Tessera Solar™
power from stirling energy systems

DOCKET
08-AFC-13
DATE JAN 15 2010
RECD. JAN 19 2010

January 15, 2010

Mr. Christopher Meyer
CEC Project Manager
Attn: Docket No. 08-AFC-13
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814-5512

Mr. Jim Stobaugh
BLM Project Manager
Attn: Docket No. 08-AFC-13
Bureau of Land Management
P.O. Box 12000
Reno, NV 89520

RE: SES Solar One Project
Applicant's Submittal of Additional Information Regarding Project Water Supply

Dear Mr. Meyer and Mr. Stobaugh:

Tessera Solar hereby submits a memorandum providing Additional Information Regarding Project Water Supply. This memo is intended to provide an update on the status of field efforts for the Project and back-up water supply. I certify under penalty of perjury that the foregoing is true, correct, and complete to the best of my knowledge.

Sincerely,

Camille Champion
Project Manager

URS

Memorandum

Date: January 15, 2010

To: Christopher Meyer, Jim Stobaugh

From: URS, on behalf of SES Solar One

Subject: **Solar One Additional Information Regarding Project Water Supply**

Enclosed in this memorandum, please find additional information on both the on-site well drilling efforts and the water supply at Cadiz for the Solar One Project. Fieldwork is being conducted on both water sources and this memo contains both data recently collected through the ongoing fieldwork and research conducted by the Applicant.

SES Solar Six, LLC and SES Solar Three, LLC (Applicant) filed an Application for Certification, December 1, 2008 with California Energy Commission (CEC). According to this original filing, potential water sources evaluated for the Project included reclaimed water, surface water, ground water, and obtaining water from a service provider. The water is required for SunCatcher equipment washing, potable water, dust control water and fire protection water as well as for work during construction. Primary fugitive dust suppression during construction would use water from a proposed groundwater well(s). The Applicant estimated that 36.2 acre-feet of water would be used annually for mirror washing and domestic use. The AFC stated that additional water wells will be drilled to augment the primary water well as needed to meet peak construction water demands.

In the first set of data requests, the CEC and BLM asked the Applicant for additional information on the reliability of the Solar One water supply from the ground water well(s). In considering the responses to these questions, an in-depth evaluation of the Solar One water supply options in terms of reliability, cost, and environmental impact was performed. In December 2009, the Applicant submitted supplemental information that summarized the various water source options pursued and a status of each. The Applicant continues to pursue two viable water source options for the SES Solar One Project. Below is a status update on each.

LAVIC GROUNDWATER BASIN

The Applicant identified four potential test well sites on the project site. A preliminary site meeting was conducted with the drillers, the Applicant and survey monitors. Drilling was initiated on the site in late December 2009 on the first test well.

The well is being installed using the mud-rotary drilling technique. Because this method requires that fluids (drilling mud) be added to the boring to facilitate removal of soil cuttings, containment of the fluids is required and disposed upon drilling completion. Rigorous well development to remove the mud cake from the boring walls is also necessary. Non-solid drilling fluids are temporarily contained within a portable storage tank on-site prior to

spreading to allow for separation of the water and solids. The water is discharged to the ground surface once the solids have settled.

As of January 10, 2010, the anticipated depth of 800 feet was reached and water was reached. The well boring has been logged from the drill cuttings and is attached for your review for the first test well.

The Applicant is now performing the water pump test, collecting water samples and submitting those to the lab for analysis. Once that information has been received and recorded, it will be submitted to the CEC and BLM for review.

The drilling equipment has moved to the second well location and has commenced drilling. All necessary environmental surveys, impact assessment, and proposed mitigation measures for these facilities will be submitted to the CEC upon completion.

CADIZ WELL

This report summarizes the results of a data review of water wells located in the vicinity of a water supply well located on property owned by Burlington Northern and Southern Pacific Railroad (BNSF) in Cadiz Valley, California. Cadiz Valley is located approximately 60 miles southeast of the Solar One site (site) located north of Interstate 40 (I-40) west of Ludlow in San Bernardino County, California. The well is located immediately south of the railroad line that extends from Barstow to Needles, California. This is the same rail line that passes just to the south of the Solar One site.

URS has conducted a review of readily available information related to the occurrence and quality of groundwater in the vicinity of Cadiz Valley. Based on a number of sources, the nature and occurrence of groundwater in Cadiz Valley is described below. The information was obtained from the following sources:

- BNSF
- California Department of Water Resources (DWR)
- Metropolitan Water District of Southern California (MWD), Final Environmental Impact
- Report/Final Impact Statement (FEIR/FEIS), dated September 2001
- U.S. Geological Survey (USGS) National Water Information System (NWIS)

Cadiz Ground Water Basin

The BNSF well is located within the Colorado River Hydrologic Basin, similar to groundwater at the Solar One site. The well is located in the Cadiz Hydrologic Unit of the Lucerne Planning Area. The planning area is characterized by basins of internal drainage, with portions of the valley floors covered by dry lakes.

Beneficial Groundwater Uses: The Colorado River Regional Water Quality Control Board (RWQCB) Basin Plan (2006) indicates that groundwater in the Cadiz Hydrologic Unit has municipal, domestic and industrial beneficial uses. It should be noted that Cadiz, Inc. located immediately south of the BNSF well extracts groundwater for agricultural uses to irrigate at least a 1,000 acres of citrus, grapes and other crops (DWR, 2003). According to

DWR, agricultural activities were initiated in the 1980s to show that groundwater is available and sustainable to serve as irrigation water to meet agricultural uses in the valley. Geology and Hydrogeology: The principal aquifer systems identified are an upper alluvial aquifer, a lower alluvial aquifer and a bedrock aquifer. The upper alluvial aquifer consists of Quaternary and late-Tertiary Age stream-deposited sand and gravel with a thickness of approximately 100 to 800 feet (DWR Bulletin 91-14). The lower alluvial aquifer consists of older, sediments of mid- to late-Tertiary age that are interbedded sand, gravel, silt and clay that are generally less permeable than the sediments in the upper alluvial aquifer. The Cadiz, Inc. wells are reported to yield 1,000 to over 2,000 gpm. A lower bedrock aquifer has been identified by Metropolitan in carbonate bedrock. There are numerous faults in these desert groundwater basins and these faults may serve as barriers that restrict groundwater movement and isolate groundwater of different quality.

Groundwater Flow: The FEIR/FEIS indicates that groundwater flow in Cadiz basin is to the southwest toward Bristol Dry Lake and toward the south. There is some disagreement with this interpretation, as faults may serve barriers and flow directions could be very different within individual fault blocks in the basin. However, the FEIR/FEIS indicates that differences in water-level elevations have not been identified in the basin to support this alternate interpretation.

Groundwater Use Estimates: Groundwater use in the Cadiz groundwater basin is reported in DWR Bulletin No. 118 and also appears in the Final EIR/EIS for the Cadiz Groundwater Storage and Dry-year Supply Program, combined with the Bristol groundwater basin. Shafer (1964) reported that 14,300 acre feet (af) of fresh water were pumped from both Bristol and Cadiz Valleys from 1910 through 1964, approximately 265 acre-feet/year (afy). The FEIR assumed that if this rate of water use continued until 1998 an additional 9,000 af were pumped from these valleys between 1964 and 1998. It is likely that the actual water use decreased considerably when locomotives went from being steam- to diesel-powered. It notes that from 1983 through 1998, Cadiz, Inc. extracted 61,740 af from its well field for agricultural operations. The FEIR concludes that that total groundwater pumped from Bristol and Cadiz Valleys from 1910 to 1998 was approximately 85,000 af.

Basin Adjudication: URS has reviewed information appearing on DWR's internet website and contacted personnel at the DWR and RWQCB to understand the status of groundwater use in the Cadiz groundwater basin. There are 22 adjudicated basins in California where groundwater use is regulated and managed by a Watermaster designated by State Superior (21 basins) or Federal Courts (1 basin). Typically the Watermaster is a water purveyor (Water District) that is located within the adjudicated basin. There are no water purveyors in the Cadiz groundwater basin, nor is there indications that it is adjudicated.

Feinstein Senate Bill: Diane Feinstein, U.S Senator from California, introduced legislation in late December 2009 to designate two new national monuments and protect other lands through additional designations throughout the Mojave Desert in response to development pressures in this region. It is known as the California Desert Protection Act of 2010. Establishment of the Mojave Trails National Monument would prohibit development on 941,000 acres of federal land and former railroad company property along a 105-mile stretch of old Route 66 (National Trails Highway), between Ludlow and Needles. The

legislation is expected to be acted upon in this current legislative session in late 2010. The boundaries of the proposed monument are shown on the map provided as Attachment A. Section 520 of the bill addresses native groundwater supplies. It states,
"The director of the Bureau of Land Management shall not access or process any application for a right-of-way for development projects that propose to use native groundwater from aquifers adjacent to the Mojave National Preserve that individually or collectively, in combination with proposed or anticipated projects on private land, require the use of native groundwater in excess of the estimated recharge rate as determined by the United States Geological Survey."

Compiled Well Data

History of Wells in Vicinity: According to BNSF personnel and review of available well data, the earliest installation of wells throughout this area of the Mojave Desert was completed in the late 19th Century with the construction of the transcontinental railroad. A reliable supply of water was needed to generate steam to provide power to locomotives. Cadiz was found to be an area where a reliable water supply of good quality was present, and many wells were located at Cadiz, in addition to a thriving local community. According to BNSF personnel, there have been at least seven wells that operated historically in Cadiz, (Forshee, pers. Comm..,2010). DWR Bulletin 91-14 identifies two wells at Cadiz [Cadiz 1 (5/14-15K1) and 2 (5/14-15L1)]. Cadiz 1 was drilled in 1910 and Cadiz 2 was drilled in 1931. The Cadiz 1 well was 400 feet deep and well yield was reported as 60 and 167 gpm. When DWR measured the depth to water in August 1964, the depth was 208.44 feet [an elevation of approximately 611.5 feet above Mean Sea Level datum (MSL)]. The Cadiz 2 well is was reportedly 541 feet deep and well yields ranged from 20 to 425 gpm. The depth to water was approximately 195.84 when measured in August 1964 (approximately 624.2 feet MSL). According to BNSF personnel, there were two other water wells that were not in use approximately 300 feet north and south of the existing well that were abandoned last year (Forshee, pers. Comm.., 2010). These may have been the Cadiz 1 and 2 wells.

BNSF Cadiz Well Characteristics

Information regarding the BNSF well was provided by BNSF personnel through correspondence and a site visit that was conducted on January 5, 2010. The purpose of the site visit was to observe the condition of the well and identify equipment needed to conduct an aquifer test to confirm information regarding well yield and drawdown, and to estimate long-term drawdown.

Location, Condition and Infrastructure: The existing BNSF well is located within 50 feet of the south side of a railroad line. It is located within a pump house and groundwater is extracted using a turbine-type pump. There is no drop tube for groundwater depth measurements, however an opening was found at the base of the pump that enabled URS to measure the depth of groundwater in the well. According to BNSF personnel, the oil seals in the pump apparatus appear to leak. This was confirmed when URS identified some oil on the water table. The depth of water could not be readily identified due to the presence of oil but it appeared to be approximately 230 feet based on sounding with an electronic water-level indicator. Water is discharged from the pump through a series of valves to a two-inch discharge pipe or a "j stand" that is used to fill water tanks.

Infrastructure near the site that could be used for railcar mobilization for water delivery to the Solar One site include a railroad spur that is infrequently used and a railroad siding. Photographs of the pump and associated equipment are provided in Attachment B.
Well Construction: A log of the well boring and other information provided by BNSF for the existing well are provided in Attachment C. According to the driller's log, the well was installed by Roscoe Moss Company in 1978. We understand that the pumping equipment was updated approximately 7 or 8 years ago. BNSF personnel indicated that the pump would need to be refurbished or replaced to provide a water supply for the Solar One site. The well boring was drilled using the cable-tool method to a depth of 510 feet below the ground surface (bgs). The well casing is constructed of mild steel that is 16 inches in diameter. The well is screened (perforated) from 250 to 444 feet bgs. The openings in the screen are 3/16 inches wide, 2 ¼ inches long with 7 openings for every 4 inches of casing.
Current Use: Because locomotives no longer run on steam, BNSF uses very little groundwater from this well. It uses 1 acre-foot (approximately 326,000 gallons) or less annually for dust control and other railroad operations.

