



United States Department of the Interior

U.S. GEOLOGICAL SURVEY

Office of the Director

Reston, Virginia 20192

MAY 5 2017

In Reply Refer To:
Mail Stop 100
GS17000743

The Honorable Diane Feinstein
United States Senate
Washington, DC 20510

Dear Senator Feinstein:

Thank you for your letter of April 7, 2017, regarding the Cadiz water extraction project. Because of its long history of hydrologic studies in southern California, the U.S. Geological Survey (USGS) was asked by the Bureau of Land Management (BLM) to review the original Cadiz Groundwater Storage and Dry-Year Supply Program (Cadiz Project) Draft Environmental Planning Technical Report (Draft Report). We delivered this review to the BLM on February 23, 2000. We received a letter from your office on December 21, 2001, regarding concerns about the Cadiz Project and responded on January 15, 2002.

In the February 2000 review of the Cadiz Project's Draft Report, the USGS evaluated the groundwater and surface-water models, water-balance analyses, chloride mass-balance calculations, and isotopic age-dating of the groundwater. As part of the review, the USGS calculated estimates of natural recharge to the Fenner, Bristol, and Cadiz basins, which ranged from approximately 2,000 to 10,000 acre-feet per year.

In October 2016, USGS researchers spoke with your staff summarizing the results of the 2000 review and reaffirming the 2000 analysis of natural recharge. We are not aware of new information that would change our recharge estimates. However, as we also indicated, we have not reviewed the current proposed Cadiz water extraction project. Similarly, we have not conducted new site-specific studies or data collection in the Cadiz area since our 2000 review. Updating our 2000 estimate of recharge in the Cadiz area would be a significant undertaking requiring a detailed review of new studies since then, along with new data collection, analyses, and modeling. Currently, the USGS does not have sufficient resources available to take on a substantial new project in the Cadiz area.

I understand that there may be more recent non-USGS studies of the area that project a higher recharge rate. Given the opportunity, we would be pleased to provide you with our scientific evaluation of those studies.

The Honorable Diane Feinstein

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Thank you again for your inquiry. We greatly appreciate your long-standing support of USGS science. If you or your staff would like more information on this topic, please contact Mark Sogge, USGS Pacific Region Director based in Sacramento at mark_sogge@usgs.gov or 916-278-9551.

Sincerely,

A handwritten signature in cursive script, appearing to read "William H. Werkheiser".

William H. Werkheiser
Acting Director



United States Department of the Interior

NATIONAL PARK SERVICE
Mojave National Preserve
2701 Barstow Road
Barstow, CA 92311



IN REPLY REFER TO:
L7621 (MOJA)

February 13, 2012

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

Re: *National Park Service Comments to Draft Environmental Impact Report for the Cadiz Valley Water Conservation, Recovery and Storage Project.*

Dear Mr. Barnes:

By Notice of Availability (NOA) dated December 5, 2011, the Santa Margarita Water District (SMWD), as the Lead Agency, informed interested parties that it had prepared a Draft Environmental Impact Report (Draft EIR) pursuant to the California Environmental Quality Act (CEQA) for the *Cadiz Valley Water Conservation, Recovery, and Storage Project* (Project), and invited comments on the Draft EIR to be submitted by February 13, 2012. The 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 who will 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). A brief summary is provided below of the NPS's main issues and concerns with this document as it moves forward in the CEQA process toward a Record of Decision. Most of the NPS's concerns center on the sustainability of the Project. Consolidated general and specific comments provided on the attached comment forms describe these main issues and concerns, as well as others, in more detail.

ISSUE #1: *Most of the non-Project related groundwater recharge studies conducted in the study area indicate that natural recharge to the Fenner and Bristol Valleys likely ranges from 2,000 to 10,000 acre-feet per year and that the Project's recharge estimate is 3 to 16 times too high.* Given the amount of recoverable groundwater that the Project 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. As noted in the NPS's March 29, 2011 scoping comments letter to this EIR, this is the same trend that was observed with the former Cadiz Project back in the early 2000s and is counter to most of the realistic recharge estimates presented by other studies in the area. The NPS's concern is best demonstrated by a comparison of recharge (and discharge) estimates from past and current Cadiz Project investigators with recharge estimates from other independent investigators presented in

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the table below. The reported estimates are based partially on a summary table of recharge study results presented in earlier revised EIS comments submitted by Dr. John Bredehoeft, Ph.D, (HydroDynamics Group, 2001) for the former Cadiz Project and reprised in the NPS's March 29, 2011 scoping comments letter to this EIR.

