Army Corps of Engineers, 911 Wilshire Boulevard, Los Angeles, California, 90017, (213) 452-3908, maintains a list of Formerly Used Defense Sites (FUDS).

2) The EIR should identify the mechanism to initiate any required investigation and/or remediation for any site within the proposed Project area that may be contaminated, and the government agency to provide appropriate regulatory oversight. If necessary, DTSC would require an oversight agreement in order to review such documents.

3) Any environmental investigations, sampling and/or remediation for a site should be conducted under a Workplan approved and overseen by a regulatory agency that has jurisdiction to oversee hazardous substance cleanup. The findings of any investigations, including any Phase I or II Environmental Site Assessment Investigations should be summarized in the document. All sampling results in which hazardous substances were found above regulatory standards should be

clearly summarized in a table. All closure, certification or remediation approval reports by regulatory agencies should be included in the EIR.

4) If buildings, other structures, asphalt or concrete-paved surface areas are being planned to be demolished, an investigation should also be conducted for the presence of other hazardous chemicals, mercury, and asbestos containing materials (ACMs). If other hazardous chemicals, lead-based paints (LPB) or products, mercury or ACMs are identified, proper precautions should be taken during demolition activities. Additionally, the contaminants should be remediated in compliance with California environmental regulations and policies.

5) Future project construction may require soil excavation or filling in certain areas. Sampling may be required. If soil is contaminated, it must be properly disposed and not simply placed in another location onsite. Land Disposal Restrictions (LDRs) may be applicable to such soils. Also, if the project proposes to import soil to backfill the areas excavated, sampling should be conducted to ensure that the imported soil is free of contamination.

6) Human health and the environment of sensitive receptors should be protected during any construction or demolition activities. If necessary, a health risk assessment overseen and approved by the appropriate government agency should be conducted by a qualified health risk assessor to determine if there are, have been, or will be, any releases of hazardous materials that may pose a risk to human health or the environment.

7) If the site was used for agricultural, livestock or related activities, onsite soils and groundwater might contain pesticides, agricultural chemical, organic waste or other related residue. Proper investigation, and remedial actions, if necessary, should be conducted under the oversight of and approved by a government agency at the site prior to construction of the project.

8) If it is determined that hazardous wastes are, or will be, generated by the proposed operations, the wastes must be managed in accordance with the California Hazardous Waste Control Law (California Health and Safety Code, Division 20, Chapter 6.5) and the Hazardous Waste Control Regulations (California Code of Regulations, Title 22, Division 4.5). If it is determined that hazardous wastes will be generated, the facility should also obtain a United States Environmental Protection Agency Identification Number by contacting (800) 618-6942. Certain hazardous waste treatment processes or hazardous materials, handling, storage or uses may require authorization from the local Certified Unified Program Agency (CUPA). Information about the requirement for authorization can be obtained by contacting your local CUPA.

9) DTSC can provide cleanup oversight through an Environmental Oversight Agreement (EOA) for government agencies that are not responsible parties, or a Voluntary Cleanup Agreement (VCA) for private parties. For additional information on the EOA or VCA, please see www.dtsc.ca.gov/SiteCleanup/Brownfields, or contact Ms. Maryam Tasnif-Abbasi, DTSC's Voluntary Cleanup Coordinator, at (714) 484-5489.

If you have any questions regarding this letter, please contact Rafiq Ahmed, Project Manager, at rahmed@dtsc.ca.gov, or by phone at (714) 484-5491.

Sincerely,

Greg Holmes
Unit Chief
Brownfields and Environmental Restoration Program

cc: Governor's Office of Planning and Research
State Clearinghouse
P.O. Box 3044
Sacramento, California 95812-3044
state.clearinghouse@opr.ca.gov.

CEQA Tracking Center
Department of Toxic Substances Control
Office of Environmental Planning and Analysis
P.O. Box 806
Sacramento, California 95812
ADelacr1@dtsc.ca.gov

CEQA # 3165

NATIVE AMERICAN HERITAGE COMMISSION
915 CAPITOL MALL, ROOM 364
SACRAMENTO, CA 95814
(916) 653-6251
Fax (916) 657-5390
Web Site www.nahc.ca.gov
ds_nahc@pacbell.net

March 21, 2011

Mr. Tom Barnes
ESA *for the*
Santa Margarita Water District
626 Wilshire Boulevard, Suite 1100
Los Angeles, CA 90017

Re: SCH#2011031002; CEQA Notice of Preparation (NOP); draft Environmental Impact Report (DEIR for the: **"Cadiz Valley Water Conservation, Recovery, and Storage Project;"** located in southeastern San Bernardino County, California

Dear Mr. Barnes:

The Native American Heritage Commission (NAHC), the State of California 'Trustee Agency' for the protection and preservation of Native American cultural resources. The NAHC wishes to comment on the above-referenced proposed Project.

This letter includes state and federal statutes relating to Native American historic properties of religious and cultural significance to American Indian tribes and interested Native American individuals as 'consulting parties' under both state and federal law. State law also addresses the freedom of Native American Religious Expression in Public Resources Code §5097.9.

The California Environmental Quality Act (CEQA – CA Public Resources Code 21000-21177, amendments effective 3/18/2010) requires that any project that causes a substantial adverse change in the significance of an historical resource, that includes archaeological resources, is a 'significant effect' requiring the preparation of an Environmental Impact Report (EIR) per the CEQA Guidelines defines a significant impact on the environment as 'a substantial, or potentially substantial, adverse change in any of physical conditions within an area affected by the proposed project, including ...objects of historic or aesthetic significance." In order to comply with this provision, the lead agency is required to assess whether the project will have an adverse impact on these resources within the 'area of potential effect (APE), and if so, to mitigate that effect. The NAHC Sacred Lands File (SLF) search resulted in; **Native American cultural resources were not identified** within 1.2 mile of the 'area of potential effect (APE), based on the USGS coordinates you provided for the project location. The NAHC "Sacred Sites,' as defined by the Native American Heritage Commission and the California Legislature in California Public Resources Code §§5097.94(a) and 5097.96. Items in the NAHC Sacred Lands Inventory are confidential and exempt from the Public Records Act pursuant to California Government Code §6254.10. The absence of evidence of archaeological items does not indicate that they do not exist at the subsurface and/or when groundbreaking activity occurs.

Early consultation with Native American tribes in your area is the best way to avoid unanticipated discoveries of cultural resources or burial sites once a project is underway. Culturally affiliated tribes and individuals may have knowledge of the religious and cultural significance of the historic properties in the project area (e.g. APE). We strongly urge that you

make contact with the list of Native American Contacts on the attached list of Native American contacts, to see if your proposed project might impact Native American cultural resources and to obtain their recommendations concerning the proposed project. The list includes additional Native American who have been monitoring this project. Consultation with Native American communities is also a matter of environmental justice as defined by California Government Code §65040.12(e). The NAHC recommends *avoidance* as defined by CEQA Guidelines §15370(a) to pursuing a project that would damage or destroy a Native American cultural resources.

Furthermore we recommend, also, that you contact the California Historic Resources Information System (CHRIS) for pertinent archaeological data within or near the APE, at (916) 445-7000 for the nearest Information Center in order to learn what archaeological fixtures may have been recorded in the APE.

Consultation with tribes and interested Native American consulting parties, on the NAHC list, should be conducted in compliance with the requirements of federal NEPA (42 U.S.C 4321-43351) and Section 106 and 4(f) of federal NHPA (16 U.S.C. 470 *et seq*), 36 CFR Part 800.3 (f) (2) & .5, the President's Council on Environmental Quality (CSQ, 42 U.S.C 4371 *et seq.* and NAGPRA (25 U.S.C. 3001-3013) as appropriate. The 1992 *Secretary of the Interiors Standards for the Treatment of Historic Properties* were revised so that they could be applied to all historic resource types included in the National Register of Historic Places and including cultural landscapes. Also, federal Executive Orders Nos. 11593 (preservation of cultural environment), 13175 (coordination & consultation) and 13007 (Sacred Sites) are helpful, supportive guides for Section 106 consultation.

Furthermore, Public Resources Code Section 5097.98, California Government Code §27491 and Health & Safety Code Section 7050.5 provide for provisions for accidentally discovered archeological resources during construction and mandate the processes to be followed in the event of an accidental discovery of any human remains in a project location other than a 'dedicated cemetery'.

To be effective, consultation on specific projects must be the result of an ongoing relationship between Native American tribes and lead agencies, project proponents and their contractors, in the opinion of the NAHC. Regarding tribal consultation, a relationship built around regular meetings and informal involvement with local tribes will lead to more qualitative consultation tribal input on specific projects.

The response to this search for Native American cultural resources is conducted in the NAHC Sacred Lands Inventory, established by the California Legislature (CA Public Resources Code 5097.94(a) and is exempt from the CA Public Records Act (c.f. California Government Code 6254.10) although Native Americans on the attached contact list may wish to reveal the nature of identified cultural resources/historic properties. Confidentiality of "historic properties of religious and cultural significance" may also be protected under Section 304 of he NHA or at the Secretary of the Interior discretion if not eligible for listing on the National Register of Historic Places. The Secretary may also be advised by the federal Indian Religious Freedom Act (cf. 42 U.S.C., 1996) in issuing a decision on whether or not to disclose items of religious and/or cultural significance identified in or near the APE and possibility threatened by proposed project activity.

If you have any questions about this response to your request, please do not hesitate to contact me at (916) 653-6251.

Sincerely,
Dave Singleton, Program Analyst

Attachment: Native American Contact List

Native American Contact List
San Bernardino County
March 21, 2011

Cabazon Band of Mission Indians
David Roosevelt, Chairperson
84-245 Indio Springs Cahuilla
Indio , CA 92203-3499
(760) 342-2593
(760) 347-7880 Fax

Joseph R. Benitez (Mike)
P.O. Box 1829 Chemehuevi
Indio , CA 92201
(760) 347-0488
(760) 408-4089 - cell

Ramona Band of Cahuilla Mission Indians
Joseph Hamilton, Chairman
P.O. Box 391670 Cahuilla
Anza , CA 92539
admin@ramonatribe.com
(951) 763-4105
(951) 763-4325 Fax

Chemehuevi Reservation
Charles Wood, Chairperson
P.O. Box 1976 Chemehuevi
Chemehuevi Valley CA 92363
chair1cit@yahoo.com
(760) 858-4301
(760) 858-5400 Fax

San Manuel Band of Mission Indians
James Ramos, Chairperson
26569 Community Center Drive Serrano
Highland , CA 92346
(909) 864-8933
(909) 864-3724 - FAX
(909) 864-3370 Fax

Fort Mojave Indian Tribe
Tim Williams, Chairperson
500 Merriman Ave Mojave
Needles , CA 92363
(760) 629-4591
(760) 629-5767 Fax

Twenty-Nine Palms Band of Mission Indians
Darrell Mike, Chairperson
46-200 Harrison Place Chemehuevi
Coachella , CA 92236
tribal-epa@worldnet.att.net
(760) 775-5566
(760) 808-0409 - cell - EPA
(760) 775-4639 Fax

Juaneno Band of Mission Indians Acjachemen Nation
David Belardes, Chairperson
32161 Avenida Los Amigos Juaneno
San Juan Capistrano CA 92675
(949) 493-4933 - home
chiefdavidbelardes@yahoo.com
(949) 293-8522

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of the statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resources for the proposed sCH#2011031002; CEQA Notice of Preparation (NOP); draft Environmental Impact Report (DEIR) for the Cadiz Valley Water Conservation, REcovery, and Storage Project; located in souteastern San Bernardino County, California.

Native American Contact List
San Bernardino County
March 21, 2011

Tongva Ancestral Territorial Tribal Nation
John Tommy Rosas, Tribal Admin.
Private Address — Gabrielino Tongva
,
tattnlaw@gmail.com
310-570-6567

Santa Rosa Band of Mission Indians
Mayme Estrada, Chairwoman
P.O. Box 609 — Cahuilla
Hemet , CA 92546
srbcioffice@yahoo.com
(951) 658-5311
(951) 658-6733 Fax

Colorado River Reservation
Ginger Scott, Acting Cultural Contact
26600 Mojave Road — Mojave
Parker , AZ 85344 — Chemehuevi
symi@rraz.net
(928) 669-9211
(928) 669-5675 Fax

Augustine Band of Cahuilla Mission Indians
Mary Ann Green, Chairperson
P.O. Box 846 — Cahuilla
Coachella , CA 92236
hhaines@augustinetribe.
(760) 398-6180
760-369-7161 - FAX

Torres-Martinez Desert Cahuilla Indians
Ernest Morreo
PO Box 1160 — Cahuilla
Thermal , CA 92274
maxtm@aol.com
(760) 397-0300
(760) 397-8146 Fax

Morongo Band of Mission Indians
Michael Contreras, Cultural Heritage Prog.
12700 Pumarra Road — Cahuilla
Banning , CA 92220 — Serrano
(951) 201-1866 - cell
mcontreras@morongo-nsn.
gov
(951) 922-0105 Fax

AhaMaKav Cultural Society, Fort Mojave Indian
Linda Otero, Director
P.O. Box 5990 — Mojave
Mohave Valley AZ 86440
(928) 768-4475
LindaOtero@fortmojave.com
(928) 768-7996 Fax

San Manuel Band of Mission Indians
Ann Brierty, Policy/Cultural Resources Departmen
26569 Community Center. Drive — Serrano
Highland , CA 92346
(909) 864-8933, Ext 3250
abrierty@sanmanuel-nsn.
gov
(909) 862-5152 Fax

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Native American Contact List
San Bernardino County
March 21, 2011

Torres-Martinez Desert Cahuilla Indians
Diana L. Chihuahua, Vice Chairperson, Cultural
P.O. Boxt 1160 Cahuilla
Thermal , CA 92274
dianac@torresmartinez.
760) 397-0300, Ext. 1209
(760) 272-9039 - cell (Lisa)
(760) 397-8146 Fax

Augustine Band of Cahuilla Mission Indians
Karen Kupcha
P.O. Box 846 Cahuilla
Coachella , CA 92236
(760) 398-6180
916-369-7161 - FAX

Fort Mojave Indian Tribe
Nora McDowell, Cultural Resources Coordinator
500 Merriman Ave Mojave
Needles , CA 92363
g.goforth@fortmojave.com
(760) 629-4591
(760) 629-5767 Fax

Fort Mojave Indian Tribe
Esadora Evanston, Environmental Coordinator
500 Merriman Ave Mojave
Needles , CA 92363
region9epa@ftmojave.com
(760) 326-1112
(760) 629-4591
(760) 629-5767 Fax

Serrano Nation of Indians
Goldie Walker
P.O. Box 343 Serrano
Patton , CA 92369

(909) 862-9883

Juaneño Band of Mission Indians
Sonia Johnston, Tribal Chairperson
P.O. Box 25628 Juaneno
Santa Ana , CA 92799
sonia.johnston@sbcglobal.
net
(714) 323-8312

Agua Caliente Band of Cahuilla Indians THPO
Patricia Tuck, Tribal Historic Perservation Officer
5401 Dinah Shore Drive Cahuilla
Palm Springs, CA 92264
(760) 699-6907

ptuck@augacaliente-nsn.gov
(760) 699-6924- Fax

Quenchan Indian Nation
Bridget Nash-Chrabascz, THPO
P.O. Box 1899 Quechan
Yuma , AZ 85366
b.nash@quechantribe.com
(928) 920-6068 - CELL
(760) 572-2423

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Native American Contact List
San Bernardino County
March 21, 2011

Ah-Mut-Pipa Foundation
Preston J. Arrow-weed
P.O. Box 160 Quechan
Bard , CA 92222 Kumeyaay
ahmut@earthlink.net
(928) 388-9456

Cahuilla Band of Indians
Luther Salgado, Sr., , Chairperson
PO Box 391760 Cahuilla
Anza , CA 92539
tribalcouncil@cahuilla.net
915-763-5549

Ernest H. Siva
Morongo Band of Mission Indians Tribal Elder
9570 Mias Canyon Road Serrano
Banning , CA 92220 Cahuilla
siva@dishmail.com
(951) 849-4676

SOBOBA BAND OF LUISENO INDIANS
Joseph Ontiveros, Cultural Resource Department
P.O. BOX 487 Luiseno
San Jacinto , CA 92581
jontiveros@soboba-msn.gov
(951) 663-5279
(951) 654-5544, ext 4137

This list is current only as of the date of this document.

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Department of Fish and Game
78-078 Country Club Drive
Bermuda Dunes, CA 92203
Phone: 760-200-9158
Fax: 760-200-9358

TO: Tom Barnes, ESA	DATE: 3/30/2011
CO/DEPT: ESA	FROM: Michael Flores CDFG
PHONE #: (213) 599-4308	NO OF PAGES: 7
FAX #: (213) 599-4301	
RE: Comment letter for NOP to Cadiz Water Project	

COMMENTS:

California Natural Resources Agency
DEPARTMENT OF FISH AND GAME
http://www.dfg.ca.gov
Inland Deserts Region
3602 Inland Empire Blvd., Suite C-200
Ontario, CA 91764
(909) 484-0167

EDMUND G. BROWN, JR., Governor
JOHN McCAMMAN, Director

March 30, 2011

Mr. Tom Barnes
626 Wilshire Boulevard, Ste. 1100
Los Angeles, CA 90017

Re: Notice of Preparation of an Environmental Impact Report
Cadiz Valley Water Conservation, Recovery and Storage Project

Dear Mr. Barnes:

The Department is responding as a Trustee Agency for fish and wildlife resources [Fish and Game Code Sections 711.7 and 1802 and the California Environmental Quality Act (CEQA) Guidelines Section 15386], and as a Responsible Agency regarding any discretionary actions (CEQA Guidelines Section 15381), such as a Lake or Streambed Alteration Agreement (California Fish and Game Code Sections 1600 *et seq.*) and/or a California Endangered Species Act (CESA) Permit (California Fish and Game Code Sections 2080 and 2080.1).

The site is located in the County of San Bernardino and is bounded on the north by the community of Cadiz, on the south by SR 62, on the east by the Old Woman Mountains, and on the west by wash and Sheephole Valley. Surrounding development consists of the Mojave National Preserve, private landowners and mining interests.

Project Description

Implementation of the proposed project may impact desert tortoise, bighorn sheep, and sensitive plants, including Borrego milkvetch.

Much of the water is captured from lowering the water table and extracting groundwater that flows to the Bristol and Cadiz Dry Lakes via Schuyler Wash. The Department has many specific concerns (see below) in addition to the comments in the later portion of this letter and recommends that these issues be addressed in the CEQA document.

1. Potential impacts from increased concentrations of dust and salts on Cadiz Dunes and the Mojave National Preserve;
2. Potential impacts to Borrego milkvetch;
3. Elimination of the dry lake ecosystem;
4. The creation of giant fissures in the dry lake beds caused by water extraction;
5. The drawing down of the water table and impacts on seeps and springs essential to wildlife;
6. Potential adverse impacts to the local bighorn sheep population;
7. Potential adverse impacts to the desert tortoise;
8. The long-term impacts of water extraction on the groundwater basin;

9. Potential impacts to the Marine Base at 29 Palms which uses water from Bristol Lake;
10. Potential adverse impacts to the ecosystem from the introduction of permanent water recharge basins;
11. Potential adverse impacts to other landowners who use the groundwater;
12. Potential adverse impacts to the Mojave National Preserve ecosystem from lowering of the water table;
13. The necessity of amending the Desert Conservation Plan;
14. The potential from land subsidence due to water extraction;
15. An analysis of how much water would be necessary to maintain the dry lake ecosystem; and,
16. The issue of water rights with respect to the Bureau of Land Management, Mojave Nature Preserve, 29 Palms Marine Base, local residents dependent upon wells, and the State of California; and
17. The necessity for a 1602 Lake and Streambed Alteration Agreement and CESA Incidental Take Permit.

The following information should be provided in the CEQA document to address some of the above concerns:

1. An analysis and graphics showing depth to groundwater of the existing water table and the water table if the project is implemented; and,
2. An analysis of the flow of water to the dry lakes during the rainy and dry seasons and the amount of water necessary to maintain the ecosystem.

The Department advises that any biological habitat assessments or walkovers be conducted within a year of distribution of the CEQA document. Habitat assessments that identify the possibility of listed threatened or endangered plants should also provide the results of any focus surveys in the CEQA document. CEQA documents that rely on future surveys or regulatory compliance (with the exception of pre-construction surveys for burrowing owls or bird nests) as mitigation may not satisfy the Department's obligations under CEQA and may require future supplemental documents processed via CEQA.

The existing condition of the project site designated as "degraded" or "agriculture use" by the lead agency does not preclude the presence of native species, such as grassland species, burrowing owl, foraging raptors, or riparian wildlife species. A basic biological resources survey should still be conducted at these sites and the results included in the CEQA document.

The Department is concerned about the continuing loss of jurisdictional waters of the State and the encroachment of development into areas with native habitat values. The DEIR should contain sufficient, specific, and current biological information on the existing habitat and species at the project site; measures to minimize and avoid sensitive biological resources; and mitigation measures to offset the loss of native flora and fauna and State waters. If the project site contains Federally- or State-listed species, the DEIR should include measures to avoid and minimize impacts to these species as well as mitigation measures to compensate for the loss of biological resources. The DEIR should not defer impact analysis and mitigation measures to

future regulatory discretionary actions, such as a Lake or Streambed Alteration Agreement, CESA Permit, or Federal Endangered Species Act (ESA) Permit.

This particular project has the potential to have significant environmental impacts on sensitive flora and fauna resources, including Federally- and State-listed endangered species. Therefore, the DEIR should include an alternatives analysis which focuses on environmental resources and ways to avoid or minimize impacts to those resources.

To enable Department staff to adequately review and comment on the proposed project, we suggest that updated biological studies be conducted prior to any environmental or discretionary approvals. The following information should be included in any focused biological report or supplemental environmental report:

1. A complete assessment of the flora and fauna within and adjacent to the project area, with particular emphasis upon identifying endangered, threatened, and locally unique species and sensitive habitats.

    a. A thorough assessment of rare plants and rare natural communities, following the Department's November 2009 guidance for Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities. The guidance document can be found at the following link: http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/Protocols_for_Surveying_and_Evaluating_Impacts.pdf

    b. A complete assessment of sensitive fish, wildlife, reptile, and amphibian species. Seasonal variations in use of the project area should also be considered. Focused species-specific surveys, conducted at the appropriate time of year and time of day when the sensitive species are active or otherwise identifiable, are required. Acceptable species-specific survey procedures should be developed in consultation with the Department and the U.S. Fish and Wildlife Service.

    c. Rare, threatened, and endangered species to be addressed should include all those which meet the CEQA definition (See CEQA Guidelines, 15380)

    d The Department's California Natural Diversity Data Base in Sacramento should be contacted at (916) 327-5960 to obtain current information on any previously reported sensitive species and habitat, including Significant Natural Areas identified under Chapter 12 of the California Fish and Game Code.

2. A thorough discussion of direct, indirect, and cumulative impacts expected to adversely affect biological resources, with specific measures to offset such impacts.

a. CEQA Guidelines, 15125(a), direct that knowledge of the regional setting is critical to an assessment of environmental impacts and that special emphasis should be placed on resources that are rare or unique to the region.

b. Project impacts should be analyzed relative to their affects on off-site habitats. Specifically, this should encompass adjacent public lands, open space, adjacent natural habitats, and riparian ecosystems. In addition, impacts to and maintenance of wildlife corridor/movement areas, including access to undisturbed habitat in adjacent areas, should be fully evaluated and provided.

c. The zoning of areas for development projects or other uses that are nearby or adjacent to natural areas may inadvertently contribute to wildlife-human interactions. A discussion of possible conflicts and mitigation measures to reduce these conflicts should be included in the environmental document.

d. A cumulative effects analysis should be developed as described under CEQA Guidelines, 15130. General and specific plans, as well as past, present, and anticipated future projects, should be analyzed relative to their impacts on similar plant communities and wildlife habitats.

e. The document should include an analysis of the effect that the project may have on any Habitat Conservation Plan or on other regional and/or subregional conservation programs under Sections 2800-2835 of the California Fish and Game Code. The Department, through the Natural Communities Conservation Planning (NCCP) program is coordinating with local jurisdictions, landowners, and the Federal Government to preserve local and regional biological diversity.