Geology and Aquifer Characteristics: Based on the driller's log, the strata penetrated by the well consist of an interbedded sequence of sand, gravel and clay to the total depth drilled. It appears that the subsurface materials are composed of alluvium and the aquifer is likely to be unconfined. The sequence appears to be composed of primarily coarse-grained materials including gravel and sand.

Depth to Water and Elevation: As indicated above, the depth to water in the BNSF well is approximately 230 feet bgs [approximately 590 feet above Mean Sea Level (MSL) datum]. This is reasonably consistent with the data for the Cadiz 1 and 2 wells appearing in DWR Bulletin No. 91-14.

Well Yield: Information appearing on the development log following installation indicates that the well was pumped at rates between approximately 730 and 1,000 gpm for periods of approximately of 12 to 13 hours. The initial static groundwater level before pumping was approximately 214 feet bgs and drawdown after 12 to 13 hours of pumping was 20 to 30 feet. These pumping rates far exceed the water needs for the Solar One project.

Water Quality: According to BNSF, it regularly tests the groundwater in accordance with California Code of Regulations CCR) Title 22 for drinking water supply sources. We understand that the Total Dissolved Solids (TDS) in the groundwater from its well are on the order of 280 mg/l. The drinking water standard and requirements for potable water supplies is 500 mg/l. Although BNSF did not provide any analytical reports for groundwater quality, some data appear in DWR Bulletin 91-14 for wells in Cadiz in 1964. Other analytical data were obtained from the U.S Geological Survey (USGS) National Water Information System (NWIS) database. These data are provided in Attachment C.

Chambless Wells

Following our site visit, BNSF personnel introduced us to Mr. Walt Chambless. Mr. Chambless owns a well in his community that is located approximately 3 miles to the north of the BNSF well (Figure 1). The following information was provided by Mr. Chambless during our site visit (Chambless, pers. comm., 2010). He sells water from his well for

drinking purposes to residents in the area. He also provides water for construction projects for dust control and compaction. He indicated that the depth of his well is approximately 400 feet bgs and the depth to water is approximately 125 feet. He has the well water tested to meet requirements of CCR Title 22. He has not conducted aquifer testing and the actual yield of his well is not known. However, he reports that the TDS of the water is similar to that observed in the BNSF well. He noted that groundwater quality deteriorates to the west. There is a well located near Kelbaker Road and the National Trails Highway approximately 5 miles to the west of Mr. Chambless' well. He indicated that the well is owned by the owner of the town of Amboy. The depth of the well is not known; however, the water is saline.

Bulletin 91-14 from 1967 indicates that there were nine private wells in the Chambless area when DWR/USGS conducted its well survey in 1964. The wells observed were installed between 1924 and 1964 primarily for domestic use. Well depths reportedly ranged from 48 to 655 feet bgs. Depth to water ranged from approximately 115 to 160 feet bgs, which corresponded to groundwater elevations ranging from approximately 555 to 612 feet above Mean Sea Level datum. Most of the wells were relatively small diameter and well yields were not reported. Well T6N R14 E-31J1 had a reported well yield of 20 gpm. A well owned and operated by Leslie Salt Company (6/14-32M2) had a reported well yield of 300 gpm wells in the Chambless area. The current operational status of these other wells is not known.

Cadiz Groundwater Storage and Dry-year Supply Program

URS obtained an electronic copy of the Final Environmental Impact Report/Final Environmental Impact Statement (FEIR/FEIS) for this proposed project from the Office of General Counsel, The Metropolitan Water District of Southern California (MWD). The FEIR/FEIS was jointly evaluated by MWD and the U.S Bureau of Land Management (BLM). Metropolitan was partnering with Cadiz, Inc. whereby the aquifer beneath Cadiz and adjacent Fenner Valleys would be used to store imported Colorado River water. In dry years the water stored and that already in the aquifer (native groundwater) would be used within MWD's service area. The project was to include infrastructure to deliver Colorado River water to the basin where it would infiltrate in spreading basins. The spreading basin was proposed approximately 1.5 miles east of the BNSF Cadiz well. A network of 15 equally spaced wells were to be located as near as one mile south and east of the BNSF Cadiz well. The purpose of these wells would be to extract groundwater for distribution by Metropolitan during dry years. A map showing these proposed well locations is provided in Attachment D.

The project has been highly controversial and there has been much concern regarding the impacts of groundwater storage and withdrawl on water quality in the Cadiz and adjacent basins. MWD withdrew from the project, but it is our understanding through review of the Cadiz, Inc. website and other internet searches that it is moving forward with permitting the project. A considerable evaluation of groundwater characteristics, quality and availability were completed as part of the FEIR/FEIS process. The details of the evaluation are not included in the FEIR/FEIS, and we understand due to ongoing litigation, these data are not available.

According to the FEIR/FEIS, there are three existing wells immediately south of the BNSF well, with the nearest being approximately 1 mile away. Well depths, yields and aquifer characteristics are not known, however, it would appear that the characteristics would be expected to be very similar to the BNSF well, since the aquifer was being considered for storage and extraction of large volumes of imported water. The FEIR/FEIS indicates that Cadiz, Inc. was extracting 5,000 to 6,000 afy from the Bristol and Cadiz basins for its agricultural operations in the valley.

CONCLUSIONS AND RECOMMENDATIONS

At the request of the Applicant, URS is currently conducting an aquifer test on the Cadiz BNSF well to confirm well yield and drawdown. The test began on January 10, 2010. A "stress test" was conducted at 100 gpm to identify an approximate test pumping rate followed by step testing and successively higher rates of 120, 140 and 160 gpm for a period of 24 hours. Drawdown was monitored using a pressure transducer in the pumping well. The maximum drawdown during the 24-hour test has been approximately 3.5 feet. Water levels will also be monitored once the pump is turned off during the recovery phase. Because there are no wells in the immediate area, there were no observation wells that were monitored during the test. The results of the test will be used to estimate long-term drawdown resulting from using water from this well as a water supply for the Solar One site. A letter report summarizing the results of the aquifer testing will be submitted to the Applicant and agencies in approximately one week. Based on this preliminary data , the small drawdown suggests that the well is a good production well that can be pumped at rates that far exceed the water demand for the Solar One site. Because of the favorable conditions at Cadiz, this source will be pursued as the primary water source for the Solar One Project. Additional analysis will be submitted to the CEC and BLM as soon as it is available.

Additionally, once the first well is installed on the Solar One site, URS will conduct the same test and alnalyses. The Applicant will forward additional information on the viability of the on-site wells once it is obtained. This water source will be continued to be pursued as a back up.

Attachments:
References
Figure 1: Well Location Map
Attachment A: Driller's Geolog - On-site Well
Attachment B: Driller's Log and Well Information – BNSF Well
Attachment C: Available Water Quality Data
Attachment D: Excerpts from FEIR/FEIS for Cadiz Groundwater Storage and Dry-year Supply Program

REFERENCES

California Department of Water Resources (DWR), 2010, Groundwater data, http://wdl.water.ca.gov/gw/map/scal.cfm, accessed January.

California Department of Water Resources (DWR), 2004a, California's Groundwater Bulletin 118, Colorado River Hydrologic Region, Cadiz Valley Groundwater Basin, updated February 27.

California Department of Water Resources (DWR), 2004b, California's Groundwater Bulletin 118, Colorado River Hydrologic Region, Bristol Valley Groundwater Basin, updated February 27.

California Department of Water Resources (DWR), 1967, Bulletin No. 91-14, "Water Wells and Springs in Bristol, Broadwell, Cadiz, Danby, and Lavic Valleys and Vicinity, San Bernardino and Riverside Counties, California," August.

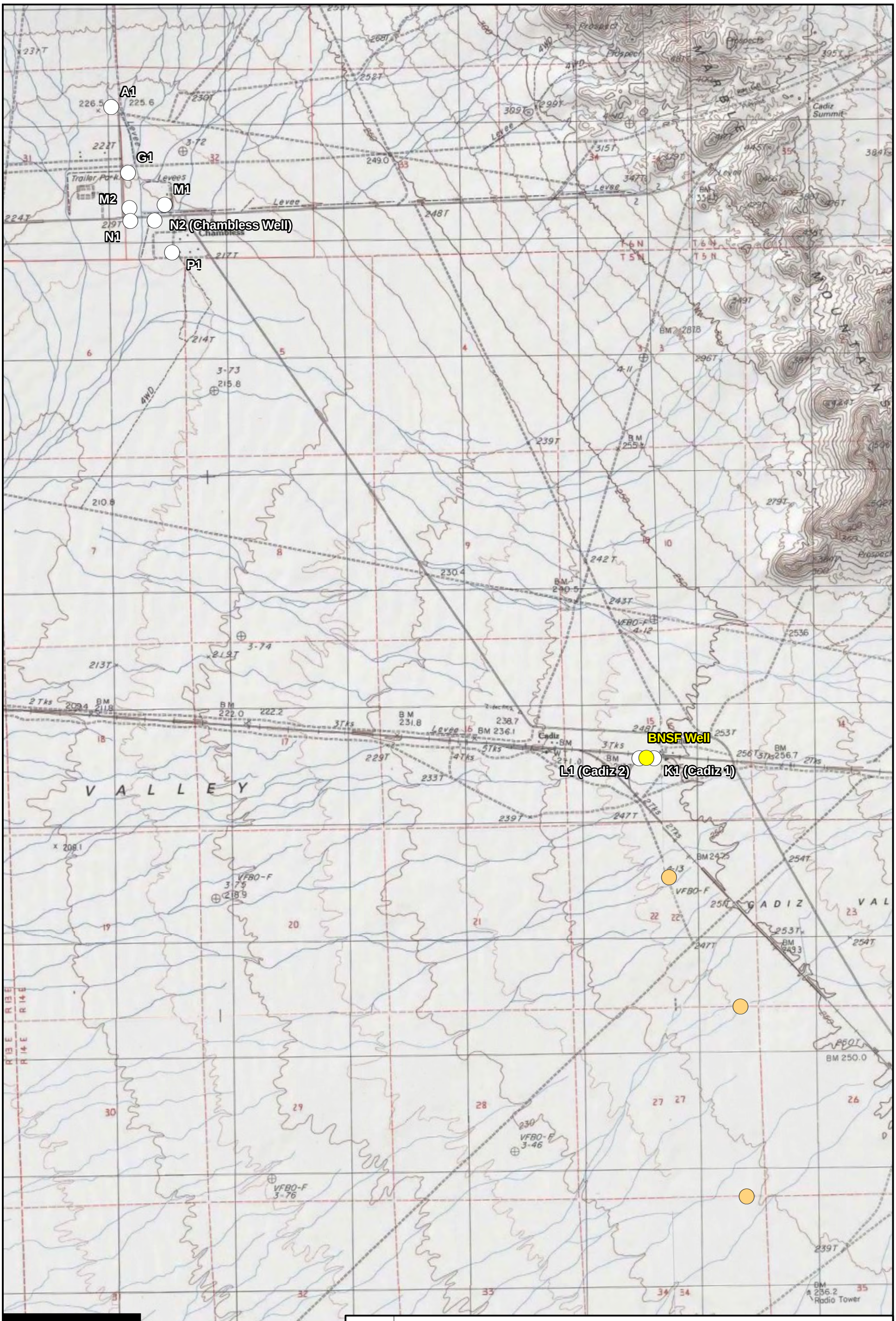
California Regional Water Quality Control Board (RWQCB), Colorado River Region, 2006, Water Quality Control Plan for the Colorado River Basin, December.

