APPENDIX J

Groundwater Resources Investigation Report
JVR Energy Park Project

Groundwater Resources Investigation Report
JVR Energy Park Project
Jacumba Hot Springs, San Diego County, California

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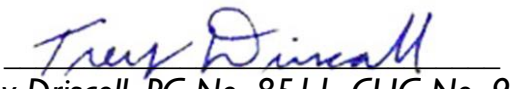

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AUGUST 2020

Printed on 30% post-consumer recycled material.

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
AC	alternating current
afy	acre-feet per year
amsl	above mean sea level
bgs	below ground surface
CIMIS	California Irrigation Management Information System
County	County of San Diego
ET	potential evapotranspiration
ETo	reference evapotranspiration
ft^2/day	square feet per day
GMMP	Groundwater Monitoring and Mitigation Plan
gpm	gallons per minute
JCSD	Jacumba Community Services District
kV	kilovolt
O&M	operations and maintenance
Proposed Project	JVR Energy Park Project
SDG&E	San Diego Gas & Electric
µg/L	micrograms per liter

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EXECUTIVE SUMMARY

Dudek has prepared this Groundwater Resources Investigation Report to evaluate the potential impact of groundwater extraction from the construction and operation of the proposed JVR Energy Park Project (Proposed Project) located within Jacumba Hot Springs, California.

The Proposed Project would involve the use of existing on-site wells (Well #2 and Well #3) for groundwater supply. This analysis addresses potential impacts on groundwater resources based on the Proposed Project requiring up to 140 acre-feet during construction (approximately 1 year), 11 acre-feet per year for ongoing operations and maintenance, and 50 acre-feet for decommissioning and dismantling. The significant results of this Groundwater Resource Investigation Report are as follows:

- The water demand from Well #2 and Well #3 is expected to be up to 45.6 million gallons, or 140 acre-feet, for construction to occur over an approximate 1-year period.
- The current groundwater storage in the Jacumba Valley alluvial aquifer, including the portion of the alluvial aquifer located in Mexico, is conservatively estimated to be 9,005 acre-feet based on updated groundwater level data and updated interpreted depth to bedrock using additional well logs.
- The volume of groundwater in storage would not be reduced to 50% or less than the current groundwater storage in the aquifer as a result of additional pumping for Proposed Project water supply.
- Estimated drawdown was based on groundwater production for the construction phase from either Well #2 or Well #3 at a rate of 352, 87, and 17 gallons per minute (rounded) for 90 days, 1 year, and 5 years, respectively. These adjusted production rates equal 140 acre-feet for each time period.
- The nearest off-site well to Well #2 is the Highland Center Well, located 1,817 feet (0.34 miles) to the west. The estimated groundwater level drawdown at the Highland Center Well is predicted to be 1.08 feet, 0.34 feet, and 0.08 feet after 90 days, 1 year, and 5 years, respectively.
- No groundwater wells are located within a 0.5-mile radius of Well #3. The nearest off-site well, Well Km, is located 3,548 feet (0.67 miles) from Well #3. The estimated groundwater level drawdown at Well Km is predicted to be 0.15 feet, 0.17 feet, and 0.08 feet after 90 days, 1 year, and 5 years, respectively.
- Based on the County of San Diego well interference threshold guidance for alluvial wells, drawdown from Well #2 and Well #3 groundwater extraction would be less than significant.

- The estimated drawdown at the nearest groundwater-dependent habitat from pumping Well #2 is predicted to be 1.08 feet, 0.34 feet, and 0.08 feet after 90 days, 1 year, and 5 years, respectively.
- The estimated drawdown at the nearest groundwater-dependent habitat from pumping Well #3 is predicted to be 3.66 feet, 1.11 feet, and 0.27 feet after 90 days, 1 year, and 5 years, respectively.
- Based on the County of San Diego groundwater-dependent habitat threshold guidance for alluvial wells, drawdown from Well #2 and Well #3 groundwater extraction would be less than significant. Estimated drawdown at the nearest groundwater-dependent habitat from pumping Well #2 and Well #3 is temporary and less than 3 feet at 1 year and 5 years. Furthermore, current groundwater levels in Well #3 are at least 12 feet higher than the historical low groundwater level recorded in the Jacumba Valley alluvial aquifer (Exhibit 2, Well K3). Therefore, drawdown as a result of Proposed Project groundwater use would be unlikely to exceed the historical low groundwater level, and impacts to groundwater-dependent habitat are anticipated to be less than significant.
- Well #2 and Well #3 are proposed to be a non-potable water source; therefore, no water quality analysis was performed for this report.

A separate Groundwater Monitoring and Mitigation Plan (GMMP, Appendix E) has been prepared for theproposed groundwater extraction from Well #2 and Well #3. The GMMP establishes groundwater level thresholds for off-site well interference and groundwater-dependent habitat. Additionally ,the GMMP details requirements for ongoing groundwater level and production monitoring and reporting to the County of San Diego

1 INTRODUCTION

1.1 Purpose of the Report

This Groundwater Resources Investigation Report was prepared on behalf of JVR Energy Park LLC by Dudek for submittal to County of San Diego (County) Planning and Development Services to satisfy groundwater resource investigation scoping requirements outlined in Guidelines for Determining Significance and Report Format and Content Requirements: Groundwater Resources (County of San Diego 2007) for the proposed JVR Energy Park Project (Proposed Project). This groundwater resource investigation evaluates the use of up to 140 acre-feet of water during Proposed Project construction, 11 acre-feet per year (afy) for ongoing operations and maintenance (O&M), and 50 acre-feet for decommissioning, which would occur after the Proposed Project has reached its expected lifetime (i.e., approximately 38 years). Proposed Project water would be supplied from two on-site groundwater wells.

The results of this groundwater investigation should not be relied upon for use in any other groundwater proposal subject to County review in Jacumba Hot Springs, California.

1.2 Project Location

The Project site is located within the Jacumba Subregional Group Area of the Mountain Empire Subregional Plan Area in unincorporated San Diego County (Figure 1, Regional Location). The Project site is located on approximately 1,356 acres in southeastern San Diego County. The Proposed Project's solar facilities would be within an approximately 643-acre fenced area south of Interstate 8, east of Jacumba Hot Springs, and immediately north of the U.S./Mexico border. The Major Use Permit boundary is an approximately 643-acre area within the Project site (Figure 2, Vicinity Map).

1.3 Project Description

The Proposed Project would have a rated capacity of up to 90 megawatts of alternating current (AC) generating capacity and would consist of photovoltaic modules fitted on single-axis solar trackers. In addition to the panels and direct current to AC conversion equipment (i.e., inverter and transformer units), the Proposed Project would include the following primary components:

- Approximately 300,000 photovoltaic (PV) modules mounted on support structures (single-axis solar trackers)
- A 1,000- to 1,500-volt direct current (DC) underground collection system linking the modules to the inverters

- 25 inverter/transformer platforms, located throughout the solar facility, to convert the power generated by the modules into a compatible form for use with the transmission network
- Approximately 5,000 feet of 34.5-kilovolt (kV) underground AC collection system and 50 feet of overhead AC feeders, approximately 30-feet-tall linking the inverters to the on-site collector substation
- An on-site collector substation located within an approximately 27,360-square-foot area (152 feet by 180 feet)
- A 138 kV switchyard adjacent to the on-site collector substation to transfer power from the on-site collector substation to the existing SDG&E 138 kV transmission line
- A 138 kV, 220-foot-long 65-foot-high overhead slack span transmission line to connect the on-site collector substation to the switchyard
- Two 138 kV overhead transmission lines (gen-tie) to loop the switchyard into the existing SDG&E Boulevard – East County 138 kV transmission line on five 70- to 115-foot-tall transmission poles
- A battery energy storage system of up to 90 MW (or 180MWh) comprised of battery storage containers located adjacent to the inverter/transformer pads (up to 3 containers at each location for a total of 75 containers on site)
- Fiber optic line
- Control system
- Five meteorological weather stations
- Site access driveways
- Internal access
- Improvements within SDG&E Transmission Corridor
- Security fencing and signage
- Lighting
- Water tanks (fire protection)
- Fuel modification zones (FMZs)
- Landscaping

The switchyard would be sized to accommodate the full 90-megawatt (AC) solar facility and the proposed battery energy storage system. The Proposed Project would be located entirely on private

lands within unincorporated San Diego County. Upon completion, the Proposed Project would be monitored and operated off site through a supervisory control and data acquisition (SCADA) system.

Access to the Project site would be provided via five access driveways, including an access driveway off of Old Highway 80 and off Carrizo Gorge Road.

1.4 Project Water Demand

The following discussion includes an estimate of the amount of water required for the Proposed Project during construction, ongoing O&M, and decommissioning. Groundwater demand would be supplied from on-site Well #2 and Well #3 (Figure 2). The Proposed Project would require a maximum water demand of approximately 358,436 gallons per day (approximately 250 gallons per minute [gpm]) for approximately the first 6 weeks during grading activities. The existing on-site wells have the capacity to supply the peak construction water demand. Total construction water demand is expected to be 140 acre-feet over 365 days. Estimated construction water demand by construction activity is provided in Table 1 (a detailed construction water demand estimate is provided in Appendix A, Construction and Operational Water Demand Estimates).

Table 1
Estimated Construction Water Demand

Activity	Description	Total Estimated Water Demand (acre-feet)[1]
Site preparation (clearing, grubbing, grinding, and dust control)	Limited clearing and grubbing will be required for fallowed agricultural land at Jacumba Valley Ranch. Assume pre-weeding od soils with 1-inch of water over 570.5 acres	48
Grading	Grading of 264,000 cubic yards. Uses estimated of on-site moisture and optimum soil of moisture to gain compaction to determine required input of water	39
Concrete	Estimated based on 65 enclosures with concrete pads measuring 14 feet by 44 feet by 1 foot. One substation pad measuring 110 feet by 215 feet by 1.5 feet. Assumes concrete free installation of beams driven into the soil using a pile/vibratory/rotary driving technique. +100% contingency added for uncertainty. Additional 15% added for additional concrete use for fence posts, lighting posts etc.	1
Dust abatement[2]	Value used from Jacumba Solar Construction Estimate: (6) 3,000-gallon water trucks per day	37
Other construction needs	Water necessary for other construction needs, such as filling tanks for fire protection; washing stations for vehicles/equipment (noxious weed mitigation); the 1,500-foot gen-tie line; and hydroseeding	15
	Total Construction Water Use	**140**

1 1 acre-foot equals 325,851 gallons.
2 Dust abatement is included in the estimate for initial site preparation (first 40 days); therefore, general dust abatement was assumed to occur over 104 days (i.e., the remainder of the construction phase).

During operation, the Proposed Project would require water for panel washing up to four times per year. Similar solar photovoltaic operations use approximately 0.3 gallons of water per square yard of panel. Based on the planned 90 MW capacity of the Proposed Project, approximately 300,000 panels at approximately 21 square feet per panel totaling 6,259,500 square feet (695, 500 square yards) may be washed up to 4 times per year. Annual water demand for panel washing is approximately up to 2.6 acre-feet. Irrigation of a landscape buffer is estimated at up to 8.4 acre-feet per year. Total operational water demand is estimated to be up to 11 afy (Table 2). A detailed operational water demand estimate is provided in Appendix A. Actual water use during operation for panel washing may be considerably less based on documented water demand for the nearby active Jacumba Solar project. In 2019, the Jacumba Solar Project used no water for project operation (Dudek 2020a).

Table 2
Estimated Operational Water Demand

Activity	Estimated Water Demand (acre-feet)
Panel washing (up to 4 times per year)	2.6
Landscape buffer	8.4
Total Water Use per Year	**11**

It is estimated that the amount of water necessary to decommission the Proposed Project would be less than that required for construction, because there would be no need to use water for concrete mixing or to hydrate and compact on-site fills. The activities associated with decommissioning would not include grading, and based on the estimates calculated for construction, water demand for decommissioning dust abatement would be approximately 40 acre-feet of water total. Additional equipment washing and modest compaction needs, if necessary, would require approximately 10 acre-feet.

The total estimated water demand for decommissioning is approximately 50 acre-feet (Table 3).

Table 3
Estimated Decommission and Dismantling Water Demand

Activity	Total Estimated Water Demand (acre-feet)
Decommission Dust Abatement	40
Equipment Washing and Compaction	10
Total Water Use	**50**

1.5 Study Area

The study area for the purpose of discussions of groundwater storage is the Quaternary alluvium, referred to as the Jacumba Valley alluvial aquifer. The study area for the purpose of discussions of recharge consists of Flat Creek (which includes Blue Angel Peak and an unnamed subwatershed; naming convention adopted from Swenson 1981), Boundary Creek, and a portion of Walker Canyon-Carrizo Creek subwatersheds (referred to in this report as "contributing watersheds"). The study area for the purpose of well interference is the 0.5-mile radius around Well #2 and around Well #3.

1.6 Applicable Groundwater Regulations

The County of San Diego Guidelines for Determining Significance and Report Format and Content Requirements: Groundwater Resources (County Guidelines) contain a series of significance thresholds for groundwater quantity and groundwater quality (County of San Diego 2007). The County Guidelines contain the following guidelines that, if met, would be considered a significant impact to local groundwater resources as a result of Proposed Project implementation.

To evaluate impacts to groundwater resources, a water balance analysis is typically required; the following guideline for determining significance is typically used (County of San Diego 2007):

> For proposed projects in fractured rock and sedimentary basins, groundwater impacts will be considered significant if a soil moisture balance, or equivalent analysis, conducted using a minimum of 30 years of precipitation data, including drought periods, concludes that at any time groundwater in storage is reduced to a level of 50% or less as a result of groundwater extraction.

To evaluate off-site well interference in alluvial wells, the following guideline for determining significance is typically used (County of San Diego 2007):

> As an initial screening tool, off-site well interference will be considered a significant impact if after a five year projection of drawdown, the results indicate a decrease in water level of 5 feet or more in the off-site wells. If site-specific data indicates alluvium or sedimentary rocks exist which substantiate a saturated thickness greater than 100 feet in off-site wells, a decrease in saturated thickness of 5% or more in the off-site wells would be considered a significant impact.

To evaluate groundwater quality impacts, the following guideline for determining significance is typically used (County of San Diego 2007):

> Groundwater resources for proposed projects requiring a potable water source must not exceed the Primary State or Federal Maximum Contaminant Levels (MCLs) for applicable contaminants. Proposed projects that cannot demonstrate compliance with applicable MCLs will be considered to have a significant impact. In general, projects will be required to sample water supply wells for nitrate, bacteria (fecal and total coliform), and radioactive elements. Projects may be required to sample other contaminants of potential concern depending on the geographical location within the County.

The Proposed Project does not propose to use groundwater as a potable water source, so the above guideline for determining significance does not apply.

To evaluate impacts to groundwater-dependent habitat, the following guideline for determining significance is typically used (County of San Diego 2010a):

> The project would draw down the groundwater table to the detriment of groundwater-dependent habitat, typically a drop of 3 feet or more from historical low groundwater levels.[1]

The County adopted the San Diego County Groundwater Ordinance in 1991; it was last amended in 2013. The ordinance establishes regulations for the protection, preservation, and maintenance of groundwater resources and is contained within the San Diego County Code of Regulatory Ordinances, Title 6, Division 7 Chapter 7 Groundwater Sections 67.701–67.750 (County of San Diego 2013). The purpose of the ordinance is to ensure that development would not occur in groundwater-dependent areas of the County unless adequate supplies are available to serve both existing and proposed uses. Section 67.722, All Other Projects, regulates all areas within the County outside Borrego Valley and any future groundwater impacted basins. For discretionary permit applications, the following findings must be made: (1) For projects using greater than 20 afy or 20,000 gallons per day, that groundwater resources are adequate to meet the groundwater demands both of the project and the groundwater basin if the basin were developed to the maximum density and intensity permitted by the General Plan, and (2) for all other projects, that groundwater resources are adequate to meet the groundwater demands of the project.

The San Diego Groundwater Ordinance defines a "water intensive use" as, "Any land use that requires a permit listed in Section 67.711 and is not exempt from this ordinance, and that will

[1] Studies have found that groundwater elevation reductions adversely affect native plant species. Two of the referenced studies (Integrated Urban Forestry 2001 and National Research Council 2002) found that a permanent reduction in groundwater elevation of greater than 3 feet is enough to induce water stress in some riparian trees, particularly willow (*Salix* spp.), cottonwood (*Populus* spp.), and *Baccharis* species.

require more water than 20 afy or more than 20,000 gallons per day." While there is an initial peak water demand required for Proposed Project construction, operational water demands are minimal, and when Proposed Project water demands are amortized over the life of the Proposed Project, do not represent a water intensive use.

Updated (and adopted) in August 2011, the San Diego County General Plan guides future growth in the unincorporated areas of the County and considers projected growth anticipated to occur within various communities. The Land Use Element includes a requirement to encourage sustainable use of groundwater and properly manage groundwater recharge areas (LU-8). Specifically, Goal LU-8 includes the following policies (County of San Diego 2011):

- Policy LU-8.1: Require land use densities in groundwater dependent areas to be consistent with the long-term sustainability of groundwater supplies, except in the Borrego Valley.
- Policy LU-8.2: Require development to identify adequate groundwater resources in groundwater dependent areas, as follows:
    - In dependent areas within currently identified groundwater overdrafted basins, prohibit new development from exacerbating overdraft conditions, and
    - In areas without current overdraft groundwater conditions, evaluate new groundwater-dependent development to assure a sustainable long-term supply of groundwater is available that will not adversely impact existing groundwater users.
- Policy LU-8.3: Discourage development that would significantly draw down the groundwater table to the detriment of groundwater-dependent habitat.

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2 EXISTING CONDITIONS

2.1 Topographic and Hydrologic Setting

Jacumba Hot Springs is located in the southeastern corner of San Diego County and is bordered by Imperial County to the east and Mexico to the south (Figures 1 and 2). The general topography of the Project site within the Jacumba Valley is gently rolling. The Project site has been previously disturbed for agricultural purposes. The elevation range within the Project site is from approximately 2,715 feet to 2,915 feet above mean sea level (amsl).

The contributing watersheds to the Project site cover 70,868 acres (111 square miles), with 76% located in Baja California, Mexico. The contributing watersheds are located in the Upper Carrizo Creek watershed as defined by the U.S. Geological Survey (Figure 3, Hydrologic Areas). The majority of flow from Mexico north into the Jacumba Valley is derived from the Flat Creek subwatershed, which includes Blue Angel Peak and an unnamed subwatershed. The subwatersheds predominantly located in the United States are the Boundary Creek and Walker Canyon-Carrizo Creek subwatersheds. The Jacumba Valley ultimately drains through a narrow constriction north of Jacumba Hot Springs known as the Carrizo Gorge.

The Flat Creek subwatershed consists of approximately 51,052 acres, with 134 acres (0.26%) of the watershed located in the United States. The Flat Creek subwatershed ranges from 4,774 feet amsl at its headwaters along the Sierra Juarez Mountains to 2,800 feet amsl near the international border. The Boundary Creek subwatershed consists of approximately 12,535 acres, with 10,106 acres (81%) of the watershed located in the United States. The Boundary Creek subwatershed ranges from 4,240 feet amsl and its headwaters along the Tecate Divide to 2,788 feet amsl. The Walker Canyon-Carrizo Creek subwatershed consist of approximately 7,281 acres, with 6,927 acres (95%) of the watershed located in the United States. The Walker Canyon-Carrizo Creek subwatershed ranges from 4,097 feet amsl at Table Mountain to 2,713 feet amsl at the north end of the Project site (Google Earth 2015).

2.2 Climate

Jacumba Hot Springs experiences warm summer months and cool winters. Average temperatures vary greatly within the region. Mean maximum temperatures in the summer months reach the high-80s to low-90s degrees Fahrenheit. Temperatures may fall below freezing in the winter, with snow levels occasionally below 2,500 feet (WRCC 2019).

2.2.1 Precipitation

The precipitation that recharges the Project site falls within the contributing watersheds. Monthly precipitation records were obtained from the County for a rain gauge previously located in Jacumba at 32°37' North latitude, 116°11' West longitude, and an elevation of 2,800 feet. The period of record available is from March 1963 until March 2011. Table 4 provides average monthly precipitation data, as well as the highest and lowest monthly precipitation for the Jacumba rain gauge (Allan 2013).

Table 4
Precipitation Data Recorded at Jacumba Rain Gauge

Month	Rainfall (inches) for 1963–2011[a]		
	Average	*Highest / Year*	*Lowest[b]*
January	1.45	5.79 / 1983	0
February	1.66	10.86 / 1993	0
March	1.82	6.76 / 1998	0
April	1.45	7.13 / 1991	0
May	0.50	2.38 / 1965	0
June	0.19	2.24 / 1981	0
July	0.06	0.96 / 1984	0
August	0.45	3.97 / 1984	0
September	0.50	3.48 / 1992	0
October	0.37	4.58 / 1976	0
November	0.60	4.37 / 2004	0
December	0.85	3.82 / 1965	0
Year	9.64	22.16 / 1982–1983	2.26

Source: Allan 2013.
Notes: Jacumba rain gauge was located at N 32°37', W 116°11', at an elevation of 2,800 feet.
a. Jacumba rain gauge was active from 1963 to 2011.
b. Lowest monthly recorded precipitation data is not available due to data gaps.

For the period from 1963 through 2011, the average annual precipitation at the Jacumba rain gauge was approximately 9.64 inches, with 85% of the precipitation occurring between October and April. Annual precipitation totals at the Jacumba rain gauge varied from a high of 22.16 inches in the 1982–1983 water year to a low of 2.26 inches in the 2001–2002 water year (Allan 2013) (see Exhibit 1).

Precipitation records from four nearby rain gauges were obtained to determine annual average rainfall within the watersheds. The rain gauges are located in Boulevard (two stations), Tierra del Sol, and Jacumba. The locations, elevations, years of operation, mean annual rainfall, and source of data are provided in Table 5.

Table 5
Rain Gauges in Project Area

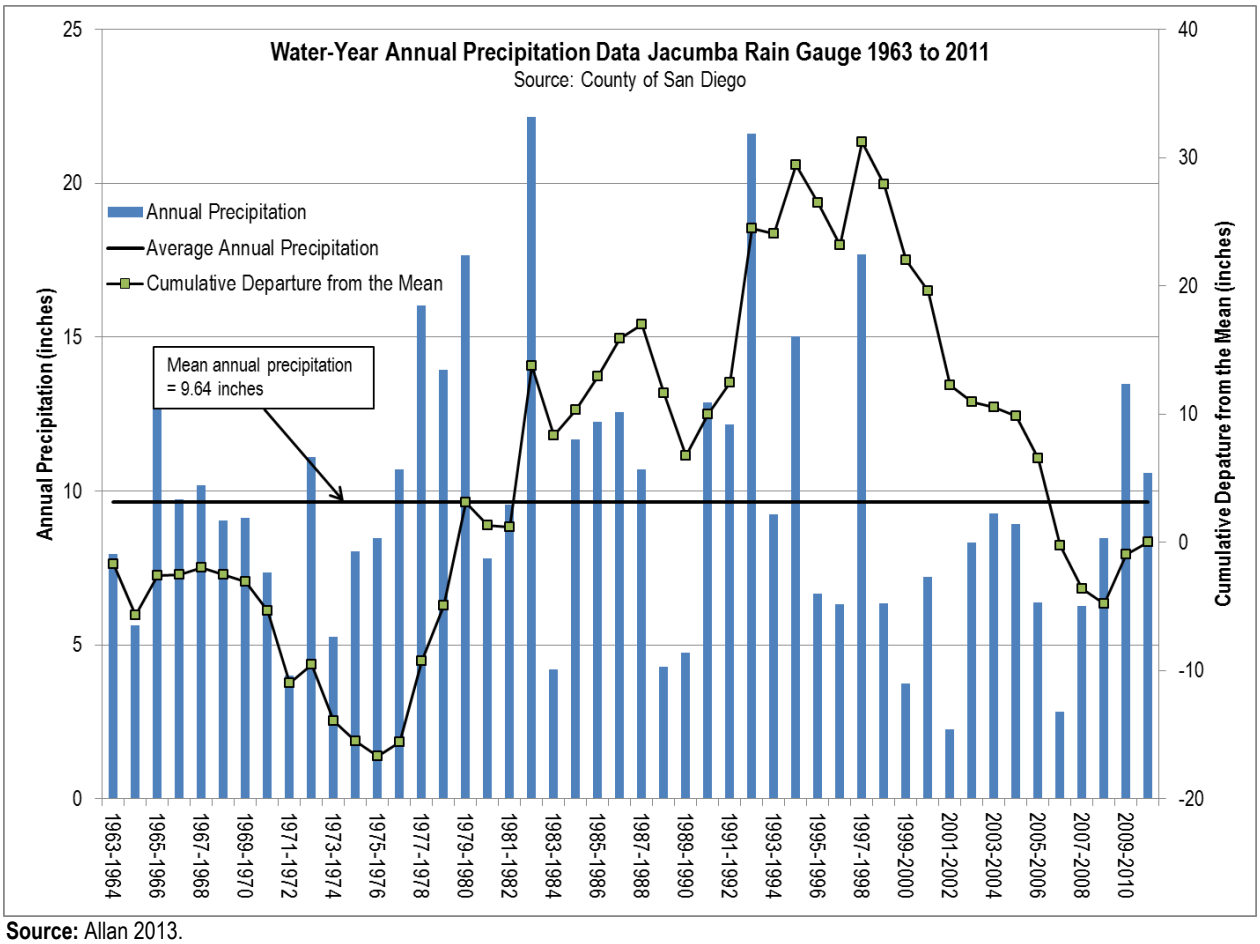
Station	Location	Elevation (feet amsl)	Years of Operation	Average Annual Rainfall (inches)	Source
Boulevard 1	N 32°40', W 116°17'	3,353	1924 to 1967	14.8	NOAA[1]
Boulevard 2	N 32°40', W 116°18'	3,600	1969 to 1994	17.0	NOAA
Tierra del Sol	N 32°39', W 116°19'	4,000	1971 to 2017	10.8	County[2]
Jacumba	N 32°37', W 116°11'	2,800	1963 to 2011	9.64	County[3]

1 NOAA 2011
2 Allan 2014
3 Allan 2013
amsl = above mean sea level

The isohyetal map of annual precipitation, developed by Swenson (1981), shows that the majority of the Flat Creek subwatershed receives an average of 11 inches of precipitation per year (Figure 4, Regional Mean Annual Precipitation). The lower elevations of the subwatershed receive an average of 9 inches of precipitation per year. Mean annual precipitation, as determined from the County of San Diego map entitled "Groundwater Limitations Map" on file with the Clerk of the Board of Supervisors as Document No. 195172, indicates the Walker Canyon-Carrizo Creek subwatershed receives an average of 9 inches of precipitation per year. The Groundwater Limitations Map indicates that the majority of the Boundary Creek subwatershed receives an average of 14 inches of precipitation per year at its highest elevation, and an average of 9 inches of precipitation per year at its lowest (County of San Diego 2004). The County Groundwater Limitations Map roughly concurs with those developed by Swenson (1981) (Figure 4).

The average annual precipitation of 9 inches at the Project site also roughly agrees with the average precipitation calculated for the Jacumba rain gauge between 1963 and 2011 of 9.64 inches (Allan 2013). The Jacumba rain gauge was located at the lowest elevation in the Flat Creek subwatershed.

Exhibit 1
Annual Precipitation Data Jacumba Rain Gauge 1963 to 2011



Source: Allan 2013.
Note: Station located at N 32°37', W 116°11' at an elevation of 2,800 feet

2.2.2 Evapotranspiration

According to the State of California Reference Evapotranspiration Map developed by the California Irrigation Management Information System (CIMIS), the Project site is located in Evapotranspiration Zone 16, with an average of 62.5 inches of reference evapotranspiration (ETo) per year (CIMIS 1999). Table 6 presents ETo by month in CIMIS Zone 16. The annual 62.5 inches of ETo is based on potential evapotranspiration (ET) from turf grass/alfalfa crop, which assumes a continuous source of moisture and does not consider summer plant dormancy. Therefore, ETo is an overestimation of actual ET, which varies with the vegetation type. To account for variations in plant water consumption and more accurately assess ET, a crop coefficient can be applied to ETo. Plants that consume less water have lower crop coefficients. Drought-tolerant plants and native vegetation have a crop coefficient of approximately 0.3 (DWR and UCCE 2000). Using this crop coefficient, the annual estimated ET for the Project site is 62.5 inches x 0.3 = 18.75 inches.

Table 6
CIMIS Zone 16 Reference Evapotranspiration

Month	Reference Evapotranspiration (inches)
January	1.55
February	2.52
March	4.03
April	5.7
May	7.75
June	8.7
July	9.3
August	8.37
September	6.3
October	4.34
November	2.4
December	1.55
Year	**62.51**

Source: CIMIS 1999

2.3 Land Use

According to the San Diego County General Plan, Jacumba Hot Springs is located within the Mountain Empire Subregional Plan area (County of San Diego 2016). Land use designations within a 0.5-mile radius of Well #2 consist of single-family residential, spaced rural residential, airstrip, communications and utilities, railroad right-of-way, road right-of-way, neighborhood shopping center, religious facility, library, other public services, and open space park or preserve (see Figure 5, Current General Plan Land Use). Land use designations within 0.5-mile radius of

Well #3 consist of spaced rural residential, single-family residential, railroad right-of-way, and open space park or preserve (County of San Diego 2011).

The parcels on which the Project site is located are zoned as single family residential, undeveloped natural area, open space park and preserve, neighborhood shopping center, and railroad right-of-way. Bordering current land uses to the Project site are open space park and preserve, spaced rural residential, single-family residential, freeway, other retail trade and strip commercial, road right-of-way, airstrip, neighborhood shopping center, and library (County of San Diego 2011) (see Figure 5).