3. A range of alternatives should be analyzed to ensure that alternatives to the proposed project are fully considered and evaluated (CEQA Guidelines 15126.6). A range of alternatives which avoid or otherwise minimize impacts to sensitive biological resources should be included. Specific alternative locations should also be evaluated in areas with lower resource sensitivity where appropriate.

   a. Mitigation measures for project impacts to sensitive plants, animals, and habitats should emphasize evaluation and selection of alternatives which avoid and/or otherwise minimize project impacts. Off-site compensation for unavoidable impacts through acquisition and protection of high-quality habitat should be addressed.

   b. The Department considers Rare Natural Communities as threatened habitats having both local and regional significance. Thus, these communities should be fully avoided and otherwise protected from project-related impacts.

c. The Department generally does not support the use of relocation, salvage, and/or transplantation as mitigation for impacts to rare, threatened, or endangered species. Department studies have shown that these efforts are experimental in nature and largely unsuccessful.

4. A CESA Permit must be obtained, if the project has the potential to result in "take" of species of plants or animals listed under CESA, either during construction or over the life of the project. CESA Permits are issued to conserve, protect, enhance, and restore State-listed threatened or endangered species and their habitats. Early consultation is encouraged, as significant modification to the proposed project and mitigation measures may be required in order to obtain a CESA Permit. Revisions to the California Fish and Game Code, effective January 1998, require that the Department issue a separate CEQA document for the issuance of a CESA permit unless the project CEQA document addresses all project impacts to listed species and specifies a mitigation monitoring and reporting program that will meet the requirements of a CESA permit. For these reasons, the following information is requested:

   a. Biological mitigation, monitoring, and reporting proposals should be of sufficient detail and resolution to satisfy the requirements for a CESA Permit.

   b A Department-approved Mitigation Agreement and Mitigation Plan are required for plants listed as rare under the Native Plant Protection Act.

5. The Department opposes the elimination of watercourses and/or their channelization or conversion to subsurface drains. All wetlands and watercourses, whether intermittent or perennial, must be retained and provided with substantial setbacks which preserve the riparian and aquatic values and maintain their value to on-site and off-site wildlife populations.

   a. Under Section 1600 *et seq.* of the California Fish and Game Code, the Department requires the project applicant to notify the Department of any activity that will divert, obstruct or change the natural flow or the bed, channel or bank (which includes associated riparian resources) of a river, stream or lake, or use material from a streambed prior to the applicant's commencement of the activity. Streams include, but are not limited to, intermittent and ephemeral streams, rivers, creeks, dry washes, sloughs, blue-line streams, and watercourses with subsurface flow. The Department's issuance of a Lake and Streambed Alteration Agreement for a project this is subject to CEQA will require CEQA compliance actions by the Department as a responsible agency. The Department, as a responsible agency under CEQA, may consider the local jurisdiction's (lead agency) Negative Declaration or Environmental Impact Report for the project. However, if the CEQA document does not fully identify potential impacts to lakes, streams, and associated resources (including, but not limited to riparian and alluvial fan sage scrub habitat) and provide adequate avoidance, mitigation, monitoring,

and reporting commitments, additional CEQA documentation will be required prior to execution (signing) of the Streambed Alteration Agreement. In order to avoid delays or repetition of the CEQA process, potential impacts to a lake or stream, as well as avoidance and mitigation measures need to be discussed within this CEQA document. The Department recommends the following measures to avoid subsequent CEQA documentation and project delays:

(i) Incorporate all information regarding impacts to lakes, streams and associated habitat within the DEIR. Information that should be included within this document includes: (a) a delineation of lakes, streams, and associated habitat that will be directly or indirectly impacted by the proposed project; (b) details on the biological resources (flora and fauna) associated with the lakes and/or streams; (c) identification of the presence or absence of sensitive plants, animals, or natural communities; (d) a discussion of environmental alternatives; (e) a discussion of avoidance measures to reduce project impacts, (f) a discussion of potential mitigation measures required to reduce the project impacts to a level of insignificance; and (g) an analysis of impacts to habitat caused by a change in the flow of water across the site. The applicant and lead agency should keep in mind that the State also has a policy of no net loss of wetlands.

(ii) The Department recommends that the project applicant and/or lead agency consult with the Department to discuss potential project impacts and avoidance and mitigation measures. Early consultation with the Department is recommended since modification of the proposed project may be required to avoid or reduce impacts to fish and wildlife resources. To obtain a Streambed Alteration Agreement Notification package, please visit our website at: http://www.dfg.ca.gov/habcon/1600/ or call (562) 430-7924.

Thank you for this opportunity to comment. Please contact Robin Maloney-Rames at (909) 980-3818, if you have any questions regarding this letter.

Sincerely,

Michael Flores
Senior Environmental Scientist

Mojave Desert Air Quality Management District
14306 Park Avenue, Victorville, CA 92392-2310
760.245.1661 • fax 760.245.2699
Visit our web site: http://www.mdaqmd.ca.gov
Eldon Heaston, Executive Director

March 2, 2011

c/o Tom Barnes, ESA
626 Wilshire Boulevard, Ste. 1100
Los Angeles, CA 90017

Project: Notice of Preparation (NOP) of a Draft Environmental Impact Report (DEIR) and Public Scoping Meeting Notice – Cadiz Valley Water Conservation, Recovery, and Storage Project

Dear Mr. Barnes:

The Mojave Desert Air Quality Management District (District) has received the NOP of a DEIR for the proposed Cadiz Valley Water Conservation, Recovery, and Storage Project. Phase I of the project would extract the amount of water that would otherwise flow into the Bristol and Cadiz Dry Lakes plus the amount needed to maintain hydraulic control in the vicinity of the wellfield. The project would also construct a 42-mile underground water conveyance pipeline sized to convey an annual average of 50,000 acre-feet per year of water from the Fenner Valley groundwater basin to the Santa Margarita Water District and other participating water agencies, for a period of 50 years. The second phase of the project, the Imported Water Componenet, would make available up to one million acre-feet of groundwater storage space to be used as part of a conjunctive use project. Phase II will be evaluated in the EIR on a programmatic basis since it will be implemented at a later date.

The District has reviewed the project and, based on the information available to us at this time, recommends that the project comply with the requirements of MDAQMD Rule 403 – *Fugitive Dust*. If the proposed project includes a pump(s) which is not grid powered, or if there is a back-up generator, District permits may be required.

Thank you for the opportunity to review this planning document. If you have any questions regarding this letter, please contact me at (760) 245-1661, extension 6726, or Tracy Walters at extension 6122.

Sincerely,

Alan J. De Salvio
Supervising Air Quality Engineer

AJD/tw Cadiz Project.doc

East Mojave Landowners Association

March 21, 2011

Hi folks,

There are two items I would like to mention that affect those of us in the East Mojave. First there is still the potential for more burglaries in our area and second the possible loss of water in our area due to the Cadiz Project.

1. The one guy that Sheriff Bob Cunningham mentioned at our meeting (James McDaniels) is still in jail with warrants out for others. But rounding them up is going to be slow. So don't let your guard down just keep your eyes and ears open for anything unusual. Officer Cunningham is on patrol back in our area. Yea!! The Needles captain has moved on and Lieutenant Ross Tarangle is the commander in Needles now. The Needles phone number is 1-760-326-9200 Then #2 on the menu. Ask for the watch commander or press "0" to get a body in Needles. They apparently do not record conversations, just messages left for a specific person. #1 on the menu goes to Victorville Dispatch. 911 should now get Victorville instead of Rialto, but neither is as good as Needles for thefts. Life threatening emergencies should probably do both 911 and Needles.

2. On March 21, 2011, I got word that the Cadiz Water Project is on again and is apparently trying to fly below the radar to get going. There is to be a pipeline to the MWD canal along the Arizona/California railroad right of way. This is done for the easements availability. They are planning to pump 50,000 acre feet of water out of the Cadiz Aquifer that is fed primarily by the Fenner Valley which is fed by most of our properties. By using (Santa Marguerita) a small water district in south Orange County as the lead there were fewer people to get upset. The deadline for comment is March 30, 2011. We have no word on what the Park service is planning to do about this. There is to be a meeting in Joshua Tree on Thursday, March 24, 2011 at 6:00 pm in the Joshua Tree Community Center, 6171 Sunburst St. There will be an environmental assessment and then another comment period after the completion of the assessment. I think this will happen late summer or fall. I feel we should all comment then as well as now.

Action Needed:

Write, Call or email both the Santa Margareta Water District and the Project manager:

Project Manager: Tom Barnes, ESA

626 Wilshire Boulevard, Ste. 1100
Los Angeles, CA 90017

Email: cadizproject@esassoc.com this site has a video you can watch to better understand what is going on.

Telephone: 213-599-4300

Santa Margarita Water District
26111 Antonio Parkway
Rancho Santa Margarita, CA

Attend if possible the second and last meeting in Joshua Tree:

Thursday, March 24, 2011, 6:00 p.m.

Joshua Tree Community Center
6171 Sunburst Street
Joshua Tree, CA

Write, Call or email your government officials:

Senator Dianne Feinstein

United States Senate
331 Hart Senate Office Building
Washington, D.C. 20510

Phone: (202) 224-3841
Fax: (202) 228-3954
TTY/TDD: (202) 224-2501

CONGRESSMAN JERRY LEWIS

2112 Rayburn House Office Building

Washington, D.C. 29515

(202) 225-5861

Fax: (202) 225-6498

For casework concerns, contact Jerry at:

CONGRESSMAN JERRY LEWIS

1150 Brookside Avenue, Suite J-5

Redlands, CA 92373

(909) 862-6030

1-800-233-1700 (within California)

Points to be made:

1. Ask for an extension for the "Notice of Preparation of a Draft EIR (NOP)" so more comments can be thoughtfully presented.
2. Comment that human and animal habitat has not been included. We depend on well water for survival as do the animals
3. 50,000 acre feet can't possibly be sustainable and even ¼ is too much to start. There must a smaller amount to start with very gradual increases only if severely needed not just to see if it works.
4. We should insist that, 1) regular monitoring of water quantity and quality be put in place in several places (ie Round Valley, 4th of July Canyon, Goffs, 7IL area, Lanfair, Budweiser Springs area, etc) prior to any draw down to set a baseline, 2) thresholds be set that would indicate whether or not negative impacts are occurring, and 3) mitigation be built into the project upfront to avoid any loss of water quality or quantity for those who are dependent upon it. Springs, wells and wildlife must be monitored prior to as well as during drawdown.
5. Most all of the water used to fight the wildfire here came from wells in Round valley and Gold Valley. When drawn down by Cadiz then what happens to us? Many of us were worried what effect the fire consumption would have on our wells but the torrential rain just after the fire and the following summer made it impossible to quantify.

Thanks,

Richard MacPherson Chairman EMLA

1-7601-928-2510 or 1-951-682-6924(Riverside)

Hc1 Box 429

Cima, Ca 92323

DEPARTMENT OF PUBLIC WORKS

FLOOD CONTROL • LAND DEVELOPMENT & CONSTRUCTION • OPERATIONS
SOLID WASTE MANAGEMENT • SURVEYOR • TRANSPORTATION

COUNTY OF SAN BERNARDINO

825 East Third Street • San Bernardino, CA 92415-0835 • (909) 387-8104
Fax (909) 387-8130

GRANVILLE M. "BOW" BOWMAN, P.E., P.L.S.
Director of Public Works

March 23, 2011

File: 10(ENV)-3.01

Tom Barnes, ESA
626 Wilshire Blvd., Ste. 1100
Los Angeles, CA. 90017

RE: NOTICE OF PREPARATION (NOP) OF A DRAFT EIR FOR THE CADIZ VALLEY WATER CONSERVATION, RECOVERY, AND STORAGE PROJECT

Dear Mr. Barnes:

Thank you for giving the San Bernardino County Department of Public Works the opportunity to comment on the above-referenced project. The environmental document was circulated to other Divisions within our Department and was found to be adequate.

If you have any questions, please contact Patrick Egle at (909) 387-1865.

Sincerely,

ANNESLEY IGNATIUS, P.E.
Deputy Director

ARI:PE:mb/CEQA Comments to NOP_SMWD_Cadiz Water Conservation.doc

cc: Patrick Egle

CENTER for BIOLOGICAL DIVERSITY
Because life is good.

protecting and restoring natural ecosystems and imperiled species through science, education, policy, and environmental law

via electronic and US mail

March 28, 2011

Santa Margarita Water District
c/o Tom Barnes, ESA
626 Wilshire Boulevard, Ste. 1100
Los Angeles, CA 90017
Telephone: 213-599-4300
FAX: 213-599-4301
cadizproject@esassoc.com

RE: Scoping Comments on the Santa Margarita Water District, Cadiz Valley Water Conservation, Recovery, and Storage Project

Dear Santa Margarita Water District,

The Center for Biological Diversity ("the Center") submits the following comments on the Notice of Preparation ("NOP") for an Environmental Impact Report ("EIR") for the proposed the Santa Margarita Water District, Cadiz Valley Water Conservation, Recovery, and Storage Project on behalf of our board, staff, and members of the public with an interest in protecting the native species and habitats in and around the Cadiz Valley.. The Center is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center has over 255,000 members and activists throughout California and the United States, with a number of them living within California and visit and enjoy the Mojave desert in the vicinity of the proposed project.

The remote desert of Cadiz Valley is surrounded by federally designated wilderness near the Mojave National Preserve. The general area is habitat for rare and endangered species, including the federally and state threatened desert tortoise (*Gopherus agassizii*), the very rare white margined beardstongue (*Penstemon albomarginatus*), the California leaf-nosed bat (*Microtus californicus*), desert bighorn sheep (*Ovis canadensis nelsonii*) and other rare species (CNDDB 2011). The proposed project also could affect rare desert riparian areas, springs and seeps – the lifeblood of the desert - outside of the physical boundaries of the project area. The proposed project area is also rich in cultural and historical significance.

The Center offers these comments regarding the scope of issues that need to be addressed in the Draft Environmental Impact Report (EIR). Most importantly, the EIR should clearly identify the purpose and need for groundwater pumping of the aquifer. The purported hydrology that the NOP describes as "The groundwater naturally flows to the Bristol and Cadiz Dry Lakes (Dry Lakes) and is lost to evaporation" need to be scientifically corroborated and the implication

Ileene Anderson, Biologist/Desert Program Director
8033 Sunset Blvd., #447 • Los Angeles, CA 90046-2401
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www.BiologicalDiversity.org

that any natural evaporation is somehow a "problem" to be "solved" needs to be fully examined. In addition, the Draft EIR should adequately demonstrate if and how each project element will fulfill the project's purpose and need, and adequately describe a range of alternatives that could avoid the significant impacts of the project, including a no action alternative. The EIR must also fully identify and analyze how the proposed project and alternatives would impact biological resources and provide minimization and mitigation measures for any impacts that cannot be feasibly avoided. Following are specific issues the Center believes must be addressed in the EIR under the California Environmental Quality Act, Public Resources Code §§ 2100 et seq. ("CEQA"). Up-to-date natural and cultural resource surveys and inventories of the area need to be completed and included in the DEIR. Complete documentation of the hydrology of the area must also be included.

The EIR Must Consider a Range of Alternatives

In general, the EIR should include "a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives," as required by Section 15126.6 (a) of the CEQA Guidelines. The alternatives should include those that would avoid or substantially lessen any of the significant environmentally negative effects of the project and ongoing management [CEQA Guidelines, section 15126.6(1)]. For each alternative, the EIR should provide a discussion on how each alternative would avoid or minimize significant impacts on biological resources.

The EIR should provide a very clear and detailed description of the purpose, goals, and objectives for the project, as this will be critical in determining the most appropriate alternative and to allow for comprehensive analysis of the avoidance and minimization opportunities and if impacts can not be avoided, mitigation for specific issues.

The EIR Must Consider Direct, Indirect and Cumulative Impacts to Biological Resources

The EIR must be prepared to address the direct, indirect and cumulative impacts of the proposed project to threatened, endangered, and sensitive species as well as unique plant communities not only within the boundaries of the proposed project, but also outside of the project area, including the seeps and springs in the adjacent areas upon which desert wildlife species depend.

Not only must the EIR fully disclose and analyze impacts to any listed, candidate, sensitive, or locally rare species, but it also must discuss alternatives that will avoid those impacts. Even if alternatives that completely avoid such impacts may be later found infeasible, the EIR must explore alternatives that minimize impacts to species and any remaining impacts to the species must be mitigated though enforceable mitigation measures. The EIR must also fully disclose and analyze impacts to sensitive vegetation types.

The EIR must include a *quantitative, data-based* analysis of the direct impacts of the proposed Park management from the loss of habitat, as well as the indirect impacts resulting

from pollution, noise, increase in fire, disturbance, invasion of non-native species, growth inducing effects, green house gas analysis and other effects on biological resources.

The analyses must not be comprised only of general, qualitative descriptions of potential impacts, but contain quantitative analyses of effects based on population data obtained from field surveys and local conditions. In addition, the EIR must include a detailed analysis of the cumulative impacts of this project together with other completed, current, and reasonably foreseeable projects in the area.

Wildlife and Plant Species

During the course of the surveys, if other rare or regionally unique species are identified during the data gathering phase for the DEIR, these species also need to be included and analyzed for impacts. The EIR must consider the impacts on each of these species and as well as the cumulative impacts.

Listed Species

The state and federally listed threatened desert tortoise (*Gopherus agassizi*), which is also the state reptile, also occurs within the vicinity of the proposed project, and the area provides an important linkage for this species between northern and southern populations.

Where "take" of a species listed under the federal or California Endangered Species Act is anticipated, the EIR must document *and quantify* past and reasonably foreseeable future take authorizations for that species issued by the U.S. Fish and Wildlife Service ("FWS") and California Department of Fish and Game ("DFG") in order to evaluate the project's direct and cumulative impact on the species. The EIR also must consider the project's impacts on the *recovery* of listed endangered and threatened species that may occur on the site. Any potential impairment of species recovery associated with the project must be considered a potentially significant impact.

Sensitive Species

The EIR should also thoroughly evaluate the impacts of the proposed permitted activities on sensitive and locally rare species (not merely federally and state-listed threatened and endangered species). The preservation of regional and local genetic diversity is very important to the long-term persistence of species. Therefore, we request that all species found at the edge of their ranges or that occur as disjunct locations be evaluated for impacts by the proposed permitted activities.

Raptor species such as golden eagles (*Aquila chrysaetos*), a "fully protected" species under California law and protected under the Migratory Bird Treaty Act, the Bald and Golden Eagle Act and the Lacey Act, likely use the proposed project area as foraging habitat and may nest in adjacent habitat. FWS recently issued a final rule on acquiring permits to "take" golden eagles[1] that maybe required for this project. Guidance is also provided for evaluating impacts to golden eagles which should be used in the EIR. The burrowing owl (*Athene cunicularia*), a state

1 http://www.fws.gov/migratorybirds/baldeagle.htm

species of concern, has potential to occur on the project site and surrounding areas, and surveys must be included for this species. The prairie falcon (*Falco mexicanus*) may also use the project area. All of these raptors require large foraging areas in the desert due to the natural paucity of prey. All species are included as Bird Species of Special Concern in California and are considered the highest priority for conservation (Remsen 1978).

Rare plant communities, including all riparian areas, seeps and springs, need to be avoided for impacts. Any proposed impacts need to be fully analyzed in the CEQA process.

Biological Surveys and Mapping

The Center requests that thorough, seasonal surveys be performed for sensitive plant species and vegetation communities, and animal species under the direction and supervision of the BLM and resource agencies such as the US Fish and Wildlife Service and the California Department of Fish and Game. Full disclosure of survey methods and results to the public and other agencies without limitations imposed by the applicant must be implemented to assure full CEQA, CESA, and ESA compliance. Confidentiality agreements should not be allowed for the surveys in support of the proposed project.

Surveys for the plants and plant communities should follow California Native Plant Society (CNPS) and California Department of Fish and Game (CDFG) floristic survey guidelines[2] and should be documented as recommended by CNPS[3] and California Botanical Society policy guidelines. A full floral inventory of all species encountered needs to be documented and included in the EIS. Surveys for animals should include an evaluation of the California Wildlife Habitat Relationship System's (CWHR) Habitat Classification Scheme. All rare species (plants or animals) need to be documented with a California Natural Diversity Data Base form and submitted to the California Department of Fish and Game using the CNDDB Form[4] as per the State's instructions[5].

The Center requests that the vegetation maps be at a large enough scale to be useful for evaluating the impacts. Vegetation/wash habitat mapping should be at such a scale to provide an accurate accounting of wash areas and adjacent habitat types that will be directly or indirectly affected by the proposed activities. A half-acre minimum mapping unit size is recommended, such as has been used for other development projects. Habitat classification should follow CNPS' Manual of California Vegetation (Sawyer et. al. 2009).

Adequate surveys must be implemented, not just a single season of surveys, in order to evaluate the existing on-site conditions. Due to unpredictable precipitation, desert organisms have evolved to survive in these harsh conditions and if surveys are performed at inappropriate times or year or in particularly dry years many plants that are in fact on-site may not be apparent

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[2] http://www.cnps.org/cnps/rareplants/inventory/guidelines.php and http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/Protocols_for_Surveying_and_Evaluating_Impacts.pdf

[3] http://www.cnps.org/cnps/archive/collecting.php

[4] http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/CNDDB_FieldSurveyForm.pdf

[5] http://www.dfg.ca.gov/biogeodata/cnddb/submitting_data_to_cnddb.asp

during surveys (ex. annual and herbaceous perennial plants). The proposed project areas can receive monsoonal rains which trigger a suite of late summer/early fall blooming annual plants, some of which are quite rare. Late season surveys should be implemented and the results should be included in the EIR.

Additionally the surveys need to be done to assess cryptobiotic soil crusts – where they exist and how to protect them. Cryptobiotic soils are an essential component of healthy desert soils, providing a protective layer that absorbs the scant precipitation events, provides "safe sites" for seed germination and prevents soil erosion. Because this and essential desert soil component is fragile and not easily restored, a full discussion of the impacts needs to be included, including alternation of the hydrology and the effects on the soil crusts.

Impact Analysis

The EIS must quantitatively evaluate all direct, indirect, and cumulative impacts to sensitive habitats/species, including impacts associated with the drawdown of ground water and its effects on adjacent spring, seeps and phreatophytic vegetation.

The EIR Must Consider Direct and Cumulative Impacts to Water Resources, Soils, and Air Quality

The pumping proposed under the project may impact water resources and water quality. These issues must be fully considered. The project components and water pumping may also affect soils by disrupting soil structure and drying.

The Mojave Desert Air Quality Management District (MDAQMD) is currently exceeding the federal standards for the criteria pollutants PM_{10} and ozone. Off-road vehicle use, military activities and other issues contribute to existing air quality problems. The EIR must fully disclose and analyze the direct, indirect and cumulative impacts of groundwater pumping on soils and the already compromised air quality in the region, and discuss effective alternatives and mitigation measures to avoid, reduce, and mitigate these impacts.

The EIR Must Adequately Describe the Environmental Baseline

Because the proposed project intends to pump groundwater from a desert basin, obviously baseline conditions in water quantity and quality need to be identified. As suggested above, hydrological studies must unequivocally prove that groundwater naturally flows to the Bristol and Cadiz Dry Lakes (Dry Lakes) and is lost to evaporation. Secondly, the proposed project must show the actual amount of recharge that is lost to evaporation. Our sense is that 50,000 afy is well above the annual recharge to the aquifer that is lost to evaporation. If additional water pumping above and beyond the evaporation rate is proposed, it will result in over-drafting of the groundwater basin and will cause significant environmental impacts. Groundwater monitoring must be put in place prior to the draft EIR so that a baseline groundwater scenario can be used to evaluate potential impacts from the proposed project.