Chambless, Walt, 2010, personal communication, January 5.

Forshee, Dean, 2010, BNSF Facilities Operations, personal communication, January 5.

Metropolitan Water District of Southern California, 2001, Final Environmental Impact Reprot/Final Environmental Impact Statement, Cadiz Groundwater Storage and Dry-year Supply Program. September.

United States Geological Survey (USGS), 2009, National Water Information System, Water Quality Samples for the Nation, http://nwis.waterdata.usgs.gov/nwis/qwdata/, accessed December 2009 and January 2010.



LEGEND

- BNSF Well
- Cadiz Inc Well
- Wells appearing In DWR Bulletin No. 91-14

SOURCES:
USGS (CADIZ 1985, CADIZ SUMMIT 1986, CALUMET MINE 1986, CADIZ LAKE NW 1986)

WELL LOCATION MAP
BNSF AND CADIZ WELLS
SOLAR ONE PROJECT

URS

1250 0 1250 2500 Feet

SCALE: 1" = 2500' (1:30,000)
SCALE CORRECT WHEN PRINTED AT 11X17

CREATED BY: RC	DATE: 01-14-09	FIG. NO: 1
PM: RKS	PROJ. NO: 27658188.40001	

Path: G:\gis\misc\ArcMAP_Layouts\11x17p.mxd, 01/21/09, camille_lill

Attachment A

Water Well #1 - 1701 - Calico/Voight Well Log

Depth	Material
01 - 20ft	soft sand & 2-4" loose rock
20 - 40ft	harder sand & smaller rock
40 - 60ft	light sand stone with small rock
60 - 65ft	black lava rock
65 - 80ft	sand stone with 6" rock formations
80 - 115ft	short rock formations with sand stone in between
115 - 125ft	hard sand stone
125 - 140ft	sand stone
140 - 145ft	hard rock
145 - 150ft	hard sand stone
150 - 152ft	hard black lava rock
152 - 160ft	light sand stone
160 - 168ft	light sand stone
168 - 170ft	hard red rock
170 - 190ft	light sand stone
190 - 220ft	lighter sand stone
220 - 240ft	lighter sand stone
240 - 265ft	lighter sand stone
265 - 270ft	hard sand stone
275 - 280ft	hard granite with quartz
280 - 290ft	granite with heavy quartz
290 - 300ft	granite with heavy quartz
300 - 320ft	hard granite
320 - 345ft	hard granite
345 - 365ft	hard granite
365 - 380ft	hard granite
380 - 390ft	hard granite
390 - 400ft	granite with a little clay
400 - 420ft	hard sandy clay
420 - 440ft	hard sandy clay
440 - 450ft	black lava rock
450 - 460ft	hard granite with a little clay
460 - 475ft	hard clay with granite
475 - 500ft	hard clay with granite
500 - 520ft	granite with black and red lava
520 - 540ft	granite with black and red lava
540 - 560ft	granite with black and red lava
560 - 580ft	granite with black and red lava
580 - 600ft	little softer granite
600 - 610ft	little softer sand
610 - 620ft	hard granite
620 - 640ft	black lava rock

640 - 660ft	granite with clay
660 - 680ft	hard clay
680 - 700ft	hard clay with black rock - more rock then clay
700 - 720ft	black rock hard
720 - 730ft	little clay with hard rock - 725-727 hard granite
730 - 740ft	hard granite
740 - 760ft	hard granite with little more rock - 755-756 hard rock
760 - 770ft	clay with granite
770 - 780ft	hard clay
780 - 790ft	hard clay with little granite
790 - 792ft	hard rock
792 - 798ft	sand
798 - 802ft	soft sticky clay

Attachment B

ROSCOE MOSS COMPANY

4360 WORTH STREET
LOS ANGELES, CAL.

m RM 114

ll No. _____ Job No. 43-487

vner The Atchison Topeka and Santa Fe

ldress Railway Company - 121 East Sixth Street
Suite 747- Los Angeles, California 90014

ocation T _____ R _____ Sec. _____
¼ ¼ ¼

pprox. 50' West and 15' South of Existing Well
Cadiz, California

arted Work May 16, 1978

ompleted Work June 7, 1978

otal Depth Drilled 510

epth Water First Encountered _____

MATERIALS

Conductor Casing

aterial Mild Steel

iameter (OD) (ID) 20 in. Wall Thickness 5/16 in.

stalled From 0 ft. To 50 ft.

emented From 0 ft. To 50 ft.

Well Casing

DIAMETER (OD)(ID)	WALL OR GAUGE	MATERIAL	FROM	TO
16"	8 gauge	Double Well Casing	0	510

tarter Used 18 ft. of 16"-2 ply 6 wall or gauge

ize Shoe 1-1/4"x12"x16"
Bit Steel Heat Treated

PERFORATIONS

ype of Perforator Used Moss Hydraulic

FROM	TO	WIDTH	LENGTH	HOLES PER FOOT	SQ. INCH PER FOOT
444	250	3/16	2-1/4	7 holes per 4"	

Formation: Mention size of water gravel —

0	ft. to	10	ft.	Sand with some gravel
10	" "	37	"	Gravel to 3" and sand
37	" "	62	"	Hard brown clay, some
62	" "	68	"	Gravel and sand
68	" "	126	"	Brown sandy clay and gr
126	" "	174	"	Sand and gravel with
	" "		"	some clay
174	" "	198	"	Brown sandy clay
198	" "	210	"	Sand and gravel
210	" "	220	"	Sand, some gravel to 1
220	" "	255	"	Sand and gravel to 1"
255	" "	284	"	Silty clay and gravel
284	" "	302	"	Sand and gravel
302	" "	322	"	Gravel and brown sandy
322	" "	336	"	Brown clay and gravel
336	" "	348	"	Sand and gravel
348	" "	360	"	Sand with cemented str
360	" "	400	"	Gravel and brown sandy
400	" "	422	"	Sand and gravel
422	" "	444	"	Brown sandy clay &grav
444	" "	455	"	Sticky brown clay
455	" "	465	"	Brown clay and gravel
465	" "	484	"	Sticky brown clay
484	" "	510	"	Very fine sand and brow
	" "		"	clay
	" "		"	
	" "		"	
	" "		"	
	" "		"	
	" "		"	
	" "		"	
	" "		"	
	" "		"	
	" "		"	
	" "		"	
	" "		"	
	" "		"	

If Well Is Reduced, Indicate:

Amount of Lap at Reduction _____ ft.

Amount of Lap at Reduction _____ ft.

Amount of lap at Reduction _____ ft.

Method of Sealing at Reduction _____

Give any additional data which may be of future value _____

Conductor Casing

aterial Mild Steel

iameter ~~(OD)~~ (ID) 20 in. Wall Thickness 5/16 in.

stalled From 0 ft. To 50 ft.

emented From 0 ft. To 50 ft.

Well Casing

DIAMETER ~~(OD)~~(ID)	WALL OR GAUGE	MATERIAL	FROM	TO
16"	8 gauge	Double Well Casing	0	510

tarter Used 18 ft. of 16"-2 ply 6 ~~XRX~~or gauge

ize Shoe 1-1/4"x12"x16" Bit Steel Heat Treated

PERFORATIONS

ype of Perforator Used Moss Hydraulic

FROM	TO	WIDTH	LENGTH	HOLES PER FOOT	SQ. INCH PER FOOT
444	250	3/16	2-1/4	7 holes per 4"	

Development & Test Record

Was Well Swabbed? Yes

lethod Cable Tool

lo. of Hours 13

otal Material Removed 165'

/ater level when Test first started 207 ft.

)raw down from standing level 15 ft.

lo. of gallons per minute pumped when Test first started 530

lo. of gallons per minute pumped when Test completed 1200

)raw down at completion of Test 28 ft.

ours Testing Well 55

336	" " 348	"	Sand and gravel
348	" " 360	"	Sand with cemented str
360	" " 400	"	Gravel and brown sandy
400	" " 422	"	Sand and gravel
422	" " 444	"	Brown sandy clay &grav
444	" " 455	"	Sticky brown clay
455	" " 465	"	Brown clay and gravel
465	" " 484	"	Sticky brown clay
484	" " 510	"	Very fine sand and brow
	" "	"	clay
	" "	"	
	" "	"	
	" "	"	
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	" "	"	

If Well Is Reduced, Indicate:

Amount of Lap at Reduction _____ ft.

Amount of Lap at Reduction _____ ft.

Amount of lap at Reduction _____ ft.

Method of Sealing at Reduction _____

Give any additional data which may be of future value _____

Driller Jack Cannon

Date of Report June 14, 1978

Type and Rig No. Used Cable Tool # 43

WELL DEVELOPMENT LOG

WELL NAME _____ PUMPER Randy Ferreira & Steve F.

LOCATION Cadiz DISCHARGE 8" ORIFICE 4 3/4 & 6 1/2 OPEN

AIRLINE 282 ft

TIME	SURGES	BACKWASH HIGH / LOW	SAND & COLOR AFTER SURGE	TIME	5	10	15	20	25	30	45	60	RPM
0630			SAND		2.2	2.6	1.5	1.4	.9	.6	.35	.19	
0700			COLOR		MED	HVY	MED	MED	MED	MED	HAZY	HAZY	1325
			SAND				.15			.22	.09	.07	
0800	0		COLOR				HAZY			HAZY	CLR	CLR	1325
		INCREASE	SAND		.12	.15	.15	.24	.3	.25	.14	.14	
0900	0	RPM	COLOR		CLR	CLR	CLR	HAZY	HAZY	HAZY	CLR	CLR	1350
			SAND				.12			.12	.1	.08	
1000	0		COLOR				CLR			CLR	CLR	CLR	1350
*		202	SAND		1.7	1.1	.8	.6	.35	.5	.4	.4	
1110	1	214	COLOR		HVY	MED	HAZY	HAZY	HAZY	HAZY	HAZY	HAZY	1425
		[redacted]	SAND				.19			.11	.09	.07	
1210	0	[redacted]	COLOR				CLR			CLR	CLR	CLR	1425
		INCREASE	SAND		.15	.1	.15	.10	.14	.1	.1	.11	
1310	0	RPM	COLOR		CLR	CLR	CLR	CLR	CLR	CLR	CLR	CLR	1450
		INCREASE	SAND		.13	.09	.1	.11	.09	.09	.08	.06	
1410	0	RPM.	COLOR		CLR	CLR	CLR	CLR	CLR	CLR	CLR	CLR	1460
		INCREASE	SAND		.12	.13	.1	.08	.06	.06	.07	.06	
1510	0	RPM	COLOR		CLR	CLR	CLR	CLR	CLR	CLR	CLR	CLR	1475
		204	SAND		24	.55	.42	.3	.2	1.4	1.8	.7	
1615	1	215	COLOR		HVY	HAZY	HAZY	HAZY	HAZY	MED	MED	HAZY	1490
			SAND				.25			.6	.7	1.	
1715	0		COLOR				HAZY			HAZY	CLR	HAZY	1490

WELL PRODUCTION						
TIME	ORIFICE READING	GPM	PUMPING LEVEL	STATIC LEVEL	DRAW DOWN	SPECIFIC YIELD
0800	6 9	530	229	214	15	35.3
0900	71	538	228	214	14	38.4
1000	90	607	330 ~~229~~	214	16	37.9
1100	90	607	229	214	15	40.4
1210	11	650	234	214	20	32.5
1310	11	650	232	214	18	36.1
1410	12½	692	235	214	21	32.9
1510	13	708	234	214	20	35.4
1610	13½	720	235	214	21	34.2
1715	14½	745	234	214	20	37.2
1815	14½	745	234	214	20	37.2

WATER LEVEL RECOVERY AFTER PUMPING														
TIME	5	10	15											
LEVEL														

HOURS PUMPED THIS SHEET	11:45
TOTAL HOURS PUMPED ON WELL	11:45

REMARKS *CHANGE to 6½" ORFICE. WHEN old well is pumping, pumping level on this well goes down 2 Feet.