Current land use within the contributing watersheds in Mexico was not available for this report, but is mostly undeveloped lands. Current land use on the United States side of the Flat Creek subwatershed consists of open space park or preserve, field crops, and vacant undeveloped land. Current land use on the United States side of the Boundary Creek subwatershed consists of spaced rural residential, single-family detached, single-family multiple-units, single-family residential without units, communications and utilities, railroad right-of-way, road right-of-way, other retail trade and strip commercial, fire/police station, other public services, elementary school, open space park or preserve, field crops, and vacant and undeveloped land. Current land use on the United States side of the Walker Canyon- Carrizo Creek subwatershed consists of spaced rural residential, single-family detached, single-family multiple-units, single-family residential without units, mobile home park, hotel/motel (low-rise), airstrip, freeway, communication and utilities, railroad right-of-way, road right-of-way, other retail trade and strip commercial, library, post office, religious facility, open space park or preserve, field crops, and vacant and undeveloped land (County of San Diego 2011).

2.4 Geology and Soils

2.4.1 Geology

Jacumba Hot Springs is located on the eastern portion of the Peninsular Range geomorphic province, which consists of northwest-oriented mountain ranges separated by northwest-trending fault-produced valleys subparallel to faults branching from the San Andreas Fault. The regional geology is depicted in Figure 6, Regional Geologic Map. Because much of the contributing watershed area is located south of the international border with Mexico, worldwide geologic data was used to depict geology south of the border (Garrity and Soller 2009).

The surface area of the contributing watersheds primarily consists of exposed Cretaceous plutonic rocks of the Peninsular Ranges Batholith. These plutonic rocks consist of the bedrock unit known as the tonalite of La Posta (also referred to as the La Posta Quartz Diorite) (USGS 2004). The Sierra Juarez Mountains, located on the southeastern side of the Flat Creek watershed in Mexico

consist of Mesozoic sedimentary rocks (Garrity and Soller 2009). Quaternary alluvium is present in low-lying areas in portions of the watershed, including the Jacumba Valley (USGS 2004).

The Project site is located within Jacumba Valley. Jacumba Valley contains exposures of the Jacumba Volcanics and the Table Mountain Formation, overlain by Quaternary alluvium (DWR 2004; Swenson 1981). The Quaternary alluvium reaches up to 175 feet in thickness and consists of Holocene-age gravels, sands, and clays (Dudek 2016a; DWR 2004). The alluvium thins toward the sides and ends of the valley (DWR 2004; Swenson 1981). The Jacumba Volcanics are encountered below the Quaternary alluvium, as reported in numerous boring log reports (County of San Diego 2018; CRA 2012; Petra 2006). The Tertiary-age Table Mountain Formation underlies the Jacumba Volcanics in some areas of Jacumba Valley and is described as medium- to coarse-grained sandstone and conglomerate, and may reach up to 600 feet in thickness (Swenson 1981). The migmatitic schist and gneiss of the Stephenson Peak Formation outcrop just west of the valley and underlie the Jacumba Valley (Swenson 1981; USGS 2004).

2.4.2 Soils

The type, areal extent, and key physical and hydrologic characteristics of soils mapped on the United States side of the contributing watersheds were identified based on a review of soil surveys completed by the U.S. Department of Agriculture, Natural Resources Conservation Service (USDA 2015). Swenson (1981) provides a map and description of soil types on the Mexico side of the Flat Creek watershed based on representative soil samples and measurements of their porosity and specific retention. Soils on the Mexico side of the Boundary Creek watershed were digitized based on aerial imagery. Soil units are shown in Figure 7, Soils Map, and are described in Table 7.

Table 7
Soil Units within the Contributing Watersheds

Map Unit, Soil Name	Acres (Percent of the Flat Creek Watershed)	Acres (Percent of the Boundary Creek Watershed	Acres (Percent of the Walker Canyon – Carrizo Creek Watershed)
Soil Identification by the U.S. Department of Agriculture			
AcG, Acid Igneous Rock Land	0 (0%)	2,237.66 (15.47%)	2,105.09 (31.49%)
CaB, Calpine coarse sandy loam, 2–5% slope	0 (0%)	14.39 (0.10%)	0 (0%)
CaC, Calpine coarse sandy loam, 5–9% slope	0 (0%)	14.69 (0.10%)	264.68 (3.96%)
CaD2, Calpine coarse sandy loam, 9–15% slopes, eroded	0 (0%)	41.85 (0.29%)	0 (0%)

Table 7
Soil Units within the Contributing Watersheds

Map Unit, Soil Name	Acres (Percent of the Flat Creek Watershed)	Acres (Percent of the Boundary Creek Watershed	Acres (Percent of the Walker Canyon – Carrizo Creek Watershed)
CeC, Carrizo very gravelly sand, 0–9% slope	0 (0%)	796.85 (5.51%)	0 (0%)
InA, Indio silt loam, 0–2% slope	18.10 (30.33%)	0 (0%)	44.90 (0.67%)
InB, Indio silt loam, 2–5% slope	0 (0%)	0 (0%)	183.72 (2.75%)
IoA, Indio silt loam, saline, 0–2% slope	0 (0%)	0.02 (0.0001%)	382.58 (5.72%)
LaE2, La Posta loamy coarse sand, 5–30% slopes, eroded	0 (0%)	1,854.48 (12.82%)	0 (0%)
LcE2, La Posta rocky loamy coarse sand, 5–30% slope, eroded	0 (0%)	1,649.29 (11.40%)	43.92 (0.66%)
LdE, La Posta-Sheephead complex, 9–30% slopes	0 (0%)	2,339.43 (16.17%)	0 (0%)
LdG, La Posta-Sheephead complex, 30–65% slopes	0 (0%)	258.21 (1.78%)	0 (0%)
Lu, Loamy alluvial land	0 (0%)	17.35 (0.12%)	0 (0%)
MnB, Mecca coarse sandy loam, 2–5% slopes	4.86 (8.14%)	0 (0%)	62.83 (0.94%)
MvC, Mottsville loamy coarse sand, 2–9% slopes	0 (0%)	948.47 (6.56%)	0 (0%)
MvD, Mottsville loamy coarse sand, 9–15% slopes	0 (0%)	65.60 (0.45%)	0 (0%)
RaC, Ramona sandy loam, 5–9% slopes	0 (0%)	0 (0%)	168.35 (2.52%)
RaD2, Ramona sandy loam, 9–15% slopes, eroded	0 (0%)	0 (0%)	26.00 (0.39%)
RkA, Reiff fine sandy loam, 0-2% slopes	17.31 (29.00%)	0 (0%)	262.87 (3.93%)
RsC, Rositas loamy coarse sand, 2–9% slope	0 (0%)	152.95 (1.06%)	531.38 (7.95%)
RuG, Rough broken land	0 (0%)	0 (0%)	342.31 (5.12%)
SrD, Sloping gullied land	19.41 (32.53%)	12.55 (0.09%)	0 (0%)
SvE, Stony land	0 (0%)	255.46 (1.77%)	933.88 (13.97%)

Table 7
Soil Units within the Contributing Watersheds

Map Unit, Soil Name	Acres (Percent of the Flat Creek Watershed)	Acres (Percent of the Boundary Creek Watershed	Acres (Percent of the Walker Canyon – Carrizo Creek Watershed)
ToE2, Tollhouse rocky coarse sandy loam, 5–30% slopes, eroded	0 (0%)	3,395.02 (23.47%)	0 (0%)
ToG, Tollhouse rocky coarse sandy loam, 30–65% slopes	0 (0%)	413.14 (2.86%)	0 (0%)
Subtotal	*59.68 (0.12%)*	*14,467.40 (100%)*	*6,685.40 (94.67%)*
Soil Identification by Swenson			
W, Sandy Alluvium	7,020.04 (13.77%)	0 (0%)	132.95 (35.35%)
X, Metamorphic and Plutonic Residuum	43,462.93 (85.27%)	0 (0%)	93.11 (24.76%)
Y, Volcanic residuum and fine sand alluvium	489.09 (0.96%)	0 (0%)	150.04 (39.89%)
Subtotal	*50,972.06 (99.88%)*	*0 (0%)*	*376.10 (5.33%)*
Total Acreage	**51,031.73**	**14,467.40**	**7,061.50**

Sources: Swenson 1981; USDA 2015

2.5 Hydrogeologic Units

The Project site is located within the California Department of Water Resources Bulletin 118 defined Jacumba Valley Groundwater Basin, Department of Water Resources Basin No. 7-47 (Figure 8, Hydrogeologic Units) (DWR 2004). The Jacumba Valley Groundwater Basin consists of two primary aquifer units. The upper alluvial aquifer unit reaches up to 175 feet in thickness and consists of Holocene-age gravels, sands, and clays (Dudek 2016a; DWR 2004). In some areas, this aquifer unit is underlain by the Jacumba Volcanics that act as a semi-confining to confining unit to the lower aquifer. The lower aquifer consists of the Tertiary-age Table Mountain Formation described as medium- to coarse-grained sandstone and conglomerate, and may reach up to 600 feet in thickness (Swenson 1981). The Table Mountain Formation lies unconformably on top of crystalline basement (DWR 2004).

On-site Proposed Project groundwater wells produce from the upper alluvial aquifer (referred to in this report as the "Jacumba Valley alluvial aquifer"). This unconfined aquifer has been estimated to have specific yields ranging from 5% to 10% (Swenson 1981) and 15% to 20% (Roff and Franzone 1994). Production wells screened in the Jacumba Valley alluvial aquifer have been reported to produce more than 1,000 gpm (Roff and Franzone 1994). Groundwater in storage has

been estimated to range from 3,200 to 6,400 acre-feet by Swenson (1981) and 9,600 to 16,000 acre-feet by Roff and Franzone (1994).

2.6 Current Groundwater Demand

The current water demand for the Jacumba Valley alluvial aquifer includes potable demand for Jacumba Valley Ranch Water Company (formerly the Ketchum Ranch Water Company), and potable and non-potable demand from the Jacumba Community Services District (JCSD) (Table 8).

The Jacumba Valley Ranch Water Company is classified as a transient non-community water system. According to County Department of Environmental Health Small Drinking Water System files, seven connections—three ranch homes, two gas stations, and two fire hydrants—are part of the Jacumba Valley Ranch water system (McCullough, pers. comm. 2015). Estimated water demands for the Jacumba Valley Ranch Water Company is 5 afy.

JCSD currently supplies potable water to 239 connections from JCSD Well #4 (Devine, pers. comm. 2019). JCSD's current water usage was not made available for this report, but historical water demand and water use calculations were used to estimate current demand. Based on available data from Barrett Consulting Group (Barrett 1996), JCSD produced between 86 and 146 acre-feet annually from 1991 to 1995, averaging 116 afy. More recent production data indicates that JCSD served 27.6 million gallons (85 acre-feet) of water from Well #4 in 2013 and 26.2 million gallons (80.4 acre-feet) from January 2014 through August 2014 to meet the water demands of the potable water system (Troutt, pers. comm. 2015). Based on the number of connections and an estimated 0.5 afy per connection, JCSD potable water demand is estimated to be 119.5 afy. This estimate roughly coincides with average historical water demand from 1991 to 1995, and conservatively overestimates production from more recent data received by the previous JCSD General Manager in 2014 (Troutt, pers. comm. 2015).

JCSD also supplies non-potable water for commercial sale. Historically, JCSD has supplied non-potable water from Well #6, a fractured rock well not screened in the Jacumba Valley alluvium. Beginning in 2016, JCSD began supplying non-potable water from the Highland Center Well and the Park Well, both screened in the Jacumba Valley alluvium. Non-potable water supply from JCSD varied based on customer demand. From February 2017 to February 2018, JCSD supplied 50.1 acre-feet from the Highland Center Well and 3.5 acre-feet from the Park Well. From February 2018 to January 2019, JCSD supplied 4 acre-feet from the Highland Center Well and 0 acre-feet

from the Park Well. Maximum annual groundwater extraction from the Jacumba Valley alluvial aquifer by JCSD for non-potable water is 53.6 afy.[2]

Based on the County Department of Environmental Health well completion report database, no additional active wells are located within the Jacumba Valley alluvium (County of San Diego 2018). Because there is the potential for active wells to exist without proper County Department of Environmental Health permitting, this report conservatively estimates six potential domestic wells that produce groundwater from the Jacumba Valley alluvial aquifer. Estimated water demands for the potential domestic wells is 3 afy, or 0.5 afy per well.

Agriculture located on the Jacumba Valley Ranch historically extracted the majority of groundwater from the Jacumba Valley alluvial aquifer. Currently no water is being extracted from the Jacumba Valley Ranch for these activities.

Table 8
Jacumba Valley Alluvial Aquifer Existing Water Demands

Groundwater Extraction Sources	Wells Names	Total Water Demand (acre-feet per year)
Jacumba Valley Ranch Water Co.	Well Km	5[a]
Jacumba Community Services District (JCSD) (potable)	Well 4	119.5[b]
JCSD (non-potable)	Highland Center Well, Park Well	53.6[c]
Potential Domestic Wells	Private Domestic Wells	3[d]
	Total Water Demand	**181.1**

a. Jacumba Valley Ranch Water Company has seven connections: three ranch homes, two gas stations, and two fire hydrants. No water demand was assigned to the fire hydrants. Water demand is estimated at approximately 1 acre-foot per connection.
b. Estimated based on 0.5 afy for 239 potable Jacumba Community Services District connections.
c. Maximum demand based on meter reads from February 2017 to February 2018.
d. Not all domestic wells are currently active or known; however, a consumptive water demand of 0.5 afy has been assigned to up to six potential domestic wells

2.7 Hydrogeologic Inventory and Groundwater Level Trends

Published well logs were reviewed to locate wells and refine the thickness of hydrologic units present within the Jacumba Valley alluvial aquifer. Table 9 provides a summary of the information available from driller well logs obtained to date. Well information has been updated based on field reconnaissance and/or historical data.

[2] Non-potable groundwater extraction from the Highland Center Well and the Park Well is based on totalizer readings collected during routine groundwater monitoring performed by Dudek staff as required for the Jacumba Solar Groundwater Monitoring and Mitigation Plan.

Table 9
Jacumba Valley Well Inventory

Well Number	Well Depth (feet bgs)/ (Year Drilled)	Depth to Water (feet btoc)/date	Approximate Production Capability (gpm)	Alluvium/ Residual Soil (feet bgs)	Bedrock Depth (feet bgs)/ (Type)
Jacumba Community Services District Wells					
JCSD 1	124 (1956)	43.0; 10/1955	148	120	124 (volcanic)
JCSD 2	140 (1963)	72.13; 11/1979	—	140	—
JCSD 3	79	—	—	—	—
JCSD 3A	49	—	—	49	—
JCSD 4	39	20.66; 6/26/2018	175[a]	0–39[b]	—
JCSD 5	—	—	—	—	—
JCSD 6	465 (2003)	5.50; 6/26/2018	600+	—	—
JCSD 7	518 (2008)	31.20; 6/26/2018	300+	0–10	10–23 (granitic)
JCSD 8	518 (2009)	31.02; 6/26/2018	275+	0–42	42–55 (granitic)
MW-3	84.5 (2007)	28.0; 3/2009	Monitor well	0–30	30–80 (granitic)
Park Well	124 (2005)	59.74; 6/26/2018	80	0–127	127 (volcanic)
Highland Center Well	125 (2016)	56.98; 6/26/2018	174	0–175	182 (granitic)
Jacumba Valley Ranch Wells					
K	102+ (1960s)	—	—	—	—
K1	110 (1950s)	42.3; 9/6/1980	—	106	—
K2	103 (1950s)	41.0; 4/1958	—	103	—
K3	117 (1950s)	8.5; 2/1996	1,000	—	—
K4	109 (1950s)	9.9; 3/1994	908	—	—
Daley Well	150 (Unknown)	36.94; 10/2018	—	—	—
Well #1	124 (Unknown)[d]	59.99; 10/2018	148	120	124 (volcanic)
Well #2	114 (2007)[d]	46.56; 10/2018	2,000[c]	113	—
Well #3	100 (2005)[d]	38.96; 10/2018	2,000[c]	112	—
Central Irrigation Well	100 (Unknown)[d]	46.56; 10/2018	—	—	—
Mid Valley Well	90.7 (Unknown)[d]	48.72; 10/2018	—	—	—
Carrizo Gorge Well	—	80.22; 7/2018	—	—	—
Well Km	150 (130 silted)	51.62; 7/2018	33.7	—	—
Test Well 1 JVR	82 (1990)	2; 5/1990	225	75	—
P-1	—	—	Monitoring well	—	—
P-2	23.72[d]	Dry; 7/30/2018	Monitoring well	—	—
P-3	30.92[d]	Dry; 7/30/2018	Monitoring well	—	—
P-4	33.71[d]	Dry; 7/30/2018	Monitoring well	—	—
P-5	27.3[d]	Dry; 7/30/2018	Monitoring well	—	—
P-6	32.26[d]	Dry; 7/30/2018	Monitoring well	—	—

Table 9
Jacumba Valley Well Inventory

Well Number	Well Depth (feet bgs)/ (Year Drilled)	Depth to Water (feet btoc)/date	Approximate Production Capability (gpm)	Alluvium/ Residual Soil (feet bgs)	Bedrock Depth (feet bgs)/ (Type)
P-7	38.8[d]	Dry; 7/30/2018	Monitoring well	—	—
P-8	39.3[d]	Dry; 7/30/2018	Monitoring well	—	—
P-9	60.17[d]	Dry; 7/30/2018	Monitoring well	—	—
Other Wells					
R1	137	—	—	—	—
R2	400	—	—	—	—
(Abandoned Well near R2)	Abandoned (1979)	—	—	—	150–492 (Sandstone)
T5	—	—	—	—	—
T8	—	—	—	—	—
T1	—	—	—	—	—
RM	34	—	—	—	—
Spa Well	200 (1955)	—	—	—	—
Daley Construction Well	230 (N/A)	—	—	—	—
Former Chevron Service Station 20-5934					
MW-8S	50 (2007)	—	—	81.5+	—
MW8-D	80 (2007)	—	—	81.5+	—
MW-9S	50 (2007)	—	—	80	80 (Volcanics)
MW-9D	80 (2007)	—	—	80	80 (Volcanics)
MW-10	57 (2007)	—	—	50+	—
MW-11	80 (2007)	—	—	80+	—
MW-12	80 (2012)	—	—	40	40 (DG to 80.5)
MW-13	80 (2012)	—	—	81+	—
MW-14	81 (2012)	—	—	80.5+	—
B-10	(2012)	—	—	55.5+	—
B-11	(2012)	—	—	66.5+	—
B-12	(2012)	—	—	57	57 (DG to 70)

Sources: Barrett 1996; CRA 2012; Pape 2015; Petra 2006; Swenson 1981
bgs = below ground surface; btoc = below top of casing; gpm = gallons per minute; JCSD = Jacumba Community Services District; N/A = not available; DG = decomposed granite

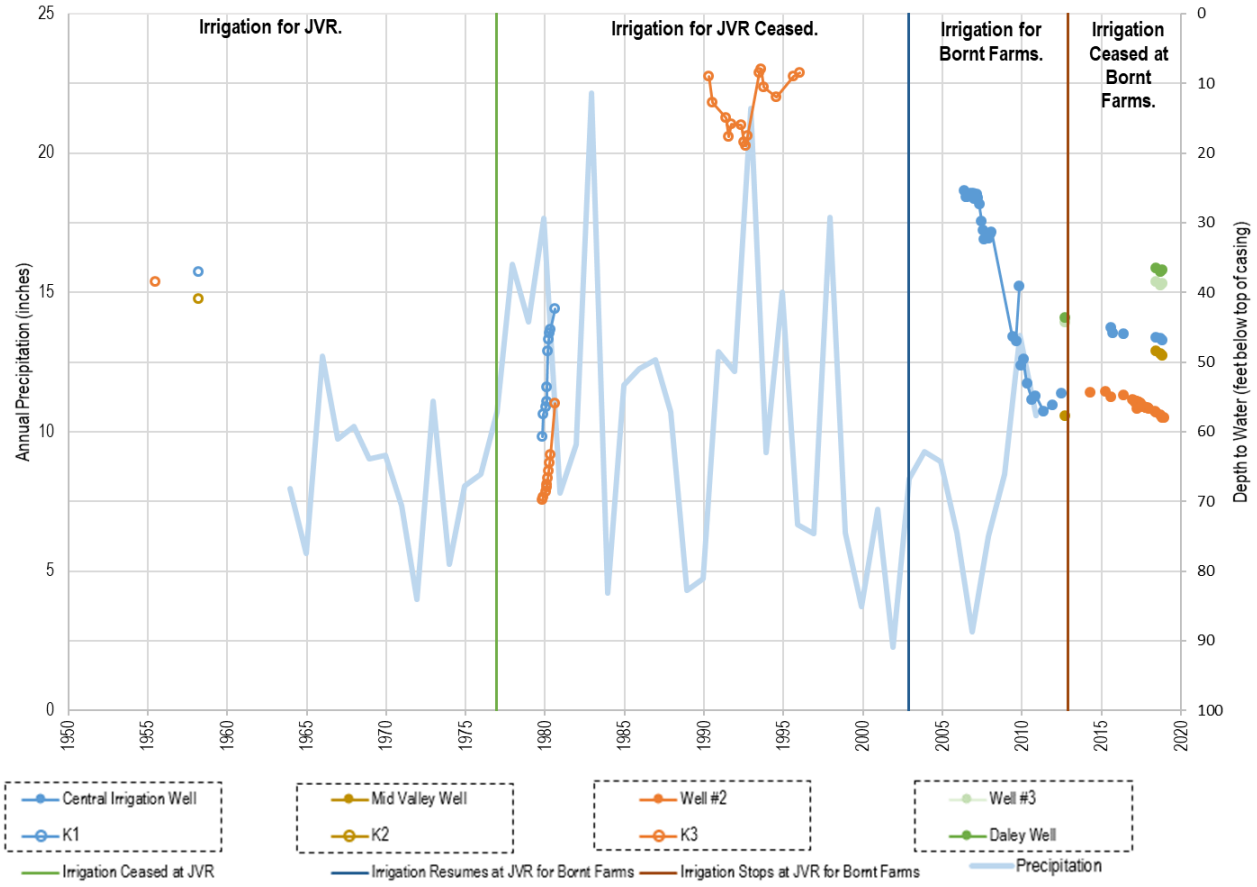
a. Reported pumping capacity provided by JCSD.
b. Alluvial depth based on total depth of Well #4.
c. Pumping rate based on airlifting by driller.
d. Based on field reconnaissance conducted in 2018 by Dudek staff.

Groundwater level data were obtained from JCSD from January 2012 through June 2018 (Devine, pers. comm. 2019; Troutt, pers. comm. 2015). Groundwater level data were also obtained from

Barrett Consulting Group (1996), Peterson (2014), and Swenson (1981). Historical groundwater level data were available for Jacumba Valley as far back as 1955, but a continuous water level record was not available. On-site groundwater levels were recently measured by Dudek in July, October, and December 2018.

Fluctuations in water levels in the Jacumba Valley alluvial aquifer result from both groundwater production and cycles of wet and dry climatic periods. Historical groundwater measurements from wells K1, K2, and K3 were used to represent trends associated with previous land use on the Project site (Exhibit 2). Wells K1, K2, and K3 have the closest geographical relationship to the Central Irrigation Well, Mid Valley Well, and Well #2, respectively.

Exhibit 2
Jacumba Valley Alluvial Aquifer Groundwater Level Data July 1955 to December 2018



Sources: Barrett 1996; Pape 2015; Peterson 2014; Swenson 1981.
Note: Boxes outlined by dashes represent wells in similar geographical locations.

Groundwater levels have fluctuated up to 61 feet in Well K3. When Well K3 was initially drilled in 1955, the groundwater level was 38.5 feet below ground surface (bgs). From 1932 to 1977, Jacumba Valley Ranch extracted on average 2,066 afy from the Jacumba Valley alluvial aquifer (Barrett 1996). Jacumba Valley Ranch pumping, in combination with lower than average precipitation in the late 1960s through the mid-1970s (see declining cumulative departure from mean precipitation in Exhibit 1), resulted in a groundwater level decline in the Jacumba Valley alluvial aquifer (Exhibit 2). Irrigation of agricultural lands ceased on Jacumba Valley Ranch in approximately 1977. In 1979, the groundwater level in Well K3 was 69.9 feet bgs (more than 30 feet lower than initial water level recorded in 1955). By 1990, groundwater levels had risen to near the surface in several Jacumba Valley alluvial aquifer wells (9 feet bgs in Well K3) because of higher recharge rates during a period of above-average precipitation in the late 1970s to mid-1980s (see ascending cumulative departure from mean precipitation in Exhibit 1) and low groundwater extraction during this time period.

Groundwater levels from the Central Irrigation Well declined from 2006 to 2011. This decline coincided with a lower than average rainfall period from 1999 to 2008 and the extraction of approximately 741 afy of groundwater by Bornt Farms. Groundwater levels began to rise after Bornt Farms ceased groundwater extraction in 2013. The current gradual declining trend in groundwater levels, shown in Well #2, can be attributed to lower than average rainfall years and recent extraction from JCSD non-potable wells. The groundwater level in Well #2 is currently 11.9 feet above the historic low groundwater level observed in Well K3, located near Well #2.

2.8 Water Quality

Spring water in the northern area of the Jacumba Valley at Carrizo Gorge had measured total dissolved solids concentrations ranging from 2,000 to 6,000 milligrams per liter. Surface water drainage measured from the Flat Creek watershed and the Boundary Creek watershed have had recorded total dissolved solids concentrations at 292 to 422 milligrams per liter and 1,640 milligrams per liter, respectively (Roff and Franzone 1994). Historically, groundwater included sodium chloride, calcium chloride, and calcium sulfate (Roff and Franzone 1994).

JCSD supplies non-potable water from the Park and Highland Center Wells, and potable water from Well #4. A water quality sample collected from the Highland Center Well in 2016 had a measured total dissolved solids concentration of 400 milligrams per liter. A wide range of constituents, including general minerals, inorganic minerals, and volatile organic compounds, were analyzed. Laboratory results indicated that no volatile organic compounds were detected and that groundwater produced from the Highland Center Well is suitable for construction water supply (Dudek 2016a). The Park Well was initially intended for use as a potable water well; however, low concentrations of volatile organic compounds were detected during drilling. Toluene was detected

at concentrations of 291 micrograms per liter (µg/L), 199 µg/L, and 520 µg/L in water quality samples collected from the Park Well in 2006 (Petra 2006). A subsequent water quality sample was collected from the Park Well on November 5, 2015, by Dudek staff. Results from the sample collected on November 5, 2015, indicated no detections above the reporting limits for all constituents analyzed, including toluene, which was previously detected in the Park Well above the drinking water maximum contaminant level of 150 µg/L. It is possible that the toluene was introduced into the Park Well as a result of drilling or from chemicals (Scothchkote™) used in splicing the submersible cable for installation of the submersible pump and motor when the well was originally tested. Dudek has previously detected toluene in other water wells after the use of Scothchkote (EnviroMatrix Analytical 2015).

Since the Proposed Project would use groundwater for non-potable use, water quality samples were not collected from on-site wells.

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3 WATER QUANTITY IMPACTS ANALYSIS

This section discusses the potential impacts on local groundwater resources in terms of the County Guidelines (County of San Diego 2007).

3.1 50% Reduction of Groundwater Storage

To apply the County methodology for determining a 50% reduction in groundwater storage to a given well, the area of the aquifer that can be accessed by a pumping well must be defined. For this analysis, the 2,061-acre extent and variable thickness of the alluvium underlying the Jacumba Valley as defined by Swenson (1981) was used to perform the 50% reduction in storage analysis.

3.1.1 Guidelines for Determination of Significance

The following requirement is set forth in the County Guidelines (County of San Diego 2007):

> For proposed projects in fractured rock and sedimentary basins, groundwater impacts will be considered significant if a soil moisture balance, or equivalent analysis, conducted using a minimum of 30 years of precipitation data, including drought periods, concludes that at any time groundwater in storage is reduced to a level of 50% or less as a result of groundwater extraction.

A Proposed-Project-specific soil-moisture-based water balance was not performed for the Project site. Instead, an updated estimate of groundwater in storage was made based on previous work conducted by Roff and Fanzone (1994) and Swenson (1981). The estimate evaluated whether the water demands for the Proposed Project would maintain at least 50% groundwater in storage over the 2,061-acre Jacumba Valley alluvial aquifer (mapped by Swenson 1981). Additionally, a one-time Proposed Project extraction of up to 112 acre-feet over a 1-year period was compared to historical groundwater extraction rates from the Jacumba Valley alluvial aquifer.

3.1.2 Methodology

3.1.2.1 Groundwater Recharge

Groundwater recharge was not calculated for the contributing watersheds or the Jacumba Valley alluvial aquifer.

3.1.2.2 Groundwater Demand

Historical Demand

The groundwater demands of the Jacumba Valley alluvial aquifer vary with time. Historically, Jacumba Valley Ranch was the primary user of groundwater from the aquifer. Jacumba Valley Ranch produced water for irrigation of agricultural lands. From 1932 through 1977, Jacumba Valley Ranch extracted on average 2,066 afy of groundwater (Barrett 1996). Irrigation ceased on Jacumba Valley Ranch and the agricultural lands were fallowed from about 1977 until 2002. From 2002 until 2013, Bornt Farms resumed irrigation at Jacumba Valley Ranch. The water demand of Bornt Farms was reported to be in excess of 1 million gallons per day (Pape, pers. comm. 2015). To determine the area of active irrigated agricultural land by year, historical aerial photographs were reviewed. Between 2002 and 2013, 187 to 465 acres of the Jacumba Valley Ranch was irrigated to grow predominantly lettuce and spinach (Google Earth 2015). Assuming a crop irrigation rate of 2.14 acre-feet per acre for lettuce, the maximum annual water demand of the lettuce crop at Bornt Farms would be 995 acre-feet (Barrett 1996; UC Davis 2011). Other estimates state that Bornt Farms extracted 7,413 acre-feet over the farm's lifetime, or an average of 741.3 afy.