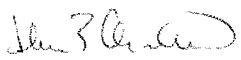
The Imported Water Storage Component needs to clearly identify the parameters of this "second phase". As the project proponent is well aware, a very similar scenario was proposed by the Metropolitan Water District (MWD) and proved infeasible. The NOP states that the potential quantity and schedule for spreading, storage, and extraction for the Water Storage Component will be "explored at the programmatic level in this EIR", we believe that is segmenting the proposed project, which is not allowed under CEQA. The DEIR needs to include the Water Storage Component as a fully developed part of the whole of the project; this component of the project cannot be segmented from the environmental review of the project as a whole.

The EIR Must Analyze the Proposed Project's GHG Emissions and the Cumulative Impacts of Global Warming on Affected Resources

Curbing greenhouse gas emissions to limit the effects of climate change is one of the most urgent challenges of our time. Fortunately, the California Environmental Quality Act ("CEQA"), Cal. Pub. Res. Code §§ 21000 et seq., 14 Cal. Code Regs. § 15000 et seq. ("Guidelines"), set forth a clear and mandatory process to address the Project's greenhouse gas and global warming impacts. The EIR must include a complete and adequate analysis any GHG emissions from any and all actions associated with the project including a full discussion of the impacts from those emissions and a thorough and quantitative analysis of alternatives and mitigation measures to reduce those impacts. In addition, the DEIR must consider how the likely changes in precipitation that are predicted under a warming climate[6] and any cumulative impacts to resources from those changes and the impacts of the proposed project.

Thank you for addressing these comments in the DEIR. Please add us to the distribution list for the EIR and all notices associated with the project.

Best regards,



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When will Lake Mead go dry?

Tim P. Barnett[1] and David W. Pierce[1]

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[1] A water budget analysis shows that under current conditions there is a 10% chance that live storage in Lakes Mead and Powell will be gone by about 2013 and a 50% chance that it will be gone by 2021 if no changes in water allocation from the Colorado River system are made. This startling result is driven by climate change associated with global warming, the effects of natural climate variability, and the current operating status of the reservoir system. Minimum power pool levels in both Lake Mead and Lake Powell will be reached under current conditions by 2017 with 50% probability. While these dates are subject to some uncertainty, they all point to a major and immediate water supply problem on the Colorado system. The solutions to this water shortage problem must be time-dependent to match the time-varying, human-induced decreases in future river flow.

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1. Introduction

[2] A number of studies over the last 20 years have suggested that there will be a decrease in runoff over the Southwestern United States because of global warming. The decrease will be caused by increasing temperatures and evapotranspiration and decreasing precipitation. The statistical/empirical studies [*Revelle and Waggoner*, 1983; *Nash and Gleick*, 1991, 1993; *Hoerling and Eischeid*, 2007], as well as climate model studies of the last few years [e.g., *Milly et al.*, 2005; *Christensen et al.*, 2004, *Christensen and Lettenmaier*, 2006; *Seager et al.*, 2007] all show a decrease in runoff to the Colorado River (see caveats on climate models below). The estimates of runoff reduction from these studies are remarkably similar, and range between 10% and 30% over the next 30–50 years. The IPCC Working Group II concludes there will be a 10–30% run off reduction over some dry regions at midlatitudes during the next 50 years with very high confidence [*Intergovernmental Panel on Climate Change*, 2008]. Current naturalized flow in the Colorado River is on the order of 15 million acre feet (MAF, 1.233×10^9 m^3) per year measured at Lees Ferry (Figure 1), so these decreases will ultimately result in a runoff reduction of 1.5–4.5 MAF/a from current levels, which we assume leads to similar reductions in Colorado River flow.

[3] The Colorado River is quite literally the life's blood of today's modern southwest society and economy. Given the agreement about both size and timing of runoff reduction, it is important to examine what it will mean to the people of the southwest and, especially, when they might expect water shortage problems to appear. In its recent report on Colorado River Basin water management, the National Academy of Sciences [*Committee on the Scientific Bases of Colorado River Basin Water Management*, 2007] notes future potential problems with availability of water in the region. It calls for a comprehensive analysis of water needs and uses in the region, but provides no analysis of the timing or magnitude of potential problems. *Hoerling and Eischeid* [2007] suggest water availability could soon fall below critical levels but offer no temporal details. *McCabe and Wolock* [2007] estimate climate changes will increase chances of failure to meet water allocation requirements of the Colorado Covenant, but their methods preclude estimates of just when this might happen.

[4] Our intent is to make a first estimate of when and how the human-induced reduced runoff will impact people. We simplistically state the question as "when will Lake Mead go dry?" assuming there are no changes in water management strategies and sector-specific consumptive use. By "going dry," we mean when the live storage (the reservoir space from which water can be evacuated by gravity) in Lakes Mead and Powell becomes exhausted (Figure 2 summarizes the various storage levels in the Lakes). As we shall see below, the answer is both startling and alarming.

[5] It is obvious that once long-term outflow exceeds inflow the system is doomed to run dry. One of our purposes in this work is to point out that currently scheduled depletions (loss of water from consumptive use), along with water losses due to evaporation/infiltration and reduction in runoff due to climate change, have pushed the system into a negative net inflow regime that is not sustainable. Another purpose is to demonstrate how natural variability, i.e., the chance of getting strings of dry years consistent with the historical record, makes the system likely to run dry even with positive net inflow. When expected changes due to global warming are included as well, currently scheduled depletions are simply not sustainable.

2. Methods

2.1. Water Balance Model

[6] The method is a simple water balance approach that keeps track of water going into and out of the major

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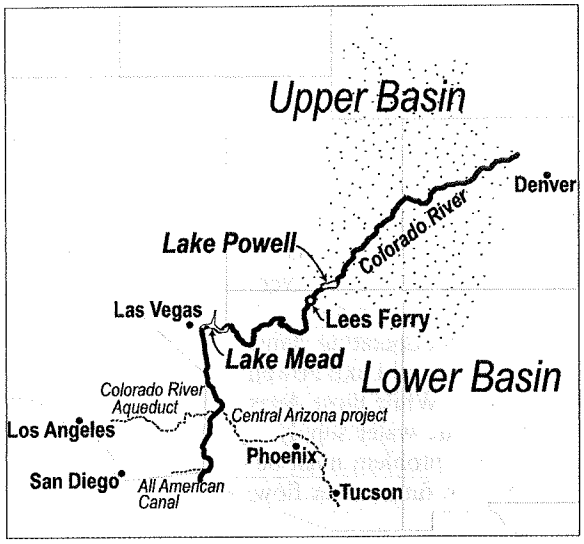

Figure 1. Overview of the region of interest (31.2°–43.7°N, 104.0°–120.3°W), which is historically separated into the "upper basin" (dots) and "lower basin" (gray). Colorado River flow from the upper to lower basins is measured at Lees Ferry.

reservoirs in the Colorado River system. The initial condition for our study (Figure 2) is the amount of water currently in live storage in the Lake Mead/Lake Powell system (25.7 MAF above the dead pool as of June 2007; U.S. Bureau of Reclamation Web page). We consider the two reservoirs as a single storage unit, consistent with the U.S. Bureau of Reclamation (USBR) plan to manage them jointly [*U.S. Bureau of Reclamation*, 2007]. We assume "perfect" management so that the amount of storage in each reservoir above dead pool is manipulated to keep the storage levels approximately the same in both reservoirs (see caveats). The naturalized flow of the Colorado River at Lees Ferry is 15 MAF/a over the period 1906–2005 (USBR Web page, http://www.usbr.gov/lc/region/g4000/NaturalFlow/current.html, accessed 10 January 2008), so we use this as a working number, although on the basis of tree ring reconstructions it is probably too high [*Committee on the Scientific Bases of Colorado River Basin Water Management*, 2007], and does not reflect the drought of the last 7 years (see caveats).

[7] Today the Colorado system is, for all intents and purposes, fully subscribed (see below) so any additional consumptive use in the upper basin as now contemplated (Figure 3), or reduced runoff into the river due to climate change, must be covered by existing storage. We consider human-induced reductions in runoff of 10 to 30%, in accordance with estimates from global climate models and statistical analysis, and take these reductions to be linear in time over the next 50 years (i.e., runoff slowly decreases until it reaches a total reduction of, say, 10% below current levels in 2057). We first do a simple deterministic analysis that does not include the complicating factors of runoff variability, evaporation, and infiltration, in order to more clearly isolate the effect of human-induced climate change on the reservoirs. We then do a probabilistic analysis of the likelihood of the reservoir storage becoming exhausted, using Monte Carlo simulations with a water budget model, and allowing for evaporation and infiltration as well as the stochastic nature of the river flow itself.

[8] We tested the water budget model by comparing it to the results obtained by *Harding et al.* [1995], who modeled a "severe sustained drought" episode on the Colorado River using a sophisticated river network model based on an enhanced version of USBR's Colorado River model, CRSS. The results (Figure 4) show the simulated, combined storage from *Harding et al.* [1995] versus that from the water

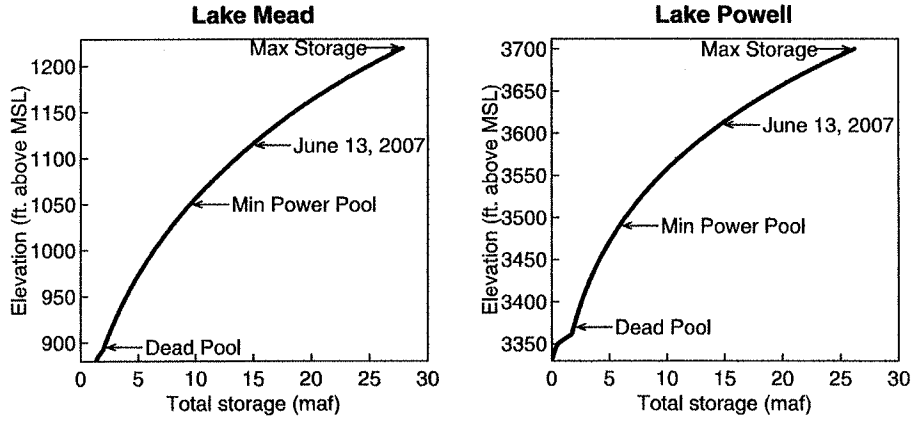

Figure 2. Total reservoir storage in Lakes Mead and Powell (million acre feet) as a function of lake surface elevation above mean sea level (feet). (We retain the units commonly used in the operation of these reservoirs; data are from Colorado River Open Source Simulator, release 1.0, 2007, http://www.onthecolorado.org/cross.cfm). Arrows indicate the maximum storage possible in each lake, the amount present on 13 June 2007, the minimum needed to enable hydroelectric power generation, and the minimum below which no more water can be extracted from the reservoir by gravity ("dead pool"). "Live storage" is all current storage above the dead pool elevation.

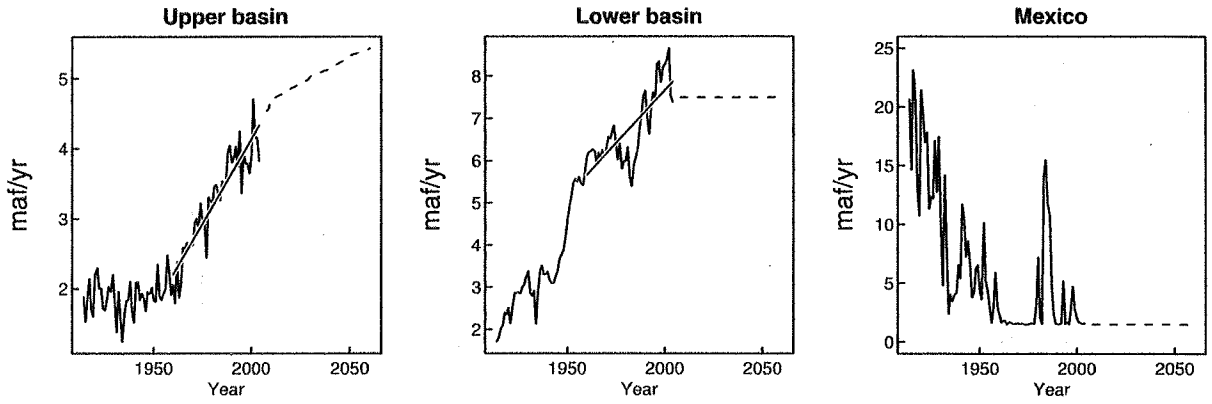

Figure 3. Historical water use (solid line) and scheduled future depletions (dashed line, 2008–2060) of the Colorado River system. Superposed lines for the upper and lower basins show the best fit least squares linear trend over the period 1960–2004. Note the abrupt change in water availability for the lower basin states.

budget analysis used here. The differences are due principally to our neglect of smaller storage units within the Colorado system. At any rate, the agreement suggests the method is adequate to address the large-scale water budget issues considered here.

[9] We tried three different methods to generate synthetic time series of Colorado River flow consistent with the historical record (Appendix A), including a simple first-order autoregressive (AR-1) approximation, fractional Gaussian noise (fGn), and a new Fourier-based technique described in Appendix A. Overall, our results are robust with respect to the method used, as the water budget effects are large compared to differences in detail of the synthetic flows. The plots shown here are made using fGn, since the more familiar index sequential method (ISM) does not correctly sample variability consistent with the historical record (see Appendix A). Synthetic time series generated with fGn also exhibit long-term persistence, which has been shown to be important for correctly simulating the statistics of hydrological processes [e.g., *Phatarfod*, 1989; *Pelletier and Turcotte*, 1997; *Wang et al.*, 2007; *Koutsoyiannis and Montanari*, 2007].

2.2. Future Depletions

[10] Future depletions are taken from published USBR schedules (appendices C and D of *U.S. Bureau of Reclamation* [2007]) over the period 2008–2060. In Figure 3 these are compared to historical water use (obtained from http://www.usbr.gov/lc/region/g4000/uses.html, accessed 14 November 2007). Total scheduled depletions rise from 13.5 MAF/a in 2008 to 14.1 MAF/a by 2030. We also include in the Monte Carlo results water loss due to evaporation and changes due to infiltration (the 1971–2004 average evaporation was 0.894 and 0.516 MAF/a for lakes Mead and Powell, respectively, while infiltration was +0.005 and −0.312 MAF/a (N. Yoder, USBR, personal communication, 2007)). Although the amount of evaporation and infiltration change with lake level, possibly providing a negative feedback as the lake area shrinks, evaporation is also likely to increase in the future as temperatures warm, and infiltration is a second-order quantity compared to the other mechanisms included here. Accordingly, in this work we have simply kept the value of evaporation/infiltration constant at −1.7 MAF/a. As a sensitivity test, we tried scaling evaporation with Lake surface area, and found it made little difference to our results; human-induced reductions in runoff overwhelm the Lake surface area-dependent changes in evaporation.

3. Results

[11] In section 3.1 we begin with deterministic estimates of when the live storage will be depleted by global warming–driven runoff reductions alone, without the outside impacts of evaporation and natural variability in the river flow. This approach is simplistic but gives an immediate feel for the scope of the climate change problem and how it relates to reservoir storage. In section 3.2 we then extend the analysis to more realistic, probabilistic estimates of the same quantities but allowing for the additional impacts of natural climate variability on runoff, as well as the effects of evaporation and infiltration. A summary of the factors included in each calculation is shown in Table 1.

3.1. Deterministic Estimates

[12] The above noted climate models and statistical studies projected decreases in runoff that can be used to compute the future decline in river flow in MAF, year by year. We start by assuming a current steady state where

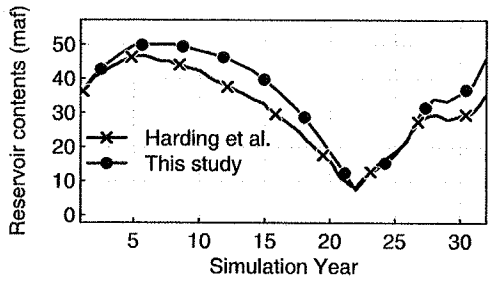

Figure 4. Reconstruction of combined Lakes Powell and Mead storage (MAF) during the "sustained severe drought" episode of the late 1500s from *Harding et al.* [1995] (crosses) and this study (circles).

Table 1. Summary of Factors Included in the Various Calculations[a]

Probabilistic Estimates?	Evaporation and Infiltration Included?	Given in Terms of Net Inflow?	Climate Change Included?	Management Strategies Considered?	Deplete to Power Pool or Dead Pool	Location of Results	10% Chance to Deplete by Year	50% Chance to Deplete by Year
No	no	no	yes	no	dead	section 3.1 (start)	NA[b]	2036
No	no	no	yes	no	power	section 3.1 (end)	NA	2021
Yes	yes	no	yes	no	dead	Figure 5	2014	2028
Yes	yes	no	yes	no	power	Figure 6	2010	2017
Yes	yes	yes	no	no	dead	Figure 7	2014[c]	2028[c]
Yes	yes	yes	yes	no	dead	Figure 8	2013[c]	2021[c]
Yes	yes	no	yes	yes	dead	Figure 9	2025[d]	2048[d]

[a]For simulations that include climate change, the quoted years are for a 20% reduction in runoff over the next 50 years.
[b]NA means not applicable.
[c]For a net inflow of −1.0 MAF/a.
[d]For a cut in requested water deliveries by 25%.

inflow to the reservoirs is equal to their discharge. In reality the Lake Mead is currently being overdrafted by about 1 MAF (T. Labonde and J. Shields, Update for Green River Basin Advisory Group, 2004, available at http://waterplan.state.wy.us/BAG/green/briefbook), so our assumption of steady state is highly conservative. We simply integrate the annual reductions in runoff in time, assuming the changes are temporally linear and levels of consumption are constant, to determine how many years until the existing live storage is gone. We find live storage will be depleted completely 23–40 years from now, or sometime in the span 2030 to 2047, for runoff reductions of 30–10% over 50 years, respectively.

[13] For further discussion, we take the median runoff reduction, from the above studies, as −0.06 MAF per year. This corresponds to a 20% decrease in runoff (3.0 MAF) 50 years from now, and yields approximately 29 years left, or calendar year 2036, before the combined Mead and Powell system is at dead pool elevation. Sensitivity studies showed the dates vary by roughly 10 years around 2036 by assuming larger/smaller 50 year runoff reduction rates or that the 20% runoff reduction will happen soon/later than 2050. The time to dead pool elevation is not very sensitive to the details and assumptions of the runoff estimates. One can also vary the date depending on when one assumes the warming impacts to set in. Recent studies show the global warming impacts have been operative in the Southwest for some decades [*Barnett et al.* 2008], but we make the conservative assumption they start in 2007. Perhaps most important are the initial conditions at the reservoirs for start of the calculations; we used the current state as of June 2007. At this time the system had about 50% of its total possible storage.

[14] In addition to water, both reservoirs are important sources of hydroelectric power. Together the two reservoirs can produce about 10,000 gW h. What do the runoff reductions mean to the availability of that latter resource? As of June 2007 there was a total, between both reservoirs, of approximately 15 MAF of water above the minimum power pool level, which is the reservoir elevation below which the power generation turbines cannot safely operate (Figure 2). Carrying through the same type of analysis as above showed that there is a 50% chance the minimum power pool elevation would be reached in around 2021; only 14 years into the future. At that point (or before), there would be an abrupt drop in the abilities of the reservoirs to generate hydroelectric power.

3.2. Probabilistic Estimates

[15] The previous results neglected the natural variability in river flow associated with weather (wet/dry years) and short-term climate variability (e.g., El Niño/La Niña). Using ten thousand realizations of river flow (statistically consistent with historic variability from 1906–2005 and tree ring flow estimates over approximately the last 1250 years), coupled with the deterministic linear runoff trend described above, allowed us to construct cumulative distribution functions (CDFs) for the depletion of the current live storage. Future depletions were taken from the USBR schedules shown in Figure 3, while evaporation plus infiltration was taken fixed at −1.7 MAF/a, as noted previously.

[16] The results are given in Figure 5 (left). The solid curve shows the likelihood of reservoir storage levels falling to the dead pool elevation with no runoff reduction. In the absence of curtailed water delivery, there is a 50% chance the system will go dry by 2037. This is driven by the sum of depletions (~14 MAF/a by 2030) plus evaporation/infiltration (1.7 MAF/a) being larger than runoff into the system (15.05 MAF/a, the average over the period 1906–2005).

[17] Included also in Figure 5 (left) are the cases where climate change decreases runoff into the river by 10% (crosses) and 20% (circles). The probability of depleting both reservoirs' live storage is 50% by 2028, if we account for natural variability and a 20% decrease in runoff (which would be fully realized in 2057). The results are rather insensitive to changes in runoff reduction. The different methods of modeling the natural variability all give essentially the same results (Figure 5, right).

[18] All of these numbers are somewhat more pessimistic than the deterministic analysis because they include evaporation/infiltration as well as allowing for natural variability in the river flow. The answers, being expressed in probabilistic format, allow the user to determine the risk levels in any decision process they undertake.

[19] The probabilistic analysis for minimum power pool levels is shown in Figure 6. There is a 50% chance the minimum power pool levels will be realized by about 2017, in the absence of management responses. This result is rather insensitive to changes in runoff, at least in the near term. At any rate, the associated drops in power production would be precipitous in time as turbine intakes went dry. It

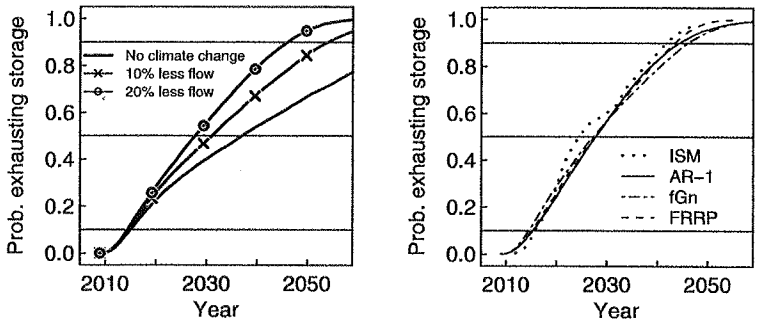

Figure 5. Cumulative distribution function (CDF) showing the probability of Lakes Mead and Powell reservoir levels falling to dead pool elevation by the indicated year. (left) Case where only natural variability is affecting river flow (solid curve) and cases where climate change produces a decrease in runoff of 10% (curve with crosses) and 20% (curve with circles). (right) CDFs obtained with four different methods of simulating natural runoff variability for the case with a 20% reduction in runoff. ISM, index sequential method; AR-1, first-order autoregressive process; fGn, fractional Gaussian noise; FRRP, Fourier reconstruction and randomized phase. See Appendix A for details.

seems clear that the threat to power production on the Colorado is both real and more imminent than most might expect.

3.3. Sensitivity to Net Inflow

[20] Are the results presented here inconsistent with previous results, modeling the severe late 1500s drought, that imply a more resilient water delivery system [*Harding et al.*, 1995]? In that work, even a severe historical drought had only a slight impact on water deliveries to lower basin states. Setting aside climate change for the moment, random weather noise provides a variable amount of water input to the system, which can vary greatly year to year. Water managers strive to deliver a near constant quantity of water every year, using reservoir storage capacity to smooth out these short-term variations. In this section we analyze the system in terms of the *net inflow*, defined as long-term mean flow into the combined Lakes Mead and Powell system minus the long-term mean of consumption plus evaporation/infiltration.

[21] If one considers the system as a whole, the net inflow is negative. The USBR scheduled delivery (Figure 3) starts at 13.5 MAF/a in 2008, which together with evaporation/infiltration of 1.7 MAF/a and a mean Colorado River flow of 15.05 MAF/a (average over 1906–2005) gives a net inflow of −0.15 MAF/a in 2008, dropping to −1.15 MAF/a by 2060 in the absence of climate change. A reduction in runoff by 10 and 20% from human-induced climate change would give net inflow of −2.6 and −4.1 MAF/a, respectively, by 2057. The reservoirs would be dry long before these levels were realized, assuming present consumption continues unchanged. Arguably more realistic would be to use the average mean Colorado River flow over the last 50 years, which would put the current net inflow even more negative, about −0.7 MAF/a, near the current overdraft of 1.0 MAF/a estimated for Lake Mead (see http://waterplan.state.wy.us/BAG/green/briefbook).