WELL DEVELOPMENT LOG

WELL NAME ______ PUMPER [illegible]

LOCATION Cadiz DISCHARGE 8" ID ORIFICE 6½ open

TIME	SURGES	BACKWASH HIGH / LOW	SAND & COLOR AFTER SURGE: TIME	5	10	15	20	25	30	45	60		RPM	WELL PRODUCTION: TIME	ORIFICE READING	GPM	PUMPING LEVEL	STATIC LEVEL	DRAW DOWN	SPECIFIC YIELD
1815	0		SAND			.9			.55	45	.25			1915	14½	745	234	214	20	37.2
			COLOR			HAZY			HAZY	CLR	CLR		1490							
1915	0		SAND			.19			.11					1945	14½	745	234	214	20	37.2
			COLOR			CLR			CLR				1490							
			SAND																	
			COLOR																	
			SAND																	
			COLOR																	
			SAND																	
			COLOR																	
			SAND																	
			COLOR																	
			SAND																	
			COLOR																	
			SAND																	
			COLOR																	
			SAND																	
			COLOR																	
			SAND																	
			COLOR																	

WATER LEVEL RECOVERY AFTER PUMPING

TIME	5	10	15									
LEVEL	15	14										

HOURS PUMPED THIS SHEET	1:40
TOTAL HOURS PUMPED ON WELL	13:35

REMARKS ______

WELL DEVELOPMENT LOG

WELL NAME _____ PUMPER Randy & Steve

LOCATION Cadiz DISCHARGE 8" ID ORIFICE 1/2 open

Hi Line 232 ft

TIME	SURGES	BACKWASH HIGH / LOW	SAND & COLOR AFTER SURGE											WELL PRODUCTION						
0630			TIME	5	10	15	20	25	30	45	60	90	RPM	TIME	ORIFICE READING	GPM	PUMPING LEVEL	STATIC LEVEL	DRAW DOWN	SPECIFIC YIELD
0700	C	214	SAND	1.2	.35	.19	.1	.09	.06	.05	.05			0800	14	732	234	214	20	36.7
			COLOR	med	HAZY	HAZY	CLR	CLR	CLR	CLR	CLR		1490							
0800	O	INCREASE	SAND	.09	.1	.08	.05	.06	.07	.1	.1			0900	16½	795	235	214	21	37.8
		RPM	COLOR	CLR	CLR	CLR	CLR	CLR	CLR	CLR	CLR		1510							
0900	O	INCREASE	SAND	.06	.7	.6	.29	.25	.25	.22	.2	.2		1030	19½	865	237	214	23	37.6
		RPM	COLOR	HAZY	HAZY	CLR	CLR	CLR	CLR	CLR	CLR	CLR	1530							
1030	O		SAND			.5			.55	.28	.13			1130	19½	865	237	214	23	37.6
			COLOR			HAZY			CLR	CLR	CLR		1530							
1130	O	INCREASE	SAND	.26	.32	.21	.19	.18	.18	.17	.12			1230	20½	885	237	214	23	39.4
		RPM	COLOR	CLR	CLR	CLR	CLR	CLR	CLR	CLR	CLR		1550							
1230	O	INCREASE	SAND	.15	.19	.23	.21	.2	.29	.42	.62	.7		1400	22½	930	238	214	24	38.7
		RPM	COLOR	CLR	CLR	CLR	CLR	CLR	CLR	HAZY	HAZY	HAZY	1580							
1400	O		SAND			.31			.12					1430	22½	930	238	214	24	38.7
			COLOR			CLR			CLR				1575							
1430	O	INCREASE	SAND	.4	.55	.4	.37	.3	.39	.35	.3	.31		1600	26½	1000	239	214	25	40.
		RPM	COLOR	HAZY	HAZY	CLR	CLR	CLR	CLR	CLR	CLR	CLR	1610							
1600	O	DECREASE	SAND			.45			.19	.2	.21	.14		1730	15	760	232	214	18	42.2
		RPM	COLOR			HAZY			CLR	CLR	CLR	CLR	1480							
1735	1		SAND	1.8	1.2	1.2	.7	.55	.55	.45	.4	.2		1905	25½	990	241	214	27	36.6
			COLOR	HAZY	MED	HAZY	HAZY	HAZY	CLR	CLR	CLR	CLR	1600							
1905	C	207	SAND			.11			.09	.09				1950	25½	990	240	214	26	38.0
			COLOR			CLR			CLR	CLR			1600							

WATER LEVEL RECOVERY AFTER PUMPING													
TIME	5	10											
LEVEL	215	214											

HOURS PUMPED THIS SHEET	13:30
TOTAL HOURS PUMPED ON WELL	26:55

REMARKS _____

WELL DEVELOPMENT LOG WELL NAME _____ PUMPER Randy STEVES

Aeline 282 ft LOCATION Cadiz DISCHARGE 8" ORIFICE 6½ open

TIME	SURGES	BACKWASH HIGH / LOW	SAND & COLOR AFTER SURGE	TIME	5'	10'	15'	20'	25'	30'	45'	60'	90'	RPM
9:30														
0700		214	SAND	1.3	.50	.30	.22	.24	.18	.12	.09	.06		
			COLOR	HAZY	HAZY	HAZY	CLR	CLR	CLR	CLR	CLR	CLR	1575	
0830	0		SAND			.05			.11	.08	.05	.03		
			COLOR			CLR			CLR	CLR	CLR	CLR	1575	
1000	0	1100 cmt RPM.	SAND	.40	.20	.45	.38	.34	.32	.8	.35	.3+		
			COLOR	CLR	CLR	CLR	CLR	CLR	CLR	HAZY	CLR	CLR	1625	
1130	0		SAND			1.7			.65	.43	.26	.14		
			COLOR			CLR			CLR	CLR	CLR	CLR	1625	
1300			SAND	.20		.20			.16					
			COLOR	CLR		CLR			CLR				1625	
1510	1		SAND	1.3	.60	.40	.39	.41	.49	.25	.25	.12		
			COLOR	HAZY	HAZY	HAZY	CLR	CLR	CLR	CLR	CLR	CLR	1700	
1610	0		SAND			.13			.1	.18	.09			
			COLOR			CLR			CLR	CLR	CLR		1700	
1615	1	207	SAND	1.6	1.2	.22	.31	.32	.19	.15	.14	.1		
		214	COLOR	MED	HAZY	CLR	CLR	CLR	CLR	CLR	CLR	CLR	1750	
1750	1	206	SAND	1.1	.4	.22	.19	.2	5.3	.33	.3	.3		
		214	COLOR	MED	CLR	CLR	CLR	CLR	CLR	CLR	CLR	CLR	1800	
1930	0		SAND			.19			.1					
			COLOR			CLR			CLR				1800	
			SAND											
			COLOR											

TIME	ORIFICE READING	GPM	PUMPING LEVEL	STATIC LEVEL	DRAW DOWN	SPECIFIC YIELD
0830	23	938	238	214	24	39.0
1000	2½	930	238	214	24	38.7
1130	28½	1045	242	214	28	37.3
1300	28½	1045	242	214	28	37.3
1330	28½	1045	242	214	28	37.3
1510	34	1140	244	214	30	38.
1610	33½	1135	247	214	30	37.8
1745	28½	1220	245	214	31	39.3
1920	40½	1250	246	214	32	39.0
1950	40½	1250	246	214	32	39.0

WATER LEVEL RECOVERY AFTER PUMPING

TIME	5	10
LEVEL	215	214

HOURS PUMPED THIS SHEET: 13:30

TOTAL HOURS PUMPED ON WELL: 40:25

REMARKS * Running two Engines

WELL DEVELOPMENT LOG

WELL NAME _____ PUMPER Randy & Steve

LOCATION Cadiz DISCHARGE 8 ID ORIFICE 6½ open

Airline 282 FT

TIME	SURGES	BACKWASH HIGH / LOW	SAND & COLOR AFTER SURGE											WELL PRODUCTION						
			TIME	5	10	15	20	25	30	45	60	90	RPM	TIME	ORIFICE READING	GPM	PUMPING LEVEL	STATIC LEVEL	DRAW DOWN	SPECIFIC YIELD
0830	0	214	SAND	1.2	.18	.16	.15	.20	.19	.14	.14	.07		0900	35½	1160	243	214	29	40.
			COLOR	MED	CLR	CLR	CLR	CLR	CLR	CLR	CLR	CLR	1740							
0900	0		SAND			.08			.03	.02				0930	35	1155	243	214	29	39.8
			COLOR			CLR			CLR	CLR			1740							
0910	1	208	SAND	1.4	.35	.15	.11	.11	.18	.07	.04			1010	36½	1175	242	214	28	41.9
		215	COLOR	HAZY	HAZY	CLR	CLR	CLR	CLR	CLR	CLR		1740							
1020	1	207	SAND	.52	.19	.12	.09	.12	.07	.07	.06			1120	37	1190	242	214	28	42.5
		215	COLOR	HAZY	CLR	CLR	CLR	CLR	CLR	CLR	CLR		1740							
1130	1	208	SAND	.36	.12	.09	.09	.06	.06	.04	.05			1230	37½	1200	242	214	28	42.8
		215	COLOR	HAZY	CLR	CLR	CLR	CLR	CLR	CLR	CLR		1740							
1235	1	208	SAND	.5	.1	.1	.08	.07	.05	.04	.05			1335	38	1210	242	214	28	43.2
		215	COLOR	HAZY	CLR	CLR	CLR	CLR	CLR	CLR	CLR		1740							
1345	1		SAND	.5	.18	.1	.07	.05	.04	.02	.02	.01		1515	38	1210	242	214	28	43.2
			COLOR	HAZY	CLR	CLR	CLR	CLR	CLR	CLR	CLR	CLR	1740							
			SAND			CURVE														
			COLOR																	
1530			SAND	.30	.09	.05	.05	.05	.03	.03	.02			1630	37½	1200	242	214	28	42.8
			COLOR	HAZY	CLR	CLR	CLR	CLR	CLR	CLR	CLR		1740							
1630			SAND	.01	.01	TRC	TRC	TRC	TRC	TRC	TRC			1730	24	960	236	214	22	43.6
			COLOR	CLR	CLR	CLR	CLR	CLR	CLR	CLR	CLR		1600							
1730			SAND	.01	TRC	TRC	TRC	TRC	TRC	TRC	TRC			1830	15	760	232	214	18	42.2
			COLOR	CLR	CLR	CLR	CLR	CLR	CLR	CLR	CLR		1500							

WATER LEVEL RECOVERY AFTER PUMPING													
TIME													
LEVEL													

HOURS PUMPED THIS SHEET	12:30
TOTAL HOURS PUMPED ON WELL	52:55

REMARKS

WELL DEVELOPMENT LOG

Airline 282ft

WELL NAME ______ PUMPER Kelly Y Steve

LOCATION Cadiz DISCHARGE 8ID ORIFICE 4" open

TIME	SURGES	BACKWASH HIGH / LOW	SAND & COLOR AFTER SURGE (CURVE) TIME	5	10	15	20	25	30	45	60		RPM
18 30			SAND	TRC	TRC	TRC	TRC	TRC	Ø	Ø	Ø		
			COLOR	CLR	CLR	CLR	CLR	CLR	CLR	CLR	CLR		1300
19 30			SAND	TRC	TRC	Ø	Ø	Ø	Ø	Ø	0		
			COLOR	CLR	CLR	CLR	CLR	CLR	CLR	CLR	CLR		1200
			SAND										
			COLOR										
			SAND										
			COLOR										
			SAND										
			COLOR										
			SAND										
			COLOR										
			SAND										
			COLOR										
			SAND										
			COLOR										
			SAND										
			COLOR										
			SAND										
			COLOR										
			SAND										
			COLOR										