Other groundwater users include the Jacumba Valley Ranch Water Company, which has historically extracted in excess of 242 afy (Barrett 1996). Groundwater extraction on the Mexican side of the border has historically been estimated to be 24 afy (Barrett 1996).

Since 1985, JCSD has extracted potable water from up to four groundwater wells within its approximately 423-acre boundary (LAFCO 2013). The water system includes storage of up to 638,000 gallons. As discussed in Section 2.6, Current Groundwater Demand, historical potable water demand has been documented to be between 85 and 146 afy (Barret 1996; Trout, pers. comm. 2015).

As discussed in Section 2.6, JCSD has historically supplied non-potable water for commercial sale from Well #6 (a fractured rock well not screened in the Jacumba Valley alluvium) and the Highland Center Well and Park Well (both screened in the Jacumba Valley alluvium). Non-potable water supply from JCSD varies based on customer demand. Based on meter reads by Dudek staff, from February 2017 to February 2018, JCSD supplied 50.1 acre-feet from the Highland Center Well and 3.5 acre-feet from the Park Well. Maximum annual groundwater extraction from the Jacumba Valley alluvial aquifer by JCSD for non-potable water is 53.6 afy.

Current Demand

Current groundwater demand from the Jacumba Valley alluvial aquifer includes extraction by JCSD, Jacumba Valley Ranch Water Company, and a few potential domestic well owners. The

Project site, which was historically produced an excess of 2,000 afy, no long extracts groundwater for agriculture. The Jacumba Valley Ranch Water Company, which has historically extracted an excess of 242 afy, currently supplies approximately 5 afy for three ranch homes, two gas stations, and two fire hydrants (Barrett 1996; McCullough, pers. comm. 2015).

JCSD continues to extract both potable and non-potable groundwater from the Jacumba Valley alluvial aquifer. As discussed in Section 2.6, JCSD is estimated to produce approximately 119.5 afy of potable water for 239 connections from Well #4, and 4 afy of non-potable water during 2018 from the Highland Center Well and Park Well (Devine, pers. comm. 2019).

There may be small volumes of groundwater (less than 3 afy) extracted from domestic wells located in the residential area in Jacumba Hot Springs.

Groundwater extraction is occurring from the fractured rock aquifer by JCSD, Jacumba Hot Springs Resort, and a few domestic well users on the outskirts of town. Since the Proposed Project is proposing to extract groundwater from the Jacumba Valley alluvial aquifer, groundwater extraction from the fractured rock aquifer was not included in this analysis.

Future Demand

Future demand is expected to include JCSD potable and non-potable demand, Jacumba Valley Ranch Water Company, and private domestic users. Potable groundwater use from JCSD, the Jacumba Valley Ranch Water Company, and private domestic users is expected to be similar to current conditions over the long-term. JCSD has the potential to serve non-potable from the Highland Center and the Park Well.

JCSD completed a manganese water treatment system for Wells #7 and #8 that is serving all potable water demands for its customers (Dudek 2016b). This treatment system came online on March 6, 2020. Wells #7 and #8 source water from the fractured rock aquifer rather than the Jacumba Valley alluvial aquifer.

Table 10 provides historical, current, and future water demand from the Proposed Project, other projects, and Proposed Project O&M. The future projected water demand conservatively evaluates the Proposed Project and other projects taking place concurrently.

Table 10
Jacumba Valley Alluvial Aquifer Groundwater Demand

Land Use	Historical Water Demand (afy)	Current Water Demand (afy)	Future Water Demand During Construction (afy)	Future Ongoing Water Demand for O&M (afy)	Future Maximum Demand During Construction (acre-feet)
Project Site (Jacumba Valley Ranch; Bornt Farms)	2,066; 741–995	0	140	11	140
Jacumba Valley Ranch Water Company	242	5	5	5	5
Private Domestic[a]	3	3	3	3	3
JCSD (Potable)	80–146[b]	119.5	0[c]	0[c]	0
JCSD (Non-Potable)	53.6	4[d]	4 (ongoing)[d] 290 (one-time use)[e]	4 (ongoing)[d] 7.3 (future O&M)	294[e]
Total Estimated Water Demand	**2,212**[f]	**131.5**	**302**	**19.3**	**302**
Total Estimated Water Demand With Project	**2,212**[f]	**131.5**	**442**	**30.3**	**442**

Source: Barrett 1996; Dudek 2015; Troutt, pers. comm. 2015

afy = acre-feet per year; O&M = operations and maintenance; JCSD = Jacumba Community Services District

a. Not all domestic wells are currently active or known; however, a consumptive water demand of 0.5 afy has been assigned to up to six potential domestic wells
b. JCSD Wells #1 and #2 supplied all potable demands for the town of Jacumba Hot Springs until JCSD Wells #3 and #4 were drilled in the early 1970s. As of March 2020 JCSD is no longer pumping water for potable supply form the alluvial aquifer.
c. Future JCSD potable water demand is supplied from Wells #7 and #8, completed in the fractured rock aquifer.
d. Assumes current groundwater demand based on Dudek metered data from 2018.
e. Water demand from all reasonably foreseeable projects includes: 50 acre-feet for Boulder Brush, 76 acre-feet for Torrey Wind, 123 acre-feet for Campo Wind, 37 acre-feet for Rugged Solar and 4 acre-feet for Cameron Solar (all values rounded to the nearest acre-foot). O&M water demand is 7 afy for Torrey Wind, 0.25 afy for Campo Wind and 0.03 afy for Cameron Solar.
f. Assumes maximum concurrent water demand from JCSD potable demand and Jacumba Valley Ranch.

Historically, groundwater demand from the Jacumba Valley alluvial aquifer has been estimated to be up to 2,066 afy (Barrett 1996). A drastic reduction in groundwater production has occurred since agriculture irrigation ceased on Jacumba Valley Ranch. The current groundwater demand from the Jacumba Valley alluvial aquifer is estimated to be 131.5 afy (Table 10). An additional 112 acre-feet would be extracted during Proposed Project construction, resulting in a 1-year extraction of 243.5 acre-feet from the aquifer, assuming other groundwater users continue their current estimated extraction amounts. However, starting in spring 2019, groundwater extraction from the Jacumba Valley alluvial aquifer for JCSD potable use is expected to cease after the completion of a manganese water treatment system for fractured rock Wells #7 and #8. This will result in a reduction of water demand from the Jacumba Valley alluvial aquifer, taking into account water demand for Proposed Project construction. The total water demand from the Jacumba Valley

alluvial aquifer during Proposed Project construction is expected to be 124 acre-feet, which includes the Proposed Project and ongoing use, minus JCSD potable demand.

After Proposed Project construction, ongoing groundwater productions from the alluvial aquifer is estimated to be 30.3 afy, based on 11 afy of Proposed Project water use for O&M, 11.3 acre-feet of continuous non-potable water use by JCSD and 8 afy for private domestic and Jacumba Valley Ranch Water Company (Table 10). Additionally, the Proposed Project would extract groundwater for decommissioning in the future.

JCSD is proposing the use of the Highland Center Well with potential backup supply provided by the Park Well to serve JCSD non-potable water to commercial customers. Based on foreseeable renewable energy projects, JCSD is proposing to extract up to 290 acre-feet of groundwater from the Highland Center and Park Wells for construction of five renewable energy projects. Water demand from all reasonably foreseeable projects includes: 50 acre-feet for Boulder Brush, 76 acre-feet for Torrey Wind, 123 acre-feet for Campo Wind, 37 acre-feet for Rugged Solar and 4 acre-feet for Cameron Solar (all values rounded to the nearest acre-foot). O&M water demand is 7 afy for Torrey Wind, 0.25 afy for Campo Wind and 0.03 afy for Cameron Solar

3.1.2.3 Groundwater in Storage

Groundwater in storage was calculated using estimates of the saturated aquifer thickness underlying the 2,060-acre area of the Jacumba Valley alluvial aquifer, as mapped by Swenson (1981). Aquifer thickness was updated from the Swenson groundwater storage compartments (A through E) with available well completion information. The estimated saturated thickness is based on recent groundwater levels measured in June and December 2018. The updated well completion information used to constrain aquifer thickness is provided in Table 11 and included in Appendix B, Well Completion Information. For compartments with multiple wells and groundwater level measurements, values were averaged to represent a non-uniform saturated aquifer thickness. In all cases, the average saturated thickness used to define groundwater in storage (Table 12) was less than the measured saturated thickness at each well (Table 11). For compartments in which no wells were located, groundwater levels were extrapolated from the nearest well (Table 12). Groundwater storage compartments and their representative wells are depicted in Figure 8. Specific yield was estimated based on historical and recent aquifer test analyses.

Table 11
Well Completion Information for Constraining Alluvial Saturated Thickness

Common Well Name	Source or County of San Diego Well Record Identification	Aquifer Thickness (feet)	Depth to Groundwater/ (feet below ground surface)	Depth to Groundwater Measurement Date	Saturated Thickness (feet)	Swenson Compartment (Swenson 1981)
JVR – Carrizo Creek	Lwell 6933	55	—	—	—	A
Leighton B-12	Leighton 1991a	20	—	—	—	A
Well #3	Lwel 16419	89	35.14	12/11/2018	50.26	C
Well #2	Lwel 1815	113	56.21	12/11/2018	55.27	C
Test Hole	Lwel 20450	100	—	—	—	C
Leighton B-2	Leighton 1991a	25	—	—	—	C
Central Irrigation Well	—	—	44.33	12/11/2018	—	C
Mid-Valley Well	—	—	47.42	12/11/2018	—	C
Well #1	—	124	57.87	12/11/2018	—	D
J2	Swenson 1981	120	—	—		D
Test Hole	Lwel 17922	108	—	—	—	D
Southwest Irrigation	Lwel 18031	86	—	—	—	D
Test Hole	Lwel 20411	150	—	—	—	D
Highland Center Well	Lwel 001506	175	56.98	6/26/2018	118.02	E
Park Well	—	—	59.74	6/26/2018	—	E
J3	Swenson 1981	60	—	—	—	E
J4	Swenson 1981	50	—	—	—	E

— = no information is available

Specific Yield (Storage Coefficient)

Previous estimates of specific yield for the Jacumba Valley alluvial aquifer were made by Swenson (1981) and calculated from aquifer testing performed by Barrett (1996). The specific yield associated with the alluvium was conservatively estimated by Swenson (1981) to be between 5% and 10%. Barrett (1996) estimated specific yield to be 25% based on aquifer testing of Well K4, Test Well No. 1, and Well Km.

Storativity (storage coefficient) was calculated for this report (Section 3.2, Well Interference and Groundwater Dependent Habitat) based on two constant-rate aquifer tests. The storage coefficient from the Well #2 aquifer test, located in compartment D, ranged from 0.008 to 0.028. The storage

coefficient from the Well #3 aquifer test, located in compartment C, was calculated to be 0.2349 (Geosyntec 2012). Since the aquifer tests were conducted in the unconfined aquifer, the calculated storage coefficient is equivalent to the specific yield (Driscoll 1986). Values for the storage coefficient for unconfined aquifers range from 0.01 to 0.30 (Driscoll 1986). The calculated storage coefficients from the Well #2 and Well #3 aquifer tests fall within this range.

Based on recent aquifer test analysis performed on Well #2 and Well #3 within the Jacumba Valley alluvial aquifer, the specific yield ranges from 0.08% to 24%, with a mean value of 12% (Geosyntec 2012). To provide a conservative estimate, a specific yield value of 10% was used for this analysis to calculate groundwater in storage.

Saturated thickness was calculated by subtracting the average alluvial thickness by recent depth to groundwater measurements recorded in 2018. Saturated thickness for each compartment was then multiplied by the compartments acreage and the 10% specific yield value to determine the groundwater in storage by compartment. Based on these calculations, the current groundwater in storage within the Jacumba Valley alluvial aquifer is estimated to be 9,005 acre-feet (Table 12).[3]

In comparison, groundwater in storage was estimated to range from 9,600 to 16,000 acre-feet by Roff and Fanzone (1994), and from 3,200 to 6,400 acre-feet by Swenson (1981). The 2018 groundwater in storage estimate is based on additional information including borings indicating depth to bedrock and site-specific specific yield values that were not available to Swenson (1981) or Roff and Fanzone (1994).

[3] The estimate of 9,005 acre-feet of groundwater in storage in 2018 for the Jacumba Valley alluvial aquifer is an initial estimate based on available data, including well logs, water levels, and aquifer properties estimated by pump testing. The estimated storage in the Jacumba Valley alluvial aquifer may be revised as additional data is acquired.

Table 12
Jacumba Valley Alluvial Aquifer 2018 Groundwater in Storage Estimate

Alluvial Aquifer Compartments*	Area (acres)	Leighton Alluvial Thickness (1991) (feet)	Average Alluvial Thickness (feet)	Depth to Water 2018 (feet below ground surface)	Average Saturated Thickness (feet)	Specific Yield (unitless)	Storage (acre-feet)
A	240.94	50+	37.5	35.14	2.36	0.10	56.86
B	104.70	50+	50	35.14	14.86	0.10	155.58
C	439.40	120+	81.75	43.5	38.25	0.10	1,680.71
D	1,082.73	100+	117	57.87	59.13	0.10	6,402.18
E	193.61	80+	95.0	58.36	36.64	0.10	709.39
Total Groundwater in Storage (rounded acre-feet)							**9,005**

* **Compartment Details:**

A Aquifer thickness estimated from an average alluvial thickness observed in well log Lwel 6933 and B-12 (Leighton 1991a). Depth to water extrapolated from Well #3 (Lwel 16419)

B Aquifer thickness defined by Leighton 1991a. Depth to water extrapolated from Well #3 (Lwel 16419)

C Aquifer thickness estimated from Well #3 (Lwel 16419), Well #2 (Lwel 1814), Test Hole (L well 20450), and Leighton B-7 (Leighton 1991a). Depth to water averaged from Well #3 (Lwel 16419) and Well #2 (Lwel 1814).

D Aquifer thickness estimated from Well J2 (Swenson 1981), Test Holes (Lwell 17922 and 201411), and the Southwest Irrigation Well (Lwell 18031). Depth to water estimated from Well #1.

E Aquifer thickness estimated from the Highland Center Well (Lwell 001506), and Wells J3 and J4 (Swenson 1981). Depth to water estimated from an average of the Highland Center Well (Lwell 001506) and the Park Well.

3.1.2.4 Long-Term Groundwater Availability (Sustainability)

Long-term groundwater availability was evaluated in context of the current available groundwater in storage, historical groundwater levels, and water demand. The volume of groundwater in storage varies depending on the rate of recharge and the volume of water pumped from storage (water demand). Sustainable groundwater availability is less than the historical average groundwater production rate of 2,066 afy from 1932 to 1977. This is observed during dry periods when the Jacumba Valley experienced groundwater overdraft, as indicated by declining groundwater levels in the alluvial aquifer wells (Exhibit 2). Pumping by Jacumba Valley Ranch between 2003 and 2013 also resulted in groundwater level declines in the alluvial aquifer. Bornt Farms grew lettuce and spinach on up to 465 acres, year-round, with an estimated maximum extraction rate of 995 acre-feet per year (Barrett 1996; UC Davis 2011). Due to Bornt Farms irrigation and below-average precipitation recorded in the contributing watersheds over the last decade, the water demands exceeded available recharge, resulting in groundwater level decline (Exhibit 2). Several years of drought and limited non-potable extraction by JCSD likely contributed to the current groundwater level decline.

The Proposed Project proposes to extract groundwater for 1 year at a maximum quantity of 140 acre-feet. This one time use of groundwater for construction is approximately 10% of the annual production quantity of Bornt Farms, and 5% of the annual production quantity of Jacumba Valley Ranch. After Proposed Project construction, groundwater extraction for O&M would be 0.9% of the annual production quantity of Bornt Farms and 0.5% of the annual production quantity of Jacumba Valley Ranch for the maximum groundwater historically extracted from the Project site. Groundwater extraction for decommissioning and dismantling would be 5% of the annual production quantity of Bornt Farms and 2% of the annual production quantity of Jacumba Valley Ranch for the maximum groundwater historically extracted from the Project site.

The Proposed Project proposes to use 140 acre-feet during construction for 1 year. Assuming no recharge to the aquifer, the Proposed Project alone would reduce groundwater in storage by 1.6% during construction. The estimated maximum extraction from all known sources during the period of Proposed Project construction is 442 acre-feet. Total reduction of groundwater in storage from all sources during the construction period is estimated to be 4.9%. Assuming a Proposed Project lifetime of 40 years (1 year of construction, 38 years of O&M, and 1 year of decommissioning), the Proposed Project would use 619 acre-feet of water. Other groundwater uses within the basin including reasonably foreseeable projects would use 1,054 acre-feet of water. This equates to a total water demand of 1,673 acre-feet, which results in a 18.6% reduction in storage over 40 years, assuming no recharge to the aquifer.

3.1.3 Significance of Impacts Prior to Mitigation

The total estimated water use for the Proposed Project, other uses, and reasonably foreseeable projects is estimated at 1,673 acre-feet over 40 years, which results in an 18.6% reduction in storage. This demonstrates that groundwater would not be depleted to 50% or less of the estimated basin storage capacity of 9,005 acre-feet.

3.1.4 Mitigation Measures and Design Considerations

Since impacts are considered less than significant, no mitigation is required.

3.1.5 Conclusions

The Proposed Project would have a less-than-significant impact to groundwater in storage, as defined by the County Guidelines (County of San Diego 2007). Proposed Project groundwater extraction, and other groundwater use, including reasonably foreseeable projects for the life of the Proposed Project, assuming a 40-year lifespan would equate to an 18.6% reduction in groundwater storage. This is less than the County's significance criteria of 50%.

3.2 Well Interference and Groundwater Dependent Habitat

3.2.1 Guidelines for Determination of Significance

3.2.1.1 Well Interference

The following significant impact requirements are set forth in the County Guidelines (County of San Diego 2007):

> *Alluvial Well:* As an initial screening tool, off-site well interference will be considered a significant impact if after a five year projection of drawdown, the results indicate a decrease in water level of 5 feet or more in the off-site wells. If site-specific data indicates alluvium or sedimentary rocks exist which substantiate a saturated thickness greater than 100 feet in off-site wells, a decrease in saturated thickness of 5% or more in the off-site wells would be considered a significant impact.

According to the County Groundwater Geologist, the primary author of the County of San Diego Guidelines, the intent of the above guideline was to cover projects that have continual ongoing water uses that remain static over time (Bennett, pers. comm. 2015). Historically, this has been the case for the majority of groundwater-dependent projects processed by the County. The Proposed Project, however, proposes to use variable quantities of water, with intensive pumping over short periods. The intensive pumping during short periods may cause direct well interference impacts. Therefore, to evaluate potential impacts from short-term pumping of groundwater, the County

Groundwater Geologist has requested a short-term drawdown analysis, in addition to the 5-year projection of drawdown, to evaluate the potential impacts from operating at the highest rate of pumping (Bennett, pers. comm. 2015).

Potential well interference impacts for Well #2 and Well #3 were evaluated over a 0.5-mile radius from each well (Figure 9, On-Site and Off-Site Wells). Table 13 lists known off-site active wells screened in the Jacumba Valley alluvial aquifer that are within a 0.5-mile radius of the on-site Proposed Project production wells.

Table 13
Alluvial Aquifer Wells Within 0.5-Mile Radius of On-Site Proposed Project Wells

Well Name	Use	Distance from Well #2	Distance from Well #3
		Feet	
Jacumba Valley Ranch Water Company			
Well Km	Public/Potable	2,453	**3,548**
Jacumba Community Services District Wells			
Highland Center Well	Public/Non-Potable	1,817	**4,835**
Park Well	Public/Non-Potable	2,256	**5,025**
Other			
Border Patrol Well	Private/Inactive	1,892	**6,235**

Note: Bold = Well is located at a distance greater than 0.5 miles (>2,640 feet).

3.2.1.2 Groundwater-Dependent Habitat

Guideline 4.2.C from the County of San Diego Guidelines for Determining Significance and Report Format and Content Requirements: Biological Resources defines the following threshold for determining a significant impact to riparian habitat or a sensitive natural community (County of San Diego 2010a):

> The project would draw down the groundwater table to the detriment of groundwater-dependent habitat, typically a drop of 3 feet or more from historical low groundwater levels.[4]

A biological field survey, including vegetation mapping, was conducted on the Project site by Dudek biologist in 2018 (Dudek 2020b). The biological survey presents the most current and site-specific vegetation on the Project site and was used to identify potential groundwater-dependent habitat for the distance drawdown calculations. Vegetation and potential groundwater-dependent

[4] Historical groundwater level hydrographs compiled by the Jacumba Community Sponsor Group –Town Center Well Hydrographs from 1990 to 2008 indicate up to 20 feet of water level decline in one well during this period of measurement (Figure 2-58 in County of San Diego 2010b). Historical groundwater level monitoring for JCSD Well #4 from 1990 to 2008 indicates up to 20 feet of water level decline during the period of measurement.

habitats present on the Project site are depicted in Figure 10, Potential Groundwater-Dependent Habitat. The survey identified two types of groundwater-dependent habitat, desert sink scrub and mesquite bosque.

The dominant species of the desert sink scrub are succulent chenopods, which occurs on fine-textured, poorly drained soils with high alkalinity or salt content. Characteristic species include iodine bush (*Allenrolfea occidentalis*), fourwing saltbush (*Atriplex canescens*), and salt heliotrope (*Heliotropium curassavicum*) (Oberbauer et al. 2008).

The dominant species of the mesquite bosque are mesquite (*Prosopis glandulosa*) with additional characteristic species including carelessweed (*Amaranthus palmeri*), white bursage, fourwing saltbush, and allscale (Oberbauer et al. 2008). Mesquite bosque commonly occur on higher alluvial terraces and near washes, streambanks, alkali sinks, or outwash plains with substantial groundwater (Dudek 2020b).

The Natural Communities Commonly Associated with Groundwater (DWR 2018) and SanGIS (SanGIS 2018) vegetation dataset were also reviewed to verify potential groundwater-dependent habitat.

3.2.2 Aquifer Testing

The following subsections describe the procedures followed during aquifer testing at Well #2 and Well #3, and the analysis of aquifer test data.

3.2.2.1 Aquifer Test Description

A 24-hour constant rate test was performed at Well #2 by Dudek on December 14, 2018, at an average pumping rate of 317 gpm. A 72-hour constant rate test was performed at Well #3 by Geosyntec on November 6, 2012, at an average pumping rate of 350 gpm (Geosyntec 2012). The purpose of the constant rate tests were to obtain approximate long-term production rates, estimate drawdown at off-site wells and groundwater-dependent habitat, and estimate aquifer properties.

3.2.2.2 Aquifer Test Analysis

Aquifer Test Analysis Methodology

Hydraulic aquifer properties (transmissivity and storativity) were estimated using the computer program Aquifer Test Solver Pro, Version 4.50 (AQTESOLV). Projected drawdown was roughly estimated using drawdown data on a log-log plot. Distance drawdown was estimated at select distances from each pumping well using the Theis non-equilibrium well equation (Theis equation).

Aquifer Properties (Transmissivity and Storativity)

Aquifer transmissivity is the rate at which water flows through a vertical strip of the aquifer 1 foot wide and extending through the fully saturated thickness under a hydraulic gradient of 1, or 100%.

The aquifer coefficient of storage (also called storativity) is the volume of water released from storage per unit decline in hydraulic head in the aquifer per unit area of the aquifer. Due to well loses and inefficiency of the pumping well, an observation well is required to calculate the coefficient of storage.

Transmissivity and storativity were calculated in AQTESOLV by fitting the Cooper-Jacob (Cooper and Jacob 1953), Theis, and Neuman methods to drawdown and recovery data, where applicable.

Projected Drawdown

Groundwater drawdown was projected using the pumping rate for each aquifer test on a log-log plot. The late time trend of the drawdown curve was projected to 90 days, 1 year (365 days), and 5 years (1,825 days).

Distance Drawdown

Groundwater drawdown after 90 days, 1 year, and 5 years was estimated at the nearest off-site wells and groundwater-dependent habitat using the Theis equation (Driscoll 1986):

$$\boldsymbol{s = \frac{114.6\, Q\, W(u)}{T}}$$

Where:

s = predicted drawdown (feet)
Q = pumping rate (gpm)
T = transmissivity (gallons per day per foot)
t = time (days)
W(u) = the well function of u

For the W(u) function, u is equal to:

$$\boldsymbol{u = \frac{1.87 r^2 S}{Tt}}$$

r = distance from pumping well (feet)
S = coefficient of storage (dimensionless)

The W(u) function, known as the Theis well function, is equal to:

$$W(u) = -0.5772 - ln\mathrm{u} + \mathrm{u} - \frac{\mathrm{u}^2}{2 \cdot 2!} + \frac{\mathrm{u}^3}{3 \cdot 3!} - \frac{\mathrm{u}^4}{4 \cdot 4!} + \cdots$$

The groundwater extraction rate used to predict drawdown was adjusted to equal the Proposed Project demand for 90 days, 1 year, and 5 years.

3.2.2.3 Aquifer Test Results

Well #2 Aquifer Test

Aquifer Properties

After 24 hours of continuous groundwater extraction, the observed groundwater level drawdown was 3.1 feet in Well #2 (pumping well) and approximately 0.5 feet in Well #1 (observation well, located 305 feet away). Drawdown in Wells #2 and #1 are shown in Figures 11 and 12, respectively.

The transmissivity values obtained from the Theis and Neuman equations using AQTESOLV were 36,290 square feet per day (ft^2/day) and 26,410 ft^2/day in Well #1, and 33,050 ft^2/day and 28,310 ft^2/day in Well #2. These values were obtained using an aquifer saturated thickness (b) equivalent to 40 feet (the saturated thickness of the screened interval of Well #2). The hydraulic conductivity values calculated by dividing transmissivity by aquifer thickness (K=T/b) ranged from 660 feet per day to 907 feet per day. The storativity values estimated using data collected in Well #1 ranged from 0.028 using Theis and 0.00826 using Neuman. Table 14 shows the range of aquifer parameters and residual statistics obtained from the AQTESOLV curve matching of drawdown and recovery data from Wells #1 and #2. AQTESOLV results from the Well #2 aquifer test are presented in Appendix C, Well #2 Aquifer Test AQTESOLV Data.

Table 14
Well #2 Aquifer Test – AQTESOLV Estimated Aquifer Hydraulic Properties

Solution Method	Estimated Aquifer Hydraulic Properties Estimates			Residual Statistics
	Transmissivity (square feet per day)	*Hydraulic Conductivity (feet per day)*	*Storativity (dimensionless)*	*Sum of Squares (square feet)*
Well #1 (Observation)				
Theis	36,290	907	0.02876	3.952
Neuman	26,410	660	0.00826	0.3775
Well #2 (Pumping)				
Theis	33,050	826	—	11.52
Neuman	28,310	708	—	14.1

Note: Storativity calculated from the observation well (Well #1).

Aquifer properties estimated by using the Neuman method provided the best fit to the observation well data (see Appendix C). The transmissivity and storativity values estimated by fitting the Neuman method to Well #1 (observation well) drawdown data in AQTESOLV are 26,410 ft^2/day and 0.00826, respectively. These aquifer hydraulic properties were used in the Well #2 (pumping well) distance drawdown calculation using the Theis equation.

Projected Drawdown

Projected drawdown was estimated in Wells #2 and #1 after 90 days, 1 year, and 5 years. At a constant pumping rate of 317 gpm, projected drawdown in Well #2 after 90 days, 1 year, and 5 years is 3.6 feet, 3.8 feet, and 4.0 feet, respectively (see Figure 13). Projected drawdown in Well #1 (located 305 feet away from the pumping well) at 90 days, 1 year, and 5 years is 1.49 feet, 1.81 feet, and 2.17 feet, respectively (see Figure 14).

Distance Drawdown

Distance drawdown calculations were performed at select distances from Well #2 to evaluate impacts to off-site well users and groundwater-dependent habitat after 90 days, 1 year, and 5 years of continuous groundwater extraction. The Proposed Project construction groundwater demand was analyzed over 90 days, 1 year, and 5 years. The adjusted extraction rates for distance drawdown after 90 days, 1 year, and 5 years were 352 gpm, 87 gpm, and 17 gpm (rounded), respectively. Transmissivity and storativity values used were from the Well #1 (observation well) AQTESOLV analysis (26,410 ft^2/day and 0.00826, respectively).

The closest off-site well to Well #2 is the Highland Center Well located approximately 1,817 feet to the west (Figure 9, On-Site and Off-Site Wells). Projected drawdown at the Highland Center Well after 90 days, 1 year, and 5 years is predicted to be 1.08 feet, 0.34 feet, and 0.08 feet, respectively. The closest groundwater-dependent habitat to Well #2 is mesquite bosque located approximately 1,820 feet south near the international border with Mexico (Figure 10). Projected drawdown at the nearest groundwater-dependent habitat after 90 days, 1 year, and 5 years is predicted to be 1.08 feet, 0.34 feet, and 0.08 feet, respectively. Table 15 summarizes projected drawdown at select distances from Well #2.