[22] Figure 7 (left) shows the CDFs of the system running dry as a function of fixed net inflow (i.e., neglecting any time-evolving contribution from climate change). It is clear that negative net inflow mandates the system running dry, but one might wonder how the system can go dry with zero or positive net inflow. Natural variability generates long periods of wet/dry years, so the system can go dry at one extreme and spill under wet conditions. These situations are equally likely from a statistical point of view when only natural variability is operating. In the absence of a management response to shortages, the system undergoes a random walk constrained only by the limits of maximum reservoir capacity (on the wet side) and completely exhausted storage (on the dry side). The middle plot of Figure 7 shows the probability of filling or going dry by year 2027 (20 years from now) as a function of net inflow. With initial reservoir storage approximately half the capacity, the curves are nearly symmetric.

[23] The CDFs shown in Figure 7 (left) have a strong sensitivity to net inflow; the system becomes rapidly prone to exhausting storage as net inflow drops from +2 MAF/a (which virtually guarantees reliable delivery) to −1 MAF/a, which has a 50% chance of running dry by 2027. So part of the reason our results seem to show a system more sensitive to climate fluctuations than earlier workers is that the

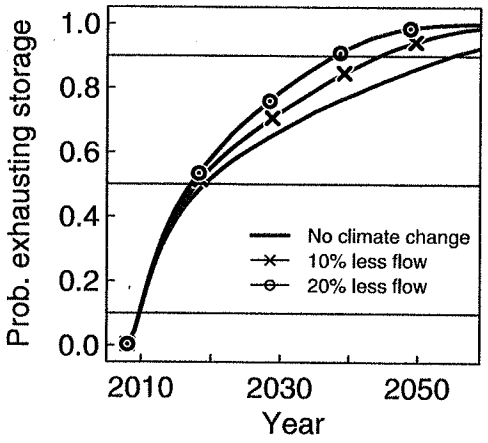

Figure 6. As in Figure 5 (left) but for reservoir storage dropping below the minimum necessary for hydropower generation.

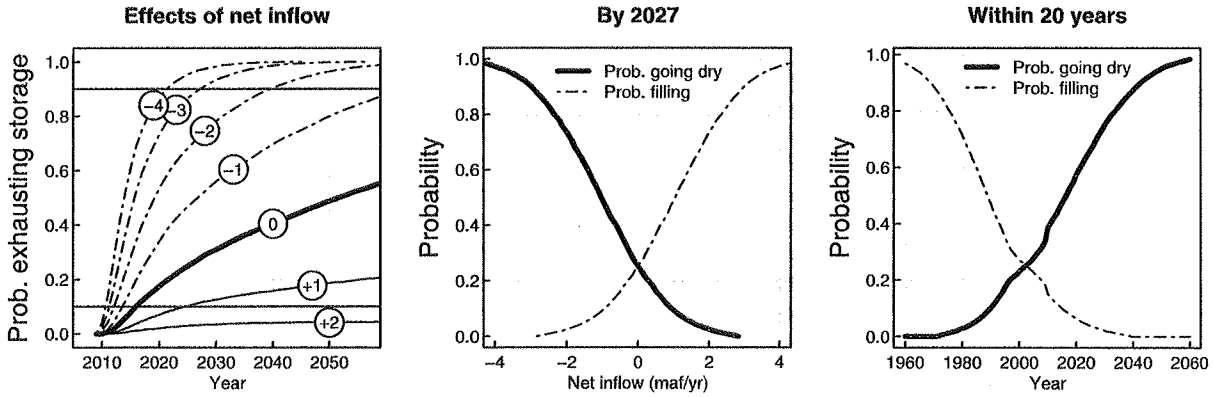

Figure 7. (left) CDFs of Lakes Mead and Powell running dry as a function of net inflow into the system, as indicated on the curves (in MAF/a). Climate change is not explicitly included. (middle) Probability of the system going dry (solid line) or filling up (dash-dotted line) by 2027, for the given net inflow (MAF/a). Climate change is not explicitly included. (right) Probability of the system going dry or filling up within 20 years of the indicated start year, given historical and future depletions and a 20% reduction in runoff due to climate change.

system becomes more unstable as the net inflow approaches zero, i.e., as the river becomes fully subscribed. Yearly depletions to the upper and lower basins have risen steadily since the 1940s (Figure 3), resulting in an increasingly unstable system.

[24] Furthermore, Figure 7 shows that the rate of increase in sensitivity of the system becomes much more rapid as the net inflow approaches zero. For example, consider the probability of the system running dry by 2027 (middle plot, thick line). The chance is negligible for a net inflow of +2 MAF/a or more, which was the case before about 1985. If the net inflow is reduced to +1 MAF/a (approximately the inflow for the late 1980s and early 1990s) the probability only rises to 9%. However, if the net inflow is further reduced to 0 MAF/a, the probability jumps to 25%; and as the net inflow drops to today's value of nearly −1 MAF/a, the probability of the system running dry by 2027 increases to 50%.

[25] We now add reductions in runoff due to climate change to the increasing sensitivity as net inflow approaches zero. The combination acts in a particularly unfortunate way. Even if current net inflow were at a somewhat safe value, such as +1 MAF/a, future reductions in runoff combined with increasing depletions (Figure 3) yield net inflows that drop to levels that render the system highly vulnerable in just a few decades. This is shown in Figure 8, where the left plot illustrates the case with initial (year 2007) net inflow of +1 MAF/a. In the absence of climate change, there is a 20% chance the system would run dry by 2040. However, a human-induced reduction in runoff by 20%, a medium value from the global model estimates, has a strong effect on the probability curve, such that there is then a 45% chance of the system going dry by 2040.

[26] In reality, we likely have a current net inflow between −0.2 and −1 MAF/a depending what base time period one wants to use for estimating mean Colorado River flow. The middle and right plots of Figure 8 show that in this regime, any reduction in river flow due to climate change has a strong effect on an already marginally reliable system, e.g., for a net inflow of −1 MAF, the probability

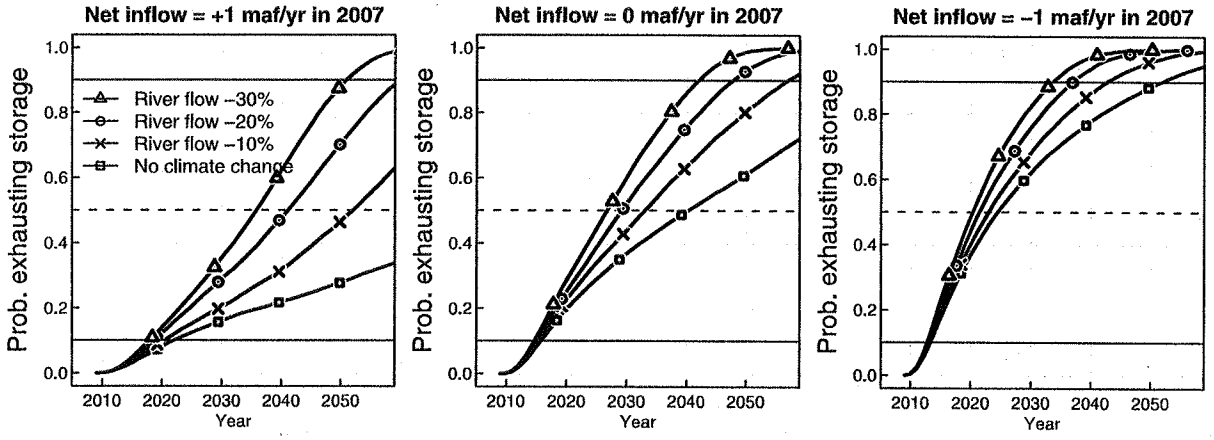

Figure 8. Effect of climate change on chances of Lakes Mead and Powell running dry, for a net inflow of (left) +1, (middle) 0, and (right) −1 MAF/a.

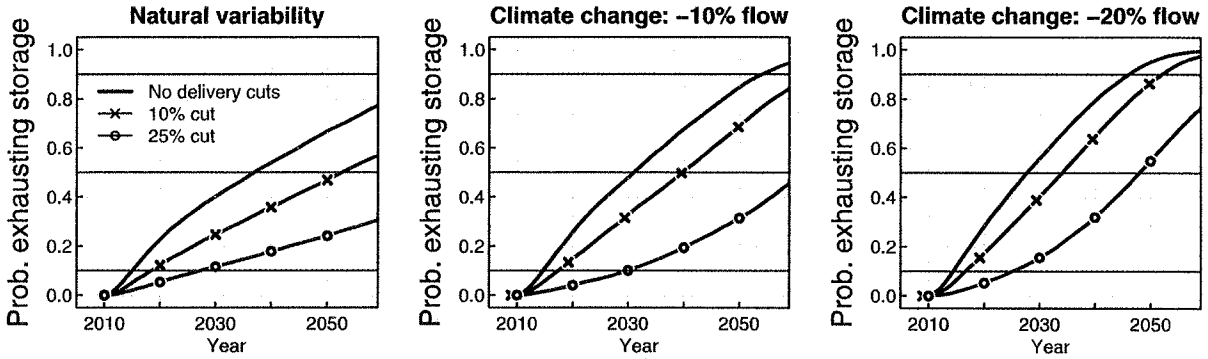

Figure 9. Effects of management strategies on likelihood of the Lakes Powell and Mead system dropping to deal pool elevations (left) for current conditions and when runoff in the Colorado River system drops (middle) 10% and (right) 20% because of climate change. Solid curve, when all requested water deliveries are supplied; curves with crosses and circles, when deliveries are cut 10 and 25%, respectively, when total storage drops below 15 MAF.

that reservoirs are at dead pool by 2021 is 50% (assuming a 20% reduction in runoff).

[27] To further illustrate the evolving reliability of the system, we combine historical and projected future depletions (Figure 3) with the reduction in runoff expected because of climate change to estimate net inflow from 1960 to 2060. Since net inflow is not intended to reflect interannual variability, we have calculated the depletions over the historical era (1960–2004) from the least squares best fit linear trends shown for the upper and lower basins in Figure 3, and taken water releases to Mexico constant at 1.5 MAF/a. Future depletions are taken from the USBR schedules. Using this net inflow, we compute the probability the system will go dry (or fill) within 20 years from the start date, including a 20% reduction in runoff over 2007–2057 due to climate change and (for consistency) a constant starting reservoir level of 25 MAF. The results are shown in the right plot of Figure 7. From 1960 to 1980, there was virtually no chance of the system running dry within 20 years; by 2000, this chance rises to 20%, and to almost 60% by 2020. In contrast, the chances of the lakes refilling drop to under 20% by 2007 and are essentially nil by 2030. At any rate, the early 2000s were marked by a significant transition, when, for the first time, the chance of the system running dry exceeded the chance of the system filling up.

4. Water Shortage Options

[28] Of course, water managers and other decision makers will do everything in their power to see that Lakes Mead and Powell do not go dry. Can the devastating scenarios laid out above be ameliorated, at least for some years, and if so how might this be done? Curtailing consumptive use is one obvious answer. The current USBR strategy for the most severe reservoir elevation reduction they consider, Lake Mead level at 1025 feet (see Figure 2), is to withhold 0.6 MAF of water per year, about 5% of Lake Mead annual releases (including evaporation) (see USBR lower Colorado Shortages Web page). Will this be enough of a reduction to solve the problem?

[29] The magnitude of the problem is illustrated in Figure 9, which shows the CDFs of Lakes Mead and Powell reaching dead pool elevation under two simplified management schemes and three runoff scenarios. The management schemes are not intended to be correct in the complicated details of how water delivery is altered under shortage conditions. Instead, they illustrate the overall sensitivities of system reliability. The curves with crosses and circles show the CDFs for when the system goes dry when water deliveries are reduced by 10% and 25% of current demand, respectively. These consumption reductions are assumed to start when combined reservoir storage falls below 15 MAF. This is equivalent to withholding 1.35 and 3.38 MAF/a on the basis of current demand. The 15 MAF cutoff was chosen as the point in time where the deliveries are to be curtailed because it corresponds to the time minimum power pool levels will be reached in the combined system (see caveats). In the presence of no runoff reduction, the chances are 50% that the dead pool volumes will be reached in 2037, 2053 and some time after 2070 for 0, 10 and 25% reduction in consumptive water delivery, respectively. If the human-induced runoff reduction is 20% then the comparable set of years to reach dead pool are 2028, 2034 and 2048, respectively.

[30] The 10% reduction in water delivery delays for about 6 years the reservoirs reaching dead pool elevations in the case of a 20% reduction in runoff, and about 10 years in the case of a 10% in runoff reduction. So a 10% reduction in consumptive delivery buys some time but does not solve the problem. Inspection of Figure 9 shows the 25% reduction in water deliveries makes a real difference in the sustainability of the reservoir storage. If we now compare the above results to the 5% delivery reduction in the USBR water shortage plan, it is clear the 5% reduction will have little impact on the sustainability of the Colorado reservoir system in a shortage situation.

5. Caveats

[31] There are a number of issues that potentially impact the results obtained above. We point these out here, although going into detail is beyond the scope of the present paper.

[32] 1. The upper basin of the Colorado has water allocations equal to those of the lower basin (7.5 MAF/a). However, they are now using something over 4 MAF/a of

water associated with those rights. Growth in that part of the West suggests this situation is changing and the upper basin is using more of this right (Figure 3). Indeed, the combined water use currently in both basins is roughly 14–15 MAF/a (USBR water accounting Web site, http://www.usbr.gov/lc/region/g4000/wtracct.html), including evaporation and infiltration. This is approximately the currently assumed average flow of the river. Is there water to satisfy increased use in the upper basin and if so, what will its use do to the net water balance of the system?

[33] 2. We implicitly assumed there would be annual releases from Lake Powell tuned to maintain storage parity between it and Lake Mead, e.g., the perfect management scenario noted above. The law of the river only requires a delivery of 75 MAF over a 10 year interval, so in principle, releases from Lake Powell could be curtailed for several years running, as long as they are made up in subsequent years. The impact on Lake Mead of such action would be devastating and, if maintained for even 2 years in the current situation, would preclude meeting consumptive allocations in the lower basin. Our methods, essentially assuming a single large reservoir, will not handle such a situation. We are interested here in longer-term, larger-scale changes and so events like Powell release or no release, which are events of a few years duration, are not considered explicitly. A more sophisticated model would be required to explore this issue.

[34] 3. Tree ring data suggest the long-term flow of the Colorado experiences more variability than has been observed over the last century [*Committee on the Scientific Bases of Colorado River Basin Water Management*, 2007]. These data also suggest prolonged droughts far worse and more extensive than seen in the last 100 years of flow record on the river are possible. Our attempt to estimate natural variability from the last 100 years alone might miss such situations, unless they are included in the methods we use to generate synthetic flows. The results given in Appendix A suggests the methods are robust to inclusion of the entire paleo tree ring record, so lack of representativeness in our model of natural variability does not seem to be a major problem. Note also, the flow reductions we have been seeing over the last 7–8 years are surprisingly close to the global warming–driven reductions in flow estimated by *Hoerling and Eischied* [2007]. They also are likely to occur by chance 10% of the time according to our FRRP statistical model of river flow (Appendix A).

[35] 4. We have assumed that 1.5 MAF will continue to go to Mexico annually per existing treaty.

[36] 5. The average annual river flow we used (15 MAF) is estimated from the 1906–2005 record of naturalized flow. However, this masks the long-term decreasing trend in flow. It might be more realistic to use the average flow over, say, the last 50 years, 14.48 MAF, or over the last 500 years, 13.7 MAF. Introduction of these lower flow estimates into our analysis would considerably speed up all of the dead pool dates cited above [*Weisheit and Harrington*, 2007].

[37] 6. We assumed that the climate model predicted changes in net moisture flux convergence would all end up in river flow. But if a significant fraction of that moisture change were, say, sequestered in the soils, then our estimates of runoff to the river would be too high [cf. *Troch et al.*, 2007]. This would allow more pessimistic estimation of future water shortages.

[38] 7. The climate models which have produced estimates of decreasing runoff have a host of problems of their own in handling the water budget from coarse resolution (little in the way of Rocky Mountains) to the variety of ways they handle soil processes and vegetation representations. However, a recent study of changes in hydrology of the western U.S. over that last 50 years shows several of the models, when run with observed anthropogenic forcings, reproduce extremely well the observed changes in river flow timing, snowpack decline and increasing air temperatures in the western United States [*Barnett et al.*, 2008]. So these models, while not perfect, have a message to tell; a message supported by their ability to reproduce well the last 50 years of multivariate hydrological observations.

[39] 8. The results shown above are based on initial conditions corresponding to the current storage levels of Lakes Mead and Powell, currently about 50% of capacity. If we rerun the simulations from full pool initial conditions, we find the CDFs are shifted to latter times, as one would expect. As a rule of thumb the dates noted above for realization of dead pool levels are pushed 15–20 years into the future.

[40] 9. We also note that the claim that the Colorado is a resilient system that can quickly recover from drought seems to depend on two factors. The *Harding et al.* [1995] simulation of the severe sustained drought of the late 1500s started with a pseudoreservoir level of about 35 MAF. Had that study been started with initial conditions from today, 10 MAF less water, the answer might have been different. Secondly, not only does the system become less reliable as net inflow approaches zero, but the rate of change of system reliability increases strongly as well. This means the system can quickly transition from a resilient to a fragile system as consumptive use of the river increases. This is exactly the regime we are in today.

6. Conclusions

[41] Twenty years of scientific research have shown the flow of the Colorado River is likely to decline 10–30% over the next 30–50 years. It is declining now and has been for some years. We have shown that reduction in runoff into the Colorado River will, within a handful of years, reduce the live storage of water in the Colorado system to nothing and seriously curtail the system's hydropower production, if no consumptive use changes are made. For example, there is a 10% chance that live storage in Lakes Mead and Powell will be gone by about 2013, and a 50% chance by 2021, if current water allocations are maintained. There is a 50% chance that minimum power pool elevations will be reached by 2017.

[42] It seems clear there are a number of management options that can forestall this disaster. Many of these problems and potential solutions were foreseen by Gleick and associates at the Pacific Institute 1–2 decades ago [*Morrison et al.*, 1996; *Gleick et al.*, 2003], and others before them. The new feature of the problem is that the Colorado River will continue to lose water in the future, if the global climate models are correct. Solutions to today's problems might not be applicable into the future [e.g., *Milly*

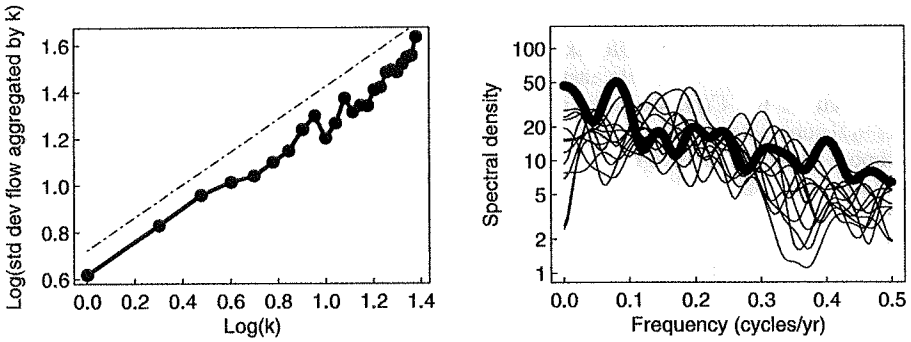

Figure A1. (left) Log of the standard deviation of Colorado River flow (1906–2005) aggregated into k-year blocks, as a function of log(k); the slope of this relationship should equal the Hurst coefficient H. The dash-dotted line has slope 0.7, for reference. (right) Spectrum of independent 100-year chunks of the paleoreconstructed Colorado River flow from *Meko et al.* [2007] (thin black lines) compared to spectrum of the synthetically constructed flow using the Fourier method (thick black line, with gray area showing the 95% confidence interval).

et al., 2008]. The challenge is to determine what combination of agricultural, environmental uses, and personal consumption is achievable in the future, when 10–30% less water must serve substantially more people.

[43] In the future we can count on some flow in the Colorado, albeit 10–30% less in (say) 50 years than the current rate. We need to determine now how that reduced supply of water will be used: Who will get some and who will not? Our call for action now goes beyond the additional study called for by the *Committee on the Scientific Bases of Colorado River Basin Water Management* [2007] because of the magnitude and immediacy of the problem. There is danger that litigation, associated with water right claims and environmental issues, will compound and put off any rational decisions on this matter until serious damage has been done to the diverse users of the Colorado River. Much of this litigation might be avoided if time-dependent water solutions are crafted to reflect today's and tomorrow's water realities. It is laudable that efforts in this direction are now being made. We hope this work will spur solutions, as time is short. The alternative to reasoned solutions to the coming water crisis is a major societal and economic disruption in the desert southwest.

Appendix A: Generation of Synthetic River Flow Time Series

[44] We construct pdfs of the likelihood of the Lake Powell/Mead system going dry using thousands of synthetic time series of Colorado River flow. We explored three different methods for generating these time series. The first method was simply a standard first-order autoregressive (AR-1) model, with the lag-1 correlation taken from the observations.

[45] The second method was fractional Gaussian noise (fGn) (see *Koutsoyiannis* [2002] for an overview), which captures the low-frequency variability of river flow and tendency for strings of wet or dry years better than the AR-1 method. We used the R statistics package "fArma" for this purpose (version 260.72, downloaded from http://cran.r-project.org on 23 November 2007). Various estimation methods reported a Hurst coefficient H between 0.6 and 0.8 for observed naturalized Colorado River flow, 1906–2005; we used $H = 0.7$ to generate the synthetic flows (Figure A1, left). Every century-long synthetic time series was set to have the same mean and standard deviation as the observed flow, which likely underestimates the true variability in runoff.

[46] The third method we used was one of our own devising that we term the "Fourier reconstruction and randomized phase" (FRRP) method. It is similar to the fGn method, but uses the observed power spectrum as the basis for a synthetic reconstruction rather than a fit to a theoretically derived power spectrum. We start with the historical time series of water year total Colorado River flow, $c(t)$. We then transform the time series to frequency space using a Fourier transform:

$$C(f) = \int_{-\infty}^{\infty} c(t) e^{2\pi i f t} dt$$

where C is a (complex-valued) amplitude in the frequency domain, and the frequency, f, is in cycles per water year.

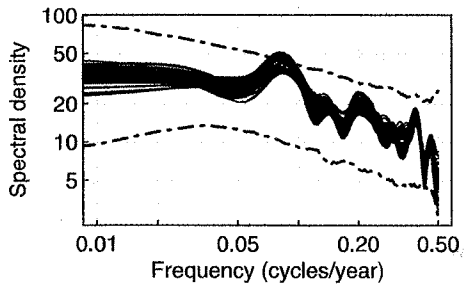

Figure A2. Spectra of 99 simulations of Colorado River flow generated with the ISM method applied to the historically observed time series (solid black lines) and 95% confidence interval of 1000 simulations of Colorado River flow generated with fractional Gaussian noise (dash-dotted line).

Since $c(t)$ is real, the properties of the Fourier transform guarantee that $C(-f) = C(f)^*$, where the asterisk denotes complex conjugate. Since we use a discrete fast Fourier transform (FFT) to calculate the $C(f)$, we have a limited number of $[C(f), C(-f)]$ conjugate pairs in frequency space. For each pair, we choose a random phase θ between $-\pi$ and π. We then calculate a new amplitude $C'(f) = C(f)e^{i\theta}$, which has the same modulus as the original amplitude but a different phase. To preserve the property that the transform of C' back to the time domain result in a real-valued function, we set $C'(-f) = C'(f)^*$. The final synthetic time series is then the inverse transform of the C' amplitudes back to the time domain. Every synthetic time series has, by construction, the same power spectrum as the original time series, and is consistent with spectra of 100 year segments of the historical flow of the Colorado River reconstructed from tree rings over the period 762–2005 [*Meko et al.*, 2007] (Figure A1, right plot).