WELL PRODUCTION

TIME	ORIFICE READING	GPM	PUMPING LEVEL	STATIC LEVEL	DRAW DOWN	SPECIFIC YIELD
19 30	75	550	225	214	11	50
20 30	25	~~340~~ 320	221	214	7	45.7 ~~[illegible]~~

WATER LEVEL RECOVERY AFTER PUMPING

TIME	.5										
LEVEL	214										

HOURS PUMPED THIS SHEET: 2:05

TOTAL HOURS PUMPED ON WELL: 55 hrs

REMARKS ______

Attachment C

STATE OF CALIFORNIA
The Resources Agency
Department of Water Resources

BULLETIN No. 91-14

WATER WELLS AND SPRINGS IN BRISTOL, BROADWELL, CADIZ, DANBY, AND LAVIC VALLEYS AND VICINITY

SAN BERNARDINO AND RIVERSIDE COUNTIES CALIFORNIA

Prepared by
United States Department of Interior
Geological Survey

FEDERAL-STATE COOPERATIVE GROUNDWATER INVESTIGATIONS

AUGUST 1967

RONALD REAGAN
Governor
State of California

WILLIAM R. GIANELLI
Director
Department of Water Resources

T6N, R14E S32

State well number	Other numbers and source of data	Date of observation	Owner or user	Year completed	Depth of well (feet)	Type and diameter (inches)	Type of pump and power	Yield (gpm)	Use	Measuring point: Description	Measuring point: Distance above or below(-) lsd (feet)	Altitude of lsd (feet)	Water level below lsd (feet)	Other data
T. 5 N., R. 14 E.														
5/14-15K1 Cadiz 1	GS	8-20-64	Atchison, Topeka, and Santa Fe Railway, Cadiz 1	1910	400	C (q)	T 10		RR	Tap	1.5	820	208.44	C,L,W
	O	1-22-29						167						
	O	1910						60						
	DWR-15X1													
15L1 Cadiz 2	GS	8-20-64	Atchison, Topeka, and Santa Fe Railway, Cadiz 2	1931	541	C (r)	T 10		RR	Tap	3.0	820	195.84	C,L,W
	DWR	5-10-54						20						
	O	2----36						425						
	O	11----32						240						
	O	6----31						390						
	DWR-15X2													
T. 5 N., R. 15 E.														
5/15-4X1	GS	8-19-64	Atchison, Topeka, and Santa Fe Railway, Siam 1	1903	0	N	N N		Ds			1,040		
	O	6-21-03		1903	895	C 13	L	60	RR	Tc	1.0		399	C,L
	DWR-34X2													
	DWR-4X1													
	DWR-4B1													
	M-181													
4X2	GS	8-19-64	Atchison, Topeka, and Santa Fe Railway, Siam 2	1907	0	N	N N		Ds			1,080		L
	O	1915		1907	888	C 12		37	RR	Lsd	0		420	
	DWR-34X1													
	DWR-4X1													
	DWR-4B2													
	DWR-4X2													
	M-181													
7B1	GS	10- 6-64			29.1	D 72	N N		Ds	Tc	0	1,520	(a)	
T. 6 N., R. 6 E.														
6/6-4G1	GS	8- 4-64	U.S. Navy Sunshine Mill		0	N	N N		Ds			1,960		C
	DGT	11-27-17			125	D	E	30	In	Lsd	0		85	
20NS1	GS	8- 5-64	U.S. Navy Peacock Spring						Un			2,630	(a)	
	W-24	1910						1	Dm				(s)	
	M-178	1908												

See footnotes at end of table.

State well number	Other numbers and source of data	Date of observation	Owner or user	Year completed	Depth of well (feet)	Type and diameter (inches)	Type of pump and power	Yield (gpm)	Use	Measuring point: Description	Measuring point: Distance above or below(-) lsd (feet)	Altitude of lsd (feet)	Water level below lsd (feet)	Other data
T. 6 N., R. 12 E.--Continued														
6/12-35F1	GS DWR DWR DWR	8-12-64 3- 5-57 9-30-55 9-24-55	H. B. Burris, Amboy 2	1955	284	16	G	160	In	Tc	3.0	790	(b) c287 187.0	C
T. 6 N., R. 13 E.														
6/13-3A1	GS	8-14-64	Castle Mine		28.0	D 72	L H		Un	Tc	0	2,240	8.23	
3A2	GS	8-14-64	Castle Mine			D	Si Gr	.12	Un			2,240	(s)	
18L1	GS	8-18-64			49.5	D 96	N N		Ds	Tc	0	1,520	(a)	
31P1	GS	8-12-64			19.0	D 120	N N		Ds	Tcc	0	824	(a)	
36M1	GS	8-19-64	H. B. Burris			R	T N		Un	Tap	2.0	800	204.04	
36P1	GS GS	8-19-64 8-19-64	R. Tull	1960	449	R 12	S ½	13	Dm	Bhc	1.0	770	t162.65 c167.96	
T. 6 N., R. 14 E. — Chambless Area														
6/14-31A1	GS	8-20-64	Frank McConnell	1924	154	12	S 3/4		Dm	Tcc	0	750	(f)	C
31J1	GS FC	10- 7-64 1-16-61	J. E. Easley	1960	270	12		12	Dm Dm			740		C
32E1	GS	8-20-64	Ruben Lomelli		280	R 8	J 1½		Dm	Tcc	1.0	735	123.61	C
32M1	GS	8-20-64	J. C. Limon	1961	248	8	S 5		Dm	Tap	2.0	722		
32M2	GS DWR-32F2	8-20-64	Leslie Salt Co.	1960	600		T 20	300	Ps			725		C
32N1	GS DWR DWR-5X1 DWR-32X1	8-19-64 5-10-54	J. M. Riddle	1933	655	C 10	T 20		Dm			715	160 130	C
32N2	GS	8-19-64	Whiting Bros. Service Station		300	6	S 1½		Dm			715		
32P1	GS	8-20-64	R. Haines	1964	d119.0		N N		Un	Tc	1.0	715	114.91	
34H1	GS	8-19-64			48.0	D 96	N N		Ds	Tc	0	1,080	(a)	

See footnotes at end of table.

Well number	Date of collection	Depth of well (feet)	Water temperature (°F)	Results in parts per million (ppm) or in milligrams per liter (mgl)														Dissolved solids		Hardness as $CaCO_3$	Noncarbonate hardness as $CaCO_3$	Percent sodium	Specific conductance (micromhos at 25°C)	pH	Analyzing laboratory and sample number
				Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Calculated (Sum of determined constituents)	Residue on evaporation at 180°C						
U.S. Public Health Service drinking-water standards (1962)					0.3							250	250	0.9	45		500	500						
5N/13E-22J1	5-10-54		72			92	16	281	4.4	277	0	112	394	1.0	24	0.5	1,060	1,130	279		67	1,940	7.5	DWR-P522
	5-23-55		66			75	18	264	4.0	273	0	90	364	1.4	18	.48	969	1,020	261		68	1,560	7.6	DWR-5761
	5-14-57		68	75		38	10	134	2.9	267	0	41	111	1.0	.2	.33	545	547	134		68	836	7.4	DWR-7870
	5-23-58			53		59	12	178	3.1	282	0	72	200	.8	0	.9	718	788	199		66	1,210	8.0	DWR-T2063
5N/14E-15K1	8-15-10					18	18	65		136		72	52				292	289	107		54			RR-10854[1]
	6-26-30					35	5.1	72		134		88	47				313	298	109		59			RR-30934[1]
Cadiz 1	5-23-55		82			26	10	54	2.5	132	0	39	48	1.4	20	.24	266	290	106		51	425	7.8	DWR-5760
	9-30-55		82			26	10	54	2.5	129	0	37	47	1.4	22	.32	264	350	108		51	447	7.7	DWR-6144
	5-25-56									88			44						105			392	7.6	DWR-7007
	5-14-57			40		26	10	54	5.1	138	0	38	46	1.0	12	.17	299	286	105		51	469	7.6	DWR-7869
	5-23-58									136	0		50						105			500	7.9	DWR-T2064
	5-17-59		85							134	0		48						108			487	7.7	DWR-R2552
	5-17-60		82							135	0		47						107			464	7.6	DWR-11479
	5-13-61			45		28	8.5	55	5.4	139	0	38	47	1.2	15	.28	311	310	105	0	52	471	7.9	DWR-12659
	5-20-63									129	0		47						110	4		473	8.3	DWR-15666
	5-11-64			37		30	7.8	53	5.2	138	0	37	50	.6	12	.37	301	298	107	0	50	450	8.0	DWR-16789
15L1	2-19-32					42	5.1	69		142		79	54				319	300	125		54			RR-32802[1]
	5-10-54		82			28	9	55	5.1	134	0	40	58	1.0	2.5	.35	265	339	107	0	52	472	7.9	DWR-P540
Cadiz 2	9-15-54					29	11	54	5.6	128		39	41	1.0	19	.35	263	295	116	11	49	455	8.0	DWR-R385
	10-18-56									133	0		50						111	2		482	7.5	DWR-7395
	9- 4-58		88	42		25	11	55	5.3	134	0	34	50	.7	12	.6	302	332	105	0	52	516	7.8	DWR-T2546
	5-24-62		87	40		30	8	53	4.7	143	0	36	45	1.1	15	.34	303	316	109	0	50	470	8.2	DWR-2767
5N/15E- 4X1	9-26-03			27		19	5.4	e73		148		51	38				286	334	270					RR[1]
6N/ 6E- 4G1	11-27-17	125		48	0.33	50	7.4	494	17	88	0	547	349		9		1,560	1,680	155		86			DGT-467
6N/11E-30G1	5- 8-53					477	32	1,200	24	22	0	284	2,720	2.6	3.5		4,750	4,910	1,320	1,300	66	7,920	7.0	FC-2645
	5- 8-53					513	15	1,200	23	15	0	225	2,610	3.0	5	2.6	4,600	5,320	1,340	1,330	66	7,920	6.8	FC-2665
30X1	12- -01	1,000				820	6.1	e1,580				409	3,600				6,420		2,080		62			RH
	5- 2-02					771	4.7	1,520				351	3,460				6,110		1,940		63			RR[1]
6N/12E-29P1	12-30-54					320	9	840	15	71	0	1,050	1,120	4.0	5.5	3.9	3,400	3,500	837	779	68	5,350	7.8	FC-3377
	4-25-55					364	2	1,000	17	41	0	1,080	1,430	4.4	7	3.9	3,930	3,990	917	883	70	6,130	7.9	FC-3523
	5-23-55		89			305	2	925	15	49	0	944	1,300	6	8.4	4.2	3,530	3,600	769	729	72	5,210	7.9	DWR-5757
	9-30-55		82							80	0		1,270	4.2					737	676		5,180	7.5	DWR-6138
	5-25-56		86	2		156	15	800	11	10	0	551	1,150	4.5	14	3.2	2,710	2,790	452	443	79	4,130	5.8	DWR-7132
	5-14-57		86	2		86	1	840	12	29	0	347	1,200	2.5	5.5	3.6	2,510	2,540	218		89	4,220	6.3	DWR-8C71
	5-24-58		86							32	0		1,250						36	9		4,180	7.9	DWR-R2061
	5-17-59		89	3		6	0	855	18	52	15	50	1,290	5.9	1.6	2.8	2,270	2,210	15	0	98	4,320	8.9	DWR-R2559
	5-17-60		89							49	12		1,300						15			4,000	9.1	DWR-R3233
32R1	7-13-57		83	38		389	6	828	17	256	0	1,650	493	1.0	120	5.5	3,670	3,560	996		64			DWR-7877

See footnotes at end of table.