Table 15
Well #2 Distance Drawdown Calculations

Nearest Off-Site Well or Groundwater-Dependent Habitat	Distance from Pumping Well #2 (feet)	Drawdown After 90 Days in Feet at a Constant Pumping Rate of 352 gpm	u	Drawdown After 1 Year in Feet at a Constant Pumping Rate of 87 gpm	u	Drawdown After 5 Years in Feet at a Constant Pumping Rate of 17 gpm	u
Highland Center Well	1,817	1.08	0.0029	0.34	0.0007	0.08	0.0001
Mesquite Bosque	1,820	1.08	0.0029	0.34	0.0007	0.08	0.0001
Park Well	2,256	0.99	0.0044	0.31	0.0011	0.08	0.0002
Well KM	2,453	0.96	0.0052	0.31	0.0013	0.08	0.0003

gpm = gallons per minute; u = a ratio of distance and storativity over transmissivity and time. See Section 3.2.2.2, Aquifer Test Analysis, for equation.

Wells #1 and #2 recovery data were evaluated using the plot of residual drawdown versus time since pumping started divided by time since pumping stopped (t/t') to assess impacts to storage from pumping. At t/t' equals to 1 (infinite time), a residual drawdown would indicate permanent dewatering or incomplete dewatering due to limited extent of the aquifer. The projected residual drawdown at infinite time for Wells #1 and #2 is 0.02 and 0.01 feet, respectively (Figures 15 and 16). This negligible residual drawdown indicates no permanent dewatering or limited extent of aquifer.

Well #3 Aquifer Test

Aquifer Properties

Aquifer properties from the Well #3 aquifer test were calculated by Geosyntec (2012). After 72 hours of continuous groundwater extraction, groundwater level drawdown was 7.3 feet in Well #3 (pumping well) and approximately 4.07 feet in the Daley Well (observation well, located 60 feet away). Drawdown in Well #3 and the Daley Well are shown in Figures 17 and 18. Aquifer properties were estimated using AQTESOLV with drawdown and recovery data recorded in Well #3 and the Daley Well (see Appendix D, Well #3 Aquifer Test Report). The transmissivity value estimated by fitting the Cooper-Jacob method (Cooper and Jacob 1953) to drawdown data recorded in the Daley Well was 8,779 ft^2/day (65,821 gallons per day per foot). The transmissivity value estimated by fitting the Theis method to recovery data recorded in Well #3 was 12,950 ft^2/day (96,872 gallons per day per foot). These values were obtained using an aquifer saturated thickness equivalent to 58 feet (the saturated thickness of the screened interval of Well #3), and equate to hydraulic conductivity values ranging from 151 feet per day to 223 feet per day. The storativity value estimated using data collected in the Daley Well was 0.2349 (Geosyntec 2012).

Projected Drawdown

Projected drawdown was estimated in Well #3 and the Daley Well after 90 days, 1 year, and 5 years of constantly pumping Well #3 at 350 gpm. The projected drawdown in Well #3 after 90 days, 1 year, and 5 years is 11.1 feet, 12.7 feet, and 14.5 feet, respectively (Figure 19). Projected drawdown in the Daley Well after 90 days, 1 year, and 5 years of pumping is 8.0 feet, 9.5 feet, and 11.4 feet, respectively (Figure 19) (Appendix D).

Distance Drawdown

Distance drawdown calculations were performed at select distances from Well #3 to evaluate impacts to off-site well users and groundwater-dependent habitat after 90 days, 1 year, and 5 years of continuous groundwater extraction. The Proposed Project construction groundwater demand was analyzed over 90 days, 1 year, and 5 years. The adjusted extraction rates for distance drawdown after 90 days, 1 year, and 5 years were 352 gpm, 87 gpm, and 17 gpm (rounded), respectively. The transmissivity and storativity values used were 8,779 ft^2/day and 0.2349, respectively (Appendix D).

The closest off-site well to Well #3 is Well KM, owned by the Jacumba Valley Ranch Water Company, located greater than 0.5 miles (3,548 feet) to the southwest (Figure 9). Projected drawdown at Well KM after 90 days, 1 year, and 5 years is predicted to be 0.15 feet, 0.17 feet, and 0.08 feet, respectively.

The closest groundwater-dependent habitat to Well #3 is mesquite bosque located 140 feet to the west (Figure 10). Projected drawdown at the nearest groundwater-dependent habitat as a result of pumping Well #3 after 90 days, 1 year, and 5 years is predicted to be 3.66 feet, 1.11 feet, and 0.27 feet, respectively. Table 16 summarizes projected drawdown at select distances from Well #3.

Table 16
Well #3 Distance Drawdown Calculations

Nearest Off-Site Well or Groundwater-Dependent Habitat	Distance from Pumping Well #2 (feet)	Drawdown After 90 Days in Feet at a Constant Pumping Rate of 352 gpm	u	Drawdown After 1 Year in Feet at a Constant Pumping Rate of 87 gpm	u	Drawdown After 5 Years in Feet at a Constant Pumping Rate of 17 gpm	u
Mesquite Basque	140	3.66	0.0015	1.11	0.0004	0.27	0.0001
Off-Site Groundwater Production Wells Greater than 0.5 Miles from Well #3							
Well KM	3,548	0.15	0.9356	0.17	0.9356	0.08	0.9356

Table 16
Well #3 Distance Drawdown Calculations

Nearest Off-Site Well or Groundwater-Dependent Habitat	Distance from Pumping Well #2 (feet)	Drawdown After 90 Days in Feet at a Constant Pumping Rate of 352 gpm	u	Drawdown After 1 Year in Feet at a Constant Pumping Rate of 87 gpm	u	Drawdown After 5 Years in Feet at a Constant Pumping Rate of 17 gpm	u
Highland Center Well	4,835	0.04	1.7374	0.10	1.7374	0.06	1.7374
Park Well	5,025	0.04	1.8766	0.09	1.8766	0.06	1.8766

gpm = gallons per minute; u = a ratio of distance and storavitivty over transmissivity and time. See Section 3.2.2.2 for equation.

Daley Well and Well #3 recovery data were evaluated using the plot of residual drawdown versus time since pumping started divided by time since pumping stopped (t/t') to assess impacts to storage from pumping. The projected residual drawdown at infinite time for the Daley Well and Well #3 is 0.5 feet (Figures 20 and 21). This residual drawdown is less than the County's standard (County of San Diego 2007) of more than 0.5 feet of residual drawdown that would indicate permeant dewatering or limited aquifer extent.

3.2.3 Significance of Impacts Prior to Mitigation

A pumping rate of 317 gpm from the Well #2 aquifer test and of 350 gpm from the Well #3 aquifer test were used to predict Proposed Project drawdown using each well's maximum pumping rate. These pumping rates equate to maximum annual production of approximately 511 afy from Well #2 and 564 afy from Well #3. The maximum annual production rates calculated for Well #2 and Well #3 are significantly greater than the Proposed Project water demand of 140 acre-feet of water during Proposed Project construction (1 year), 11 afy for ongoing O&M (approximately 38 years), and 50 acre-feet for decommissioning and dismantling (1 year).

To assess the potential for Proposed Project groundwater extraction to draw down the groundwater table to the detriment of nearby groundwater-dependent habitat, or to cause well interference, projected drawdown within a 0.5-mile radius of Wells #2 and #3 was estimated using the Theis equation. Periods of 90 days, 1 year, and 5 years were used to calculate the potential long-term impacts to nearby groundwater-dependent habitats and domestic and public pumping wells. Pumping rates for each well were adjusted to reach total Proposed Project construction demand at the end of 90 days, 1 year, and 5 years.

Based on the drawdown calculations performed, drawdown at the closest off-site groundwater well to Well #2, the Highland Center Well, after 90 days, 1 year, and 5 years of pumping is predicted

to be 1.08 feet, 0.34 feet, and 0.08 feet, respectively. Drawdown at the nearest groundwater-dependent habitat to Well #2 (located approximately 1,820 feet south) after 90 days, 1 year, and 5 years of pumping is predicted to be 1.08 feet, 0.34 feet, and 0.08 feet, respectively.

No groundwater wells are located within a 0.5-mile radius of Well #3. The nearest off-site production well is Well Km, located 3,548 feet (greater than 0.5 miles) southwest of Well #3. The projected drawdown at Well Km from Well #3 pumping after 90 days, 1 year, and 5 years is predicted to be 0.15 feet, 0.17 feet, and 0.08 feet, respectively. Drawdown at the nearest groundwater-dependent habitat to Well #3 (located approximately 140 feet west) after 90 days, 1 year, and 5 years of pumping is predicted to be 3.66 feet, 1.11 feet, and 0.27 feet, respectively.

Current groundwater levels near Well #2 and Well #3 are at least 12 feet higher than the historical low groundwater level recorded in the Jacumba Valley alluvial aquifer (Exhibit 2, Well K3). Well #2 and #3 pumping is not expected to draw down the groundwater table greater than 3 feet from the historical low.

Based on the Theis methods, the effects of Proposed Project pumping on nearby groundwater-dependent vegetation and off-site domestic and public pumping wells is anticipated to be less-than-significant. Proposed Project pumping is not anticipated to adversely impact nearby groundwater-dependent vegetation or cause well interference. Additionally, the analysis performed is a conservative approach, since it likely overestimated predicted drawdown. This is because the calculations assumed no rainfall recharge to occur over the time periods tested. Recharge will offset groundwater-level decline related to groundwater extraction during periods of above-average annual rainfall (non-drought conditions).

3.2.4 Mitigation Measures and Design Considerations

Actual conditions during groundwater extraction for the Proposed Project may vary from the above analysis, so a Groundwater Monitoring and Mitigation Plan (GMMP) has been prepared to ensure that pumping does not significantly impact existing well users and groundwater dependent habitat. The GMMP provides for monitoring the duration and rate of Proposed Project pumping to document the total volume of groundwater extracted. The GMMP also provides for monitoring groundwater levels from Proposed Project pumping and monitoring wells.

3.2.5 Conclusions

The analysis above indicates that the potential for Proposed Project groundwater extraction from Wells #2 and #3 to impact off-site wells or nearby groundwater-dependent habitat is anticipated to be less-than-significant. For safe measure, groundwater-level monitoring would be performed in several wells to record groundwater levels during groundwater extraction. A GMMP detailing groundwater

thresholds for off-site well interference and groundwater-dependent habitat has been prepared. Annual review of groundwater-level data would be conducted by a Professional Geologist or Certified Hydrogeologist registered in the State of California to evaluate long-term impacts.

4 WATER QUALITY IMPACT ANALYSIS

The Proposed Project does not propose to use groundwater as a potable water source; therefore, no water quality impact analysis was conducted.

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5 SUMMARY OF PROJECT IMPACTS AND MITIGATION

5.1 50% Reduction in Groundwater Storage

As discussed in Section 3.1, 50% Reduction of Groundwater Storage, a Proposed-Project-specific soil-moisture-based water balance was not performed for the Project site. Instead, a 1-year Proposed Project construction groundwater extraction volume of 140 acre-feet was compared to historical, ongoing, and future estimated groundwater extraction rates from the Jacumba Valley alluvial aquifer and updated estimates of groundwater in storage originally made by Roff and Franzone (1994) and Swenson (1981). The analysis evaluated whether the water demands for Proposed Project construction, ongoing groundwater extraction, and maximum non-potable extraction by JCSD maintain at least 50% groundwater in storage over the 2,060-acre Jacumba Valley alluvial aquifer. The analysis evaluated groundwater extraction of 140 acre-feet for Proposed Project construction, 8 afy for ongoing domestic and Jacumba Valley Ranch Water Company use, 4 acre-feet for ongoing JCSD non-potable supply and 290 acre-feet for one-time construction supply of reasonably foreseeable renewable energy projects. The total water demand of 442 acre-feet for these projects is 4.9% of the current estimated groundwater storage of the Jacumba Valley Alluvial aquifer. The analysis concluded that groundwater extraction for the Proposed Project and for ongoing and future water demands would maintain at least 50% groundwater in storage.

Total groundwater extraction over the assumed lifetime of the Proposed Project was also analyzed along with groundwater extraction from other users and reasonably foreseeable projects. The total estimated groundwater extraction for the 40-year lifetime (1,673 acre-feet) of the Proposed Project is 18.6% of the current groundwater in storage. Since the Proposed Project would not exceed the 50% reduction in groundwater storage threshold, and other cumulative groundwater demands would be met, groundwater impacts to storage would be less than significant.

5.2 Well Interference

As presented in Section 3.2.2.2, Aquifer Test Analysis, based on the Theis equation, drawdown at the closest off-site groundwater well to Well #2, the Highland Center Well, after 90 days, 1 year, and 5 years of pumping is predicted to be 1.08 feet, 0.34 feet, and 0.08 feet, respectively (Table 15). No groundwater wells are located within a 0.5-mile radius of Well #3. These results indicate that drawdown is not predicted to exceed the County well interference threshold of significance of a decrease in water level of 5 feet or more in off-site alluvial wells (County of San Diego 2007).

5.3 Groundwater-Dependent Habitat

As presented in Section 3.2.1.2, Groundwater-Dependent Habitat, Mesquite Bosque located approximately 1,820 feet south of Well #2 is potentially groundwater-dependent habitat. Based on the Theis equation, drawdown at the closest groundwater-dependent habitat to Well #2 after 90 days, 1 year, and 5 years is predicted to be 1.08 feet, 0.34 feet, and 0.08 feet, respectively (Table 15).

Mesquite Basque located approximately 410 feet west of Well #3 is potentially groundwater-dependent habitat. Based on the distance drawdown calculations, drawdown at the closest groundwater-dependent habitat to Well #3 after 90 days, 1 year, and 5 years of pumping is predicted to be 3.66 feet, 1.11 feet, and 0.27 feet, respectively. Current groundwater levels in Well #3 are at least 12 feet higher than the historical low groundwater level recorded in the Jacumba Valley alluvial aquifer (Exhibit 2, Well K3). Therefore, the Proposed Project is unlikely to draw down the groundwater table to the detriment of groundwater-dependent habitat, and impacts are anticipated to be less than significant.

5.4 Mitigation Measures

Proposed Project production wells, Well #2 and Well #3, should be fitted with totalizing flow meters to record production during each phase of the Proposed Project. Groundwater wells should also have access for taking groundwater-level measurements. Monitoring would be in place during groundwater production for Well #2 and Well #3 to monitor impacts to groundwater storage, well interference, and groundwater-dependent habitat. A GMMP has been prepared that details groundwater thresholds for off-site well interference and groundwater-dependent habitat.

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7 LIST OF PREPARERS AND PERSONS AND ORGANIZATIONS CONTACTED

This report was prepared by Dudek Hydrogeologist Trey Driscoll, PG, CHG, who is a County of San Diego–approved hydrogeologist. Dudek hydrogeologist Hugh McManus conducted fieldwork, report preparation, graphics, and GIS mapping. Dudek hydrogeologist Devin Pritchard-Peterson performed aquifer test data analysis and preparation of associated graphics, and composed sections of this report. Peer review was provided by Kayvan Ilkhanipour, PG, CHG. This report was prepared in coordination with County Groundwater Geologist Jim Bennett with meteorological input from Rand Allan from the San Diego County Flood Control. Billy Devine, General Manger, Jacumba Community Services District, assisted with background information and data for this report.

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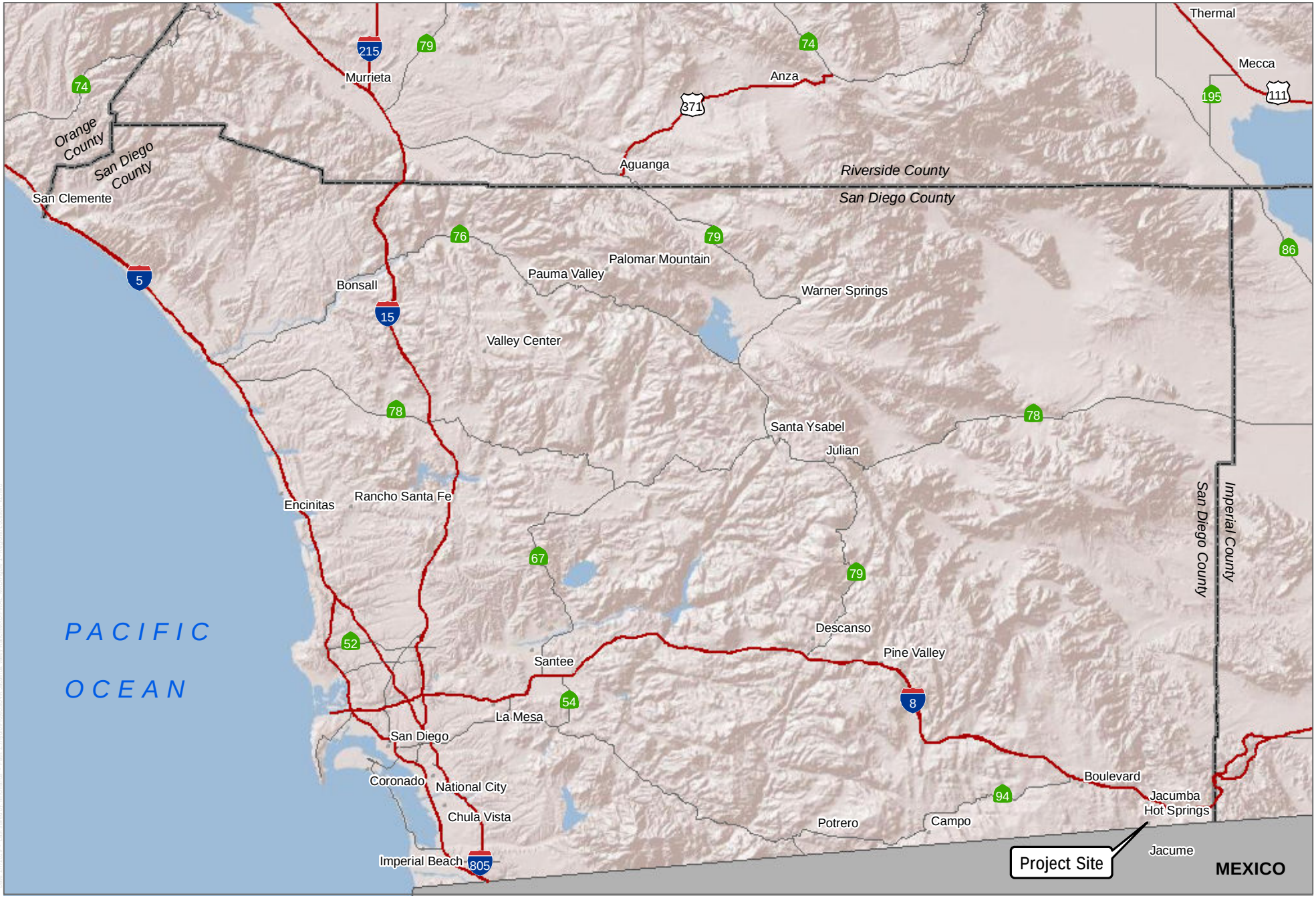

SOURCE: ESRI

DUDEK

0 5 10 Miles

FIGURE 1

Regional Location

Groundwater Resources Investigation - JVR Energy Project

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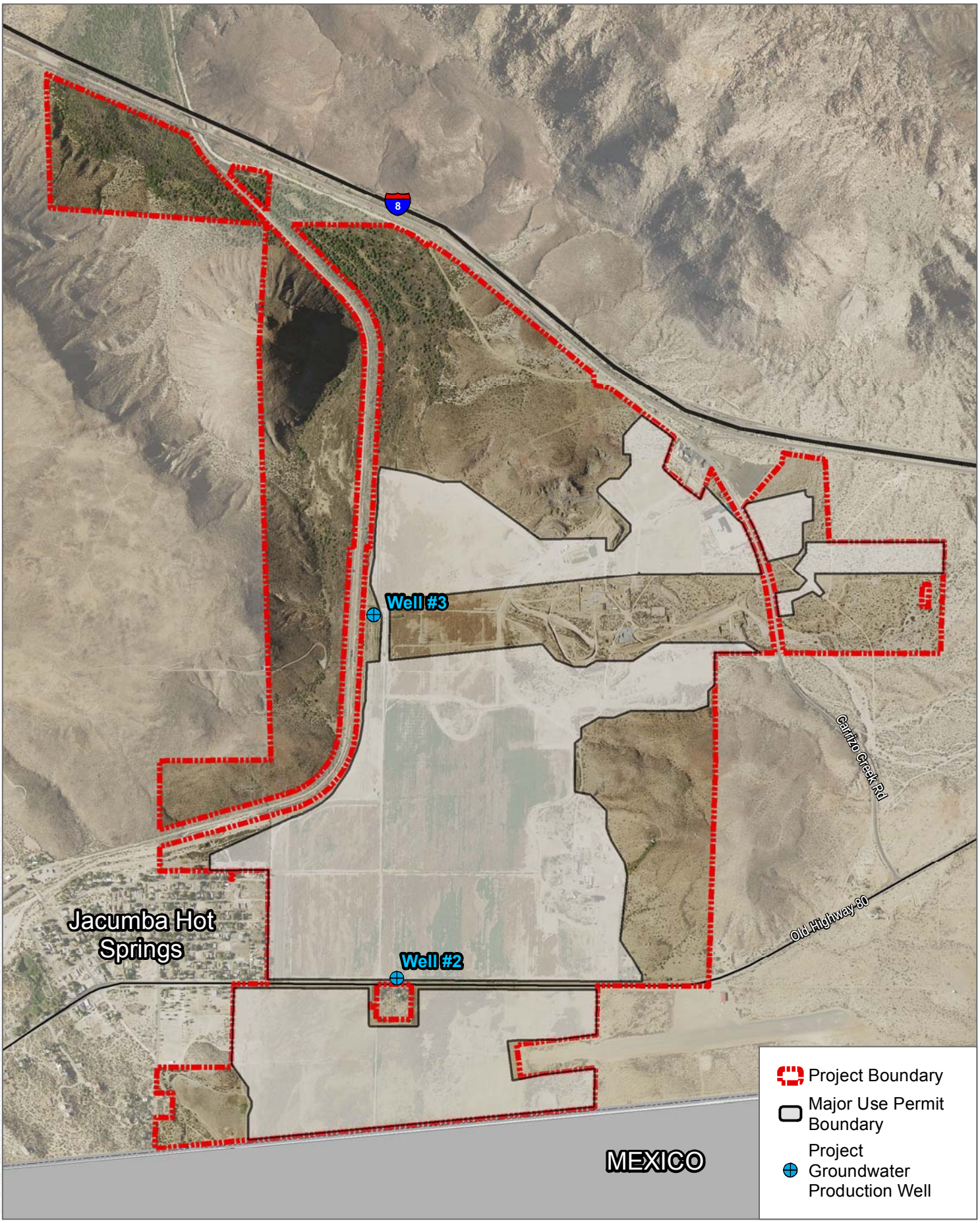

SOURCE: SANDAG; SanGIS

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FIGURE 2

Vicinity Map

Groundwater Resources Investigation - JVR Energy Park

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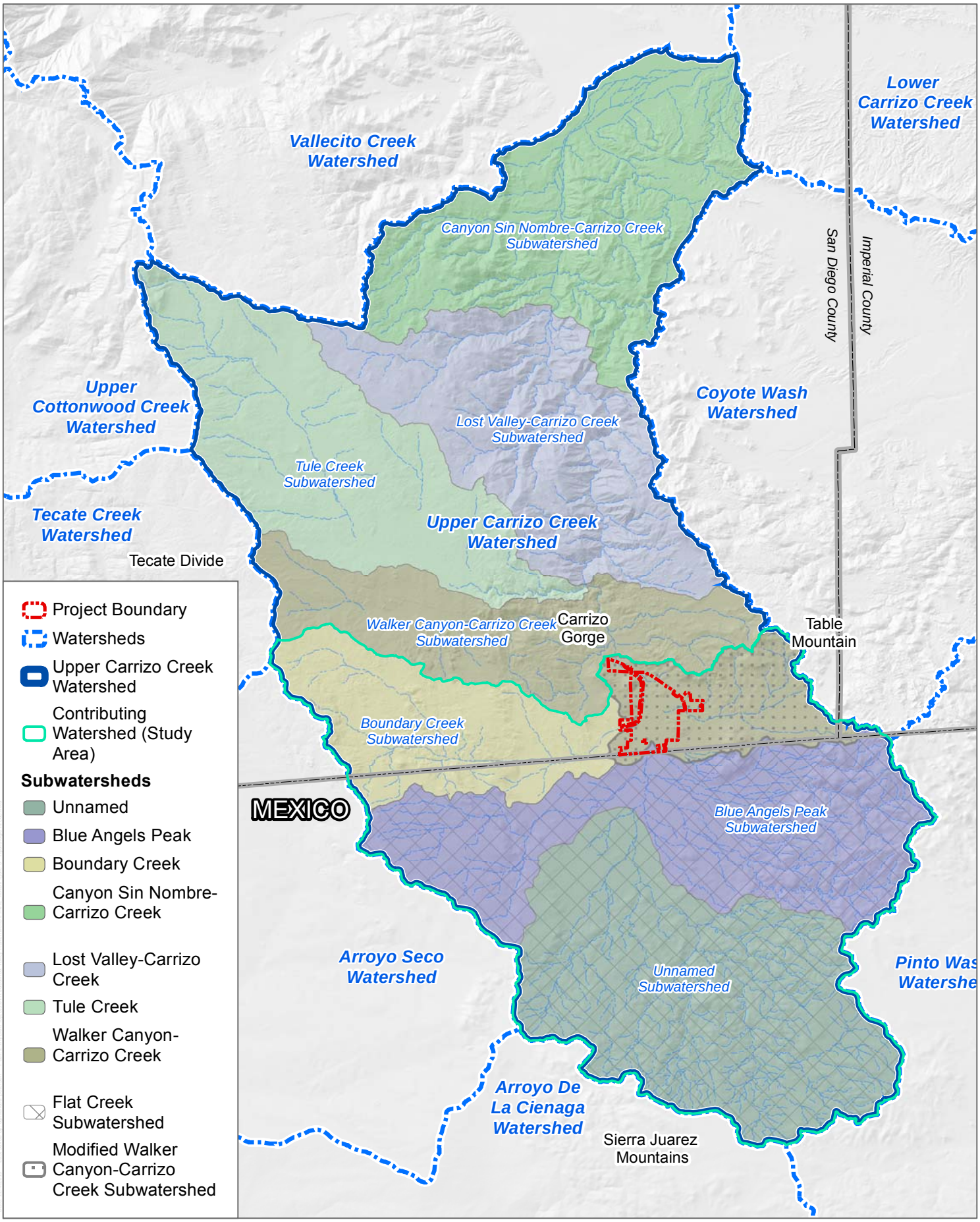

SOURCE: USGS

DUDEK

0 2 4 Miles

FIGURE 3

Hydrologic Areas

Groundwater Resources Investigation - JVR Energy Project

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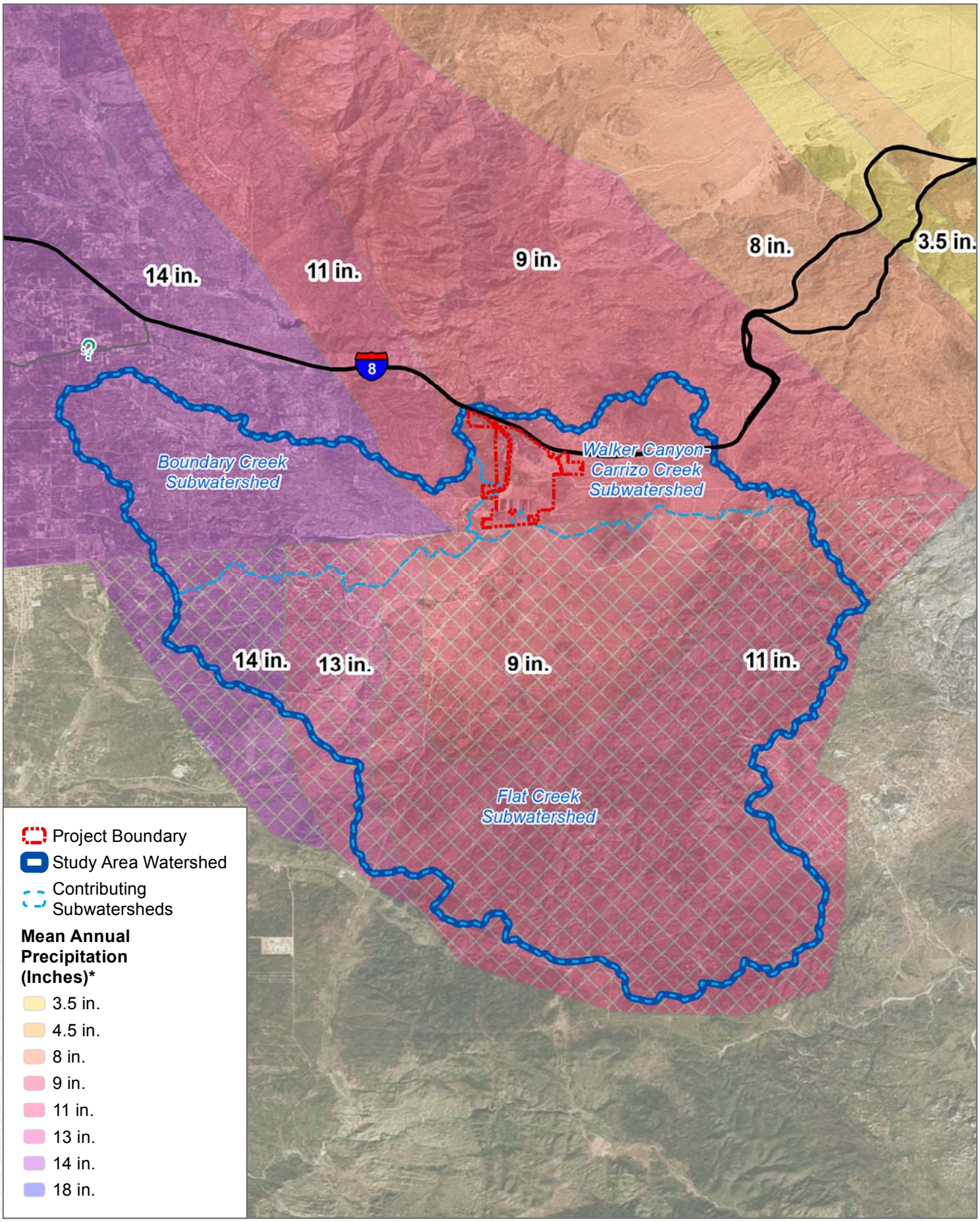