[47] The three methods of estimating natural variability of the flow are compared in Figure 5 (right) amongst themselves and with the index sequential method (ISM) currently in use by the USBR [*Ouarda et al.*, 1997] for a runoff reduction of 20%. The three methods are essentially equivalent, and more conservative than the ISM approach. It is clear that the water balance, or lack thereof, is driving our results, not the nature of the model used to generate natural variability.

[48] As a final note, we deliberately chose not to use the ISM approach, even though it is familiar to many and widely used in USBR simulations. By continually sampling the historical record in sequence, ISM always includes any outliers than may be in the historical record, yet fails to sample all the variability that is consistent with the observed record but did not chance to occur in the past 100 years. This is illustrated in Figure A2; the spectra of 99 ISM realizations of Colorado River flow (solid black lines) show simultaneously a far narrower range of variability than spectra generated with fGn (95% confidence interval shown by the dash-dotted lines), and yet show consistently more power than would be expected at a frequency of ~0.07 cycles/a because of repeated sampling of the same particular historical sequence. This results in a statistical bias in the estimates of natural variability. Both the fGN and FRRP can produce natural climate variability outside the historical record, and simulate extreme events in ensembles of many thousands of simulations in a consistent way.

[49] **Acknowledgments.** This work was supported under a joint program between the University of California San Diego and Lawrence Livermore Research Lab called LUSCid. At UCSD, the program was run out of the San Diego Supercomputing Center, and work was done at the Scripps Institution of Oceanography. We wish to especially thank Dennis Lettenmaier for his comments and patience and also Mike Dettinger and P. Gleick for suggestions on early drafts of the manuscript. D.W.P. received partial salary support from the California Energy Commission.

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T. P. Barnett and D. W. Pierce, Scripps Institution of Oceanography, University of California, San Diego, La Jolla, CA 92037, USA. (tbarnett-ul@ucsd.edu)

From: Dick MacPherson [dnkmac@the2h2o.com]
Sent: Monday, March 28, 2011 4:14 PM
To: Cadiz Project
Subject: Cadiz Valley water draw down

Mojave Preserve Landowners Association
March 27, 2100

Project Manager
Mr. Tom Barns , ESA

It is imperative that an extension of the NOP be granted so that many more folks can have the chance to make appropriate comments of the Cadiz Plan. The short notice to the very limited "mailing" list was not acceptable!

We don't feel you can justify 50,000afy of water draw down as sustainable with out drastically effecting our springs and wells which we depend on for our existence. Your own figures don't seem to substantiate that level of draw down. Possibly 5,000afy draw down to start and only after many springs and wells are monitored for at least a year before draw down starts. Draw down increases made possible only after continued monitoring showing no negative effects on quantity or quality of all monitored water sources. All increases, if allowed, to be in small increments only. All monitoring to be provided by a neutral organization funded by you in an escrow account. Our wells and spring provide basic water for a variety of wildlife, agriculture, and humans. Perhaps USGS has the ability to start monitoring now if asked.

The following is a partial list of places that must be monitored prior to any draw down: Springs and or wells in the Granite Mountains on north and south sides, Springs and or wells in the Van Winkle, Horse Hills, and lower Providence Mts. Springs and wells on both sides of the Providence Mts. Springs and wells in Mid Hills, Gold Valley, Round valley, Pinto valley and Fourth of July Canyon. areas, and Caruthers canyon., Springs and wells on all sides of the New York range, wells in the portion of Lanfair Valley that drain south, Springs in the Hackberry Mts., Wells in Goffs and Essex areas, springs in the Clipper Mts., Springs in the Old Woman Mts. on both sides, and possible effected sites in Joshua Tree National Park, and at least 1/3 of the Mojave National Preserve will definitely be effected.

During the 2005 fire, the many thousands of gallons of water were used to fight the fire came from Round Valley and Gold Valley wells. We were worried then that the draw down would effect our wells, but the torrential storms of '05 and '06 after the fire made monitoring impossible. There must be a contingency plan including hauling potable water to the residents effected by low or no water levels in our wells. There must be an appropriate budget and time line established also. There must be a additional fund established for drilling deeper wells for the private land owners and the Park Service if the draw down continues. As You know well drilling is not cheap, so the escrow fund must be well funded. The pumping rate from the Cadiz must be monitored by a neutral, mutually approved agency. That agency must have an escrow account to draw from to monitor the out put from Cadiz and the possible input to Cadiz.

There would appear to be a significant deficit of at least 12,000afy in the recharge rate if your figures are used . Where is that missing water coming from??? What is the time involved in a recharge cycle if in fact the aquifer is capable of recharge?? How old is the water in the "tank", and is it all drinkable water?? We need unbiased proof of these things that effect hundreds of residents of the East Mojave and the thousands of wildlife that depend on that water to live here.

Please send a packet of the information sent to a few and "available " at the meeting where most land owners could not attend. We feel very left out of a vital decision regarding our existence in the East Mojave. (send to Riverside address please)

Sincerely,

Richard MacPherson
Chairman

3660 Valencia Hill Dr.
Riverside, CA 92507
951-682-6924

HCR1 Box 429
Cima, Ca 92323
760-928-2510

cc: Congressman Jerry Lewis; Senator Feinstein; MDHCA; County Supervisor Metzelfelt; MWD

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1303 J Street, Suite 270 | Sacramento, CA 95814 | tel 916.313.5800 | fax 916.313.5812
www.defenders.org

March 29, 2011

Santa Margarita Water District
c/o Tom Barnes, ESA
626 Wilshire Boulevard, Ste. 1100
Los Angeles, CA 90017
(Sent by email to: cadizproject@esassoc.com)

RE: Scoping Comments on the Santa Margarita Water District, Cadiz Valley Water Conservation, Recovery, and Storage Project

Dear Mr. Barnes:

Thank you for the opportunity to review and comment on the Notice of Preparation ("NOP") for an Environmental Impact Report ("EIR") for the proposed the Santa Margarita Water District, Cadiz Valley Water Conservation, Recovery, and Storage Project These comments are submitted by Defenders of Wildlife ("Defenders"), a non-profit public interest conservation organization with offices in California as well as elsewhere in this country.

Defenders has 950,000 members and supporters nationally, 145,000 of whom reside in California. Defenders is dedicated to protecting all wild animals and plants in their natural communities. To this end, we employ science, public education and participation, media, legislative advocacy, litigation, and proactive on-the-ground solutions in order to impede the accelerating rate of extinction of species, associated loss of biological diversity, and habitat alteration and destruction.

The proposed project is very similar to an endeavor by the Metropolitan Water District of Southern California ("MWD") called the Cadiz Water Project, which was the subject of environmental review under the California Environmental Quality Act ("CEQA") approximately 10 years ago. Ultimately, MWD abandoned its plan for the Cadiz Water Project.

We recommend that the EIR for the proposed project rigorously address the following issues:

1. Purpose and Need; Alternatives: The purpose and need for the project needs to be clearly defined. The NOP indicates the proposed project is intended to augment the current water supply of the Santa Margarita Water District, Three Valleys Municipal Water District, Suburban Water Systems, and Golden State Water Company.

The need to augment the water supply for the four water purveyors needs to be justified, and alternative means to provide additional desired water need to be identified and analyzed. The

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EIR should include "a range of reasonable alternatives to the project which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives," as required by Section 15126.6 (a) of the CEQA Guidelines. The alternatives should include those that would avoid or substantially lessen any of the significant environmentally negative effects of the project and ongoing management [CEQA Guidelines, section 15126.6(1)]. For each alternative, the EIR should provide a discussion on how each alternative would avoid or minimize significant impacts. Alternatives should include conservation of existing supplies through reduced consumption and recycling, and alternative sources.

2. Groundwater Hydrology. An independent study and assessment of the groundwater hydrology of the Cadiz and Fenner valleys need to be performed in order to determine the amount and quality of groundwater in the affected area; the amount of annual recharge; the amount of evaporation form Bristol, Cadiz and Danby Dry Lakes; and the amount of water used by native vegetation. The effect of climate change of long-term precipitation and groundwater recharge within the Cadiz and Fenner Valleys needs to be addressed in the analysis.

We are aware there are significant differences of opinion on groundwater recharge and sustainable use. One prominent hydrologist, Dr. John Bredehoeft, in comments on MWD's proposed Cadiz Water Project[1], estimated that the annual recharge to the groundwater in the Cadiz Groundwater Basin was approximately 5,000 afy, approximately 10 times the amount of groundwater that would be pumped under the MWD's former project and the proposed project. Sustainable use of groundwater needs to also consider the amount of near-surface water on and near the affected dry lakes necessary to minimize dust and sustain native vegetation.

The effects of groundwater pumping on wetlands, seeps and springs, and water quality within or adjacent to the Cadiz and Fenner Valleys needs to be fully studied and disclosed. Furthermore, the effect of proposed project on groundwater quantity and quality underlying federal public land needs to be analyzed.

3. Biological Resources. The effects of the proposed project, and alternatives, on sensitive biological resources need to be carefully analyzed. Such sensitive biological resources include, but are not limited to, Desert Tortoise, Mojave Fringe-toed Lizard, Golden Eagle, Prairie Falcon, Burrowing Owl and Desert Bighorn Sheep. Direct and indirect effects should be analyzed including habitat loss, disruption of movements, breeding and foraging.

4. Availability of Colorado River Water. Although the NOI indicates that the importation and storage of Colorado River water during periods when "excess" water is available is not part of the initial proposed project, we believe it must be analyzed under CEQA because it is a part of the overall intent of the project – it can't be analyzed at a later time due to prohibition against segmenting related activities. The analysis should fully analyze the projected availability of "excess" Colorado River Water for storage and subsequent pumping, and such availability must take into account the effects of climate change on Colorado River flows and demands from users who hold rights to divert such water.

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[1] Bredehoeft, John. 2001. Revised Comments: Cadiz Groundwater Storage Project, Cadiz and Fenner Valleys, San Bernardino County, California. Prepared for Western Environmental Law Center, Taos, New Mexico. 21 pp.

5. Effect on Public Lands and Resources. Private lands proposed to be used for the project are surrounded by federal public lands in the California Desert Conservation Area managed by the Bureau of Land Management. These lands support numerous species of plants and animals, some of which are federal and state listed threatened (Desert Tortoise) or designated as sensitive (Mojave Fringe-toed Lizard, Golden Eagle, Burrowing Owl, Desert Bighorn Sheep, and numerous species of plants). The effects of the proposed project on these species and their habitats need to be fully analyzed. There are also several designated federal wilderness areas near the proposed project. The effects of the proposed project on these areas, their biological resources and air quality should be analyzed as well.

I hope that these comments are helpful in preparing the Draft Environmental Impact Report for the proposed project. Please add me to the distribution list for the EIR and all notices associated with the project.

Sincerely,

Jeff Aardahl
California Representative
46600 Old State Highway, Unit 13
Gualala, CA 95445
Email: jaardahl@defenders.org

National Parks Conservation Association®
Protecting Our National Parks for Future Generations®

March 29, 2011

Cadiz Scoping Comments
c/o Tom Barnes, ESA
626 Wilshire Boulevard, Ste. 1100
Los Angeles, CA 90017

Dear Mr. Barnes:

The National Parks Conservation Association (NPCA) has been the leading voice of the American people in protecting our national parks since 1919. NPCA has over 325,000 members and supporters and is the largest independent membership organization dedicated to protecting the natural, cultural, and historic treasures of our National Park System. Our mission is to protect and enhance our national parks today for our children and grandchildren tomorrow.

NPCA welcomes the opportunity to provide scoping comments on the Cadiz Valley Water Conservation, Recovery, and Storage Project and is concerned about the environmental impacts of this project on the Mojave National Preserve, air quality and water resources. The draft EIR must use sound science and address the following issues:

Impacts to Mojave National Preserve

The 1.6 million acre Mojave National Preserve was created by the 1994 Desert Protection Act and the National Park Service is mandated by the 1916 Organic Act to preserve its natural and cultural resources "Unimpaired for future generations".

The Mojave National Preserve has outstanding natural features like singing sand dunes, the largest and densest Joshua tree forest in the world and alpine fir communities high atop the New York Mountains. The Preserve also has a rich history of Native American tribes that hunted and gathered along the steep bajadas and broad alluvial fans; miners who searched for the mother lode and ranchers who raised cattle on this parched land. The Preserve is loved by hikers, campers, backpackers, equestrians, four wheel drive enthusiasts, birdwatchers and hunters.

But the Mojave National Preserve is not only a refuge for outdoor recreationists, nature lovers and history buffs, but is a local and regional economic engine. In fiscal year 2009, there were almost 530,000 visitors to the Preserve who contributed over 10 million dollars to local economies and supported over 100 jobs[1].

[1] according to the Michigan State University Money Generation Model.

The Cadiz Valley Water Conservation Recovery and Storage Project must not harm or impair the natural or cultural resources of the Mojave National Preserve or the social and economic fabric of reliantdesert communities. The draft EIR must use the best and most realistic assessment of how the capture and recovery of 50,000 acre feet of groundwater from the Fenner Valley Watershed through the Fenner Gap will affect seeps, springs and groundwater in the Mojave National Preserve, **especially in areas like Clipper Springs**. Additionally, the true impacts of fugitive dust that may be created from the desiccation of the Bristol and Cadiz Dry Lakes must be accurately assessed and viewed cumulatively in combination with other concurrent efforts within 100 miles of the project.

California Climate Change and Groundwater

Phase I of the Cadiz Valley Water Conservation, Recovery, and Storage Project NOP states that this project is sustainable becausethe amount of water that will be diverted is evaporating from the Bristol and Cadiz Dry Lake beds with a recharge rate of 32,500 acre feet/ year and an additional aquifer recharge of 17,500 acre feet for a total of 50,000 acre feet/year of annual recharge during the project's 50 year life span. Phase II assumes that there will be a sufficient water to allocate and store from the Colorado River. NPCA questions both of these assumptions due to the increasing demand for water resources, the natural variability of desert hydrologic systems and climate change. The DEIR should provide detailed information relating to the projected availability of Colorado River water for diversion and a plan for acquisition.

Climate Change

The draft EIR must contain a thorough and scientifically meaningful evaluation of how climate change will affect water resources. The California Climate Adaptation Strategy says, "Generally, research indicates that California should expect overall hotter and drier conditions with a continued reduction in winter snow (with concurrent increases in winter rains), as well as increased average temperatures, and accelerating sea-level rise. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing. The impacts assessment indicates that extreme weather events, such as heat waves, wildfires, droughts, and floods are likely to be some of the earliest climate impacts experienced."[2]

Additionally, it predicts temperature increases of 2-5 deg. F by 2050[3], an average annual precipitation of 12-35% decrease by 2050[4] and a sea level rise 12-18" by 2050[5]. The adaptation strategies also make the following predictions:

• Average temperature increase is expected to be more pronounced in the summer than in the winter season.[6]

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[2] 2009 California Climate Adaptation Strategy. California Natural Resources Agency. Sacramento, CA. p.15 Available online at www.climatechange.ca.gov.adaptation/count/click/php

[3] Ibid, p.15
[4] Ibid, p.15
[5] Ibid, p.15
[6] Ibid, p.16

• Inland areas are likely to experience more pronounced warming than coastal regions.[7]

• Heat waves are expected to increase in frequency, with individual heat waves also showing a tendency toward becoming longer, and extending over a larger area, thus more likely to encompass multiple population centers in California at the same time.

The California Climate Adaptation Strategy also states that,

"While the precipitation results vary more than the temperature projections, 11 out of 12 Precipitation models run by the Scripps Institution of Oceanography suggest a small to significant (12-35 percent) overall decrease in precipitation levels by mid-century. In addition, higher temperatures increase evaporation and make for a generally drier climate, as higher temperatures hasten snowmelt and increase evaporation and make for a generally drier climate. Moreover, the 2009 Scenarios Project concludes that more precipitation will fall as rain rather than as snow, with important implications for water management in the state. California communities have largely depended on runoff from yearly established snowpack to provide the water supplies during the warmer, drier months of late spring, summer, and early autumn. With rainfall and melt water running off earlier in the year, the state will face increasing challenges of storing the water for the dry season while protecting Californians downstream from floodwaters during the wet season."[8]

Other sources indicate that the American Southwest will be one of hardest hit areas in the country[9] because it has high values of "climate responsiveness" or where climate will change the most.[10] The Southwest's climate responsiveness comes not from just higher temperatures or less precipitation, but increased variability, especially in terms of precipitation.[11]

The U.S. Global Change Research Program[12] predicts the following about climate change in the Southwest:

- Recent warming in the southwest among the most rapid in the nation[13].
- SW temperatures have already increased 1.5 deg. F compared to a 1960-1979 baseline[14]
- Late this century the average annual temp could increase 4-10 deg F above the baseline[15]
- Large reductions in spring precipitation, as much as 30-40% less under a high emissions scenario by 2080-2099[16]

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[7] Ibid, p. 16
[8] Ibid, p.17
[9] Kerr, Richard. "Climate Change Hot Spots Mapped Across the United States." Science Magazine: August 21, 2008

[10] Ibid
[11] Ibid
[12] U.S. Global Change Research Program. "Southwest". Washington, DC. 2009.
Available online at www.globalchange.gov/publications/reports/scientific-assessments/us-impacts/regional-climate-change-impacts/southwest

[13] Ibid
[14] Ibid
[15] Ibid

- Increased competition for water supplies[17]

The draft EIR must address the following questions about water resources and climate change:

1) What study has assessed the total recharge rate at 50,000 acre feet/year and has it undergone peer review?

2) The Project Manager mentioned during the scoping session that the recharge figure of 50,000 acre feet/ year was within a range of numbers. Where does 50,000 acre feet year fall in that range and why has this figure been selected?

3) What scientific methodologies were used to determine recharge rates and are they the same methodologies that are endorsed by the United States Geologic Survey and other scientific organizations?

4) Do the figures listed in the NOP differ from United States Geologic Survey or other agencies' or organizations' studies, surveys or estimates and why might that be?

5) Is it realistic to assume that recharge rates for a desert aquifer will remain constant over a fifty year period in light of climate change and the natural variability of desert hydrologic systems?

6) How might the increasing variability in precipitation in the Southwest, drought and increased evaporation due to higher temperatures that are predicted with climate change affect project recharge estimates over a 50 year period?

7) What data suggests there will be sufficient water available in the Colorado River for phase II based on the natural variability of hydrologic systems, climate change and the changing demographics of the American west?

Cumulative Impacts

The cumulative impacts section of the draft EIR must have a thorough, meaningful and science based examination of how current and proposed projects in the area will affect the environment. Of particular concern are developments outlined in the Bureau of land Management and Department of Energy's Solar Programmatic Environmental Impact Statement, which seeks to carry out a mandate of developing 10,000 megawatts of solar energy on BLM lands in six western states. Under one alternative, 22 million acres of BLM lands would be opened to solar development, but concentrated in Solar Energy Zones or SEZs. The second alternative would limit solar development to 676,000 acres of BLM land on proposed SEZs.

Under the first alternative, BLM lands surrounding the Cadiz Valley Water Conservation, Recovery, and Storage Project would be open to solar development, as well as the proposed 106,000 acre Iron

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[16] Ibid
[17] Ibid

Mountain Solar Energy Zone that would be less than 15 miles away from the proposed Cadiz Valley Water Conservation, Recovery, and Storage Project. If the second scenario prevails, up to 80% of the 106,000 acre Iron Mountain Solar Energy Zone would be developed with utility scale solar energy. It is well documented that utility scale solar development can impair air quality during construction and operations, disrupt wildlife corridors, cause light pollution and drawdown water resources.

The following questions should be thoroughly examined by the draft EIR in terms of the cumulative impact of the Cadiz water storage project in combination with other foreseeable industrial development :

1) How will the proposed solar development on lands adjacent to the Cadiz Valley Water Conservation, Recovery, and Storage Project or the nearby Iron Mountain SEZ affect water resources in the region?
2) How will the proposed solar development on lands adjacent to the Cadiz Valley Water Conservation, Recovery, and Storage Project or the nearby Iron Mountain SEZ impact visual resources, night skies and air quality on the Mojave National Preserve, wilderness and the environmental health of the region in general?
3) How will the proposed solar development on lands adjacent to the Cadiz Valley Water Conservation, Recovery, and Storage Project or the nearby Iron Mountain SEZ impact wildlife corridors and habitat for rare and endangered species in the region?

In closing, NPCA thanks you for the opportunity to provide scoping comments on the Cadiz Valley Water Conservation, Recovery and Storage Project. As the EIR process moves forward it is essential that the true impacts of this project on the Mojave National Preserve, air quality and water resources are assessed. It is also paramount that any future project honors the will of the American people who have gone to considerable effort and expense to protect the unique ecosystems and history of the Mojave National Preserve.

Sincerely,

Seth Shteir
California Desert Field Representative
National Parks Conservation Association
sshteir@npca.org
760-332-9776

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Executive Office

March 30, 2011

Via Electronic and Federal Express
cadizproject@esassoc.com

Tom Barnes, ESA
626 Wilshire Boulevard, Ste 1100
Los Angeles, CA 90017

Dear Mr. Barnes:

Cadiz Valley Water Conservation, Recovery, and Storage Project, Notice of Preparation

The Metropolitan Water District of Southern California (Metropolitan) received the Notice of Preparation (NOP) of a Draft Environmental Impact Report (DEIR) for the Cadiz Valley Water Conservation, Recovery, and Storage Project (Project). The Santa Margarita Water District (SMWD) is acting as the Lead Agency under the California Environmental Quality Act (CEQA) for this proposed Project.

Metropolitan is a public agency and regional water wholesaler, comprising 26 member cities and water agencies charged with providing a reliable supply of high quality drinking water to more than 19 million people in six counties (San Diego, Orange, Riverside, Los Angeles, San Bernardino, and Ventura) in Southern California. One of Metropolitan's primary water supplies is the Colorado River. Metropolitan owns and operates the Colorado River Aqueduct (CRA) to bring water from the Colorado River to its service area.

The NOP describes the proposed Project as including use of "the CRA delivery system owned and operated by the Metropolitan Water District of Southern California (Metropolitan)." (NOP, p. 4.) The NOP notes that Metropolitan's approval is required for the construction and operation of any modifications to the CRA, and for the use of Metropolitan facilities to deliver water for the proposed Project. (NOP, p. 6.) As a public agency that must approve aspects of the Project, Metropolitan is a responsible agency for purposes of CEQA. (Public Resources Code § 21069.) This letter provides Metropolitan's comments on the scope and content of the environmental information that is germane to Metropolitan's role as a responsible agency in the CEQA process. (Public Resources Code § 21080.4.)

On the basis of the Project description in the NOP, the environmental information pertinent to Metropolitan's role in the proposed Project includes:

- Identification and description of the environmental impacts from construction and operation of any Project facilities (e.g., turn-out structure, pipeline) that would be constructed on Metropolitan property,
- Environmental effects of construction and operation of any water treatment facilities that may be required to introduce the water supply into Metropolitan's conveyance system, and
- Environmental effects of the construction and operation of any electric power generating or transmission facilities that may be required to deliver the water supply through Metropolitan's conveyance system.

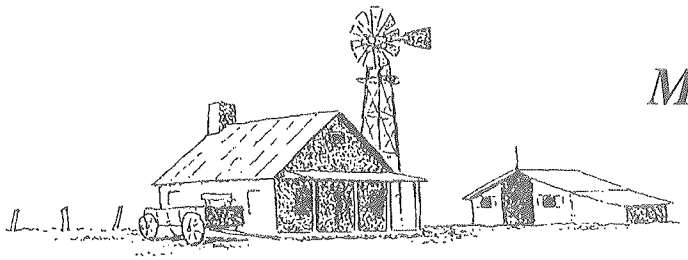
We appreciate the opportunity to provide input to your planning process and we look forward to receiving the Draft EIR for the proposed Project. Please direct all further communications related to the proposed Project to Dr. Marty Meisler at (213) 217-6364.