Well number	Date of collection	Depth of well (feet)	Water temperature (°F)	Results in parts per million (ppm) or in milligrams per liter (mg/l)																		Percent sodium	Specific conductance (micromhos at 25°C)	pH	Analyzing laboratory and sample number
				Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids: Calculated (Sum of determined constituents)	Dissolved solids: Residue on evaporation at 180°C	Hardness as $CaCO_3$	Noncarbonate hardness as $CaCO_3$				
U.S. Public Health Service drinking-water standards (1962)					0.3							250	250	0.9	45		500	500							
5N/13E-22J1	5-10-54		72			92	16	281	4.4	277	0	112	394	1.0	24	0.5	1,060	1,130	279		67	1,940	7.5	DWR-P522
	5-23-55		66			75	18	264	4.0	273	0	90	364	1.4	18	.48	969	1,020	261		68	1,560	7.6	DWR-5761
	5-14-57		68	75		38	10	134	2.9	267	0	41	111	1.0	.2	.33	545	547	134		68	836	7.4	DWR-7870
	5-23-58			53		59	12	178	3.1	282	0	72	200	.8	0	.9	718	788	199		66	1,210	8.0	DWR-T2063
5N/14E-15K1	8-15-10					18	18	65		136		72	52				292	289	107		54			RR-10854[1]
	6-26-30					35	5.1	72		134		68	47				313	298	109		59			RR-30934[1]
Cadiz 1	5-23-55		82			26	10	54	2.5	132	0	39	48	1.4	20	.24	266	290	106		51	425	7.8	DWR-5760
	9-30-55		82			26	10	54	2.5	129	0	37	47	1.4	22	.32	264	350	108		51	447	7.7	DWR-6144
	5-25-56									88			44						105			392	7.6	DWR-7007
	5-14-57			40		26	10	54	5.1	138	0	38	46	1.0	12	.17	299	286	105		51	469	7.6	DWR-7869
	5-23-58									136	0		50						105			500	7.9	DWR-T2064
	5-17-59		85							134	0		48						108			487	7.7	DWR-R2552
	5-17-60		82							135	0		47						107			464	7.6	DWR-11479
	5-13-61			45		28	8.5	55	5.4	139	0	38	47	1.2	15	.28	311	310	105	0	52	471	7.9	DWR-12659
	5-20-63									129	0		47						110	4		473	8.3	DWR-15606
	5-11-64			37		30	7.8	53	5.2	138	0	37	50	.6	12	.37	301	298	107	0	50	450	8.0	DWR-L6789
15L1	2-19-32					42	5.1	69		142		79	54				319	300	125		54			RR-32802[1]
	5-10-54		82			28	9	55	5.1	134	0	40	58	1.0	2.5	.35	265	339	107	0	52	472	7.9	DWR-P540
Cadiz 2	9-15-54					29	11	54	5.6	128		39	41	1.0	19	.35	263	295	116	11	49	455	8.0	DWR-R385
	10-18-56									133	0		50						111	2		482	7.5	DWR-7395
	9- 4-58		88	42		25	11	55	5.3	134	0	34	50	.7	12	.6	302	332	105	0	52	516	7.8	DWR-T2546
	5-24-62		87	40		30	8	53	4.7	143	0	36	45	1.1	15	.34	303	316	109	0	50	470	8.2	DWR-2767
5N/15E- 4X1	9-26-03			27		19	5.4	a73		148		51	38				286	334	270					RR[1]
6N/ 6E- 4G1	11-27-17	125		48	0.33	50	7.4	494	17	88	0	547	349		9		1,560	1,680	155		86			DGT-487
6N/11E-30G1	5- 8-53					477	32	1,200	24	22	0	284	2,720	2.6	3.5		4,750	4,910	1,320	1,300	66	7,920	7.0	FC-2645
	5- 8-53					513	15	1,200	23	15	0	225	2,610	3.0	5	2.6	4,600	5,320	1,340	1,330	66	7,920	6.8	FC-2665
30X1	12- -01	1,000				820	6.1	a1,580				409	3,600				6,420		2,080		62			RR
	5- 2-02					771	4.7	1,520				351	3,460				6,110		1,940		63			RR[1]
6N/12E-29P1	12-30-54					320	9	840	15	71	0	1,050	1,120	4.0	5.5	3.9	3,400	3,500	837	779	68	5,350	7.8	FC-3377
	4-25-55					364	2	1,000	17	41	0	1,080	1,430	4.4	7	3.9	3,930	3,990	917	883	70	6,130	7.9	FC-3523
	5-23-55		89			305	2	925	15	49	0	944	1,300	6	8.4	4.2	3,530	3,600	769	729	72	5,210	7.9	DWR-5757
	9-30-55		82							80	0		1,270	4.2					737	676		5,180	7.5	DWR-6138
	5-25-56		86	2		156	15	800	11	10	0	551	1,150	4.5	14	3.2	2,710	2,790	452	443	79	4,130	5.8	DWR-7132
	5-14-57		86	2		86	1	840	12	29	0	347	1,200	2.5	5.5	3.6	2,510	2,540	218		89	4,220	6.3	DWR-8071
	5-24-58		86							32	0		1,250						36	9		4,180	7.9	DWR-R2061
	5-17-59		89	3		6	0	855	18	52	15	50	1,290	5.9	1.6	2.8	2,270	2,210	15	0	98	4,320	8.9	DWR-R2559
	5-17-60		89							49	12		1,300						15			4,000	9.1	DWR-R3233
32R1	7-13-57		83	38		389	6	828	17	256	0	1,650	493	1.0	120	5.5	3,670	3,560	996		64			DWR-T877

See footnotes at end of table.

Well number	Date of collection	Depth of well (feet)	Water temperature (°F)	Results in parts per million (ppm) or in milligrams per liter (mg/l)																				
				Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids: Calculated (Sum of determined constituents)	Dissolved solids: Residue on evaporation at 180°C	Hardness as $CaCO_3$	Noncarbonate hardness as $CaSO_4$	Percent sodium	Specific conductance (micromhos at 25°C)	pH	Analyzing laboratory and sample number
U S Public Health Service drinking-water standards (1962)					0.3							250	250	0.9	45		500	500						
6N/12E-35F1	1955	284		22		200	24	883		67	0	749	1,200		4.0	4.0	3,110	3,140	600		36	4,900	7.6	SE
	9-30-55	284	86			214	3	590	19	29	0	321	1,070	4.0	4.0	3.0	2,240	2,530	539		69	3,500	8.1	DWR-6137
	10-18-56	284	86	25		106	2	735	18	49	0	376	1,170	4.8	12	3.5	2,570	2,820	497		76	4,420	7.7	DWR-7344
	3- 5-57					219	.5	660	21	40	0	380	1,140	3.6	3.0	3.4	2,450	2,700	549	514	72	4,170	7.6	PC-1065
	5-14-57	284	84	25		213	2	642	19	42	0	358	1,090	3.6	10	2.4	2,390	2,590	540		71	3,980	7.0	DWR-7872
	5-24-57	284	86							23	0		1,090						430			3,930	7.7	DWR-R2056
	9- 4-58	284	89							32			1,100						557	531		3,980	6.8	DWR-9449
	5-17-59	284	87	23		222	1	605	28	24	0	310	1,120	4.2	2.5	2.0	2,330	2,420	560	217	69	3,140	7.2	DWR-R2606
	9-10-59	284	86							27	0		1,110						553			4,180	7.9	DWR-R2805
	6-17-60	284	86	28		224	2.9	663	18	27	0	306	1,220	3.8	3.0	2.5	2,480	2,660	571		71	4,070	7.3	DWR-11469
	5-13-61	284	85							29	0		1,160						580	556		4,100	7.6	DWR-12629
	5-25-62	284	86	23		225	12	640	18	23	0	309	1,200	2.8	0	2.8	2,440	2,860	613	593	69	4,000	7.7	DWR-2757
	5-20-63	284	85	13		230	4.3	750	23	18	0	322	1,310	3.0	0	3.3	2,670	3,100	593	578	72	4,200	6.4	DWR-L4490
	6- 5-64	284	88	19		230	36	720	22	21	0	313	1,380	3.0	0	3.9	2,740	2,830	725	708	68	4,000	7.5	DWR-L6788
6N/14E-31A1	1-12-61					28	5	70	5.1	156	0	39	49	1.8	13	.57	288	342	93	0	61	514	7.8	PC-5927
	5-13-64	154		36		29	6.3	74	5.5	53	0	42	53	2.0	11	.6	285	332	98	0	60	500	8.1	DWR-L6775
31J1	1-16-61	270				18	5	72	5.3	142	0	35	45	1.9	8.6		261	297	64	0	68	455	8.0	PC-5928
	5-13-64			32		26	4.9	67	5.2	134	0	39	55	2.0	12	.47	310	320	84	0	62	450	7.8	DWR-L6784
32E1	4- 2-62					22	6	66	5.5	146	0	32	39	2.2	18	.28	263	284	82	0	62	449	8.0	PC-6575
	5-12-64			29		22	7.1	62	5.1	145	0	34	35	2.0	15	.33	282	288	83	0	60	430	8.1	DWR-L6780
33M2	5-17-60	600	89	41		19	6	74	5.1	143	0	37	46	2.4	17	.26	318	290	73		67	482	7.9	DWR-R3247
	9-20-60	600		20		7	5	70	7.2	98	4	20	64	4.7	9	.36	250	320	35	0	80	447	9.9	DWR-L294
	5-13-61	600								127	10	49							69	0		490	8.3	DWR-12628
	5-25-62	600		33		20	6	78	5	143	0	55	47	2.5	12	.24	329	336	76	0	68	510	8.2	DWR-2734
	5-20-63			39		16	5.5	80	5.4	146	0	39	43	2.9	12	.36	315	320	63	0	71	508	8.1	DWR-15508
	5-11-64			33		19	4.6	83	4.9	144	0	44	50	3.0	12	.40	325	318	67	0	71	500	8.1	DWR-L6781
32N1	5-10-54		91			22	8.1	89	5.5	141	0	51	74	3.6	14	.38	337	414	89	0	67	585	8.0	DWR-P533
	9-15-54		91			25	3	98	5.9	137	0	54	73	1.4	13	.45	341	365	74	0	72	602	7.6	DWR-R383
	5-23-55		91			23	5	92	5.6	134	0	50	69	5.0	9.4	.38	325	355	78	0	70	627	8.0	DWR-5759
	9-30-55									144	0		72	4.0					77	0		594	8.0	DWR-6143
	5-25-56			25		13	4	88	4.8	122	0	48	67	4.0	1.0	.42	315	300	49		78	467	7.7	DWR-7118
	10-17-56		92							137	0								81			536	7.3	DWR-7394
	5-14-57			35		18	7	91	5.1	137	0	53	69	4.0	7.8	.41	357	384	75		71	596	7.3	DWR-7991
	5-23-58									140	0		73						75			602	7.5	DWR-R2063
	9- 4-58									140	0		76						75	0		613	7.3	DWR-T2532
	5-17-59		91							137	0		69						78	0		594	7.7	DWR-R2553
	5-16-60									134	0		71						72	0		572	7.4	DWR-11546
	5-13-61			30		82	8	96	5.2	143	0	70	71	2.5	8.2	.48	383	380	88	0	69	590	7.7	DWR-L1263
	5-24-62			37		24	3.8	93	4.5	139	0	50	69	2.8	8.0	.42	360	376	75	0	72	578	8.1	DWR-2774
	5-20-63			24		20	7.4	88	5.6	139	0	50	66	4.0	9.0	.46	342	386	80	0	69	590	8.2	DWR-L4488
	5-11-64			36		25	3.9	94	5.4	142	0	55	75	2.8	8.6	.37	376	374	78	0	71	570	8.1	DWR-L6787
7N/ 8E- 8B1	1883	(d)															470							RR[1]/
	1883	(e)															521							RR[1]/
7N/ 9E-25Z1	4-15-02					31	4.3	441		593		357	136				1,260		91					RR
7N/11E-36K1	6- 5-64		73	31		30	7.2	110	5.3	205	0	82	56	1.4	16	.86	441	446	105	0	68	690	7.8	DWR-L6800

Chambless Wells

1. Analysis calculated by the Geological Survey from hypothetical combinations.
2. Analysis also indicates 383 ppm strontium (Sr).

d. Water sample collected from 285-foot depth.
e. Water sample collected from 1,048-foot depth.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)

5N/12E-5Z1. 12-inch casing reduced to 6-inch casing. No lengths given. Altitude about 639 ft.