SOURCE: County of San Diego; SANDAG; Swenson, 1981
*Note: Hatched area precipitation data inferred from Swenson, 1981 isohyetal lines

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0 2 4 Miles

FIGURE 4

Regional Mean Annual Precipitation

Groundwater Resources Investigation - JVR Energy Park

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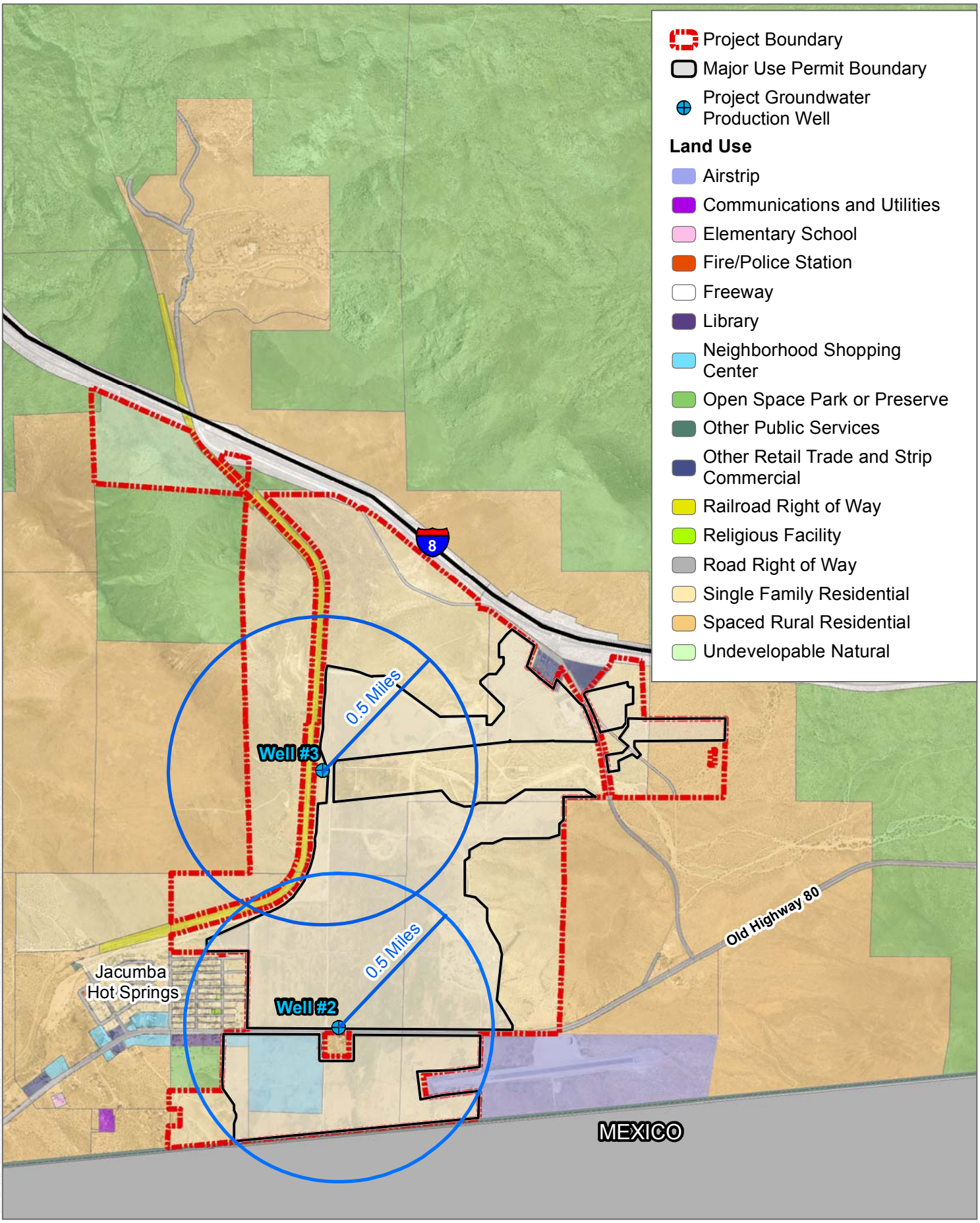

SOURCE: SANDAG, SanGIS

DUDEK

0 0.25 0.5 Miles

FIGURE 5

Current General Plan Land Use

Groundwater Resources Investigation - JVR Energy Project

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Project Boundary

Study Area Watershed

Contributing Subwatersheds

Quaternary Alluvial Aquifer (Study Area)(Swenson, 1981)

Project Groundwater Production Wells

Geologic Units (CGS 2012)

Late Holocene (Surficial Deposits)

Qa, Alluvial Valley Deposits

Middle to Early Pleistocene

Qvot, Very Old Terrace Deposits

Tertiary Units (Bedrock)

Tss, Coarse-Grained Tertiary Age Formations

Tv, Tertiary Age Formations of Volcanic Origin

Mesozoic and Older Units (Bedrock)

Kss, Coarse-Grained Cretaceous age Formations of Sedimentary Origin

pKm, Cretaceous and Pre-Cretaceous Metamorphic Formations of Sedimentary and Volcanic Origin

gr, Granitic and Other Intrusive Crystalline Rocks

Faults and Geologic Contacts (CGS 2012)

contact, identity and existence certain, location accurate

contact, identity and existence certain, location approximate

reference contact, identity and existence certain, location concealed

reference contact, identity or existence questionable, location accurate

fault, identity and existence certain, location accurate

fault, identity and existence certain, location approximate

fault, identity and existence certain, location concealed

fault, identity and existence certain, location inferred

Geologic Units (GSA 2005)

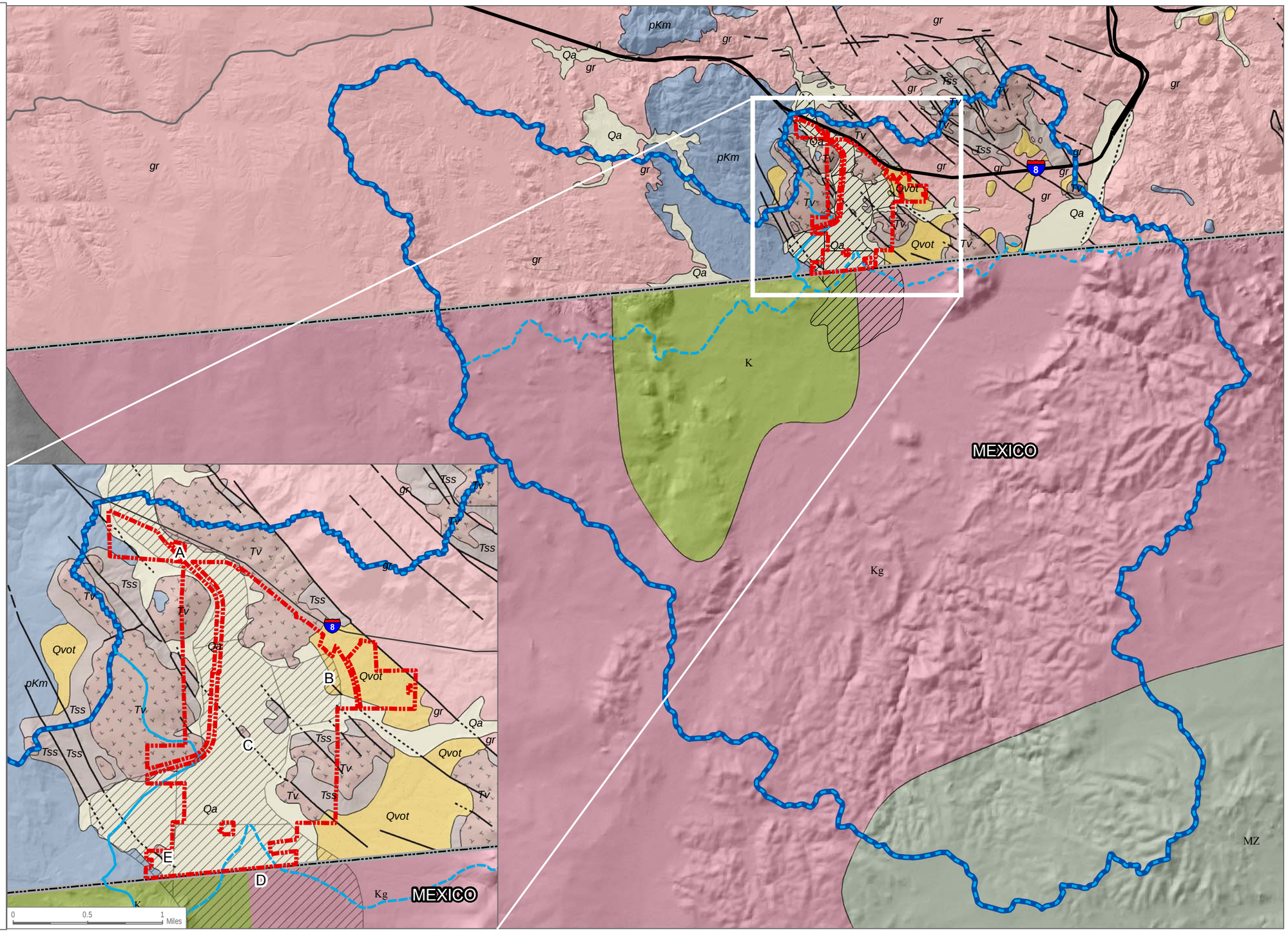
K, Sedimentary, Cretaceous

Kg, Plutonic, undivided grantic rocks, Cretaceous

MZ, Sedimentary, Mesozoic

Geologic Contacts (GSA 2005)

Location accurate



SOURCE: USGS; GSA; Swenson, 1981

DUDEK

0 1 2 Miles

FIGURE 6

Regional Geologic Map

Groundwater Resources Investigation - JVR Energy Park

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Project Boundary
Study Area Watershed
Contributing Subwatersheds
Project Production Wells

Soil Map Unit Symbol, Name (Swenson, 1981)

W, Sandy alluvium
X, Metamorphic and Plutonic residum
Y, Volcanic residum and Fine sand alluvium

Soil Map Unit Symbol, Name (USDA)

AcG, Acid igneous rock land
CaB, Calpine coarse sandy loam, 2 to 5 percent slopes
CaC, Calpine coarse sandy loam, 5 to 9 percent slopes
CaD2, Calpine coarse sandy loam, 9 to 15 percent slopes, eroded
CeC, Carrizo very gravelly sand, 0 to 9 percent slopes
InA, Indio silt loam, 0 to 2 percent slopes
InB, Indio silt loam, 2 to 5 percent slopes
IoA, Indio silt loam, saline, 0 to 2 percent slopes
LaE2, La Posta loamy coarse sand, 5 to 30 percent slopes, eroded
LcE2, La Posta rocky loamy coarse sand, 5 to 30 percent slope s, eroded
LdG, La Posta-Sheephead complex, 30 to 65 percent slopes
LdE, La Posta-Sheephead complex, 9 to 30 percent slopes
Lu, Loamy alluvial land
MnB, Mecca coarse sandy loam, 2 to 5 percent slopes
MvC, Mottsville loamy coarse sand, 2 to 9 percent slopes
MvD, Mottsville loamy coarse sand, 9 to 15 percent slopes
RaC, Ramona sandy loam, 5 to 9 percent slopes
RaD2, Ramona sandy loam, 9 to 15 percent slopes, eroded
RkA, Reiff fine sandy loam, 0 to 2 percent slopes
RsC, Rositas loamy coarse sand, 2 to 9 percent slopes
RuG, Rough broken land
SrD, Sloping gullied land
SvE, Stony land
ToG, Tollhouse rocky coarse sandy loam, 30 to 65 percent slo pes
ToE2, Tollhouse rocky coarse sandy loam, 5 to 30 percent slop es, eroded

SOURCE: Bing Maps; USDA; USGS; Swenson, 1981
*Note: Hatched area soils based on USDA soil classification using aerial photography

DUDEK 0 1 2 Miles

FIGURE 7
Soils Map
Groundwater Resources Investigation - JVR Energy Park

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- Project Boundary
- Major Use Permit Boundary
- Aquifer Thickness Well
- Jacumba Valley Groundwater Basin (DWR 7-47)

Quaternary Alluvial Aquifer Units (Swenson, 1981)

- Compartment A
- Compartment B
- Compartment C
- Compartment D
- Compartment E

Geologic Units (CGS 2012)

Late Holocene (Surficial Deposits)

- Qa, Alluvial Valley Deposits

Middle to Early Pleistocene

- Qvot, Very Old Terrace Deposits

Tertiary Units (Bedrock)

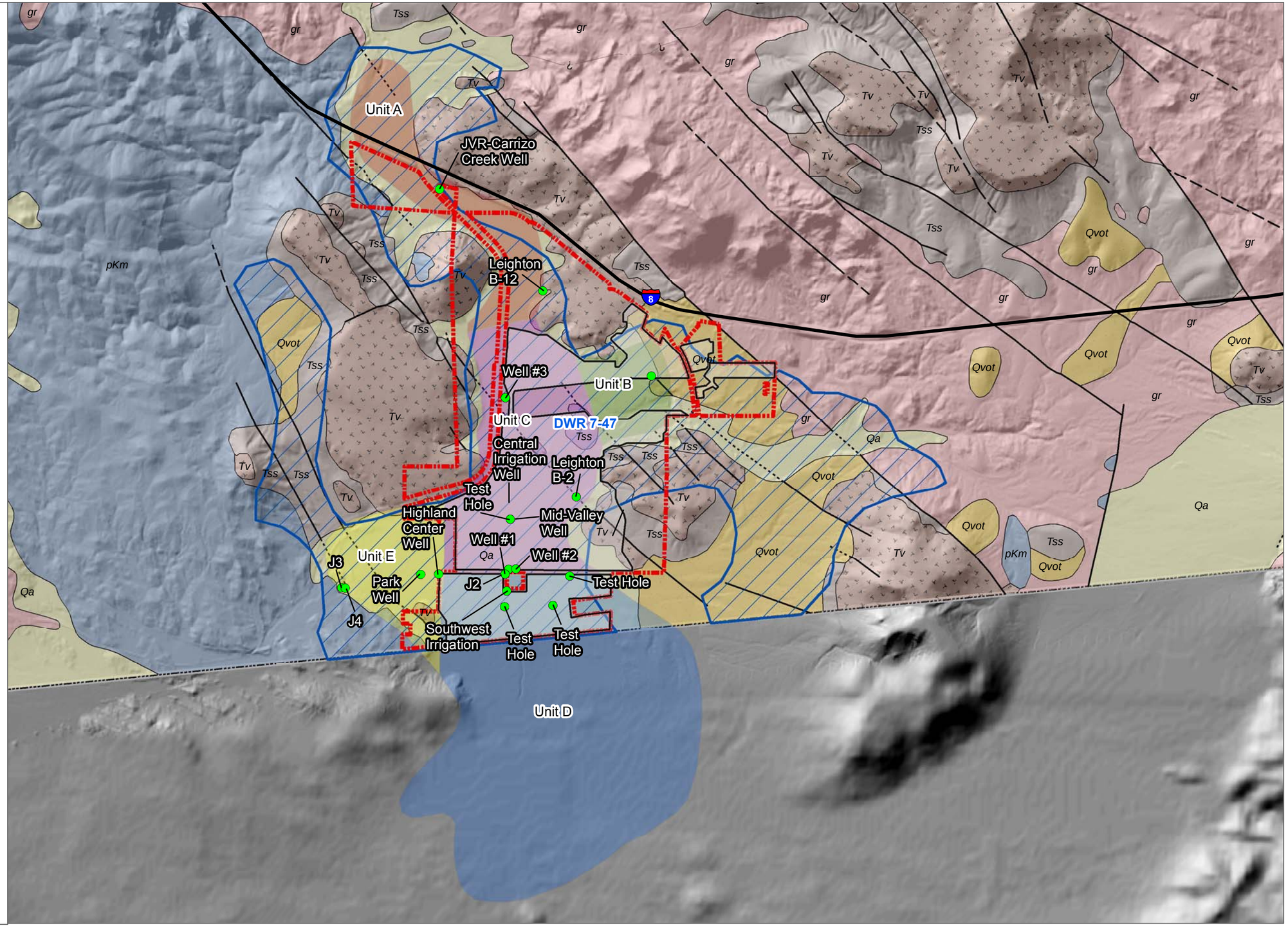
- Tss, Coarse-Grained Tertiary Age Formations
- Tv, Tertiary Age Formations of Volcanic Origin

Mesozoic and Older Units (Bedrock)

- Kss, Coarse-Grained Cretaceous age Formations of Sedimentary Origin
- pKm, Cretaceous and Pre-Cretaceous Metamorphic Formations of Sedimentary and Volcanic Origin
- gr, Granitic and Other Intrusive Crystalline Rocks

Faults and Geologic Contacts (CGS 2012)

- contact, identity and existence certain, location accurate
- contact, identity and existence certain, location approximate
- reference contact, identity and existence certain, location concealed
- reference contact, identity or existence questionable, location accurate
- fault, identity and existence certain, location accurate
- fault, identity and existence certain, location approximate
- fault, identity and existence certain, location concealed
- fault, identity and existence certain, location inferred



SOURCE: Swenson, 1981; DWR; CGS 2012
*Note: Aquifer thickness wells include Swenson, 1981 study wells and wells with available completion information

DUDEK

0 0.5 1 Miles

FIGURE 8
Hydrogeologic Units
Groundwater Resources Investigation - JVR Energy Project

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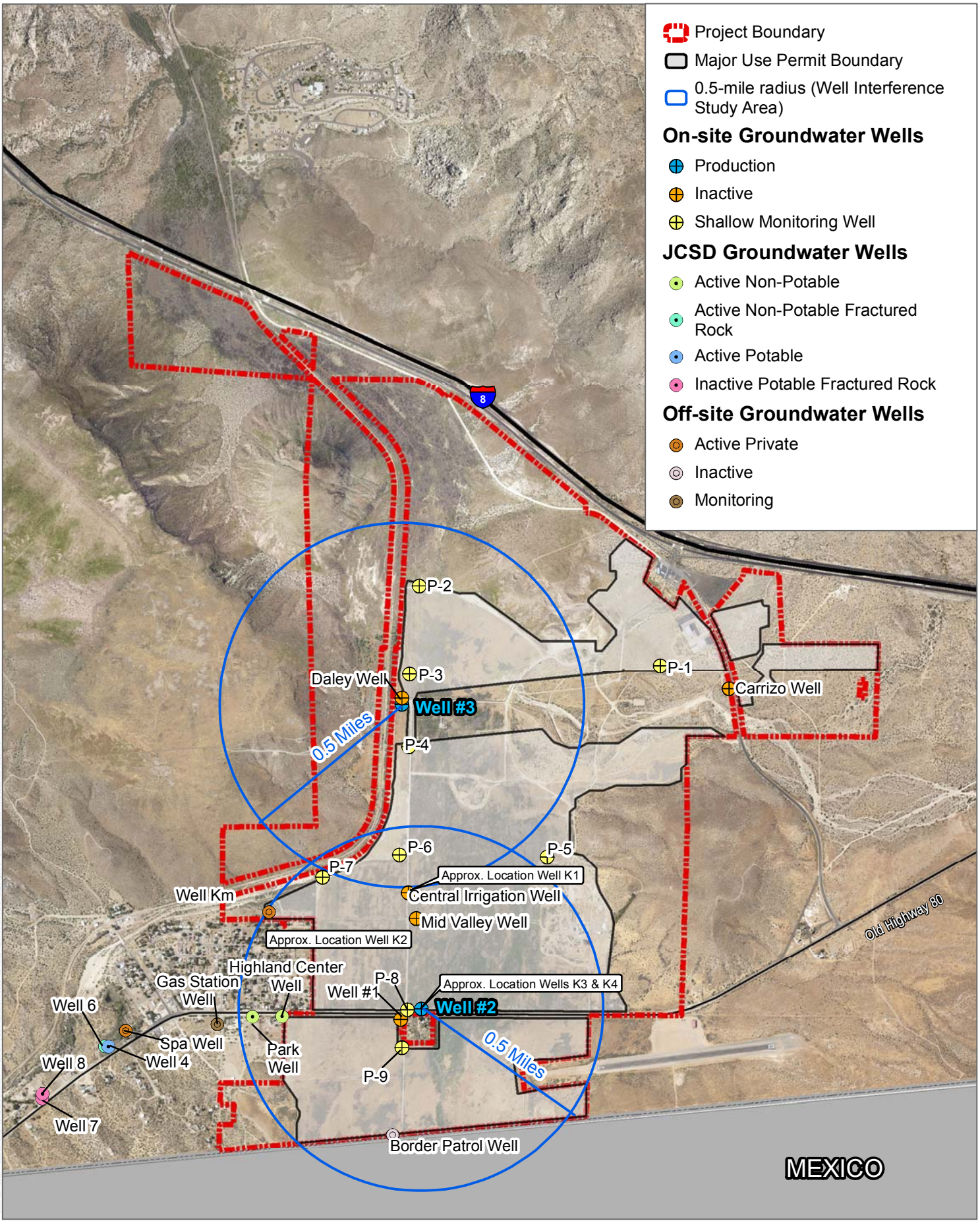

SOURCE: JCSD; JVR; SanGIS

DUDEK

0 0.25 0.5 Miles

FIGURE 9

On-site and Off-site Wells

Groundwater Resources Investigation -JVR Energy Project

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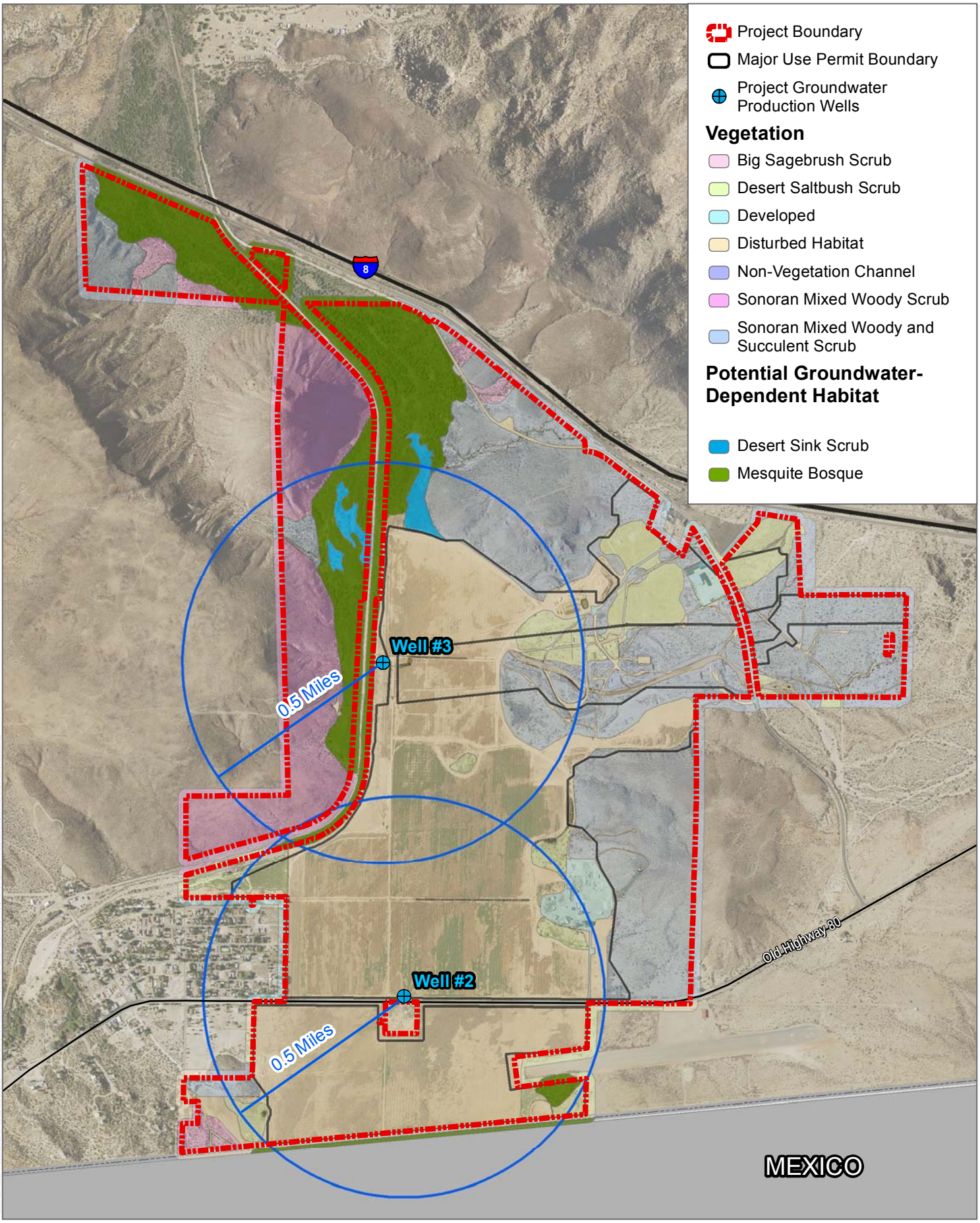

SOURCE: Dudek 2019

DUDEK

0 0.25 0.5 Miles

FIGURE 10

Potential Groundwater-Dependent Habitat

Groundwater Resources Investigation - JVR Energy Park

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Figure 11. Well #2 24-Hour Constant Rate Test: Well #2 Drawdown

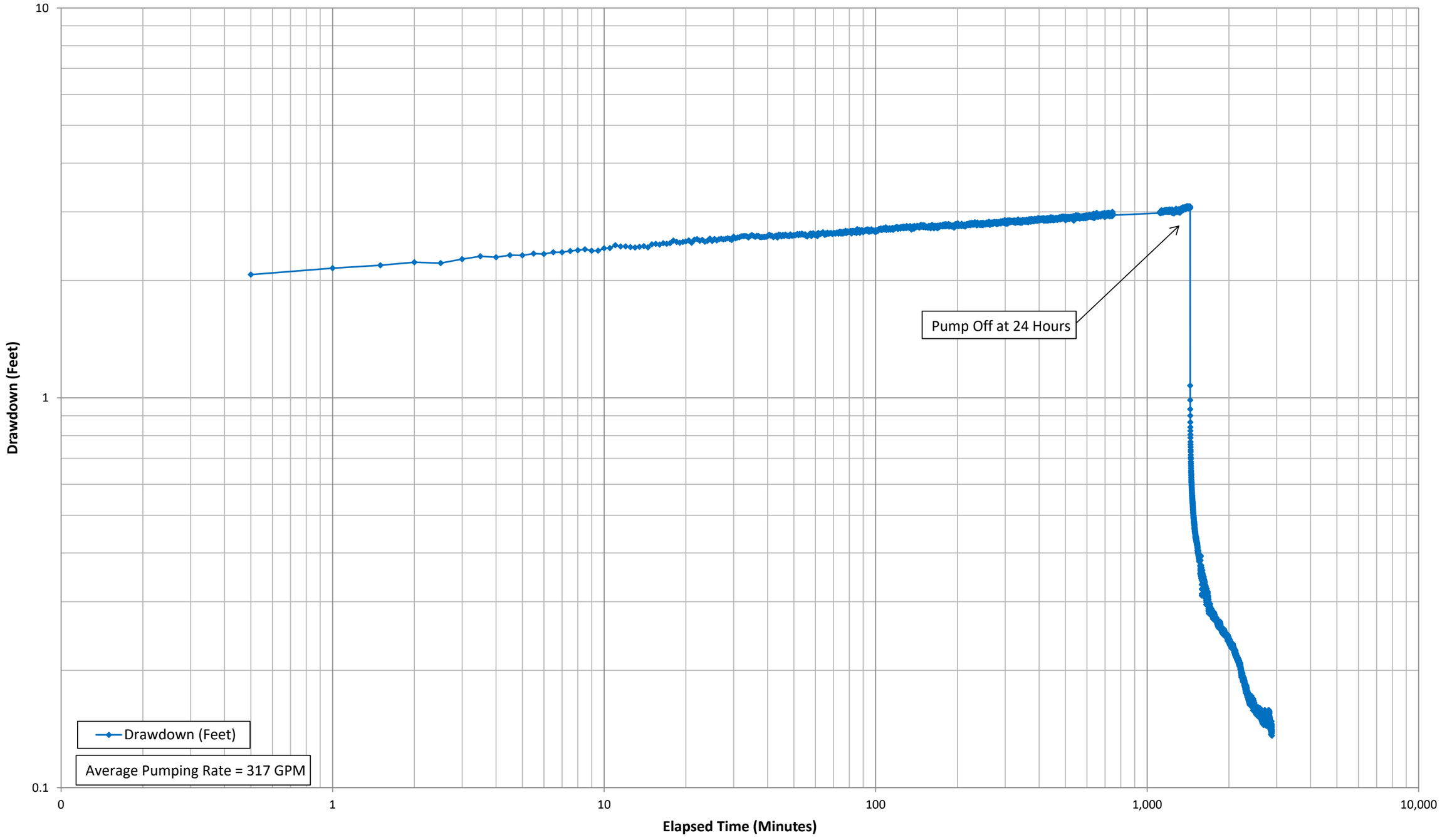

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Figure 12. Well #2 24-Hour Constant Rate Test: Well #1 Drawdown