Very truly yours,

John Shamma

John Shamma
Manager, Environmental Planning Team

MM:rdl
(J:\Environmental-Planning&Compliance\COMPLETED JOBS\March 2011\Job No. 2011032433)



Mojave Desert Heritage and Cultural Association

30 March 2011

Tom Barnes
ESA
626 Wilshire Boulevard, Suite 1100
Los Angeles, CA 90017

Re: Comments regarding the Notice of Preparation of a Draft EIR (NOP) for the Cadiz Valley Water Conservation, Recovery and Storage Project

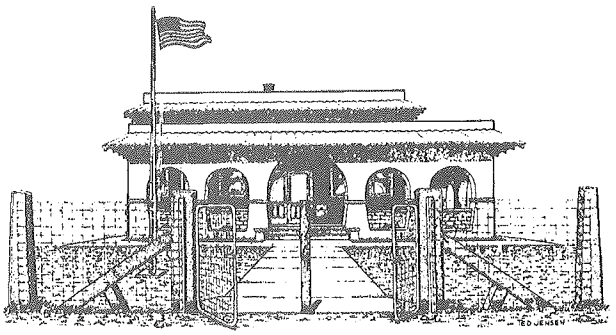
Dear Mr. Barnes:

As a follow-up to my comments made at the public scoping meeting held March 16, 2011 at the Santa Margarita Water District offices, this letter constitutes the complete comments of the Mojave Desert Heritage and Cultural Association (MDHCA). I am a member of the MDHCA Board of Directors and have been authorized to speak on behalf of our organization.

The MDHCA is a 501(c)(3) nonprofit corporation operating a 75-acre cultural center in the community of Goffs, California, located within the Fenner Watershed. Our mission is to preserve the heritage of the East Mojave Desert. We represent a membership of 700 citizens who care for the well-being and history of our desert. The grounds of the cultural center house the Goffs Schoolhouse, which is a National Register Property, the Mojave Desert Archives in the Dennis G. Casebier Library, and many significant historic structures, displays, and artifacts.

The MDHCA is not averse to the concept of recovering groundwater that naturally discharges to the atmosphere or the concept of using an aquifer to store surplus surface water supplies and extracting these stored supplies during dry years. The MDHCA is concerned that the planned draw down of 50,000 acre feet per year (AFY) from the Fenner Watershed by the Cadiz Valley project may negatively impact the quality and quantity of domestic water in its wells in Goffs as well as water for all uses permitted by the zoning regulations of San Bernardino County, such as commercial, livestock, and agricultural.

Chris Ervin
President
Telephone: 760-733-4482



Goff's Schoolhouse
37198 Lanfair Road — G-15
Essex, California 92332

The Goffs Cultural Center is solely dependent for its water upon two 900-foot water wells, drilled at great expense to the organization. The most recent well, installed in 2007, was funded by a grant from the State of California. Because our grounds are open to the public, we are required by the County of San Bernardino to regularly monitor the quality of our water supply.

The projected draw down of 50,000 AFY is characterized by Cadiz as sustainable. Yet the recoverable water model presented in the Cadiz Water Conservation Project presentation by CH2M HILL dated February 8, 2010 indicates previous estimates of recoverable water as low as 2,070 to 10,343 AFY (USGS, 2000) to a high of 15,839 to 41,539 AFY (GSSI, 1999). Two aspects of this data are of concern;

1) the planned draw down of 50,000 AFY creates an annual water deficit of ~8,500 acre feet using the highest estimate (41,539 AFY) or an annual deficit of nearly 40,000 acre feet using the lowest estimate (10,343 AFY), and,

2) the estimates from the three sources cited (GSSI, USGS, Davison and Rose) vary so widely that it calls into question the reliability of any of the estimates. It is difficult to see how the data supports characterizing the projected 50,000 AFY draw down as sustainable.

The MDHCA is resolute in the absolute need for early identification of any negative trend or the detection of any unanticipated impacts to the water our organization and the visiting public depend upon. Otherwise, it may be too late to reverse negative trends and impacts once a problem is detected. Therefore, the MDHCA strongly recommends:

1) Including within the Cadiz Valley project a water monitoring program for the Fenner Watershed to measure any impacts, negative or positive, to the quality or quantity of water used for domestic, commercial, livestock, and agricultural purposes. Monitoring stations should be located near the highest point of the watershed (Lanfair Valley) and other critical points, and operate for one year prior to any draw down of water from the Fenner Watershed. The monitoring program should continue throughout the 50-year life of the project.

2) Setting thresholds of water quality and quantity for each station of the monitoring program to determine the occurrence of negative impacts to all water use. Any measurements falling outside the set thresholds of the Cadiz Valley project monitoring program should immediately initiate mitigation actions.

3) Including predefined mitigation actions that would immediately halt the draw down of water from the Fenner Watershed to avoid any further loss of water quality or quantity for those who are dependent upon it.

4) Having a third party conduct the monitoring program, such as the U.S. Geological Survey, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, National Park Service, or Bureau of Land Management. The data from the monitoring program should be shared with both Cadiz and the affected community.

Ten years ago, during the comment period of the prior Cadiz Valley project, the MDHCA offered use of our well for the purpose of monitoring water quantity and quality. We again make that same offer to the current project.

Consideration of Residents and Wildlife within the Fenner Watershed

The Cadiz Valley project needs to recognize the vast amount of private land and the large number of residents with domestic wells within the Fenner Watershed. It's worth noting the special status of private property within the MNP. The California Desert Protection Act (CDPA) of 1994 specifically states that private property within the boundaries of the MNP are within and under the jurisdiction of the County of San Bernardino, not federally managed public lands. The planned draw down to intentionally induce more water to flow down from these high elevations seems likely to negatively impact the water quantity and quality for the residents of Fourth of July Canyon, Round Valley, Pinto Valley, Lanfair Valley, Gold Valley, Vontrigger, and Goffs. These land owners should be made aware of this project and the possible impacts on their water and the value of their land. There should be a public meeting held near the affected real estate, such as at the Goffs Schoolhouse, Hole-In-The-Wall Fire Station, or Kelso Depot. As it is, the two public meetings held were over 100 miles from the affected private property.

There is also a great diversity of wildlife dependent upon the numerous springs in the Mojave National Preserve (MNP) adjacent to Goffs. It is important that the planned draw down not upset the delicate natural balance, as it would have serious consequences to the wildlife found there.

Thank you for the opportunity to provide comments on the Cadiz Valley project NOP. Your contact at the Mojave Desert Heritage and Cultural Association will be Chris S. Ervin, MDHCA Director, at the return address on the letterhead.

Sincerely,

Chris S. Ervin
Director

LAND USE SERVICES DEPARTMENT

COUNTY OF SAN BERNARDINO

ADMINISTRATIVE OFFICE
385 North Arrowhead Avenue • San Bernardino, CA 92415-0187
(909) 387-4431 Fax (909) 387-3223
http://www.sbcounty.gov/landuseservices

CHRISTINE KELLY
Director

March 30, 2011

Tom Barnes, ESA
626 Wilshire Boulevard, Ste. 1100
Los Angeles, CA 90017
Telephone: 213-599-4300

Re: NOTICE OF PREPARATION OF A DRAFT EIR
Cadiz Valley Water Conservation, Recovery, and Storage Project
SCH # 2011031002

Dear Mr. Barnes:

Pursuant to the Guidelines for California Environmental Policy Act, Title 14, Cal. Code Regs. ("CEQA Guidelines") § 15103, the County of San Bernardino ("County") submits the following comments on the above-referenced Notice of Preparation ("NOP") for the Cadiz Valley Water Conservation, Recovery, and Storage Project ("Project"):

1. Lead Agency Designation

The County reserves all rights with respect to the Santa Margarita Water District's (SMWD) assertion of lead agency status for the Project, including, without limitation, the right to initiate the Office of Planning and Research lead agency designation process pursuant to Public Resource Code §21165.

The County and SMWD are currently consulting regarding lead agency designation for the Project in accordance with CEQA Guidelines § 15053. In the event that County and SMWD reach agreement on the designation of SMWD as lead agency for the Project, the County will be a "Responsible Agency" for the Project within the meaning of CEQA Guidelines § 15381. In such event the County will have all of the rights and responsibilities of a Responsible Agency, including but not limited to (i) the right and duty to evaluate potential impacts of the Project; (ii) discretion whether to issue or reject discretionary approvals of the Project under the County's zoning and building laws and regulations; (iii) discretion whether to issue or reject discretionary approvals for the Project under the County's ordinances pertaining to groundwater including but not limited to the Desert Groundwater Management Ordinance (San Bernardino County Code, Title 3, Division 3, Chapter 6, Article 5, sections 33.06551 et seq.); and (iv) authority to regulate the extraction and use of groundwater resources within the County as enunciated in *Baldwin v. County of Tehama* (1994) 31 Cal.App.4th 166. Because of the limitations of the Project Description set forth in the NOP (see discussion below), the County is unable to ascertain the full scope of required permits for the Project, including the requirement for subsequent conditional use permits. Consequently, the County reserves the right to require additional zoning, building and other permits pursuant to County laws and regulations.

2. Project Description

The Project Description in the NOP does not provide an adequate description of the Project. Specifically, detailed maps are needed to indicate where proposed facilities will be located and what the physical components of the facilities will be. The County is most interested in the location and physical requirements of the proposed extraction wells (well-field).

Both phases of the Project need to be clearly defined, including at a minimum, physical components, amount of water to be extracted and stored, and proposed timing and duration for each phase.

3. Desert Groundwater Management Ordinance

The Project will be subject to the Desert Groundwater Management (GM) Ordinance (San Bernardino County Code, Title 3, Division 3, Chapter 6, Article 5, sections 33.06551 et seq.) that is intended to protect groundwater resources within the un-adjudicated, unincorporated desert regions of the County, including the health of individual aquifers, and the continued ability of those aquifers to store and maintain water.

In complying with provision of the GM Ordinance, the project is subject to the County's discretionary review. The County's discretionary review of the Project will apply to: (a) the proposed well-field; (b) the sources of energy to power the well-field and pumping stations; and (c) the construction of a new pipeline and pump stations (if any). The County's evaluation will be consistent with the purposes of the GM Ordinance and consider the potential cumulative extractions from the proposed Project as well as those undertaken pursuant to the existing Cadiz CUP.

The EIR must clearly identify this groundwater management permit as a required entitlement of the Project and include the requisite analysis in the EIR for the County to assess the environmental impacts associated with issuing such a permit. The EIR must identify mitigation, as required, to reduce potentially significant impacts associated with permit issuance.

The County reserves all rights pursuant to CEQA Guidelines § 15096 to determine the adequacy of the Project EIR relative to required County permits and discretionary approvals, and to require additional CEQA review as necessary, including a subsequent or supplemental EIR as provided in CEQA Guidelines §§ 15162 and 15163.

4. Compliance with County Conditional Use Permits

The EIR must assess the Project's compliance with adopted County Conditional Use Permits and the Mitigation Monitoring Program promulgated through the 1993 Final EIR (SCH #89020203).

5. Subsidence

The pending EIR for the Project must evaluate the potential for the project to exacerbate existing subsidence issues and cumulative loss of available groundwater.

6. Growth-Inducing Impacts

Consistent with Section 15126.2, the EIR must evaluate for all phases of the Project potential growth-inducing impacts. This discussion must describe the ways in which the Project could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment.

7. Project Alternatives

Consistent with Section 15126.6 (e) of the CEQA Guidelines, the "no project" analysis presented in the EIR must discuss the existing conditions at the time the notice of preparation is published. Existing conditions must include current groundwater use on the Cadiz property, which according to the *Twelfth Annual Groundwater Monitoring Report (January – December 2009) Cadiz Valley Agricultural Development, prepared by Cadiz, Inc., dated June 30, 2010* was approximately 1,882 acre feet in 2009.

A project alternative must include build-out conditions under existing County entitlements for the Cadiz property. These entitlements include: GPA/90-0017, CUP/90-0019, CUP/90-0031, CUP/90-0032 and CUP/95-0015 (as revised), Maximum entitlements permitted under GPA/90-0017, CUP/90-0019, CUP/90-0031, CUP/90-0032 are limited to the groundwater extraction assumptions evaluated under certified Final EIR SCH #89020203, and Mitigation Measure WR6 which stipulates provisions for groundwater monitoring.

The County appreciates SMWD's attention to its concerns regarding the deficiencies of the NOP. The County looks forward to working with SMWD to achieve a thorough and adequate EIR.

Please do not hesitate to contact me at (909) 387-4431 should you have any questions.

Sincerely,

Christine Kelly
Director of Land Use Services

cc: Kevin M. O'Brien
Gregory C. Devereaux
Dena Smith
Jim Squire
Wes Reeder
Joe Scalmanini
Will Halligan
Joann Lombardo

From: joe ross [rossjoe@hotmail.com]
Sent: Saturday, March 12, 2011 7:51 AM
To: Cadiz Project
Cc: joe ross
Subject: Cadiz NOP

To: Tom Barnes, ESA
626 Wilshire Boulevard, Ste. 1100
Los Angeles, CA 90017

Hello Tom,

I briefly glanced at the SMWD Notice of Preparation of a Draft EIR (NOP) for the Cadiz Valley Water Conservation, Recovery and Storage Project.

It appears that the project and associated lands would be incompatible with lands being analyzed (under their Alternative 3) by the U.S. Marine Corps for potential expansion of the Marine Corps Air Ground Combat Center in 29 Palms. Their project Draft EIS was just recently released about 25 Feb, and comments are being solicited until 26 May:

http://www.marines.mil/unit/29palms/LAS/Pages/EIS.aspx

Public meetings for that project will be held on 12-14 April:

http://www.marines.mil/unit/29palms/LAS/Documents/EIS/29_Palms_EIS_NOA_NOPM_-_FINAL_-_2011-02-14_%20rev%2015.pdf

Within the "Environmental Consequences" section of their Draft EIS, there are many statements about the Cadiz landholdings and project made:

ON Page 4.1-11:

4.1.4 Alternative 3 Impacts

4.1.4.1 Plans and Policies
Alternative 3 would potentially be inconsistent with the CDCA Plan's multiple use objectives, including provisions for mining access and, in turn, approved plans and permits that allow for current operation of the TETRA Technologies, Inc. (TETRA) Amboy Operation and National Chloride mines in the east study area (see Figure 3.1-5 and Section 4.12, *Geological Resources*). Although the ability to continue mine operations would be considered on a case-by-case basis if Alternative 3 were implemented, it is possible that these two mines could, after such an evaluation, require closure (see Mining below). In addition, BLM has assigned a Known Sodium Leasing Area (43 Code of Federal Regulations [CFR] 2400) land classification to lands in the vicinity of these two mines, further indicating its intent to retain access to mineral resources without interference from other uses.
Alternative 3 would be inconsistent with San Bernardino County agricultural land use designation in the east study area and associated agricultural operations on 1,600 acres (648 hectares)

within the Cadiz Inc.
landholdings.
These inconsistencies with plans and policies related to mining on public lands and agriculture on private,
agriculturally designated lands are considered to be significant and unavoidable.

ON Page 4.1-12:
4.1.4.5 Agriculture
The majority of the Cadiz Inc. land holdings are undeveloped with the exception of approximately 1,600
acres (648 hectares) of existing agricultural operations which contain citrus, vineyards, and row crops.
No prime or unique soils or farmlands of state or local importance have been identified. There are seven
groundwater production wells that supply water for agricultural irrigation. Alternative 3 would be
incompatible with existing agricultural land use. Approximately 1,000 acres (405 hectares) are cultivated
in citrus and vineyards, which constitutes over 25% of San Bernardino County's fruit and nut crop
acreage. However, land use impacts associated with agricultural land use are considered to be less than
significant on a county-wide basis due to the fact that there were 1,021,585 acres (413,400 hectares) in
agricultural production in San Bernardino County (San Bernardino County 2008), of which the 1,000
acres cultivated by Cadiz Inc. represent less than 2% of the agricultural acreage in San Bernardino
County.
Note that socioeconomic effects on the agricultural sector (e.g., jobs) are addressed in Section 4.3.4. A
proposed major water recharge project on the Cadiz Inc. landholdings is addressed in Section 4.13.3,
Water Resources and Chapter 5, *Cumulative Impacts*.

ON Page 4.1-20 (in Table 4.1-3 reference impacts under Alternative 3):
Agriculture
 LSI and incompatible due to loss of 1,600 acres of cultivated agricultural lands; the 1,000
acres cultivated by Cadiz Inc. represents less than 2% of the agricultural acreage in San
Bernardino County.

On Page 4.3-17 and 4.3-18:
4.3.4 Alternative 3 Impacts
4.3.4.1 Impacts to Displaced Residents and Businesses
There are no existing residences within the boundaries of the east and south study areas that would be
displaced by the proposed land acquisition under Alternative 3. As discussed in Section 3.1, *Land Use*
and Section 3.12, *Geological Resources*, three operating businesses are located in the east study area
(Cadiz Inc. agricultural holdings and mining operations by TETRA and National Chloride Company).
Based on public records for all three companies, the analysis for Alternative 3 conservatively estimated
that a total of 150 employees (100 for Cadiz Inc. and 25 each for the two mining

companies) would be
displaced if the acquisition of the east study area were implemented. These job losses were factored into
the EIFS modeling along with the proposed increase in installation personnel.

As indicated in Section 2.6, *Disposition of Mines*, individual mine properties (e.g., TETRA and National
Chloride Company in the east study area) would be evaluated before implementation of any selected
project alternative to determine whether the properties would be acquired or if reasonable access to the
property would be afforded so that operations could continue following project implementation. In the
case of mining operations on or near dry lake beds (which are not conducive to military training
operations), providing reasonable access for business operations may be a realistic option. Although it is
not a mining operation, similar consideration would be applicable to Cadiz Inc.'s agricultural and
groundwater holdings. Should Cadiz Inc.'s plans for development of groundwater production to serve the
Los Angeles area become viable, it may be possible to provide reasonable access to the groundwater
assets, from either inside or outside the boundaries of the Alternative 3 east study area. Provided that
reasonable accommodation of Cadiz Inc.'s business plans would not interfere with achieving training
objectives under an Alternative 3 scenario, the Marine Corps would consider such accommodations
during the real estate acquisition process. According to the company's public records, the potential
realization of Cadiz Inc.'s business plans for groundwater development depend more on identifying and
implementing a means of transporting the water to the market area than on extracting the water from the
source. Potential plans for transporting the retrieved water to the market area are not sufficiently defined
to allow an evaluation of their compatibility with Alternative 3 at this time. Accordingly, an analysis of
the potential economic opportunity cost of not developing this water source would be hypothetical and
purely speculative, and is outside the scope of this EIS.
Given the considerations above, the existence of programs to assist and fairly compensate displaced
businesses, and the fact that only three such businesses occur in the acquisition study areas, Alternative 3
would have less than significant direct impacts to private property owners in the west and south study
areas.

ON Page 4.12-13:
Cadiz Inc. has agricultural operations on 1,600 acres (648 hectares) on alluvial soils in the north-central
portion of the east study area. Due to overlap of planned direct and indirect fire SDZs, the Cadiz Inc.
facilities and their personnel would present incompatible use and safety concerns for the planned military

uses of the east study area. The owners of the property would be offered fair market value for their land,
the agricultural operations would be closed, and the facilities and equipment would be removed. As
stated in Section 4.1.4.5, San Bernardino County has 1,021,585 acres (413,400 hectares) in agricultural
production. Therefore, loss of access to agricultural soil in the east study area would be a less than
significant impact to soil resources.

On Page 4.12-14:
Paleontological Resources
As described in Section 3.12.3.4, some specific locations of paleontological resources in the east study
area were documented through a survey conducted in conjunction with the Cadiz Groundwater Storage
and Dry-Year Supply Program (Metropolitan Water District [MWD] and BLM 2001). Under Alternative
3, areas known to contain significant fossil resources could be among those planned for ordnance delivery
and military vehicle travel (activities that would crush/destroy fossils). However, paleontological
resources within the east study area would be managed by the MAGTF Training Command NREA
Natural and Cultural Resources Branch, and would be addressed by a proactive management and
conservation program to minimize damage or loss. Therefore, under Alternative 3 there would be less
than significant direct impacts. There would be no indirect impacts.

On 4.13-3:
• impacts to southern California water supply by eliminating the Cadiz Project.

Within the "Cumulative Impacts" section of their Draft EIS, the following statements are made:

ON Page 5-8:
5.3.2.7 Cadiz Groundwater Storage and Dry-Year Supply Program
An EIS/Environmental Impact Report was prepared in September 2001 to evaluate the environmental
impacts associated with the Cadiz Project proposal. The Cadiz Valley Dry Year Supply Project is an
aquifer storage, recovery, and dry-year supply project designed to provide southern California with as
much as 150,000 acre-feet (AF) per year of reliable water during droughts, emergencies, or other periods
of need. The project is designed to store surplus water available during 'wet' years on the Colorado
River, or – by way of exchanges – from other sources of surplus water. Total storage capacity is greater
than 1 million AF. When needed, indigenous groundwater or previously stored water would be recovered
by wells and conveyed to the Colorado River Aqueduct for delivery to participating water agencies
throughout southern California. The Cadiz Project components include a water conveyance facility,

spreading basins, pumping plant, wellfield, power distribution facilities, and groundwater and air quality
monitoring facilities. The 390-acre (158-hectare) spreading basins would be located to the south of the
Burlington Northern and Santa Fe railroad lines, and northeast of the proposed wellfield. The project
wellfield would be constructed in the Fenner Gap in the vicinity of the spreading basins and would travel
in a generally southeasterly direction. Most of the project facilities would be constructed in the east study
area. The EIS/Environmental Impact Report concluded that after implementation of identified mitigation
measures there would be significant unavoidable adverse impacts to air quality (during construction only),
hazardous materials (related to the potential to unearth unexploded ordnance[UXO]), and paleontological
resources.

ON Page 5-50:

5.4.12 Geological Resources

5.4.12.1 Alternative 1

The majority of the projects listed above in Section 5.3 (e.g., construction projects at the Combat Center,
the wind and solar energy projects in the surrounding area, and development within the City of
Twentynine Palms) would involve ground disturbance. As such, they have the potential to disrupt soil
surfaces and cause compaction and erosion of soils in the ROI. As ground-disturbing projects, they also
have the potential to damage paleontological resources that may be present. The Environmental Impact
Report/EIS for the Cadiz Groundwater Storage and Dry-Year Supply Program found that the project
would have significant, unavoidable adverse impacts to paleontological resources that were determined to
be present within the project footprint for the water pipeline. Implementation of Alternative 1 would have
less than significant impacts to soils and paleontological resources because such resources would be
managed according to existing Natural Resources and Environmental Affairs (NREA) programs designed
to protect such resources and minimize impacts to them. In conjunction with other past, present, and
foreseeable future projects in the region, Alternative 1 would marginally increase the potential for impacts
to these resources, but such impacts are expected to be less than significant.

ON Page 5-52:

5.4.13.3 Alternative 3

The Alternative 3 acquisition study area includes approximately 35,000 acres (14,200 hectares) of Cadiz
Inc. landholdings. Cadiz Inc. is the main water user in the Cadiz Valley Area. Cadiz Inc. currently
cultivates approximately 1,500 acres (600 hectares) of their 9,000 acres (3,600 hectares) that are zoned for
agriculture. Agriculture is considered a beneficial use of water in the state of California. Alternative 3

would eliminate or curtail this agricultural operation and the Cadiz Inc. access to portions of its existing
water supply system. Therefore, Alternative 3 would have significant impacts to Cadiz Inc. groundwater
supplies.
Implementation of Alternative 3 would also interfere with or preclude the Cadiz Water Conservation and
Storage Project, a potential new water supply for southern California, because the alternative would
overlap in the east study area with the proposed footprint of the Cadiz Water Conservation and Storage
Project. The project is currently under environmental review and it is unknown if or when this project
would be implemented. While acquisition of the Cadiz Inc. land may be beneficial for the water supply
on the Combat Center, it would have a regionally significant impact because it would inhibit Cadiz from
instituting their Conservation and Storage Project.

ON Page 5-61 (in Table 5-5) in reference to their Alternative 3 a "signficiant impact" is notated:
SI
 The proposed action would inhibit Cadiz Inc. from instituting their Conservation and Storage Project. It would also reduce their agricultural operations and limit access to the existing agricultural water supply.