No record	1,500	1,500	Bedrock	25	1,525

Cadiz 1

5N/14E-15K1. Drilled by L. A. Clampitt Co. 12-inch casing 0-300 ft, 10-inch casing 0-400 ft, open hole 400-425 ft. Altitude about 820 ft.

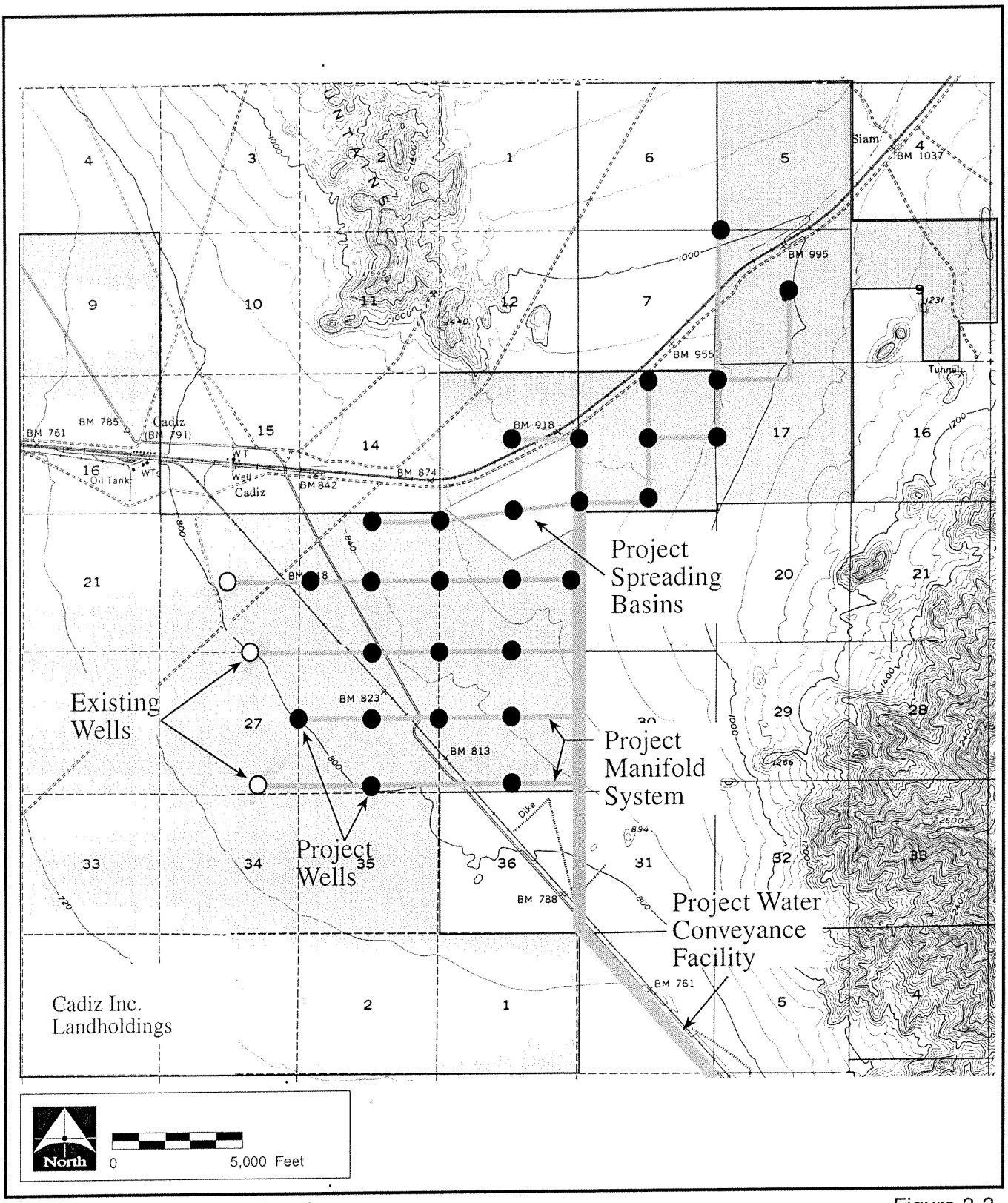
Gravel, cemented	210	210	Sand	100	360
Gravel and sand	50	260	Sand, cemented	65	425

Cadiz 2

5N/14E-15L1. Drilled by A. F. Fulkerson Co. 20-inch casing 0-207 ft, 12-inch casing 0-541 ft, perforated 214-280 ft and 490-535 ft. Altitude about 820 ft.

Sand	3	3	Sand, clay, and gravel	64	406
Sand and gravel, hard-	32	35	Sand, cemented	8	414
Sand, shaly; and clay-	14	49	Gravel, large	12	426
Sand and gravel, cemented	12	61	Clay, white	3	429
Sand and clay	9	70	Sand, fine	6	435
Gravel, dry and large-	15	85	Sand, hard and cemented	4	439
Sand and rocks	100	185	Sand, fine	5	444
Sand, cemented	3	188	Clay, yellow	6	450
Clay, sandy; and gravel	26	214	Gravel and sand	10	460
Sand, coarse	9	223	Clay and sand	8	468
Sand; and rocks, large	37	260	Clay, yellow	31	499
Sand; clay; and gravel, coarse	48	308	Sand, cemented	1	500
Sand, cemented	3	311	Sand, coarse	7	507
Sand, clay, and gravel	19	330	Clay, yellow	15	522
Sand, cemented; and gravel, large	12	342	Sand, clay, and gravel	19	541

Attachment D



Source: P&D Consultants, Inc. (1999).

Figure 3-3

Cadiz Groundwater Storage & Dry-Year Supply Program

Final EIR/EIS

Proposed Wellfield and Manifold System

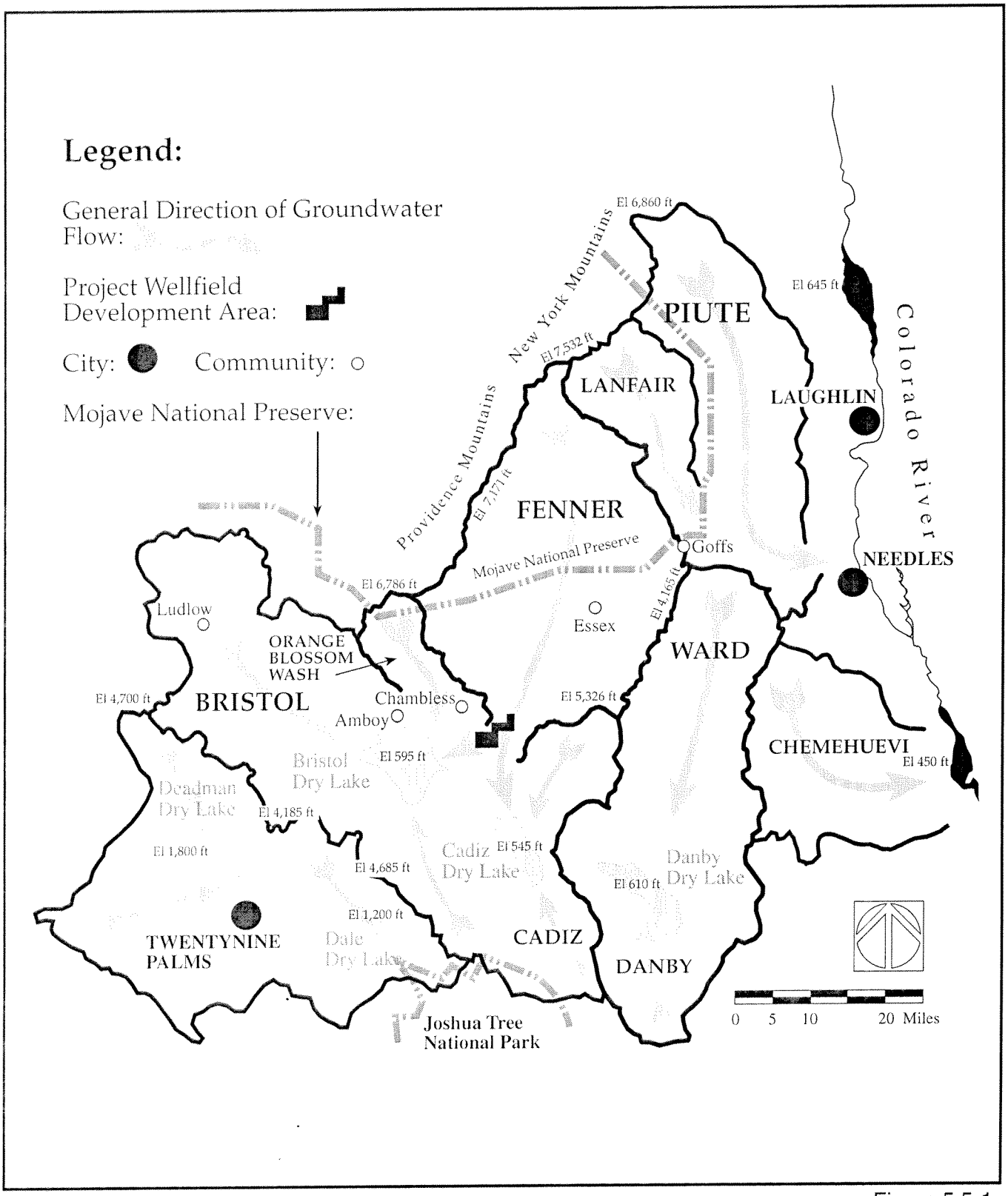


Figure 5.5-1

Location of Neighboring National Parks Units and Nearby Communities in Relation to the Project Area Regional Watersheds