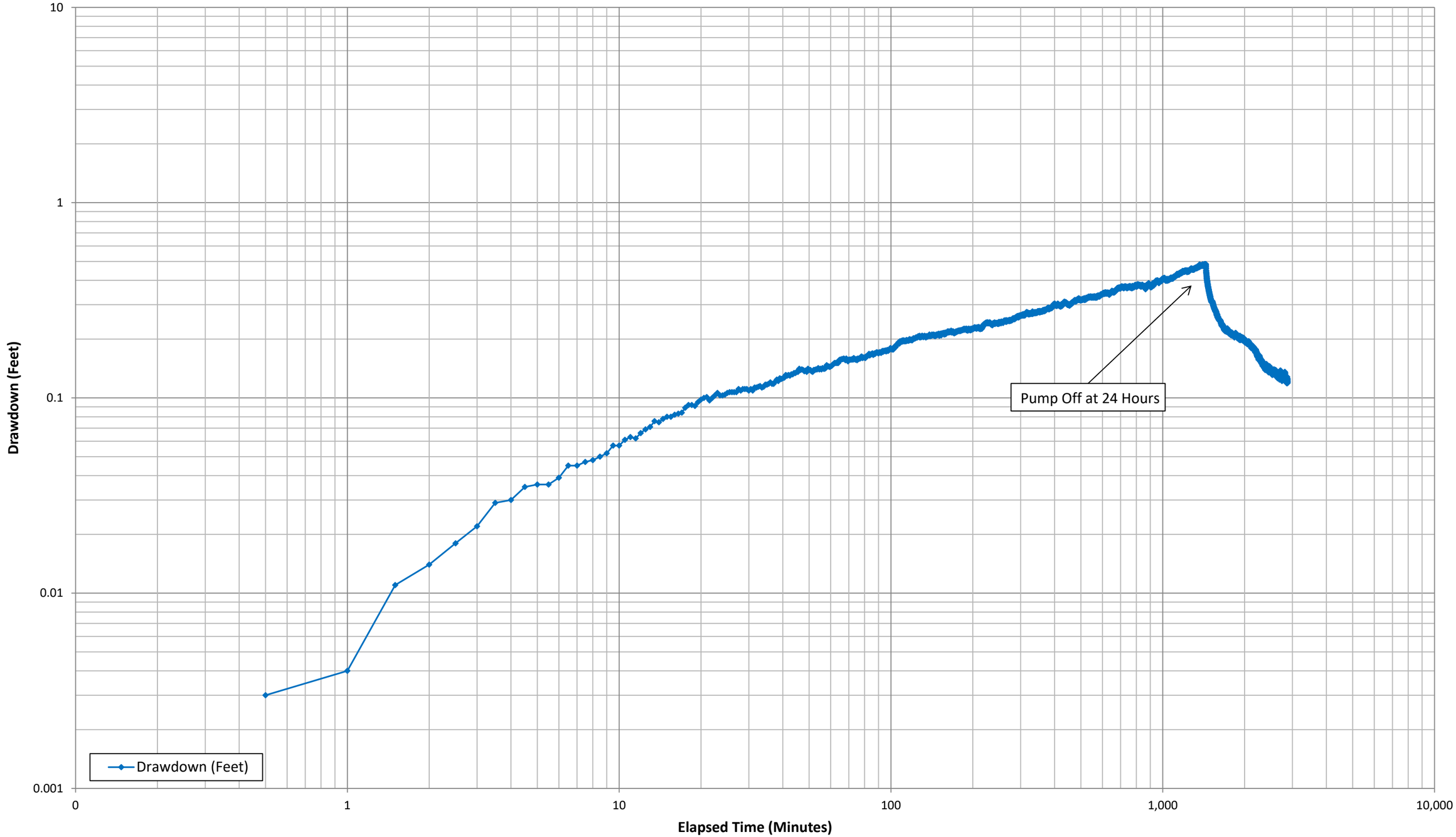

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Figure 13. Well #2 24-Hour Constant Rate Test: Well #2 Projected Drawdown

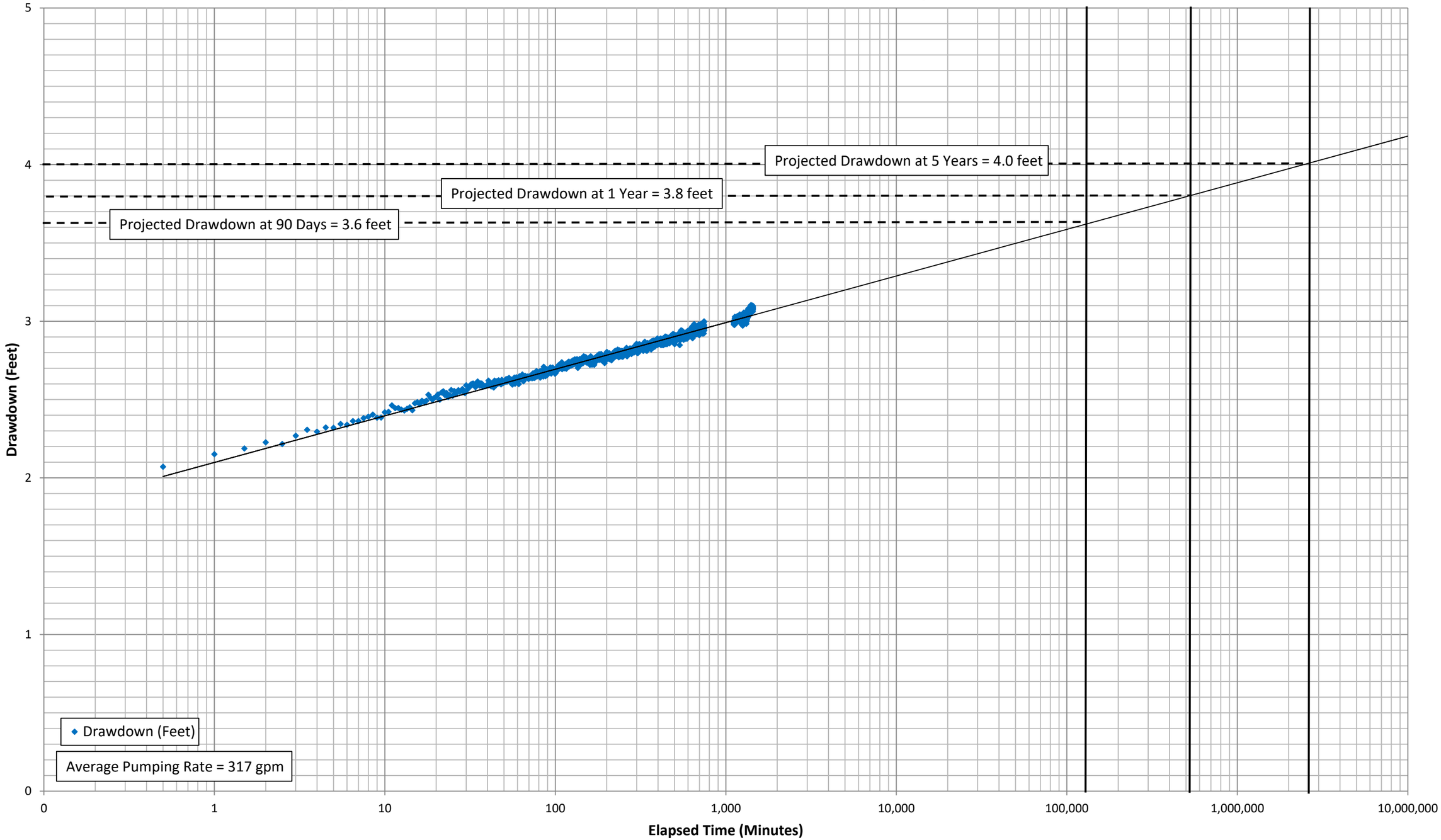

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Figure 14. Well #2 24-Hour Constant Rate Test: Well #1 Projected Drawdown

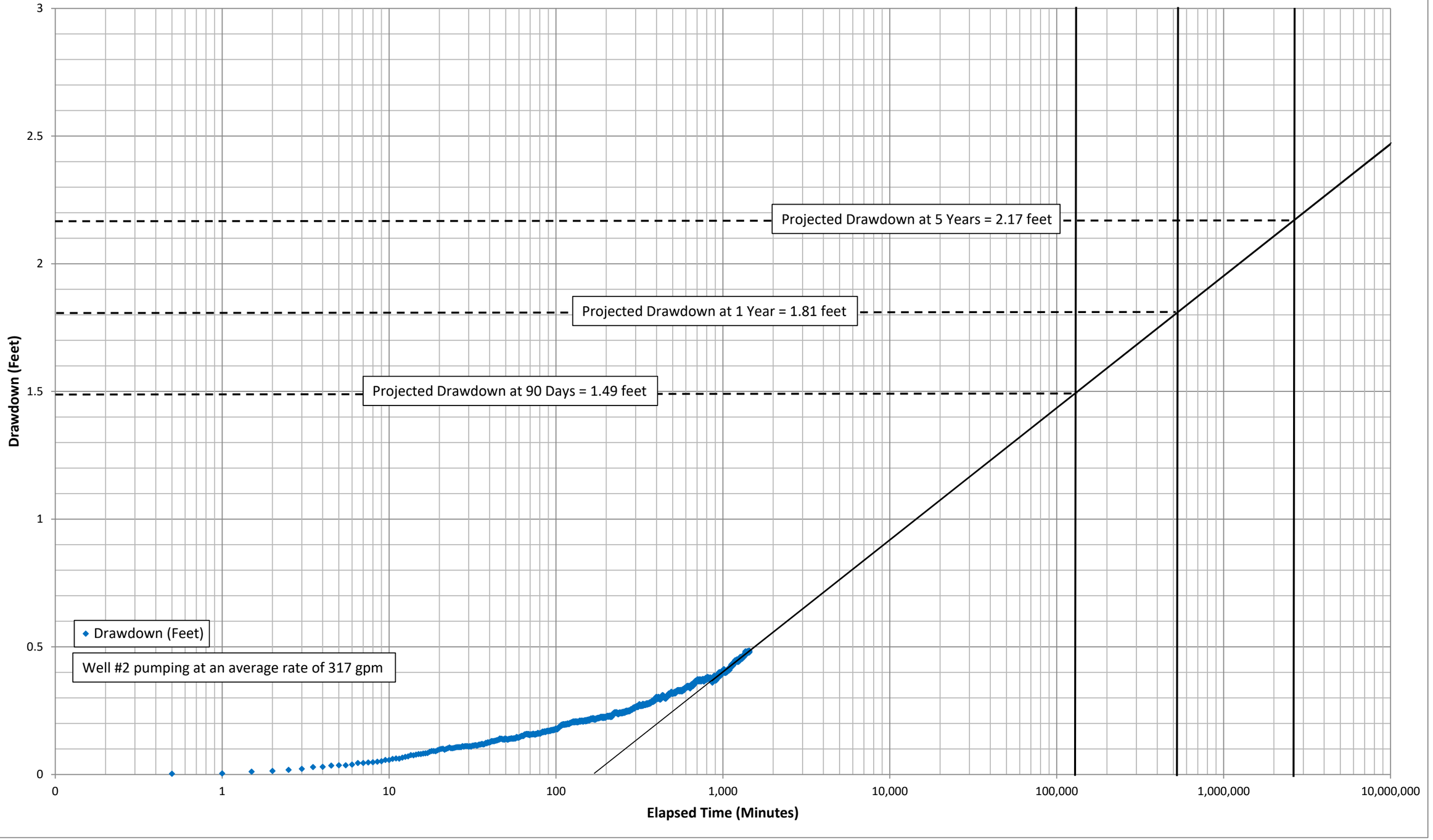

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Figure 15. Well #2 24-Hour Constant Rate Test: Well #2 Recovery

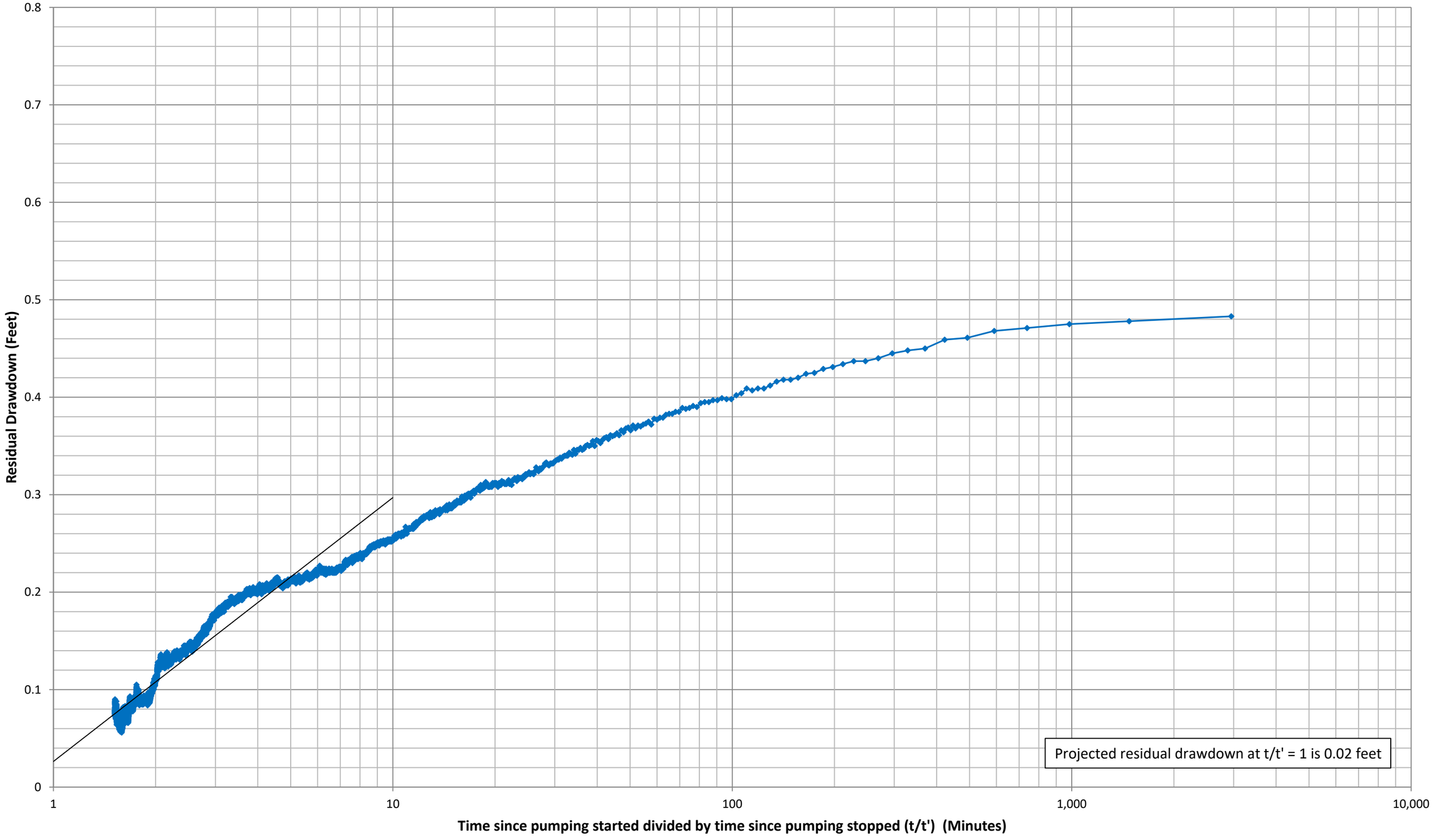

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Figure 16. Well #2 24-Hour Constant Rate Test: Well #1 Recovery

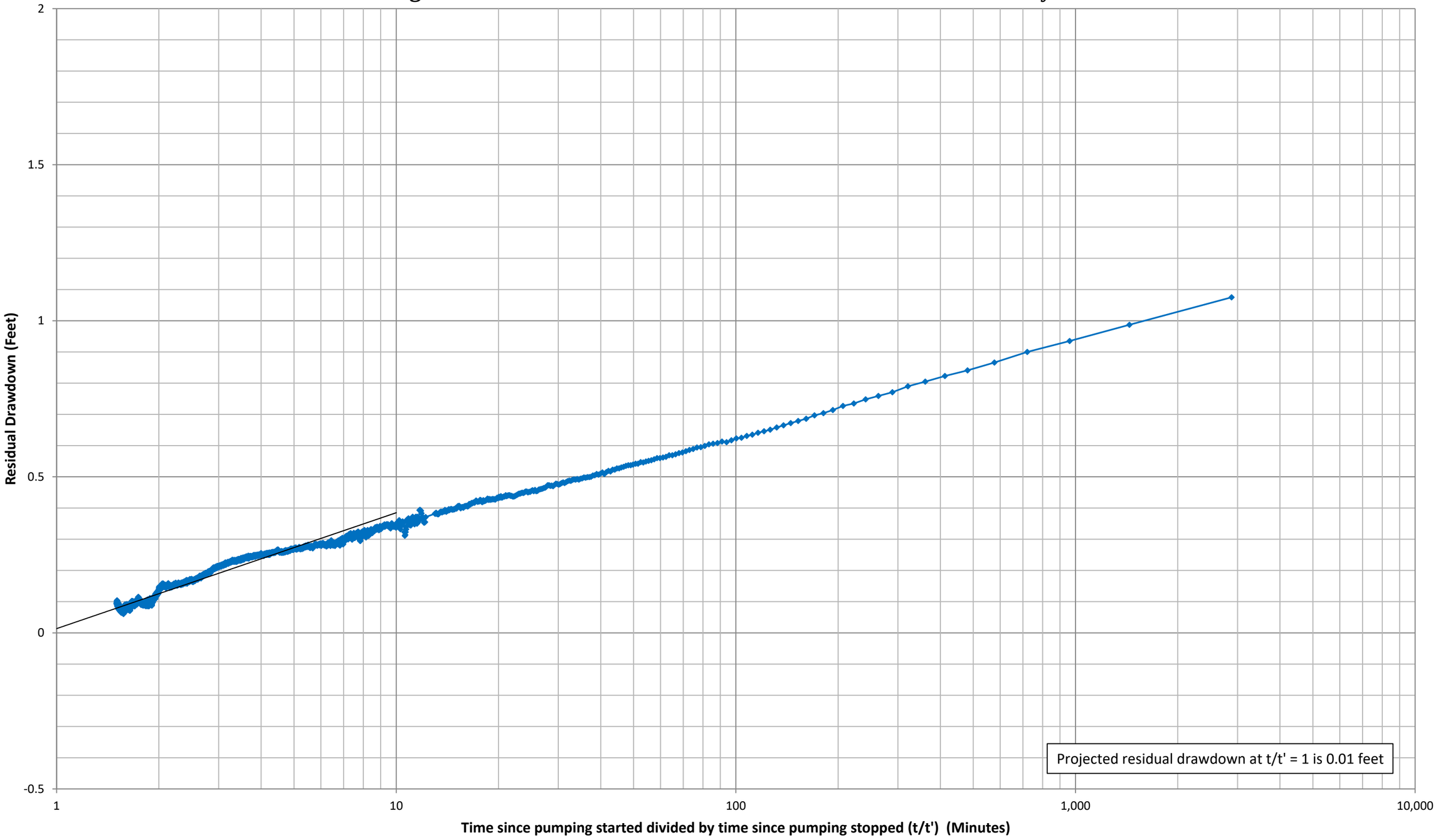

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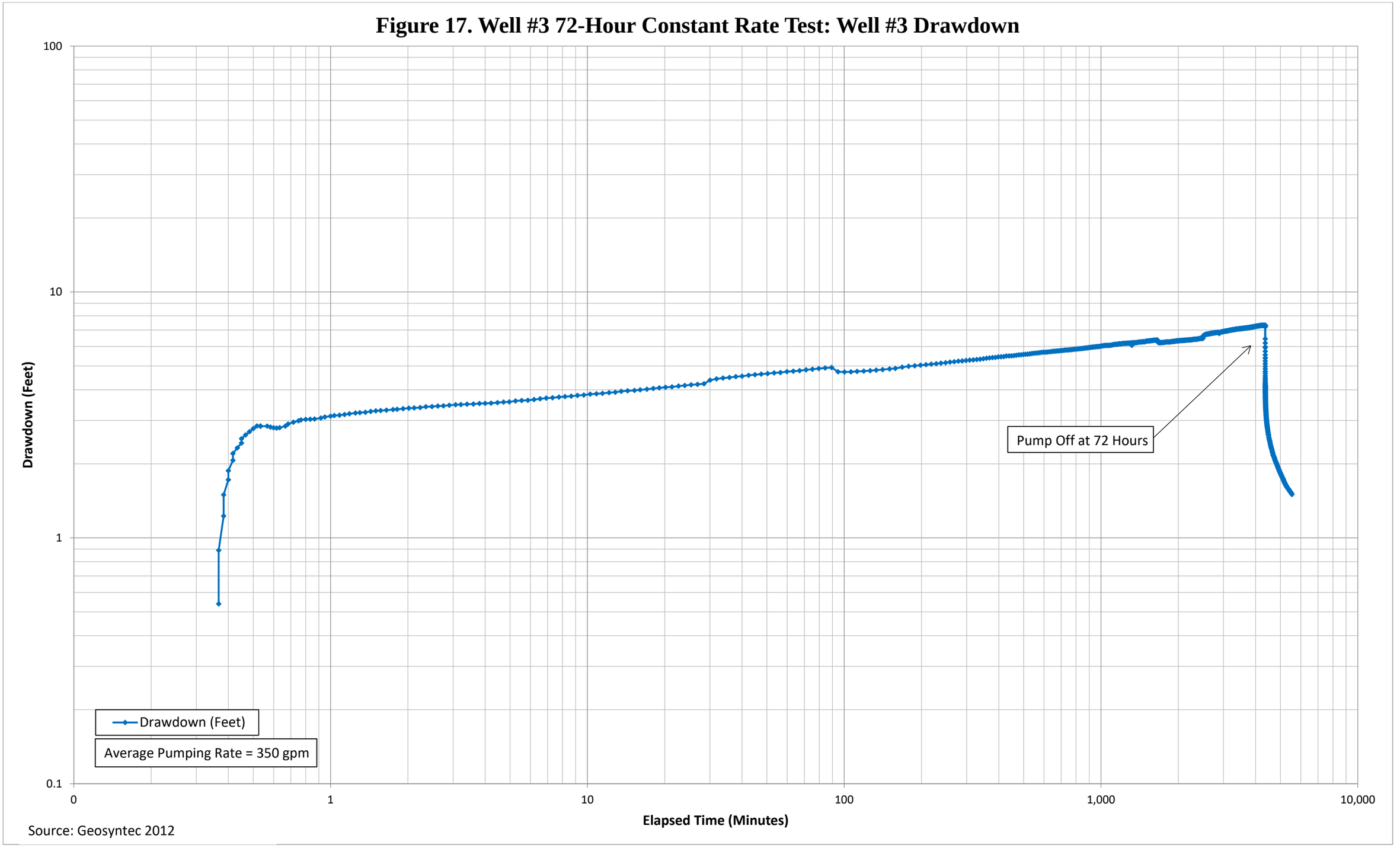
Figure 17. Well #3 72-Hour Constant Rate Test: Well #3 Drawdown



Source: Geosyntec 2012

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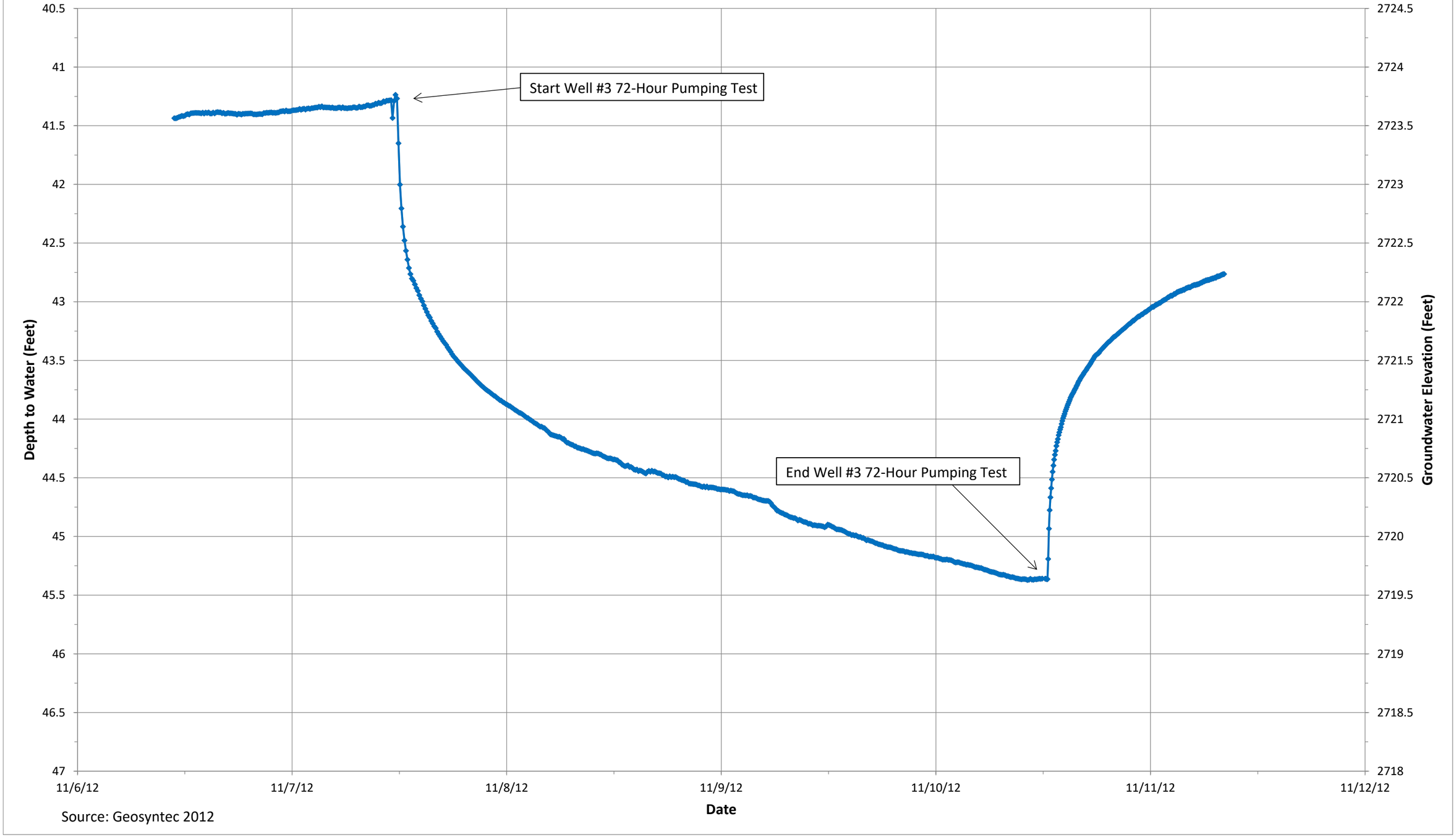
Figure 18. Well #3 72-Hour Constant Rate Test: Daley Well Hydrograph