<u>METHODOLOGY/AUTHOR</u>	<u>RECHARGE ESTIMATES (acre-feet/year)</u>	
	<u>Other Investigators</u>	<u>Cadiz Investigators</u>
1. Watershed Runoff Modeling		
MWD & BLM (1999) – <i>Cadiz Project I</i>		20,000 – 70,000
CH2M Hill (2010) – <i>Cadiz Project II</i>		32,000
2. Groundwater Modeling		
Geoscience (1999) – <i>Cadiz Project I</i>		50,000
CH2M Hill (2010) – <i>Cadiz Project II</i>		32,400
3. Maxey/Eakin Method		
USGS (2000)	2,550 - 11,200	
Durbin (2000)	5,000	
LLNL (2000) – <i>Cadiz Project I</i>		16,200 – 29,200
4. Fenner Gap Groundwater Flow		
Friewald (1984 – USGS)	270	
Geothermal Surveys (1984) – <i>Cadiz Project I</i>		18,000 - 36,000
Todd (1984) – <i>Cadiz Project I</i>		11,000
LaMoreaux (1995)	3,700	
USGS (2000)	2,600 – 4,300	
5. Chloride Mass Balance Method (correctly applied)		
USGS (2000)	1,700 – 9,000	
Durbin (2000)	2,000	
6. Drawdown Associated with Cadiz Co. pumping		
Boyle Engineering (1996)	4,000	
7. Evaporative Discharge from Dry Lake Areas (estimated using rates from other studies in region)		
CH2M Hill (2010) – <i>Cadiz Project II</i>		6,000 – 42,000
NPS	4,700 – 7,800	
	Range of Estimates:	270 – 11,200
	Mean Estimate ⁽¹⁾ :	4,100
		6,000 – 70,000
		30,500

⁽¹⁾ Where a range of values is given, the mean of the range was taken as one value, and then this value was averaged with all other estimates to arrive at the "mean value" reported.

To put this into perspective, consider that the Death Valley Regional Groundwater Flow System drains an area of about 15,800 square miles in Nevada and southern California, and includes 30

hydrographic basins (USGS, Harrill and Prudic, 1998, Prof Paper 1409-A). Groundwater discharge by evapotranspiration from the floor of Death Valley, the terminal discharge from the Death Valley Regional Groundwater Flow System, was estimated by the USGS at approximately 35,000 AFY (DeMeo and others, 2003, Water Resources Investigation Report 2003-4254). By comparison, the drainage area of the four Cadiz project watershed(s) totals 2,320 square miles, which is a much smaller drainage area than the Death Valley system. All else equal, the contributing area to the Death Valley Regional Groundwater Flow System is roughly 7 times larger than the contributing area to the Cadiz Project, suggesting that the annual recharge (and discharge) from the Project area should be on the order of 5,000 AFY.

The project proponent's estimates of the annual recharge (and discharge) for the Cadiz project watershed in the range of 30,000 AFY are not reasonable and should not even be considered. The recharge estimates provided in 2000 by the USGS in its technical review of the former Cadiz Project, which were computed by a variety of methods, ranged from 2,000 – 10,000 AFY. These values, computed by a scientific agency with no financial stake in the proposed project, peer-reviewed and made available to the public, provide a reasonable range of recharge estimates for the Project area. This range of values should be used to guide evaluation of the proposed Cadiz Project.

ISSUE #2: It is inappropriate to conclude "a priori" that all springs in the watershed area are hydraulically discontinuous with the target aquifer. The SMWD presents a brief reconnaissance study in the Draft EIR of potential effects on springs and seeps from groundwater pumping by the Project concluding, unsurprisingly, that springs are not connected to the target aquifer and thus will be unaffected by the Project. Available evidence indicates that some springs within Mojave National Preserve likely are hydraulically continuous with the aquifer that is the target of the subject groundwater development, and that other springs within the Preserve likely are not hydraulically continuous with this aquifer. In the absence of more conclusive, site-specific studies, it would be inappropriate to conclude "a priori" that all springs in the area are hydraulically discontinuous with the target aquifer. To resolve this uncertainty, the NPS requests that a study of selected springs within Mojave National Preserve be a component of any proposed Monitoring and Management Plan.

ISSUE #3: An alternative Project scenario limiting pumping in the watersheds to the perennial yield amount would likely increase the conservation efficiency of the Project, decrease adverse impacts in the project watersheds, and allow Cadiz to achieve many of their Project objectives and "Green Compact" stewardship principles. Pumping in excess of the perennial yield of the basin under the currently proposed project pumping scenarios increasingly exacerbates mining of groundwater, as evidenced by the three pumping schemes that were simulated. Capture of groundwater that is ultimately destined for the dry lake areas could likely be achieved through a less aggressive pumping scheme that would not withdraw groundwater in excess of the perennial yield of the basin, and if the current objective of trying to

maximize the retrieval of fresh groundwater that is already down-gradient of the proposed wellfield is abandoned.