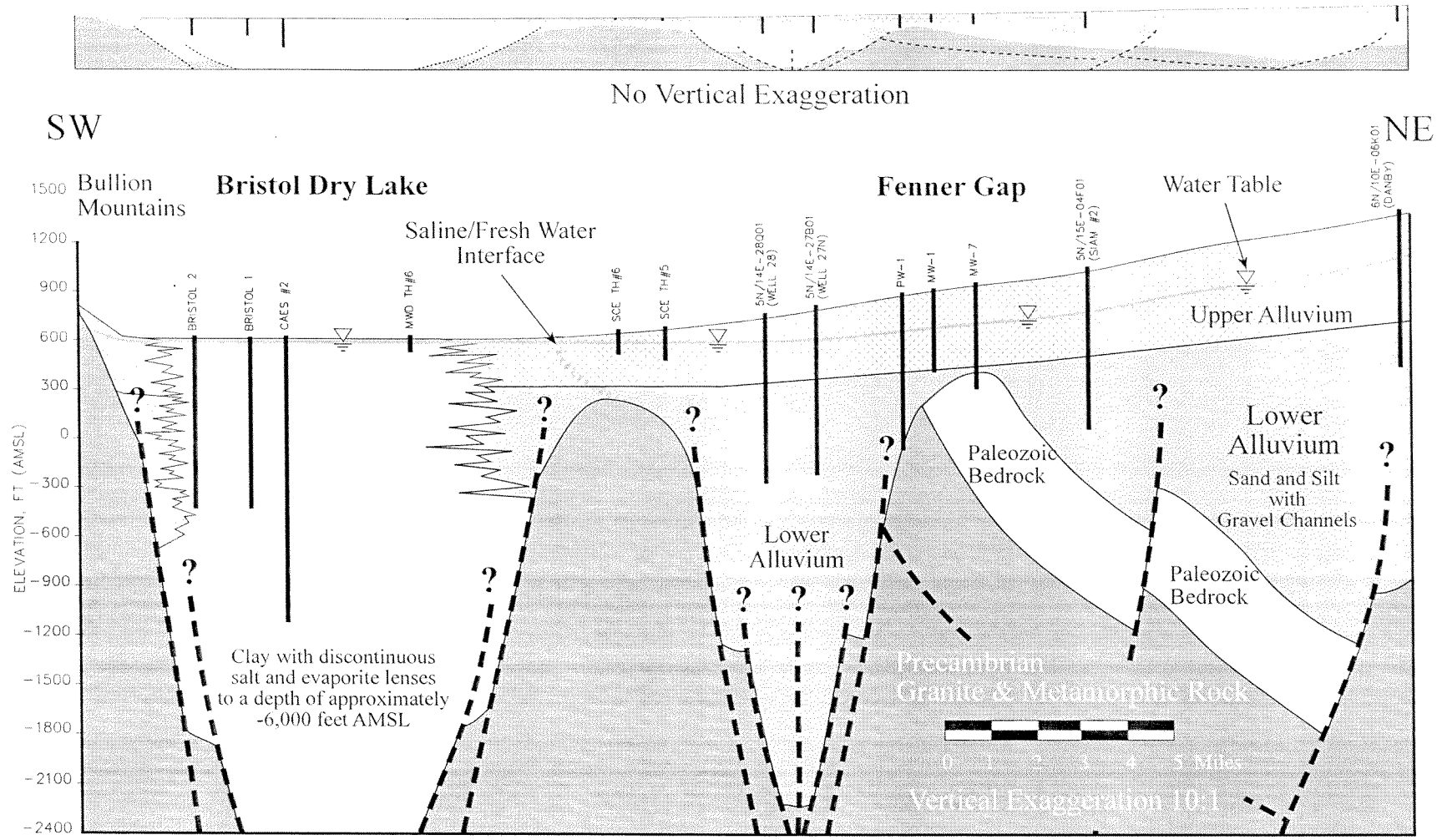
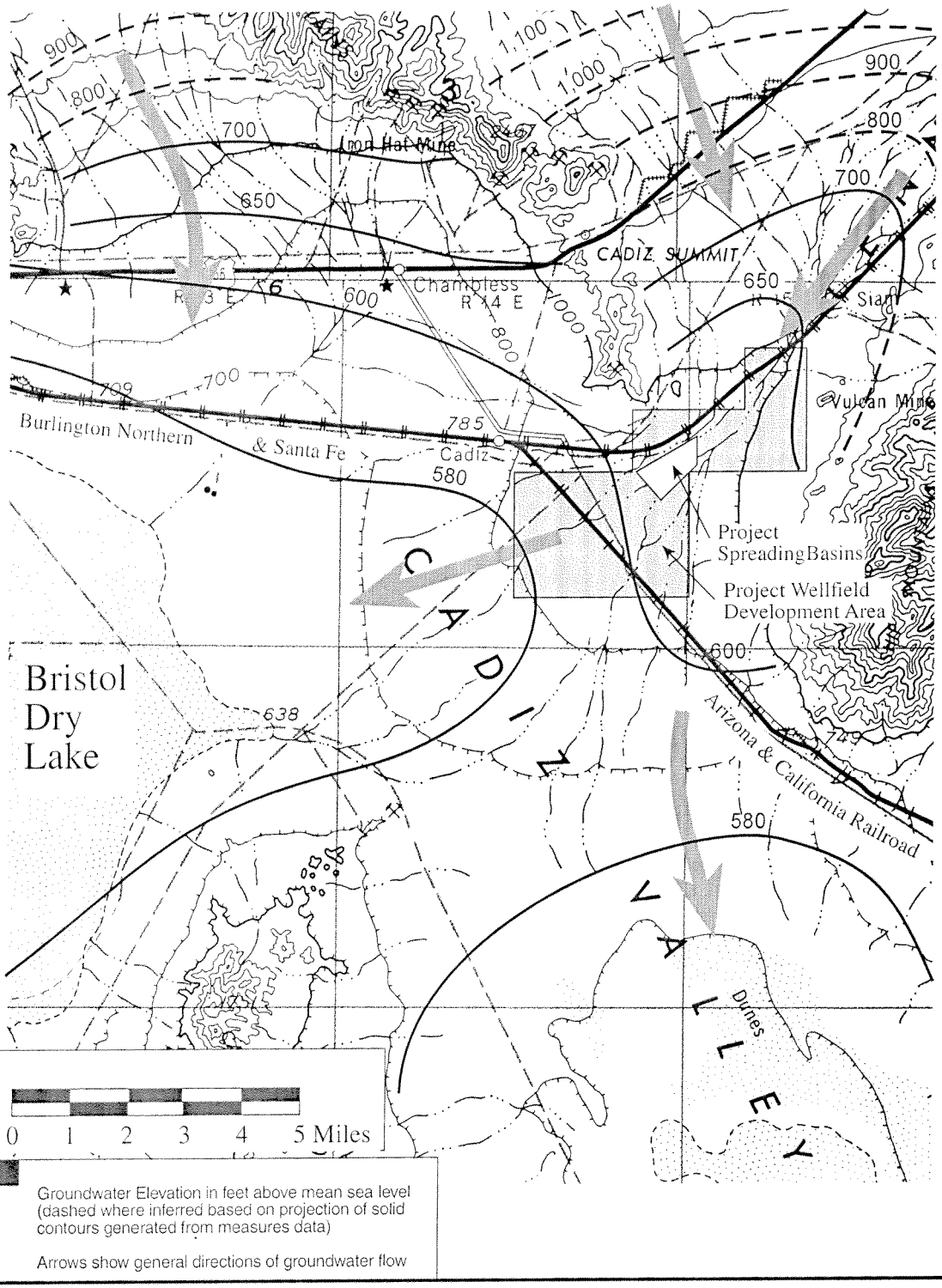


Figure 5.5-10

Cadiz Groundwater Storage & Dry-Year Supply Program

Final EIR/EIS

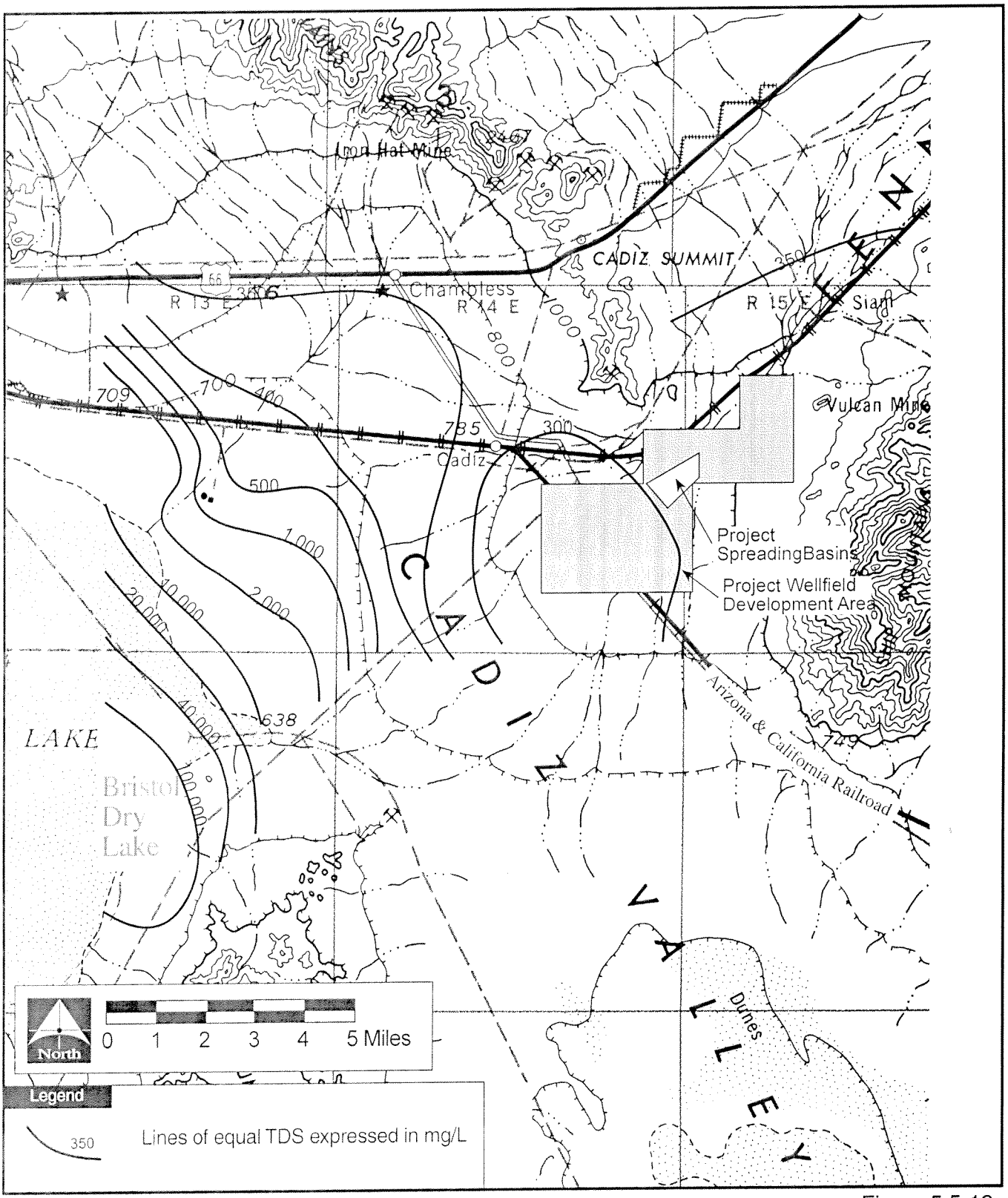
Generalized Aquifer Cross Section from Fenner Valley to Bristol Dry Lake



Source: Metropolitan Water District (1999b).

Figure 5.5-11

Groundwater Elevation Contour Map for Fenner Gap Portion of the Project Area



Source: Metropolitan Water District (1999b).

Figure 5.5-12

Cadiz Groundwater Storage & Dry-Year Supply Program

Final EIR/EIS

Total Dissolved Solids in Groundwater in the Fenner Gap and Bristol Dry Lake Areas

BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT
COMMISSION OF THE STATE OF CALIFORNIA
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APPLICATION FOR CERTIFICATION
For the SES SOLAR ONE PROJECT

Docket No. 08-AFC-13

PROOF OF SERVICE
(Revised 12/2/09)

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DECLARATION OF SERVICE

I Corinne Lytle , declare that on January 15, 2010, I served and filed copies of the attached Applicant's Submittal of Additional Information Regarding Project Water Supply.The original document, filed with the Docket Unit, is accompanied by a copy of the most recent Proof of Service list, located on the web page for this project at:

[www.energy.ca.gov/sitingcases/solarone].

The documents have been sent to both the other parties in this proceeding (as shown on the Proof of Service list) and to the Commission's Docket Unit, in the following manner:

(***Check all that Apply***)

FOR SERVICE TO ALL OTHER PARTIES:

____ sent electronically to all email addresses on the Proof of Service list;

____ by personal delivery or by depositing in the United States mail at with first-class postage thereon fully prepaid and addressed as provided on the Proof of Service list above to those addresses **NOT** marked "email preferred."

AND

FOR FILING WITH THE ENERGY COMMISSION:

____ sending an original paper copy and one electronic copy, mailed and emailed respectively, to the address below (***preferred method***);

~~***OR***~~

depositing in the mail an original and 12 paper copies, as follows:

CALIFORNIA ENERGY COMMISSION
Attn: Docket No. 08-AFC-13
1516 Ninth Street, MS-4
Sacramento, CA 95814-5512
docket@energy.state.ca.us

I declare under penalty of perjury that the foregoing is true and correct.

Original signed by

Corinne Lytle

*indicates change