I hope that you will find this input to be helpful as part of your NOP scoping process.

Best wishes,
Joe Ross

p.s.
Pls feel free to add my email address to your contact list, but I wish to withhold my snailmail address from public review.

Cadiz Project
Project Manager: Tom Barnes, ESA
626 Wilshire Boulevard, Ste. 1100
Los Angeles, CA 90017

March 23, 2011

Dear Mr. Barnes:

I am writing to you today regarding a water project that is very disturbing for my husband and I, as we have recently purchased acreage in the East Mojave desert. I am referring to the Cadiz Project and the aquifers that will be impacted by the draining of 50,000 acre feet of water.

Mr. Barnes, we rely solely on our well water in the 4th of July Canyon. Our well is an aquifer that has been sustaining the water needs of the people in that area for at least a century now. However, we are limited to the amount of water we can pump from our aquifer on a daily basis. Ours is a community well, and we have had to set a limit of 45 minutes of pumping per day. Any pumping in excess of 45 minutes compromises the quality of the water. Our concern is, if we lose any water due to the Cadiz Project, we are in serious risk of not having enough water to live on our ranch.

Water is a precious resource and the draining of an aquifer in the middle of the desert is most certainly going to impact the area in detrimental ways. There is no positive effect from the Cadiz Project, for the flora, fauna or humans living in the East Mojave. The draining of 50,000 acre feet can't possibly be sustainable. There must be a smaller amount to start with very gradual increases only if severely needed.

Our specific concerns; first of all, we need an extension for the "Notice of Preparation of a Draft EIR (NOP)" so more comments can be thoughtfully presented. Second, there must be regular monitoring of water, quantity and quality, in place. Especially in Round Valley, 4th of July Canyon, Goffs, 7IL area, Lanfair and the Budweiser Springs area, prior to any draw down, so that a baseline may be set. Thresholds must be set that would indicate when negative impacts are occurring, and mitigation be built into the project upfront to avoid any loss of water quality or quantity for those of us who are dependent upon it. Springs, wells and wildlife must be monitored prior to the pumping, as well as during drawdown. Lastly, most all of the water used to fight the wildfire here came from wells in Round Valley and Gold Valley, when drawn down by Cadiz, what happens to us and our homes?

Mr. Barnes, a copy of this letter has also been sent to both Senator Feinstein and Congressman Lewis, so that they may bring these concerns to the table for those of us living in the East Mojave Desert Region.

Sincerely,

Russell Woodruff Marilyn E Woodruff

Russell and Marilyn Woodruff
Parcel #0567101420000
San Bernardino Co.

2234 EAGLE DR
LA VERNE CA. 91750

From: Brendan Hughes [jesusthedude@hotmail.com]
Sent: Friday, March 25, 2011 9:39 PM
To: Cadiz Project
Subject: Comment

Hello. My name is Brendan Hughes and I would like to be kept informed via email regarding this project.

Also, I would like the environmental documents to do a thorough analysis of the impacts to springs and seeps, desert tortoises, rare plant assemblages, wilderness characteristics, and burrowing owls.

Thank you.

Note: Please do not send me paper mail regarding this issue. Please use email.

Brendan Hughes
jesusthedude@hotmail.com

March 25, 2011

Mr. Tom Barnes, ESA
Cadiz Project Manager
626 Wilshire Blvd, St e 1100
Los Angeles, CA 90017

Valerie Finstad
8965 10th Ave
Hesperia, CA 92345

Dear Mr. Barnes:

Per our telephone conversation today regarding the Cadiz Project, my concerns and comments are as follows:

The East Mojave Property Owners have just become aware of the Cadiz Project and need additional time to make comments and voice our deep concerns before the NOP is finalized.

We certainly feel that human and animal habitat must be included. All of our survival in the area depends on natural springs (many of which dry up in the summer) and well water.

The amount of water suggested for draw down is a vast concern. With the little rain we get in the area, the 50,000 acre-feet cannot possibly be replenished. What took millions of years to accumulate will be gone. Owens Dry Lake keeps recurring in my thoughts. We certainly do not need a repeat of that travesty.

I would hope that a baseline at several monitoring stations would be established prior to any drawdowns occurring. Progress would be tracked and procedures put in place in case quality or quantity changes.

Fire protection must be considered. Lightning strikes burned 70,000 acres 6 years ago. Water was scare then! Since that fire, nothing has grown back. There isn't enough moisture. The pinions and cedars grew during a wetter period. Pulling water from the Cadiz watershed only adds insult to injury.

I can only relate to you what I have observed during the 40 years I have had the property in the New York Mtns. There are two mine shafts I periodically visit. In 1971 both were full to the brim. It was that way pretty consistently for about 10 years. They have since continually dropped. The first shaft is 12' lower and the lower shaft is 5' lower. There is a hand dug well just above my property. It varied with rains and snows, but always about 8 to 15 feet down during the dry periods. In the last 15 years no water was visible at all

during the dry period. The Park Service has recently filled it full of concrete to protect the ground water. The concrete truck driver told us they hit water at 40 feet.

These are my concerns and the concerns of others in the area. Please keep me advised of any meetings. If you would like to visit the area, please let me know and I will arrange a tour.

Sincerely,

Valerie Finstad

Valerie Finstad

From: Chris Brown [CBrown@pbewarehouse.com]
Sent: Monday, March 28, 2011 6:37 PM
To: Cadiz Project
Subject: Regarding East Mojave Preserve
Attachments: Newsletter 3.21.11.docx

My name is Chris Brown. I am a representing the East Mojave Landowners Association. I, nor any of the property owners in the East Mojave Preserve have been notified of your intent to exploit ground water resources in the Cadiz area. The property owners in the Preserve rely solely on water wells which feed your aquifer. I watched your video which described where the basin gets its water resources from and I can assure you allot comes from our area due to our elevation. I have attached a letter that has been e-mailed from our Chairman that should give you some understanding of our concerns. I have a good understanding of ground water tables in the East Mojave and have been a witness to many wells that have been drilled. Most property owners own the water rights to their properties. A significant pumping of your aquifer could result in a draw down of the water table in the East Mojave Preserve especially at the higher elevations. Many wells are close to the surface, some having static water at twenty feet. Others can be much deeper.

I know your project requires you make a profit! I would hope you consider the water rights of your neighbors up stream by allowing our input. I also hope your company might make the investment to monitor static water levels in the Preserve while your project gets underway. Any significant water table draw down could and should be a direct result of your project getting underway.

Thank you,
Chris Brown
19508 N. 78' Ave.
Glendale, Az. 85308
602 328-0978

Regarding property address:
52202 New York Mountain Rd.
Cima, Ca. 92323
760 928-0978

From: Eldenhughes@aol.com
Sent: Monday, March 28, 2011 9:09 PM
To: Cadiz Project
Subject: (no subject)
Attachments: CBD'sScopingcommentsCWCRSPfinal3-28-11.zip

Elden Hughes
7544 Sunny Vista Road
Joshua Tree, CA 92252
760 592-1212

By electronic and US mail

March 28, 2011

C/o Tom Barnes, ESA
626 Wilshire Boulevard, Ste. 1100
Los Angeles, CA 90017
Telephone: 213-599-4300
FAX: 213-599-4301
cadizproject@esassoc.com

RE: Scoping Comments on Cadiz Valley Water Conservation, Recovery, and Storage Project

Dear Mr. Barnes,

I am Elden Hughes, Honorary Vice President of the Sierra Club and past chair of the Sierra Club's Desert Committee. These scoping comments are made in behalf of me and the Sierra Club, a California corporation.

I have read and studied the scoping comments of the Center for Biological Diversity and I defer to their greater experience in developing scoping comments. With the permission of the Center and by reference I include their comments as part of these comments. Beyond that, I will add some personal observations.

IMPORTED WATER STORAGE COMPONENT Water can now be stored for free in Lake Mead. The economic viability of water storage in the Cadiz aquifer depends on government decisions which are out of the control of the project proponents and decisions which are extremely unlikely. This should not be a part of this EIR.

NATIVE VALUES In the next valley to the east, Ward Valley, an entire project for the disposal of low level nuclear waste that was fully approved by the State of California has been abandoned because the proponents did not trouble themselves to study and learn the spiritual importance to Native Americans of the trail system and native sites. I have been told of trails in the Cadiz Valley and I have personally observed portions of trails in the vicinity as well as spiritual sites. These must be fully inventoried and protected.

WILDLIFE The second largest herd of bighorn sheep in the California Desert is in the Marble Mountains which forms the immediate northern and eastern boundary of the Cadiz Valley. This herd depends on springs and seeps which may well be put at risk by any lowering of the aquifer in the Cadiz Valley.

I have observed eagle's nests east of Fenner. The project area is certainly part of their foraging area.

PLANT LIFE Two new species of plants have just been found in the area adjacent to the project site. The project site has not been adequately surveyed and requires at minimum of a fall and a spring survey each following rains.

AIR QUALITY If the project is able to achieve its goal of intercepting the water presently evaporating from Bristol and Cadiz dry lakes, it may well create an "Owens Lake" dust source that could be devastating to air quality in San Bernardino County and the Mojave National Preserve. Presently the Los Angeles Department of Water and Power is spending one-half billion dollars seeking to control the dust they created.

NEPA Federal lands will be affected by this project although NEPA is not being considered. If a reservoir near Danby and/or Freda becomes necessary then even more certainly NEPA should be part of process.

I hope that my comments and the comments of the Center for Biological Diversity are helpful in guiding the preparation of an EIR that will adequately protect the beautiful resource that is the Cadiz Valley. Please add me to the distribution list for the EIR and all notices associated with the project.

Sincerely,

Elden Hughes

Attachment:

Arizona • California • Nevada • New Mexico • Alaska • Oregon •Washington • Illinois • Minnesota • Vermont • Washington, DC
Ileene Anderson, Biologist/Desert Program Director
8033 Sunset Blvd., #447 • Los Angeles, CA 90046-2401
tel: (323) 654.5943 *fax:* (323) 650.4620 *email*: ianderson@biologicaldiversity.org
www.BiologicalDiversity.org
protecting and restoring natural ecosystems and imperiled species through science, education, policy, and environmental law
via electronic and US mail

March 28, 2011
Santa Margarita Water District
c/o Tom Barnes, ESA
626 Wilshire Boulevard, Ste. 1100
Los Angeles, CA 90017
Telephone: 213-599-4300
FAX: 213-599-4301
cadizproject@esassoc.com
RE: Scoping Comments on the Santa Margarita Water District, Cadiz Valley Water Conservation, Recovery, and Storage Project

Dear Santa Margarita Water District,

The Center for Biological Diversity ("the Center") submits the following comments on the Notice of Preparation ("NOP") for an Environmental Impact Report ("EIR") for the proposed the Santa Margarita Water District, Cadiz Valley Water Conservation, Recovery, and Storage Project on behalf of our board, staff, and members of the public with an interest in protecting the native species and habitats in and around the Cadiz Valley.. The Center is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center has over 255,000 members and activists throughout California and the United States, with a number of them living within California and visit and enjoy the Mojave desert in the vicinity of the proposed project.
The remote desert of Cadiz Valley is surrounded by federally designated wilderness near the Mojave National Preserve. The general area is habitat for rare and endangered species, including the federally and state threatened desert tortoise (*Gopherus agassizii*), the very rare white margined beardstongue (*Penstemon albomarginatus*), the California leaf-nosed bat (*Microtus californicus*), desert bighorn sheep (*Ovis canadensis nelsonii*) and other rare species (CNDDB 2011). The proposed project also could affect rare desert riparian areas, springs and seeps – the lifeblood of the desert - outside of the physical boundaries of the project area. The proposed project area is also rich in cultural and historical significance.
The Center offers these comments regarding the scope of issues that need to be addressed in the Draft Environmental Impact Report (EIR). Most importantly, the EIR should clearly identify the purpose and need for groundwater pumping of the aquifer. The purported hydrology that the NOP describes as "The groundwater naturally flows to the Bristol and Cadiz Dry Lakes (Dry Lakes) and is lost to evaporation" need to be scientifically corroborated and the implication

that any natural evaporation is somehow a "problem" to be "solved" needs to be fully examined. In addition, the Draft EIR should adequately demonstrate if and how each project element will fulfill the project's purpose and need, and adequately describe a range of alternatives that could avoid the significant impacts of the project, including a no action alternative. The EIR must also fully identify and analyze how the proposed project and alternatives would impact biological resources and provide minimization and mitigation measures for any impacts that cannot be feasibly avoided. Following are specific issues the Center believes must be addressed in the EIR under the California Environmental Quality Act, Public Resources Code §§ 2100 et seq. ("CEQA"). Up-to-date natural and cultural resource surveys and inventories of the area need to be completed and included in the DEIR. Complete documentation of the hydrology of the area must also be included.

The EIR Must Consider a Range of Alternatives

In general, the EIR should include "a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives," as required by Section 15126.6 (a) of the CEQA Guidelines. The alternatives should include those that would avoid or substantially lessen any of the significant environmentally negative effects of the project and ongoing management [CEQA Guidelines, section 15126.6(1)]. For each alternative, the EIR should provide a discussion on how each alternative would avoid or minimize significant impacts on biological resources. The EIR should provide a very clear and detailed description of the purpose, goals, and objectives for the project, as this will be critical in determining the most appropriate alternative and to allow for comprehensive analysis of the avoidance and minimization opportunities and if impacts can not be avoided, mitigation for specific issues.

The EIR Must Consider Direct, Indirect and Cumulative Impacts to Biological Resources

The EIR must be prepared to address the direct, indirect and cumulative impacts of the proposed project to threatened, endangered, and sensitive species as well as unique plant communities not only within the boundaries of the proposed project, but also outside of the project area, including the seeps and springs in the adjacent areas upon which desert wildlife species depend.

Not only must the EIR fully disclose and analyze impacts to any listed, candidate, sensitive, or locally rare species, but it also must discuss alternatives that will avoid those impacts. Even if alternatives that completely avoid such impacts may be later found infeasible, the EIR must explore alternatives that minimize impacts to species and any remaining impacts to the species must be mitigated though enforceable mitigation measures. The EIR must also fully disclose and analyze impacts to sensitive vegetation types.

The EIR must include a *quantitative, data-based* analysis of the direct impacts of the proposed Park management from the loss of habitat, as well as the indirect impacts resulting

from pollution, noise, increase in fire, disturbance, invasion of non-native species, growth inducing effects, green house gas analysis and other effects on biological resources.
The analyses must not be comprised only of general, qualitative descriptions of potential impacts, but contain quantitative analyses of effects based on population data obtained from field surveys and local conditions. In addition, the EIR must include a detailed analysis of the cumulative impacts of this project together with other completed, current, and reasonably foreseeable projects in the area.

Wildlife and Plant Species

During the course of the surveys, if other rare or regionally unique species are identified during the data gathering phase for the DEIR, these species also need to be included and analyzed for impacts. The EIR must consider the impacts on each of these species and as well as the cumulative impacts.

Listed Species

The state and federally listed threatened desert tortoise (*Gopherus agassizi*), which is also the state reptile, also occurs within the vicinity of the proposed project, and the area provides an important linkage for this species between northern and southern populations.
Where "take" of a species listed under the federal or California Endangered Species Act is anticipated, the EIR must document *and quantify* past and reasonably foreseeable future take authorizations for that species issued by the U.S. Fish and Wildlife Service ("FWS") and California Department of Fish and Game ("DFG") in order to evaluate the project's direct and cumulative impact on the species. The EIR also must consider the project's impacts on the *recovery* of listed endangered and threatened species that may occur on the site. Any potential impairment of species recovery associated with the project must be considered a potentially significant impact.

Sensitive Species

The EIR should also thoroughly evaluate the impacts of the proposed permitted activities on sensitive and locally rare species (not merely federally and state-listed threatened and endangered species). The preservation of regional and local genetic diversity is very important to the long-term persistence of species. Therefore, we request that all species found at the edge of their ranges or that occur as disjunct locations be evaluated for impacts by the proposed permitted activities.
Raptor species such as golden eagles (*Aquila chrysaetos*), a "fully protected" species under California law and protected under the Migratory Bird Treaty Act, the Bald and Golden Eagle Act and the Lacey Act, likely use the proposed project area as foraging habitat and may nest in adjacent habitat. FWS recently issued a final rule on acquiring permits to "take" golden eagles[1] that maybe required for this project. Guidance is also provided for evaluating impacts to golden eagles which should be used in the EIR. The burrowing owl (*Athene cunicularia*), a state

1 http://www.fws.gov/migratorybirds/baldeagle.htm

during surveys (ex. annual and herbaceous perennial plants). The proposed project areas can receive monsoonal rains which trigger a suite of late summer/early fall blooming annual plants, some of which are quite rare. Late season surveys should be implemented and the results should be included in the EIR.

Additionally the surveys need to be done to assess cryptobiotic soil crusts – where they exist and how to protect them. Cryptobiotic soils are an essential component of healthy desert soils, providing a protective layer that absorbs the scant precipitation events, provides "safe sites" for seed germination and prevents soil erosion. Because this and essential desert soil component is fragile and not easily restored, a full discussion of the impacts needs to be included, including alternation of the hydrology and the effects on the soil crusts.

Impact Analysis

The EIS must quantitatively evaluate all direct, indirect, and cumulative impacts to sensitive habitats/species, including impacts associated with the drawdown of ground water and its effects on adjacent spring, seeps and phreatophytic vegetation.

The EIR Must Consider Direct and Cumulative Impacts to Water Resources, Soils, and Air Quality

The pumping proposed under the project may impact water resources and water quality. These issues must be fully considered. The project components and water pumping may also affect soils by disrupting soil structure and drying.

The Mojave Desert Air Quality Management District (MDAQMD) is currently exceeding the federal standards for the criteria pollutants PM_{10} and ozone. Off-road vehicle use, military activities and other issues contribute to existing air quality problems. The EIR must fully disclose and analyze the direct, indirect and cumulative impacts of groundwater pumping on soils and the already compromised air quality in the region, and discuss effective alternatives and mitigation measures to avoid, reduce, and mitigate these impacts.

The EIR Must Adequately Describe the Environmental Baseline

Because the proposed project intends to pump groundwater from a desert basin, obviously baseline conditions in water quantity and quality need to be identified. As suggested above, hydrological studies must unequivocally prove that groundwater naturally flows to the Bristol and Cadiz Dry Lakes (Dry Lakes) and is lost to evaporation. Secondly, the proposed project must show the actual amount of recharge that is lost to evaporation. Our sense is that 50,000 afy is well above the annual recharge to the aquifer that is lost to evaporation. If additional water pumping above and beyond the evaporation rate is proposed, it will result in over-drafting of the groundwater basin and will cause significant environmental impacts. Groundwater monitoring must be put in place prior to the draft EIR so that a baseline groundwater scenario can be used to evaluate potential impacts from the proposed project.

Helena Bongartz
PO Box 695
Twentynine Palms, CA 92277

T 760 3613035

helenabongartz@mac.com

March 28, 2011

c/o Tom Barnes, ESA
626 Wilshire Boulevard, Ste.1100
Los Angeles, CA 90017

Dear Mr. Barnes:

Before commenting on the proposed Cadiz Valley Water Conservation, Recovery, and Storage Project, I would like to request an extension of the comment period beyond the March 30, 2011 deadline. Adequate notice was not given, particularly to those in the Eastern Mojave and the public meetings held too recently and for many at too great a distance to allow a considered and informed response.

My comments on the project are as follows:

1. This project threatens the groundwater resources essential to sustaining habitat and wildlife in the Mojave National Preserve and surrounding areas It poses a serious threat to the desert and Preserve by potentially depleting water supplies upon which humans, animals and plants rely for their survival. USGS studies estimate the groundwater recharge rate for the underlying aquifer to be 5 to 25 times less than the study used for the earlier project shows. Other studies also show a substantially lower recharge rate. This discrepancy needs to be addressed, and the actual rate of recharge determined. This should be throughly analyzed prior to any pumping in excess of the amount of water currently pumped by Cadiz for their agricultural use, approximately 5,000 as-ft/yr. Pumping in excess of this amount threatens the integrity of the Eastern Mojave desert as well as the economic activities of those companies who mine Bristol Lake.

2. While monitoring is essential if the project is implemented, a system must be implemented that can detect between the effects of the pumping and the effects of natural fluctuations. In fact the latter ought to be studied first. What threshold level would constitute a signal of adverse impacts on the groundwater and what remedial measures would be taken to stop the adverse consequences.

3. How is this project a "conservation" project? While it proposes to prevent loss of water to evaporation, it also would lower the groundwater table thus depriving current users of its benefit. It is also possible that the highly saline waters under Bristol Lake would be drawn into the aquifer. What measures would be implemented to monitor and prevent this?

4. If groundwater is pumped beyond the recharge rate, it is understood that the negative effects of this on the desert ecosystem would persist significantly beyond the date that pumping was suspended.

5. What is the connection between springs in the area and pumping operations? The springs are the water source for many mammals including the Desert Bighorn Sheep, a large population of which lives in the Marble Mountains. Also, a lowering of the groundwater would cause the death of the vegetation upon which animals rely. How could the vegetation ever be replaced?m

6. What about DUST? If the groundwater level drops, the ground will dry up causing a dust problem similar to that in Owens Valley.

7. Can this project be considered economically viable if only 5,000 ac-ft/yr of water is pumped?

8. Is the construction of an underground water pipeline to the Colorado River Aqueduct under an existing railroad right of way consistent with the granting of the right of way across BLM property (for railway use)?

9. If monitoring wells were to be installed, does Cadiz have the permits for these wells, and if not is the project viable without them?

10. What organization would oversee extraction/injection of water from/into the aquifer?

11. What is the federal need for water in the Eastern Mojave, the National Preserve and the wilderness areas? How can adverse effects be mitigated?

12. What private uses of water might be affected by this project? How can adverse effects be mitigated?

13. What are the Cadiz water rights to the aquifer? How does it exercising it's rights conflict with the rights of others (11 and 12 above).

14. I am also concerned about the visual and sound impacts of this project, not only during the construction phase but also during operation. What would these be and what measures could be taken to mitigate adverse impacts. The dark skies and silence are part of the beauty of this desert and a vanishing resource.

Thank you for your consideration of the above comments. I would appreciate your informing me of developments in the EIS process as they occur.

Because of the severe time constraint imposed by the March 30, 2011 deadline, I am also sending an email with an attachment of this letter to cadizproject@esassoc.com.

Sincerely yours,

Helena Bongartz

From: Helena Bongartz [helenabongartz@mac.com]
Sent: Tuesday, March 29, 2011 9:25 AM
To: Cadiz Project
Subject: Cadiz Project additional comments for EIR
Attachments: Cadiz Project

Dear Mr. Barnes:

I would like to add one further question to my comments which I sent to you yesterday by both mail and email (email attached includes letter). What might the potential impact be on the water of the Dale Basin located to the south of the project area. How would this potential to drain water from this basin be assessed and what controls or monitoring system could be put in place to monitor this?

Thank you for including this email with my previous comments.

Sincerely,
Helena Bongartz

30 March 2011

Tom Barnes
ESA
626 Wilshire Boulevard, Suite 1100
Los Angeles, CA 90017

Re: Comments regarding the Notice of Preparation of a Draft EIR (NOP) for the Cadiz Valley Water Conservation, Recovery and Storage Project

Dear Mr. Barnes:

The comments that follow may seem familiar in some respects. The reason is that I have sent comments on the Cadiz Valley project under a separate cover on behalf of the Mojave Desert Heritage and Cultural Association (MDHCA) in my role as Board Director and contact. In this letter I am providing you with comments in my role as an owner of private property and a private water well within the Fenner Watershed.

My wife Leslie and I own nine parcels totaling 156 acres in the East Mojave desert across Round Valley, Pinto Mountain, and Lanfair Valley. We are stakeholders in the Cadiz Valley project, as our property near Pinto Mountain has a well and other improvements within the boundaries of the Fenner Watershed. The property sits at about 5,000 feet elevation.