Source: Geosyntec 2012

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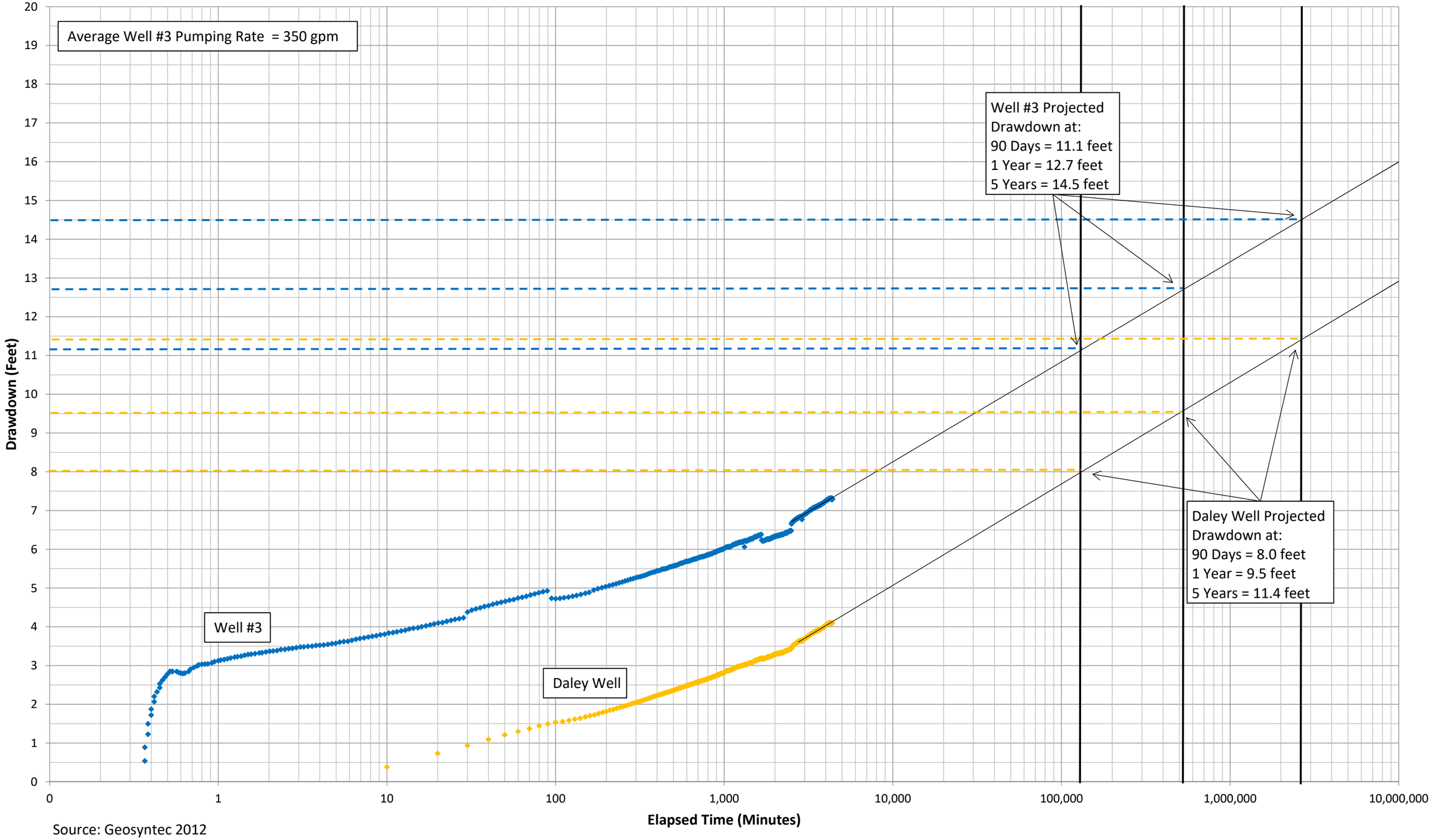
Figure 19. Well #3 72-Hour Constant Rate Test: Well #3 and Daley Well Projected Drawdown



Source: Geosyntec 2012

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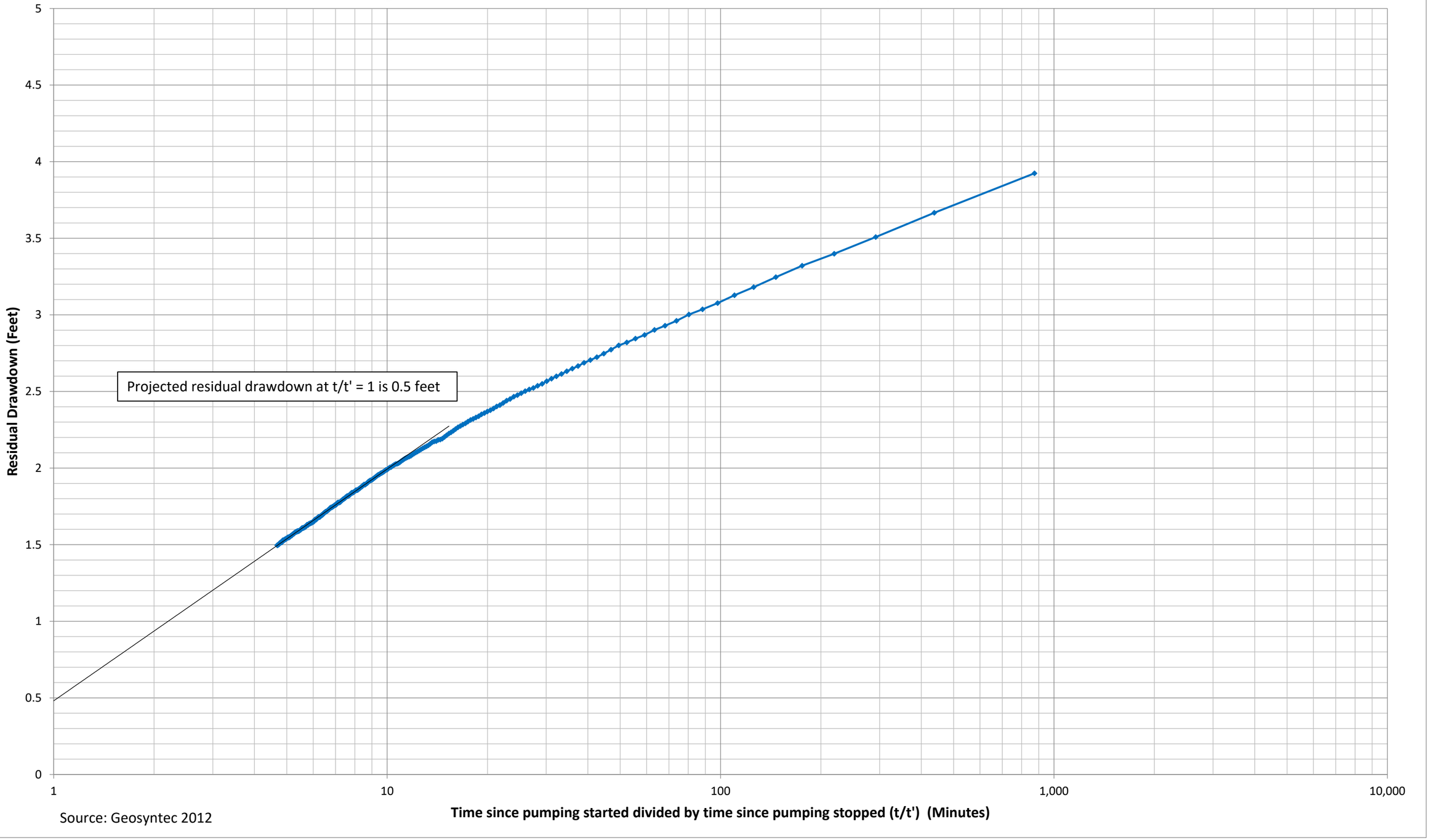
Figure 20. Well #3 72-Hour Constant Rate Test: Daley Well Recovery



Source: Geosyntec 2012

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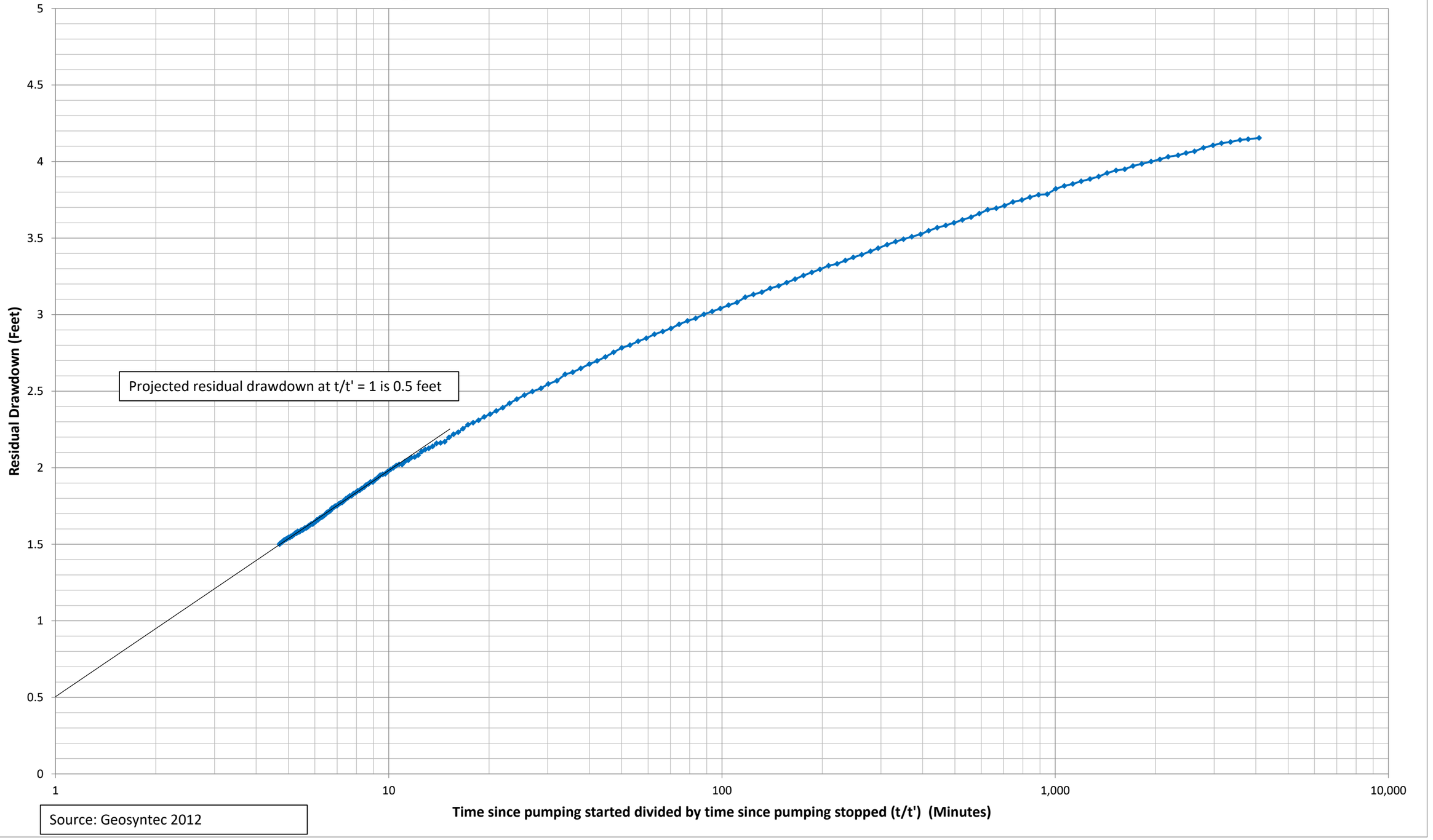
Figure 21. Well #3 72-Hour Constant Rate Test: Well #3 Recovery



Source: Geosyntec 2012

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APPENDIX A

Construction and Operational Water Demand Estimates

APPENDIX A
Construction and Operational Water Demand Estimates

Draft Preliminary Construction Water Demand Estimation Sheet

Project: JVR Energy Park, Jacumba Hot Springs, San Diego County, California		
Subject: PRELIMINARY ESTIMATE Construction Water Demand Prepared May 8, 2020		
Estimated Water Use Initial Site Preparation (Clearing, Grubbing, Grinding and Pre-Wetting)		
Based on pre-wetting surface with 1-inch of water for clearing, grubbing, and grinding	27,154	GAL/ACRE
Input Total Disturbance	570.54	ACRE
Total water to clear, grub, grind and pre-wet	15,492,586	GAL
Conversion to gallons per acre-foot	325,851	
Total water to clear, grub, grind and pre-wet	**48**	**ACRE-FT**
Total water to clear, grub, grind and pre-wet	**570.54**	**ACRES**
Input expected duration to clear, grub and grind	90	DAY
Water demand to clear, grub and grind	0.53	ACRE-FT/DAY
Water demand to clear, grub and grind	172,140	GAL/DAY
Estimated Mass grading		
Input quantity of on-site fill used to balance site	264,000	CY
Input optimum moisture content	9	%
Input observed moisture content	2.0	%
Input dry unit weight of on-site fill	115	PCF
Weight of water to reach saturation	8.050	PCF
Water required to hydrate and gain compaction	29	GAL/CY
Input contingency to account for evaporation during summer months	1.667	
Water required to hydrate and gain compaction	48	GAL/CY
Water for grading	12,785,294	GAL
Conversion to gallons per acre-foot	325,851	
Water required for grading	**39.2**	**ACRE-FT**
Input quantity of Scrapers (CAT 627H @ 24 cubic yards per load)	4	EA
Volume per haul	96	CY/EA
Time per haul	10	MIN
Hauls per hour	6	EA/HR
Grading Rate	576	CY/HR
Grading Rate for each work day	4,608	CY/DAY
Time to complete grading (work days)	90	DAYS
Water demand to complete mass grading	0.44	ACRE-FT/DAY
Water demand to complete mass grading	142,059	GAL/DAY
Estimated Water Use for Concrete		
Quantity of concrete for concrete pad foundations	5594	CY
Rate of water use for concrete hydration	40	GAL/CY
Total water use for concrete pad foundations (Substation + inverters)	225,957	GAL
Total water use for concrete pad foundations (Substation + inverters)	**0.7**	**ACRE-FT**
Daily Dust Control		
Number of Construction Days after clearing/grubbing/grinding	365	Days
Typical Rate of Water Use	30,000	GAL/DAY

Draft Preliminary Construction Water Demand Estimation Sheet

Project: JVR Energy Park, Jacumba Hot Springs, San Diego County, California		
Subject: PRELIMINARY ESTIMATE Construction Water Demand Prepared May 8, 2020		
Approx. No. High Wind Days over Period (Based on Boulevard Met Data)	27	High Wind Days
Rate of Water Use on Windy Days (Average Winds > 15 MPH)	54,000	GAL/DAY
Total water use for high wind days	1,458,000	GAL
Total Water Use for Daily Dust Control	12,138,000	GAL
Total Water Use for Daily Dust Control	**37.3**	**ACRE-FT**
Additional Miscellaneous Items		
Fire Protection Requirements	30,000	GAL
Noxious Weed Mitigation	624,000	GAL
Quarter-mile underground Gen-Tie Line	13,200	GAL
Hydroseeding	4,279,050	GAL
Additional Miscellaneous Items	**13.1**	**ACRE-FT**
Total Estimated Construction Demand		
Total Project Water Usage	45,588,087	Gallons
	139.9	**ACRE-FT**

Draft Preliminary Operation and Maintenance Water Demand Estimation Sheet

Project: JVR Energy Park, Jacumba Hot Springs, San Diego County, California		
Subject: PRELIMINARY ESTIMATE Construction Water Demand Prepared May 8, 2020		
Panel Washing Water Demand		
Number of panels	300,000	panels
Panel rating	300	watts
Project size	90	MW
Panel type	72	cells per panel
Panel height	6.42	feet
Panel width	3.25	feet
Panel area	21	square feet
Project panel area	6,259,500	square feet
Project panel area	695,500	square yards
Per wash water demand	0.3	gallons per square yard
Per wash water demand	208,650	gallons
Washes per year	4	washes per year
Gallons per year	834,600	gallons
Panel Washing Water Demand	**2.6**	**acre-feet per year**
Landscape Buffer		
Landscape Buffer	5.39	acres
CIMIS Zone 16 Reference Evapotranspiration (Eto)1	5.21	feet
Crop Coefficient (expressed as percentage of Eto)	0.3	percent
Landscape Buffer Water Demand	**8.4**	**acre-feet per year**

Draft Preliminary Operation and Maintenance Water Demand Estimation Sheet

Project: JVR Energy Park, Jacumba Hot Springs, San Diego County, California		
Subject: PRELIMINARY ESTIMATE Construction Water Demand Prepared May 8, 2020		
Total Estimated Operational Water Use		
Total Estimated Operational Water Use	**11.0**	**acre-feet per year**

1. Water requirements of a mixed-species xeriscape with low water demand (WUCOLS 2020). Categories of Water Needs. Univ. Calif. Coop. Ext. https://ucanr.edu/sites/WUCOLS/WUCOLS_IV_User_Manual/Categories_of_Water_Needs/

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APPENDIX B

Well Completion Information

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

WELL PERMIT APPLICATION 6983

APN 614 100 20
Control # W02683

614-100-15

TYPE OF WORK (Check)	USE (Check)	EQUIPMENT (Check)
New Well ☒	Individual Domestic ☐	Rotary mud ☒
Repair or Modification ☐	Agricultural ☒ $ TEST	Cable Tool ☐
Time Extension ☐	Industrial ☐ Community ☐	Other ☐
Destruction ☐	Other _____	

PROPOSED WELL DEPTH
Max. 100 Min. 50 (Feet)

PROPOSED CASING
Type PVC Depth FULL Diameter 6" ID Wall or Gage 240

PROPOSED SEALING ZONE(S)
From 0 to 90 Feet
From _____ to _____ Feet
From _____ to _____ Feet

PROPOSED PERFORATIONS OR SCREEN
From 20 to BOTTOM Feet
From _____ to _____ Feet
From _____ to _____ Feet
From _____ to _____ Feet

SEALING MATERIAL (Check)
Neat Cement Grout ☐ Bentonite Clay ☒
Sand Cement Grout ☒ Concrete ☐
Other-Specify: _____

DATE OF WORK
Start MAY 90
Completion MAY 90

NAME OF WELL OWNER
WILLIAM KETCHEM

NAME OF WELL DRILLER
FRANK MURPHY

LOCATION OF WELL Interstate 8
SEC MAP (JACUMBA)

COMPANY
MURPHY'S WELL DRILLING

DISPOSITION OF APPLICATION
(FOR HEALTH OFFICERS USE ONLY)

☐ APPROVED ☐ DENIED

☒ APPROVED WITH CONDITIONS

Report Reason(s) for Denial or Necessary Conditions Here:
Well INSTALLATION TO be in Accordance with San Diego County AND STATE Code. Test hole IS To Be dug within 30 days

none

Joyce Tinkler
HEALTH OFFICER

5/17/90
DATE

BUSINESS ADDRESS
PO 434 JACUMBA 92034

LICENSE NUMBER
505834

Cash Deposit ☐
Bond Posted ☒

$150 Fee paid on _____

I hereby agree to comply with all regulations of the Department of Health Services and with all ordinances and laws of the County of San Diego and of the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work I will furnish the Department of Health Services with a complete and accurate log of the well.

Frank G. Murphy
APPLICANT'S SIGNATURE

5-17-90
DATE

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

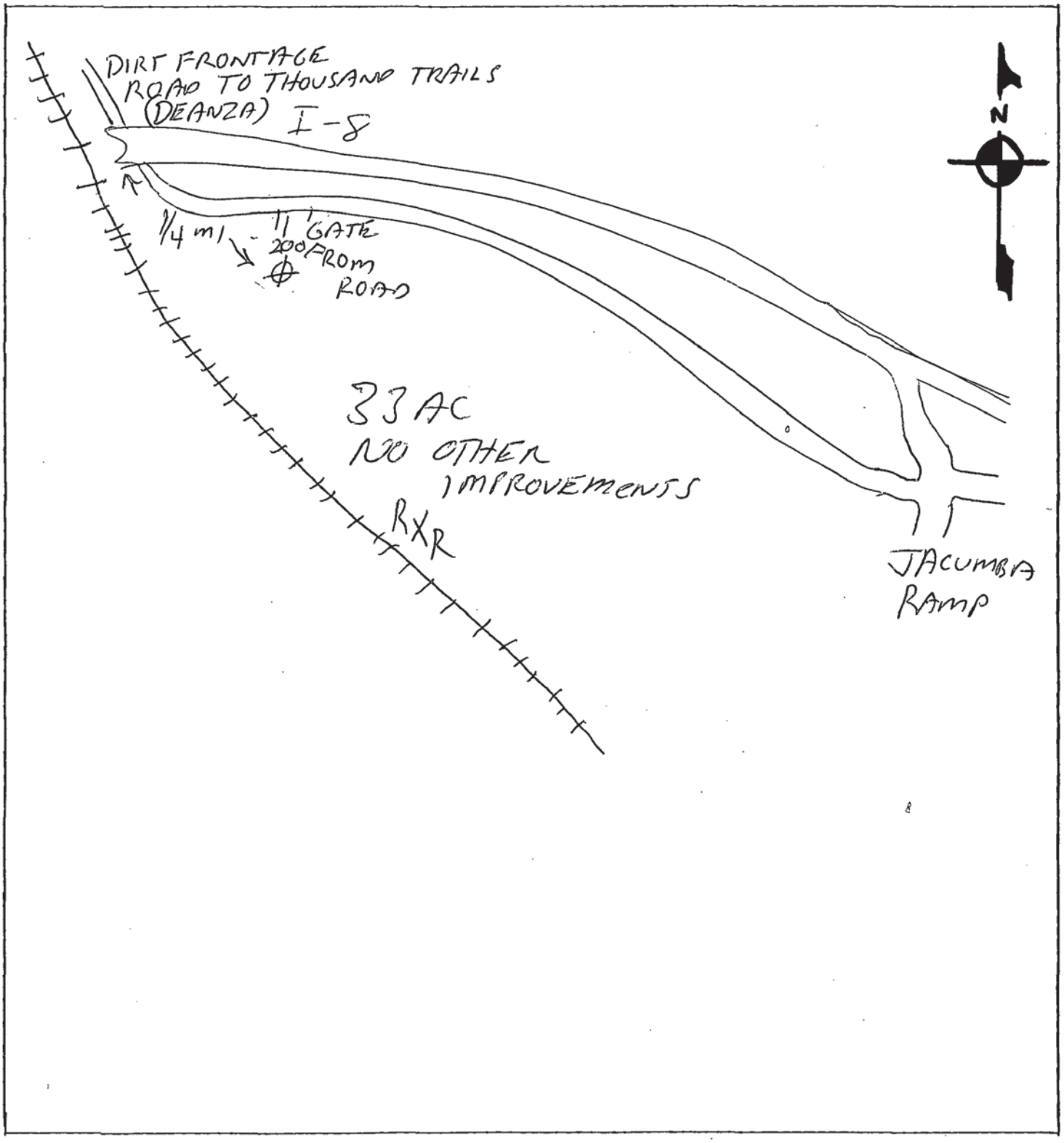
WELL PERMIT APPLICATION

Control # WO2683

Assessor's Parcel No. 614-100-20

LOCATION

INDICATE BELOW THE VICINITY AND EXACT LOCATION OF WELL WITH RESPECT TO THE FOLLOWING ITEMS: PROPERTY LINES, WATER BODIES OR WATER COURSES, DRAINAGE PATTERN, ROADS, EXISTING WELLS, SEWERS AND PRIVATE SEWAGE DISPOSAL SYSTEMS AND OTHER POTENTIAL CONTAMINATION SOURCES, INCLUDING DIMENSIONS.



WDR to C
8/24/1988

ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

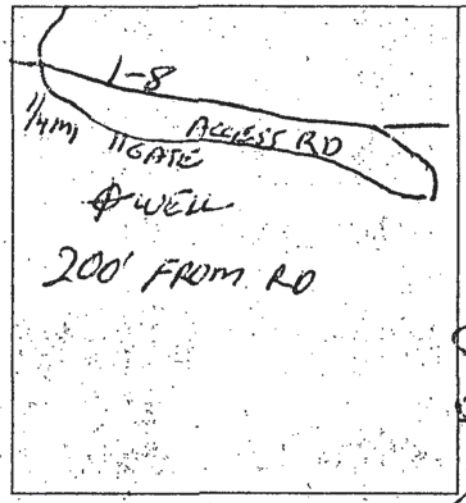
WATER WELL DRILLERS REPORT

Do not fill in
No. 341230

Notice of Intent No. _____
Local Permit No. or Date W-02683

State Well No. _____
Other Well No. _____

(2) LOCATION OF WELL (See instructions):
County SAN DIEGO Owner's Well Number _____
Well address if different from above JACUMBA VALLEY RANCH
Township 17S Range 8E Section 32
Distance from cities, roads, railroads, fences, etc. SEE MAP



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☐
Irrigation ☒
Industrial ☐
Test Well ☒
Municipal ☐
Other ☐
(Describe)

(5) EQUIPMENT:
Rotary ☒ MUD Reverse ☐
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK: Yes ☒ No ☐ Size 3/4 X 1/8
Diameter of bore 12"
Packed from 0 to 78' ft.

(7) CASING INSTALLED:
Steel ☒ Plastic ☒ Concrete ☐

From ft.	To ft.	Dia in.	Gage or Wall
0	20	6"	SCH 200

(8) PERFORATIONS:
Type of perforation or size of screen

From ft.	To ft.	Slot size
20	78	1/8X4

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 20 ft.
Were strata sealed against pollution? Yes ☒ No ☐ Interval _____ ft.
Method of sealing CLAY & CEMENT GROUT

(10) WATER LEVELS:
Depth of first water, if known APPROX. 24' ft.
Standing level after well completion APPROX. 4' ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? DRILLER
Type of test Pump ☐ Bailer ☐ Air lift ☒
Depth to water at start of test 7' ft. At end of test _____ ft.
Discharge 240 gal/min after 10 hours Water temperature COLD
Chemical analysis made? Yes ☐ No ☐ If yes, by whom? _____
Was electric log made Yes ☐ No ☐ If yes, attach copy to this report

(12) WELL LOG: Total depth 81' ft. Completed depth 78' ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	24'	CLAY - RUST BROWN COLOR
24	55	CORSE SAND
55	65	BROKEN GRAVEL
65	75	BLACK SAND
75	81	VOLCAN. ROCK

Good Seal
J. Murphy
5/30/91

Work started 5-10-1990 Completed 5-14-1990

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Signed Fred A. Murphy (Well Driller)
NAME MURPHY'S WELL DRILLING (Person, firm, or corporation) (Typed or printed)
Address PO 434
City JACUMBA CA ZIP 92034
License No. 505834 Date of this report 5-23-90

DWR 188 (REV. 12-86) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM 86 96355

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # W LW2L/16419
WELL COMPUTER #
FEE:
WATER DIST:

1. Property Owner: (Lessee) BORNT FARMS Phone: 760-356-2233
   2307 EAST Hwy 98 (Mailing Address) HOLTVILLE (City) 92250 (Zip)
2. Well Location - Assessors Parcel Number 660-020-05
   OLD Hwy 80 (Site Address) JACUMBA (City) 91934 (Zip)
3. Well Contractor - Well Driller Joe EDWARDS Company Name: FAIN DRILLING
   12029 OLD CASTLE Rd (Mailing Address) VALLEY CENTER (City) 92082 (Zip)
   Phone#: 760-749-0701 C-57#: 328289 ☐ Cash Deposit ☒ Bond Posted
4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other AG-WELL
5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd
6. Type of Equipment: ROTARY
7. Depth of Well: Proposed: 100' Existing: 0
8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: Steel A-139-B	☒ Yes ☐ No	☒ Yes ☐ No	S.S. 304 STAINLESS WIRE WRAP SCREEN
Depth: 100	Depth: 20 ft.	From: 20 To: 100	From: 40 To: 100
Diameter 14 in.	Diameter 24 in.	Type: PEA GRAVEL	From: To:
Wall/Gauge: .250	Wall/Gauge: .250	Wall/Gauge:	From: To:

9. Annular Seal: Depth: 20 ft. Sealing Material: Cement
   Borehole diameter: 32 in. Conductor diameter: 24 in. Annular Thickness 5 in.
10. Date of Work: Start: 1-21-05 Complete: 1-24-05

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Joe R. Fain Date: 1-20-05

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

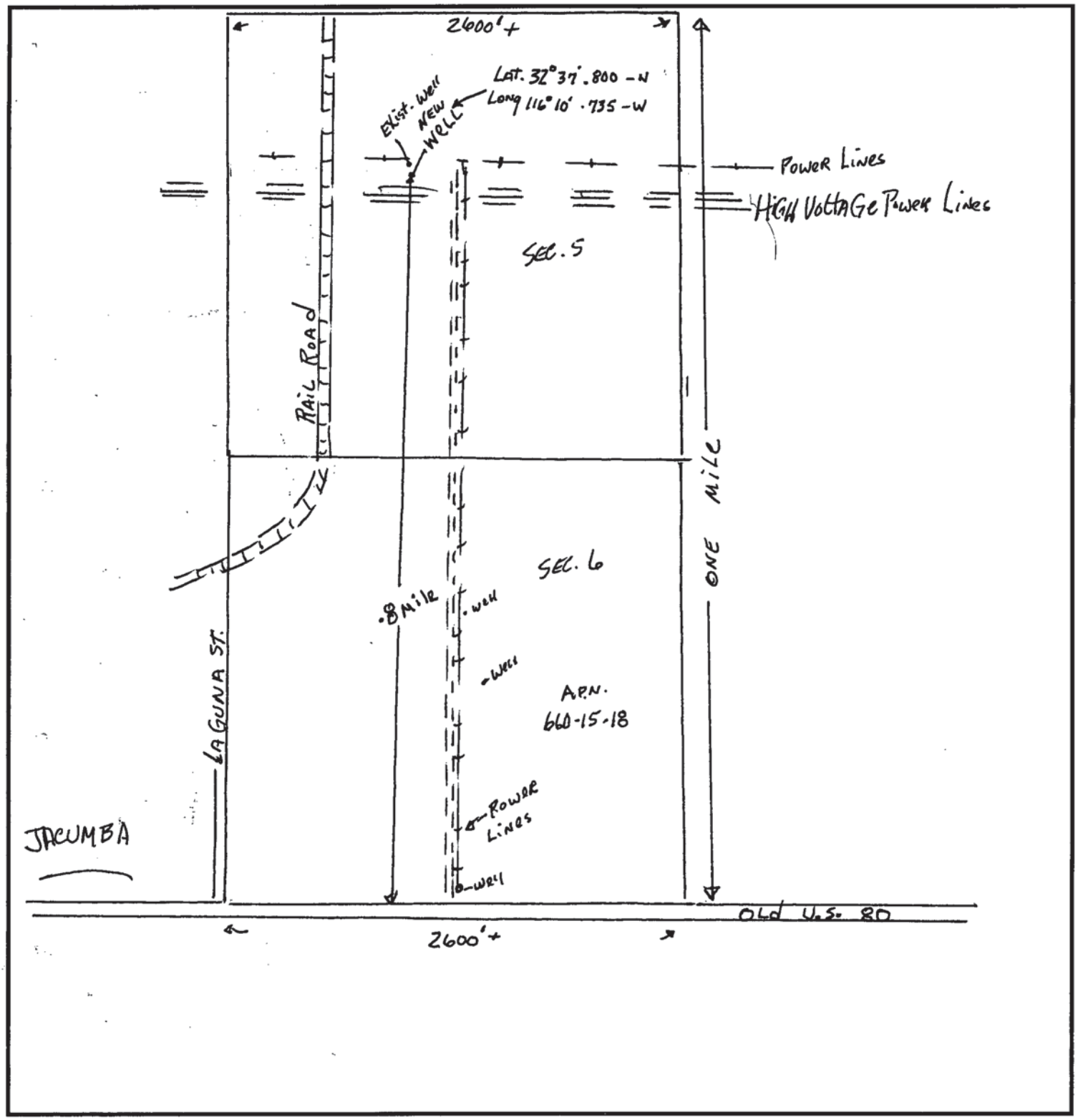
Specialist: Date: 1/29/05

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LUEL 16419
Assessor's Parcel Number: 660-020-05

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.