ISSUE #4: The hydrologic analysis in the Draft EIR is technically deficient with respect to constraining the Project recharge estimate through physical measurement and quantification of groundwater discharge from the playa areas. Data are presented that indicate extensive evaporation from the playa is unlikely, including reports of water depths beneath Bristol Dry Lake ranging from 8 to 35 feet, which would require an unrealistic capillary rise to support a discharge of 32,000 AFY. The NPS demonstrates through extrapolation of results from a USGS study of groundwater discharge rates in Death Valley (which compensates for the effect of surface water runoff to soil evaporation) that total groundwater discharge from the dry lakes (and therefore, recharge to the Project area) is probably on the order of 4,650 to 7,750 AFY at best. This estimated range falls within the range of recharge (2,000 to 10,000 AFY) provided by the USGS in 2000. As noted in the NPS's March 29, 2011 scoping comments letter to this EIR, estimates of groundwater discharge need to be verified through physical measurements of soil evaporation at the dry lake sites and groundwater levels beneath 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 rejected.

ISSUE #5: The distributed parameter watershed model INFIL3.0 likely is over-estimating recharge in the Project watersheds. Based on a recent USGS study near Joshua Tree, CA that utilized an earlier version of the INFIL3.0 distributed-parameter watershed model, a numerical flow model and several supporting field techniques, coupled with the Cadiz Project's over-reliance on the INFIL3.0 watershed model results without additional supporting field data to constrain the recharge estimates, it is likely that the Cadiz project's recharge estimates using INFIL3.0 could be larger than the true recharge by a factor of 2 to 10 times. The NPS also suspects that the Fenner Basin watershed model may be under-estimating the amount of evapotranspiration and surface water runoff occurring in the basin, all of which contributes to an over-estimation of the amount of water infiltrating past the root zone.

ISSUE #6: The ability of the numerical groundwater flow model to accurately simulate groundwater discharge by evapotranspiration is questionable. Model water balance results suggest that the model is not producing annual volumes of evapotranspiration discharge equivalent to the amounts of recharge going into the model. The NPS estimates that the model is only discharging 76% of the 32,000 AFY of recharge going into the model. The NPS is also concerned with how the model estimates evapotranspiration discharge, when the existing pre-pumping depth to water (18 feet) beneath Bristol Dry Lake already exceeded the extinction depth of 15 feet prior to simulating any of the pumping/recharge scenarios. The USGS has also shown in a study from nearby China Lake 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, thus calling into question the validity of the extinction depth established for the model.

ISSUE #7: The SMWD has failed to adequately consider inclusion of monitoring and mitigation measures developed under the earlier Cadiz Project, and to adequately demonstrate the effectiveness of certain current mitigation measures proposed to address pumping-related impacts. As noted in the NPS's March 29, 2011 scoping comments letter to this EIR, the SMWD should consider the relevancy of the mitigation measures that were developed and proposed under the former Cadiz Project and determine which measures might have utility to this EIR. The NPS recommends that the principal features of that plan be adopted, including a participatory role for the potentially affected parties (like the NPS), establishment of an array of "early-warning" monitoring wells between the proposed project pumping and Mojave National Preserve, and "action criteria" to trigger consideration of mitigation measures as effects are observed over time. With all the inherent uncertainty that exists on groundwater projects such as this, it is imperative that the project proponent practice adaptive management of their project, with coordination and input from their neighbors, the potentially affected parties.

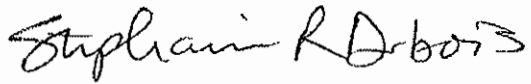
Additionally, the NPS is not convinced that the SMWD has sufficiently demonstrated the effectiveness of several key mitigation measures to be able to conclude that the direct and cumulative impacts to groundwater and surface water resources would be less than significant with mitigation and would not be cumulatively considerable. The SMWD needs to better demonstrate and discuss the potential effectiveness of these important corrective measures in the EIR document using existing and/or additional groundwater modeling simulations that test these corrective measures.

CONCLUSIONS

While the NPS is concerned about the SMWD's broad characterization of natural evapotranspiration processes as "wasted water," we are not averse to the concept of recovering groundwater that naturally discharges to the atmosphere if it is not destructive of natural ecosystems, nor are we 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 (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. Based on several deficiencies with the current analysis presented in the Draft EIR, the NPS recommends that additional refinements be made in the Final EIR that provide a more accurate representation and evaluation of the groundwater flow system, the affected environment, and the effectiveness of proposed mitigation measures. Much of this can be accomplished using additional scientific methods to better constrain the recharge estimate of the study area. Until these refinements are made, the NPS is not confident concluding that the proposed Cadiz Project is sustainable and protective of park resources.

Thank you for the opportunity to provide comments on this Draft EIR. For any clarification or follow up regarding our comments, please contact Debra Hughson, Science Advisor, Mojave National Preserve at (760) 252-6105.

Sincerely,

A handwritten signature in cursive script that reads "Stephanie R. Dubois".

Stephanie R. Dubois
Superintendent

cc:

PWRO-REC per Alan Schmierer
Bill Hansen - WRD
Bill Van Liew - WRD
Gary Karst - PWR
Debra Hughson - MOJA