My wife and I are not averse to the concept of recovering groundwater that naturally discharges to the atmosphere or the concept of using an aquifer to store surplus surface water supplies and extracting these stored supplies during dry years. But we are concerned that the planned draw down of 50,000 acre feet per year (AFY) from the Fenner Watershed by the Cadiz Valley project may negatively impact the quality or quantity of the water in our well at our Pinto Mountain property. We're also concerned about how the Cadiz Valley project may impact our neighbors' water wells.

The projected draw down of 50,000 AFY is characterized by Cadiz as sustainable. Yet the recoverable water model presented in the Cadiz Water Conservation Project presentation by CH2M HILL dated February 8, 2010 indicates previous estimates of recoverable water as low as 2,070 to 10,343 AFY (USGS, 2000) to a high of 15,839 to 41,539 AFY (GSSI, 1999). Two aspects of this data are of concern;

1) the planned draw down of 50,000 AFY creates an annual water deficit of ~8,500 acre feet using the highest estimate (41,539 AFY) or an annual deficit of nearly 40,000 acre feet using the lowest estimate (10,343 AFY), and,

2) the estimates from the three sources cited (GSSI, USGS, Davison and Rose) vary so widely that it calls into question the reliability of any of the estimates.

It is difficult to see how the data supports characterizing the projected 50,000 AFY draw down as sustainable.

My wife and I are resolute in the absolute need for early identification of any negative trend or the detection of any unanticipated impacts to the water at our Pinto Mountain property and the wells of our many neighbors. Otherwise, it may be too late to reverse negative trends and impacts once a problem is detected. Therefore, we strongly recommend:

1) Including within the Cadiz Valley project a water monitoring program for the Fenner Watershed to measure any impacts, negative or positive, to the quality or quantity of water used for domestic, commercial, livestock, and agricultural purposes. Monitoring stations should be located near the highest point of the watershed (Round Valley, Fourth of July Canyon, Pinto Valley, or Lanfair Valley) and other critical points, and operate for one year prior to any draw down of water from the Fenner Watershed. The monitoring program should continue throughout the 50-year life of the project.

2) Setting thresholds of water quality and quantity for each station of the monitoring program to determine the occurrence of negative impacts to all water use. Any measurements falling outside the set thresholds of the Cadiz Valley project monitoring program should immediately initiate mitigation actions.

3) Including predefined mitigation actions that would immediately halt the draw down of water from the Fenner Watershed to avoid any further loss of water quality or quantity for those who are dependent upon it.

4) Having a third party conduct the monitoring program, such as the U.S. Geological Survey, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, National Park Service, or Bureau of Land Management. The data from the monitoring program should be shared with both Cadiz and the affected community.

The Ervins' Pinto Mountain property is solely dependent for its water upon a 100-foot well. Water stands at a depth of 66 feet. When you take into consideration the necessary depth of our solar pump, we have only about 30 feet of usable water column. Our well will quickly become dry and our property useless should the Cadiz Valley project lower the water column in our well. I am sure my neighbors are in similar situations with the potential impact the project poses to their wells.

The Ervins offer use of our well at Pinto Mountain to the Cadiz Valley project for the purpose of monitoring water quantity and quality in the area.

Insufficient Notification to Stakeholders within the Fenner Watershed

The Cadiz Valley project needs to recognize the vast amount of private land and the large number of residents with domestic wells within the Fenner Watershed. It's worth noting the special status of private property within the MNP. The California Desert Protection Act (CDPA) of 1994 specifically states that private property within the

boundaries of the MNP are within and under the jurisdiction of the County of San Bernardino, not federally managed public lands.

I became aware of the Cadiz Valley project NOP not because I received a stakeholder package in the mail, but in my capacity as a director with the MDHCA, which did receive notification. A quick survey of my neighbors confirmed that residents and property owners in the affected area were not notified by Cadiz, Inc. of the potential impact of the Cadiz Valley project to their water and their property.

A check of the San Bernardino County property records would have alerted Cadiz to the presence of many private property holdings and water well improvements within the Fenner Watershed. A study of the San Bernardino County Assessor's records I conducted in 2006 revealed 3,264 private properties in the East Mojave, owned by 2,023 unique individuals. That is quite a large constituency for the Cadiz Valley project to exclude from receiving the NOP stakeholder package. I believe you'll agree this is a significant omission by your project team and amounts to insufficient notification of stakeholders with regard to the Cadiz Valley project.

The planned draw down to intentionally induce more water to flow down from the high elevations where many property owners are dependent upon wells seems likely to negatively impact the water quantity and/or quality for the residents of Fourth of July Canyon, Round Valley, Pinto Valley, Lanfair Valley, Gold Valley, Vontrigger, and Goffs. It is incumbent upon the Cadiz Valley project to make property owners aware of this project and the possible impacts on our water and the value of our land. There should be a public meeting held near our affected real estate, such as at the Goffs Schoolhouse, Hole-In-The-Wall Fire Station, or Kelso Depot. As it is, the two public meetings held were over 100 miles from our properties.

Thank you for the opportunity to provide comments on the Cadiz Valley project NOP. Please feel free to contact me using the contact information below.

Sincerely,

Chris S. Ervin
25 Via Gatillo
Rancho Santa Margarita CA 92688-3185

949-888-9745 (home)
714-428-1288 (work)
714-824-9978 (mobile)

Attachment 6
Scoping Meeting Comments

Santa Margarita Water District
Cadiz Valley Water Conservation, Recovery, and Storage Project
NOP Scoping Meeting
March 16, 2011

Public Comments

- Are there any existing roadblocks?
- What is the quality of water at the surplus zone? Does it change as it is pumped out?
- Fenner Watershed: Mojave Desert Cultural Center
- Concerns about preservation of the history of the Mojave Desert
    - Depends on existing wells
- Offer existing wells for monitoring
    - Quantity concern
- Set thresholds
    - Trigger remediation
- Is there groundwater modeling and/or simulations?
    - What is the extent of it?

Joshua Tree Community Center – March 24, 2011 - 6:00pm
Cadiz Scoping Meeting Notes

Whiteboard Notes

- What would have to change to make the storage component worthwhile?
- Does the estimated recharge amount take into account variability within the desert?
- Climate change could change recharge amount over time?
- Please refer to climate change report by Governor of California reference in EIR (Climate Adaptation Strategies 2009)
- Impacts to the Mojave National Preserve need to be understood
- Parks are an important aspect of an economy. What are the impacts to parks?
- Indicate type of water will be collected.
- Will the project impact mining operations?
- Will there be dust since the project would be removing water from the dry lake?
- Surface water sinks down into mineral deposits. Will the project affect surface water?
- If project assumes that water is evaporating now, but it is actually being used by mine.
- Recharge was estimated at 6,000 acre-feet/year under Cadiz property in a study 10 years ago.
- Does your current study of 32,000 afy differ from USGS estimates?
- Address impacts to private property and wells in area
- 10 years ago monitoring wells were proposed. Are they proposed now?
- Visual impacts: what type of facility will be constructed? Will there be lights?
- Feasibility of Phase II assumes water is available from Colorado River
- Will project affect plants and animals on dry lake if evaporation is eliminated?
- What are the impacts on towns and homes along 66?
- Does hydraulic control impact the flow of water towards it?
- How far does the project proposed to draw down the water table?
- Wells along route 66 are a concern
- Ability of desert land and plants to store carbon – deep root system
- Bighorn sheep dependent on springs. What will happen to the springs?
- Where is Mitchell Cavern?
- How much excavation will occur?
- Will there be disturbance in mountains?
- Where is the power coming from for the wells?
- Will there be noise? When construction is finished will there be noise?
- How will new service roads affect the area?
- Is railroad right of way leased from BLM still BLM land?
- If there is a problem with groundwater levels, who takes Cadiz to court? How are project limits enforced?
- Would there be any impacts to Mojave Wilderness Areas or other lands outside Preserve?
- Air quality and water quality can affect those distant areas.
- Are GIS files available of pipeline route?
- Who approves this project? Why Santa margarita Water District?.

Attachment 7
Matrix of Comments

NOP Comments
Summary Table

Agency/ Organization	Mitigation measures	Insufficient notification to stakeholders / Extension of comment period	Water draw down/ withdrawal / recharge rate too high	Use of Railroad Right of Way	Private land water rights	Need for monitoring system of water resources	Need to consider cumulative impacts	Climate change / GHG	Fire protection	Human/ animal and plant habitat needs attn	Wilderness and Public Lands	US Marine Corps	Dust concerns	Solar Dev. concerns	Cadiz	Impacts to Mojave National Preserve	Impact to Dale Basin (south)	Air Quality	Toxic Materials
Federal Agencies																			
US Department of Interior – National Park Service	X		X	X		X										X			
United States Marine Corps												X – expansion in Alternative 3 would include portion of land owned by Cadiz							
State Agencies																			
Governor's office of Planning and Research (State Clearinghouse)																			
Department of Toxic Substances Control																			X
Native American Heritage Commission																			
California Department of Fish and Game	X		X – specifically the elimination of the dry lake ecosystem; creation of giant fissures in the dry lake beds		X		X			X – specifically Borrego milkvetch, desert tortoise, bighorn sheep		X – Bristol Lake water	X			X – also, need to amend the Desert Conservation Plan			
Organizations																			

NOP Comments
Summary Table

Agency/ Organization	Mitigation measures	Insufficient notification to stakeholders / Extension of comment period	Water draw down/ withdrawal / recharge rate too high	Use of Railroad Right of Way	Private land water rights	Need for monitoring system of water resources	Need to consider cumulative impacts	Climate change / GHG	Fire protection	Human/ animal and plant habitat needs attn	Wilderness and Public Lands	US Marine Corps	Dust concerns	Solar Dev. concerns	Cadiz	Impacts to Mojave National Preserve	Impact to Dale Basin (south)	Air Quality	Toxic Materials
Mojave Desert Air Quality Management District													X						
East Mojave Land Owners Association	X	X	X		X	X			X	X									
San Bernardino County Public Works Department																			
Center for Biological Diversity			X – establish baseline					X		X						X		X	
Mojave Preserve Land Owners Association		X	X		X	X			X	X						X			
Defenders of Wildlife			X							X	X								
National Parks Conservation Association			X				X	X					X	X		X			
Metropolitan Water District			X																
Mojave Desert Heritage and Cultural Association	X	X – Public meeting should be held near affected real estate	X		X	X – include monitoring for Fenner Watershed; third party conduct monitoring program										X			
San Bernardino County Land Use Services Department	X		X – project will be subject to Desert Groundwater Management Ordinance				X – Growth inducing impacts												
Individuals																			

NOP Comments
Summary Table

Agency/ Organization	Mitigation measures	Insufficient notification to stakeholders / Extension of comment period	Water draw down/ withdrawal / recharge rate too high	Use of Railroad Right of Way	Private land water rights	Need for monitoring system of water resources	Need to consider cumulative impacts	Climate change / GHG	Fire protection	Human/ animal and plant habitat needs attn	Wilderness and Public Lands	US Marine Corps	Dust concerns	Solar Dev. concerns	Cadiz	Impacts to Mojave National Preserve	Impact to Dale Basin (south)	Air Quality	Toxic Materials
Joe Ross												X - Inconsistencies between project and Marine Base expantion							
Russel and Marilyn Woodruff	X		X			X			X	X									
Brenden Hughes										X									
Valerie Finstad			X			X			X	X									
Chris Brown		X	X		X	X				X	X					X			
Elden Hughes			X							X – Cultural resources; bighorn sheep	X – Concern that NEPA should be involved, esp. concerning Danby or Freda		X						
Helena Bongartz	X	X	X	X	X	X – specifically between pumping effects and natural fluctuations	X – water, visual, sound			X			X		X – Does Cadiz have water rights? Does Cadiz have permits for monitoring wells?	X				

NOP Comments
Summary Table

Agency/ Organization	Mitigation measures	Insufficient notification to stakeholders / Extension of comment period	Water draw down/ withdrawal / recharge rate too high	Use of Railroad Right of Way	Private land water rights	Need for monitoring system of water resources	Need to consider cumulative impacts	Climate change / GHG	Fire protection	Human/ animal and plant habitat needs attn	Wilderness and Public Lands	US Marine Corps	Dust concerns	Solar Dev. concerns	Cadiz	Impacts to Mojave National Preserve	Impact to Dale Basin (south)	Air Quality	Toxic Materials
Helena Bongartz (2)						X											X		

Attachment 8

Matrix of Alternative Suggestions

NOP Comments
Summary of Proposed Alternatives

Organization/ Agency	Commenter	Proposed Alternative Summary
Federal Agencies		
US Department of Interior – National Park Service	Christine Lehnertz	1. DEIR needs to demonstrate that the proposed path of the water conveyance infrastructure is entirely on privately owned land and not on a right-of way-that includes portions of public land (NOP describes the AZ and CA Railroad right-of-way as privately owned, but also identifies US Fish and Wildlife Service and US Army Corps of Engineers as involved, which would activate NEPA). An alternative would be to prove acquisition of needed rights from the legal holder of the right-of-way. 2. Project needs to adhere to a hydrologic sustainable yield concept. 3. Lead/responsible agencies should be guided by peer-reviewed science in the development and preparation of DEIR; estimate of annual groundwater discharge should be supported by several independent lines of analysis. 4. the DEIR should recognize that most of the groundwater recharge studies conducted in the study area indicate that natural recharge to the Fenner and Bristol Valleys ranges from 2,000 to 11,000 acre-feet per year and that the Project's recharge estimate is 3 to 120 times too high. 5. Provide a thorough discussion of all previous hydrologic investigations relating to quantifying the amount of water entering, moving through and discharging from the groundwater systems beneath the study area or in other proximal valleys. 6. The current estimate of annual groundwater recharge for the Project should be supported by several independent lines of analysis. 7. If a watershed model is used in the DEIR to calculate the recoverable water in the basin, the model should account for bedrock permeability when estimating the amount of recharge to the groundwater system. The model should also incorporate routines to route water through the surface drainage network and estimate downstream flow and subsequent populations. 8. If a chloride mass balance approach is used in the DEIR to support groundwater recharge estimates it should be properly applied to the study area. 9. If isotopic data are used in the DEIR to support groundwater recharge estimates, proper data should be collected so that reliable groundwater age determinations can be made or estimated. 10. The Lead Agency should consider seeking an impartial technical review of the EIR's water resource impact analysis from the US Geological Survey. 11. The DEIR should clearly demonstrate the Project's need for the groundwater stored in the Bristol and Fenner Valleys. 12. Project should strive to maintain its total groundwater pumping within the sustainable yield of the watersheds. 13. Project needs to demonstrate that soil evaporation is actively occurring from the dry lakes and that their pumping will lower groundwater beneath the dry lake discharge areas to a level that prevents the natural evaporation from occurring during the life of the Project. 14. The meaning of "hydraulic control" must be addressed in presenting Phase I of the proposed Project; does this relate

		only to the establishment of a sufficient drawdown area or does it also apply to the lowering of groundwater levels enough to cause natural evaporation to cease from the dry lake areas? 15. The DEIR should address in detail whether California statues allow for the banking of unused groundwater rights for use in future years, and if so, how the banking of carry-over water will be managed Phase I and 2 of the Project. 16. DEIR should provide a thorough evaluation and discussion of reasonable alternatives to the Proposed Action. 17. The DEIR should utilize groundwater flow modeling to simulate the potential impacts to water resources. 18. The EIR should thoroughly discuss the potential impacts associated with the various programmatic elements of the Imported Water Storage Component of the project (Colorado River surplus, preliminary modeling of potential impacts to the groundwater flow system resulting from artificial recharge and subsequent pumping, expected evaporative losses, etc.). 19. If potential adverse impacts to water resources are determined to be significant enough to warrant implementation of mitigation measures, the EIR should first consider the relevancy of the mitigation measure that were developed and proposed under the former Cadiz Project. 20. The DEIR should provide a thorough discussion on closure plans associated with the Project.
United States Marine Corps	B.R. Norquist	Proposed Marine Corps expansion designates land to the west of the existing base, although Alternative 3 does include a large portion of the Cadiz Inc. held lands. Even though this land does not appear to include the Cadiz Valley Water Project's proposed well fields or spreading basins, it does include large amounts of adjacent lands. Marine Corps encourages the DEIR to fully consider the land use and other impacts of the Twentynine Palms Land Acquisition and Airspace Establishment project on the Cadiz Valley Water project.
State Agencies		
Office of Planning and Research (State Clearinghouse)	Scott Morgan	N/A
Department of Toxic Substances Control	.Leonard Robinson	1. DEIR needs to evaluate whether conditions at site will pose a threat to human health or the environment. 2. Hazardous soils need to be appropriately removed from the site, as well as hazardous structures and chemicals in compliance with CA codes.
Native American Heritage Commission	Dave Singleton	N/A

California Department of Fish and Game	Michael Flores	1. An analysis and graphics showing depth to groundwater of the existing water table and the water table if the project is implemented. 2. An analysis of the flow of water to the dry lakes during the rainy and dry seasons and the amount of water necessary to maintain the ecosystem. 3. Basic biological survey needs to be conducted, preferably within a year of the distribution of the CEQA document. 4. A CECA permit must be obtained. 5. Incorporate all information regarding impacts to lakes, streams and associated habitat within the DEIR, which should include an analysis of impacts to habitat caused by a change in the flow of water across the site.

Organizations		
Mojave Desert Air Quality Management District	Alan De Salvio	Recommends that the project comply with the requirements of MDAQMD Rule 403 – Fugitive Dust. If the proposed project includes a pump which is not grid powered, or if there is a back-up generator, District permits may be required.
East Mojave Land Owners Association	Richard MacPherson	1. Regular monitoring of water quantity and quality be put in place in several places (ie Round Valley, 4th of July Canyon, Goffs, 7IL area, Lanfair, Budweiser Springs area, etc) prior to any drawdown to set a baseline. 2. Thresholds set would indicate whether or not negative impacts are occurring. 3. Mitigation should be built into the project upfront to avoid any loss of water quantity or quality for those who are dependent upon it. Springs, wells, and wildlife must be monitored prior to as well as during drawdown.
San Bernardino County Public Works Department	Annesley Ignatius	N/A
Center for Biological Diversity	Ileene Anderson	1. DEIR needs to clearly identify the purpose and need for groundwater pumping of the aquifer. 2. Alternatives should include those that would avoid or substantially lessen any significant environmental negative effects o the project. 3. EIR must consider direct, indirect and cumulative impacts to Biological Resources. All species found at the edge of their ranges need to be evaluated for impacts. 4. Surveys need to be done for cryptobiotic soil crusts, and late season surveys should be implemented and the results included in the DEIR. 5. The DEIR needs to include the Water Storage Component as a fully developed part of the whole project – this component cannot be segmented from the environmental review of the project as a whole. 6. The DEIR must adequately describe the environmental baseline.

NOP Comments
Summary of Proposed Alternatives

Mojave Preserve Land Owners Association	Richard MacPherson	1. All monitoring to verify draw down levels needs to be completed by a neutral organization. 2. Following places must be monitored prior to draw down: Granite Mountains on north and south sides; springs or wells in Van Winkle, Horse Hills, lower Providence Mountains; Springs and wells on both sides of Providence Mountains, Mid Hills, Gold Valley, Round Valley, Pinto Valley, Fourth of July Canyon, Caruthers Canyon, New York Range, Lanfair Valley; Hackberry Mountain springs; wells in Goffs and Essex; springs in Clipper Mountains and Old Woman Mountains; Joshua Tree National Park and Mojave National Preserve. 3. Contingency plan must be set up to deal with water loss for residents with wells.
Defenders of Wildlife	Jeff Aardahl	1. Purpose and need for the project needs to be clearly defined. 2. The need to augment the water supply for the four water purveyors needs to be justified and alternative means to provide additional desired water need to be justified and analyzed. Alternatives should include conservation of existing supplies through reduced consumption and recycling, and alternative sources. 3. Independent study and assessment of the groundwater hydrology of Cadiz and Fenner Valley's needs to be completed, including long-term effects of climate change.4. The project must analyze the projected availability of "excess" Colorado River Water for storage and subsequent pumping. 5. Direct and indirect effects on sensitive biological species need to be analyzed. 6. Project effects on surrounding public land and wilderness needs to be addressed.
National Parks Conservation Association	Seth Shteir	1. DEIR should provide detailed information relating to the projected availability of Colorado River water for diversion and a plan for acquisition. 2. DEIR must contain a thorough and scientifically meaningful evaluation of how climate change will affect water resources. 3. DEIR must assess how the capture and recovery of 50,000 acre feet of groundwater from the Fenner Watershed will affect seeps, springs and groundwater in the Mojave National Preserve. 4. Included in the DEIR must be a cumulative discussion of solar projects in the area and how they will affect the environment, specifically: How will the proposed solar development on lands adjacent to the project or nearby Iron Mountain SEZ affect water resources in the region, visual resources, night skies and air quality on the Mojave Preserve, wilderness and the environmental health of the region, wildlife corridors and habitat for rare species in the region?
Metropolitan Water District	John Shamma	N/A
Mojave Desert Heritage and Cultural Association	Chris Ervin	1. Include a water monitoring program for the Fenner Watershed to measure any impacts, negative or positive, to the quality or quantity of water used for domestic, commercial, livestock, and agricultural purposes. Monitoring stations should be located near the highest point of the watershed (Round Valley, Fourth of July Canyon, Pinto Valley, Lanfair Valley).

		Monitoring should continue through the 50 year life cycle of project. 2. Setting thresholds of water quality and quantity at each water monitoring station to determine negative impacts. 3. Include predefined mitigation actions that would immediately halt water draw down. 4. Third party needs to conduct monitoring program (US Geological Survey, US Army Corps of Engineers, US Fish and Wildlife Service, NPS, BLM).
San Bernardino County Land Use Services Department	Christine Kelly	1. Both phases of the project need to be clearly defined, including physical components, amount of water to be extracted and stored, and proposed timing and duration for each phase. Specifically, detailed maps are needed to indicate where proposed facilities will be located and what the physical components of the facilities will be. 2. The project will be subject to the Desert Groundwater Management Ordinance that intends to protect groundwater in the unincorporated desert regions of the County. The DEIR must clearly identify this groundwater management permit as a required entitlement of the Project. 3. Project must address cumulative loss of available water and evaluate all phases of the project for potential growth-inducing impacts.
Individuals		
Public commenter	Joe Ross	N/A
Public commenter	Russel and Marilyn Woodruff	1. Thresholds must be set that would indicate when negative impacts are occurring, and mitigation be built into the project upfront to avoid any loss of water quality or quantity. 2. Springs, well, and wildlife must be monitored prior to the pumping, as well as during the drawdown.
Public commenter	Brenden Hughes	N/A
Public commenter	Valerie Finstad	1. Baseline at several monitoring stations be established prior to any drawdown occurring.
Public commenter	Chris Brown	Monitor static water levels in the Mojave Preserve while the project gets underway.
Public commenter	Elden Hughes	1. Imported water storage component should not be part of the DEIR. Cultural resources need to be inventoried and protected. 2. Project site requires a minimum of two surveys per year to detect flora and fauna. 3. NEPA needs to be part of the process.
Public commenter	Helena Bongartz	1. Discrepancy between various studies assessing recharge rates needs to be addressed in DEIR. 2. Monitoring system must be addressed that can detect the difference between the effects of pumping and the effects of natural fluctuations.

Public commenter	Helena Bongartz (2)	N/A
Public commenter	Chris Ervin	1. Include a water monitoring program for the Fenner Watershed to measure any impacts, negative or positive, to the quality or quantity of water used for domestic, commercial, livestock, and agricultural purposes. Monitoring stations should be located near the highest point of the watershed (Round Valley, Fourth of July Canyon, Pinto Valley, Lanfair Valley). Monitoring should continue through the 50 year life cycle of project. 2. Setting thresholds of water quality and quantity at each water monitoring station to determine negative impacts. 3. Include predefined mitigation actions that would immediately halt water drawdown. 4. Third party needs to conduct monitoring program (US Geological Survey, US Army Corps of Engineers, US Fish and Wildlife Service, NPS, BLM).