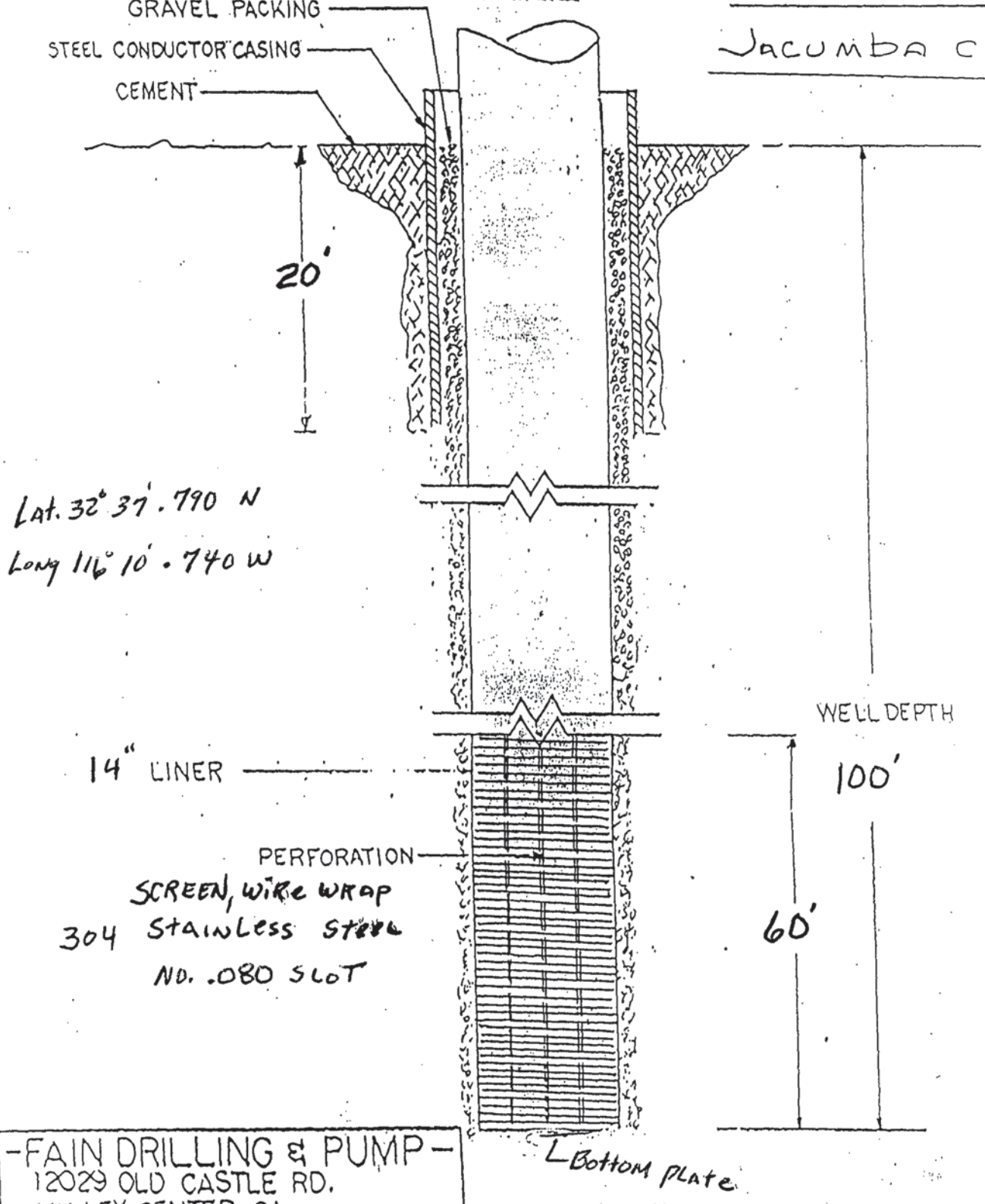


LWEL 16419

"AS BUILT" WELL

BORN T. FARMS

JACUMBA CA.



Lat. 32° 37'. 790 N

Long 116° 10'. 740 W

SCREEN, WIRE WRAP
304 STAINLESS STEEL
NO. .080 SLOT

-FAIN DRILLING & PUMP-
12029 OLD CASTLE RD.
VALLEY CENTER CA.

STEEL CONDUCTOR 24" X 20'
STEEL LINER 14" X 100'
GRAVEL SIZE 5/16 X 7

BY JAF 1-26-05

JOE FAIN-OWNER

QUADRUPLICATE
For Local Requirements

Page 1 of 1

Owner's Well No. One

Date Work Began 1/17/05, Ended 1/25/05

Local Permit Agency [illegible]

Permit No. 16419 Permit Date 1/25/05

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 0909529

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID Gel

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	11	Clayey sand and silt fine grains
11	56	Grey clayey sand fine to coarse medium grained
56	76	Coarse sand and gravel
76	89	sand fine to coarse with gravel and boulders
90	112	Clay weathered rock

116.10.740
32 37.790

TOTAL DEPTH OF BORING 112 (Feet)
TOTAL DEPTH OF COMPLETED WELL 100 (Feet)

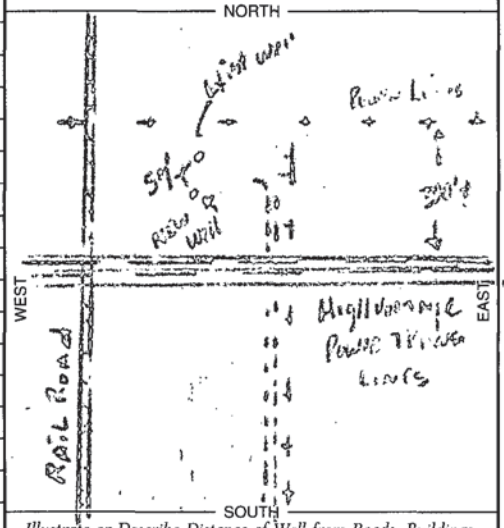
WELL OWNER

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

WELL LOCATION

Address n/o Hwy 80 & East Hwy 94
City Jacumba
County San Diego
APN Book 660 Page 020 Parcel 05
Township 16-S Range 8-E Section 5
Lat 32 DEG. 37 MIN. 790 SEC. N
Long 116 DEG. 10 MIN. 740 SEC. W

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

USES (✓)

WATER SUPPLY
___ Domestic ___ Public
X Irrigation ___ Industrial
___ MONITORING
___ TEST WELL
___ CATHODIC PROTECTION
___ HEAT EXCHANGE
___ DIRECT PUSH
___ INJECTION
___ VAPOR EXTRACTION
___ SPARGING
___ REMEDIATION
___ OTHER (SPECIFY)

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 12 (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 9 (Ft.) & DATE MEASURED 1-26-05
ESTIMATED YIELD * 2000 (GPM) & TEST TYPE Air Lift
TEST LENGTH 2 (Hrs.) TOTAL DRAWDOWN 90 (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	32	X				Steel A-53	23.5	.250	
0	40	22	X				Steel A-139	18.5	.250	
41	100	22		X			304 S.S.	17.5	.250	.080

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
0	100				Sand #3

ATTACHMENTS (✓)

___ Geologic Log
X Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
X Other Sand

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Fain Drilling & Pump Co. Inc.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS 12029 Old Castle Rd. CITY Valley Center STATE Ca ZIP 92082

Signed Joe R. Fain
C-57 LICENSED WATER WELL CONTRACTOR
DATE SIGNED 1-29-05
C-57 LICENSE NUMBER 327297

DWR 188 REV. 05-03

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM


6600200500
PRIVATE RD
01502000
501700
6601501800
600 f

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # W Wsel 17922
WELL COMPUTER #
FEE: _____
WATER DIST: _____

1. Property Owner: BORNT FARMS Phone: 619-766-4213
   2307 EAST Hwy 98 (Mailing Address) HOLTVILLE CA 92250 (City, Zip)
2. Well Location - Assessors Parcel Number 661-060-22
   Old Hwy 80 (Site Address) JACUMBA (City) _____ (Zip)
3. Well Contractor - Well Driller Joe EDWARDS Company Name: FAIN Drilling
   12029 Old CASTLE Rd (Mailing Address) VALLEY CENTER (City) 92082 (Zip)
   Phone#: 760-749-0701 C-57#: 328287 ☐ Cash Deposit ☒ Bond Posted
4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other _____
5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd
6. Type of Equipment: ROTARY
7. Depth of Well: Proposed: 120' Existing: 0
8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: STEEL	☒ Yes ☐ No	☒ Yes ☐ No	
Depth: 120	Depth: 20 ft.	From: 20 To: 120	From: 60 To: 120
Diameter 14" in.	Diameter _____ in.	Type: _____	From: _____ To: _____
Wall/Gauge: .250	Wall/Gauge: _____	Wall/Gauge: _____	From: _____ To: _____

9. Annular Seal: Depth: 20 ft. Sealing Material: CEMENT
   Borehole diameter: 32 in. Conductor diameter: 24 in. Annular Thickness 4 in.
10. Date of Work: Start: MAY 26-06 Complete: MAY-31-06

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: [signature] Date: MAY-19-06

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

Specialist: [signature] Date: [redacted] 5/19/06

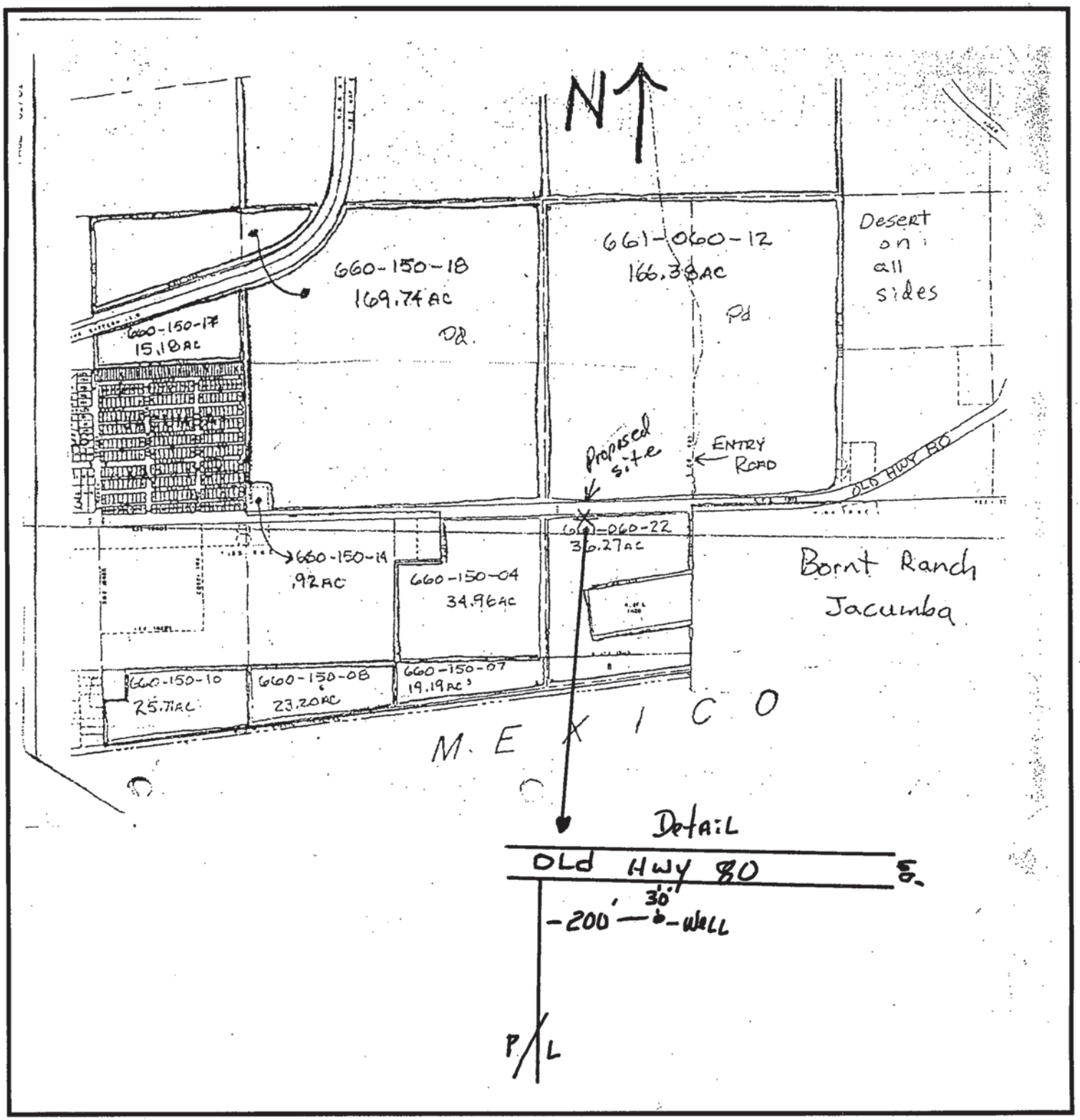
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: 2wel 17922

Assessor's Parcel Number: 661-060-22

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



QUADRUPLICATE
For Local Requirements

Rec 9/18/06 M

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 1085056

J

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Page 1 of 1
Owner's Well No. TEST WELL
Date Work Began 6/26/06 , Ended 7/6/06
Local Permit Agency DEH
Permit No. LWEL 17922 Permit Date 5/19/06

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID Gel

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	8	Loose silty sand - brown color
8	17	Claey sand
17	45	Medium to coarse sand - brown color
45	75	Medium to coarse sand and small aggregates round to sub-round partly cemented - red to purple color
75	108	Claey sand and small aggregated purple color
108	120	Hard, cemented aggregates - purple color

116, 17025
32, 61767

TOTAL DEPTH OF BORING 120 (Feet)
TOTAL DEPTH OF COMPLETED WELL 0 (Feet)

WELL LOCATION

Address Old Hwy 80
City Jacumba
County San Diego
APN Book 661 Page 060 Parcel 22
Township 18S Range 6E Section 9
Lat ___ DEG. ___ MIN. ___ SEC. N
Long ___ DEG. ___ MIN. ___ SEC. W

LOCATION SKETCH

NORTH
Old Hwy 80
200' 30'
36.27 AC
JACUMBA AIRPORT
WEST
EAST
MEXICO
SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

— A NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING ___
TEST WELL X
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 40 (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 25 (Ft.) & DATE MEASURED 7/5/06
ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___
TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
* *May not be representative of a well's long-term yield.*

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	CASING (S) TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)

DEPTH FROM SURFACE Ft.	to Ft.	ANNULAR MATERIAL TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	120		X		

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
✓ Other Site Map

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Bain Drilling & Pump Co Inc (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
12029 Old Castle Rd. Valley Center, Ca 92082
ADDRESS CITY STATE ZIP
Signed Joel R. Bain
C-57 LICENSED WATER WELL CONTRACTOR
7-5-06 DATE SIGNED
772454 C-57 LICENSE NUMBER

DWR 188 REV. 05-03

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # LWCL-1803
WELL COMPUTER #
FEE: _____
WATER DIST: _____

1. Property Owner: BORNT FARMS Phone: 619 766-4213
   2307 EAST Hwy 98 (Mailing Address) HOLTVILLE CA 92250 (City, Zip)
2. Well Location - Assessors Parcel Number 660-150-04
   OLD Hwy 80 (Site Address) JACUMBA (City) _____ (Zip)
3. Well Contractor - Well Driller Joe EDWARDS Company Name: FAIN DRILLING
   12029 Old CASTLE Rd (Mailing Address) VALLEY CENTER (City) 92082 (Zip)
   Phone#: 760-749-0701 C-57#: 328287 ☐ Cash Deposit ☒ Bond Posted
4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other AG-WELL
5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd
6. Type of Equipment: Rotary
7. Depth of Well: Proposed: 100' Existing: ~~0~~
8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: Steel - A-139	☒ Yes ☐ No	☒ Yes ☐ No	
Depth: 100 ±	Depth: 20 ft.	From: 20 To: 100	From: 50 To: 90
Diameter 14" in.	Diameter 24 in.	Type:	From: To:
Wall/Gauge: .250	Wall/Gauge: .250	Wall/Gauge:	From: To:

9. Annular Seal: Depth: 20 ft. Sealing Material: CEMENT
   Borehole diameter: 32 in. Conductor diameter: 24 in. Annular Thickness 4 in.
10. Date of Work: Start: AUG - 2006 Complete: AUG-2006

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: for R. Dain Date: 8-1-06

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies. _____

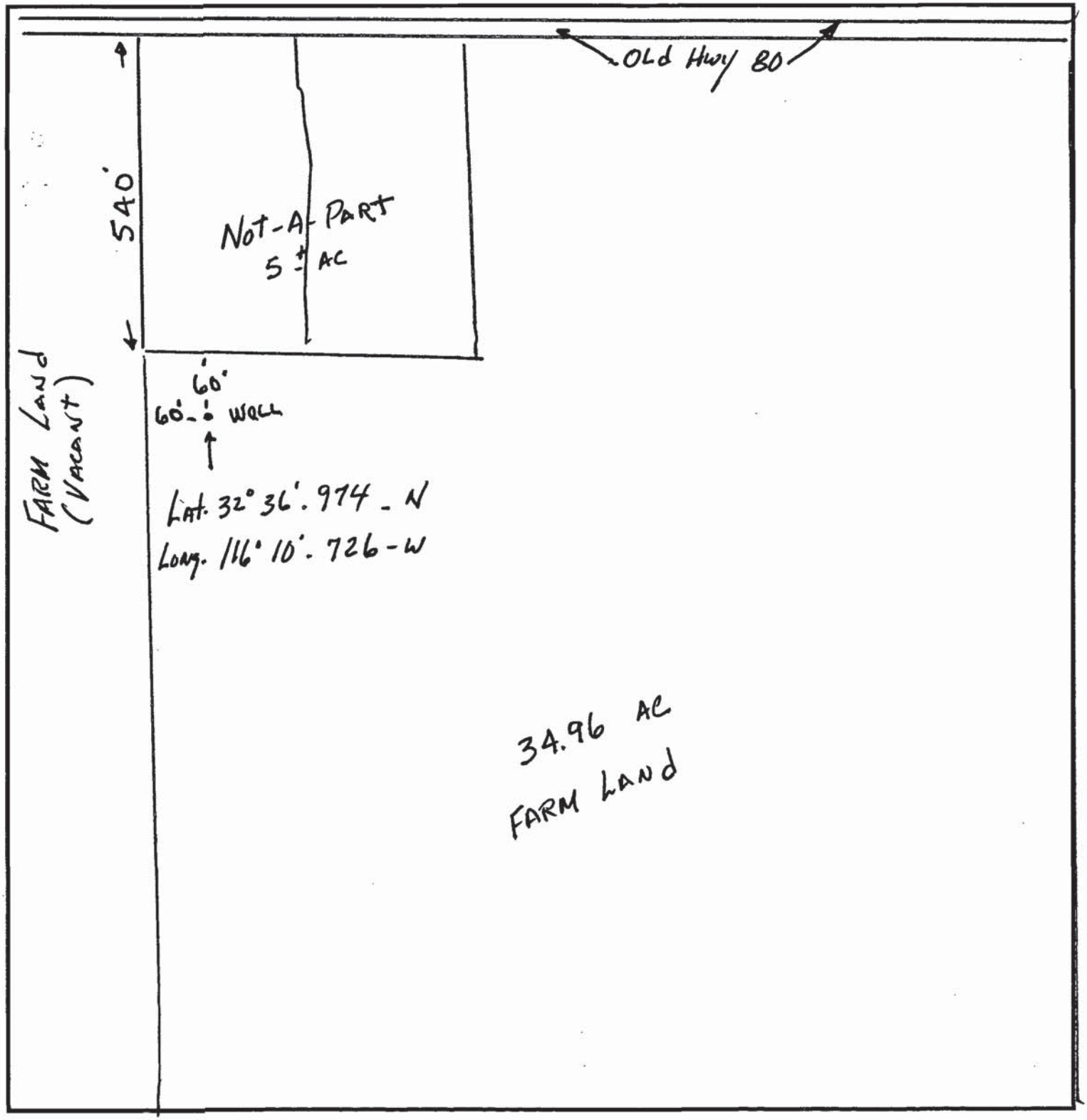
Specialist: _____ Date: 8-4-06

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

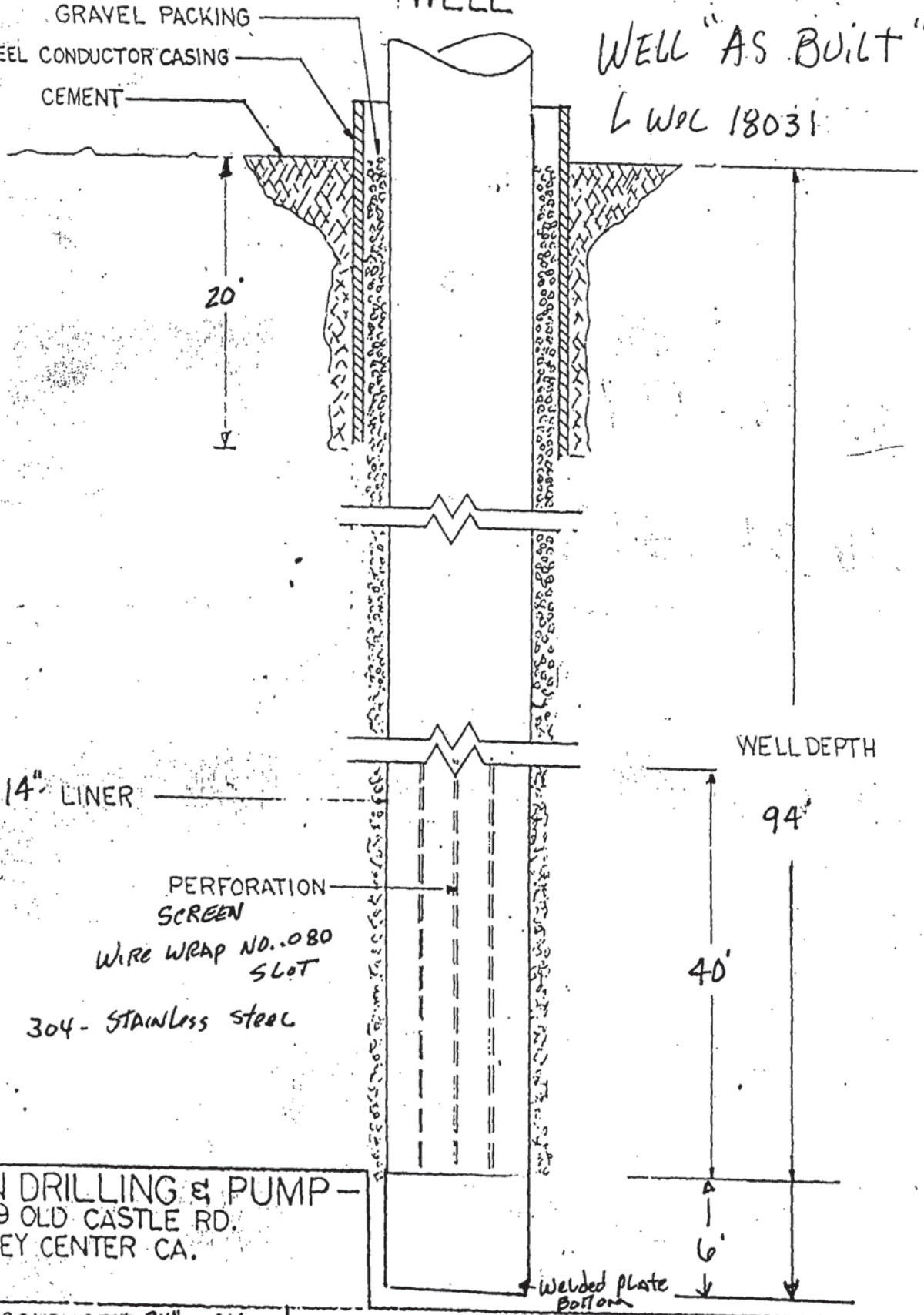
Control #: LWel - 18031
Assessor's Parcel Number: 660-150-04

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



BORNT FARMS
WELL "AS BUILT"
L WPC 18031



-FAIN DRILLING & PUMP-
12029 OLD CASTLE RD.
VALLEY CENTER CA.

STEEL CONDUCTOR 24" X 21'
STEEL LINER 14" X 96'
GRAVEL SIZE 5/16 X 7

BY: [signature] 8-5-06
JOE FAIN-OWNER

QUADRUPLICATE
For Local Requirements

Rec 9/18/06

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 1085057

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Page 1 of 1
Owner's Well No. 2006
Date Work Began 7/27/06, Ended 8/2/06
Local Permit Agency DEH
Permit No. LWEL 18031 Permit Date 8/4/06

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID Gel

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	23	Fine grained silty sand, partly cemented - brown color
23	56	Fine to medium gravel sand brown color
56	86	Coarse sand with gravel
86	96	Weathered bedrock
96	105	Black meta - volcanics

116.10.726
32.36.974

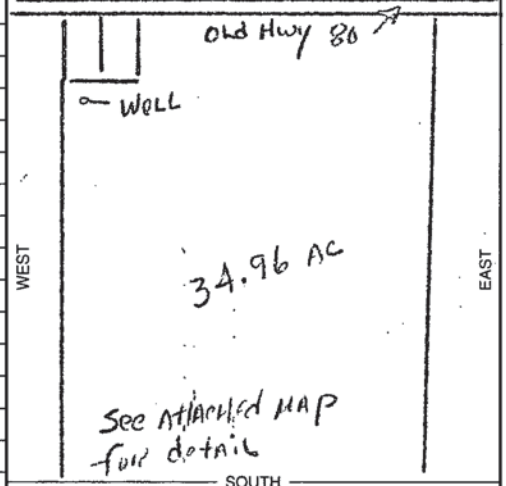
TOTAL DEPTH OF BORING 105 (Feet)
TOTAL DEPTH OF COMPLETED WELL 94 (Feet)

WELL OWNER

WELL LOCATION

Address Old Hwy 80
City Jacumba
County San Diego
APN Book 660 Page 150 Parcel 04
Township 18S Range 8E Section 9
Lat 32 DEG. 36 MIN. 974 SEC. N
Long 116 DEG. 10 MIN. 726 SEC. W

LOCATION SKETCH



*Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. **PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

USES (✓)

WATER SUPPLY
___ Domestic ___ Public
X Irrigation ___ Industrial
MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 57 (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 38 (Ft.) & DATE MEASURED 8/2/06
ESTIMATED YIELD * 1000 (GPM) & TEST TYPE airlift
TEST LENGTH 4 (Hrs.) TOTAL DRAWDOWN 40 (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	32	X				Steel	23.5	.250	
0	50	22	X				Steel	13.5	.250	
50	90	22		X			Steel-SS	13.5	.250	
90	96	22	X				Steel	13.5	.250	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
0	96				5/16x7

ATTACHMENTS (✓)

___ Geologic Log
X Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
X Other site map

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME FAIN DRILLING & PUMP CO INC
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS 12029 Old castle Rd. valley Center, Ca 92082 CITY STATE ZIP

Signed [signature] 8-5-06 32927
C-57 LICENSED WATER WELL CONTRACTOR DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 05-03

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # W LWEL - 18415
WELL COMPUTER #
FEE: _____
WATER DIST: _____

1. Property Owner: BORNT FARMS Phone: 619-766-4213
   2307 EAST HWY 98 (Mailing Address) HOLTVILLE, CA (City) 92250 (Zip)
2. Well Location - Assessors Parcel Number 660-150-18
   OLD HWY 80 (Site Address) JACUMBA (City) _____ (Zip)
3. Well Contractor - Well Driller JOE EDWARDS Company Name: FAIN DRILLING
   12029 OLD CASTLE RD (Mailing Address) VALLEY CENTER (City) 92082 (Zip)
   Phone#: (760) 749-0701 C-57#: 328287 ☐ Cash Deposit ☒ Bond Posted
4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other _____
5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd
6. Type of Equipment: ROTARY
7. Depth of Well: Proposed: 110' Existing: 0
8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: STEEL	☒ Yes ☐ No	☒ Yes ☐ No	
Depth: 110'	Depth: 20' ft.	From: 20 To: 120	From: 70 To: 110
Diameter 14 in.	Diameter 24" in.	Type: _____	From: _____ To: _____
Wall/Gauge: .250	Wall/Gauge: .250	Wall/Gauge: _____	From: _____ To: _____

9. Annular Seal: Depth: 20 ft. Sealing Material: CEMENT
   Borehole diameter: 32" in. Conductor diameter: 24 in. Annular Thickness 4 in.
10. Date of Work: Start: 7-A-07 Complete: 7-24-07

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: _____ Date: 7-13-07

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies. _____

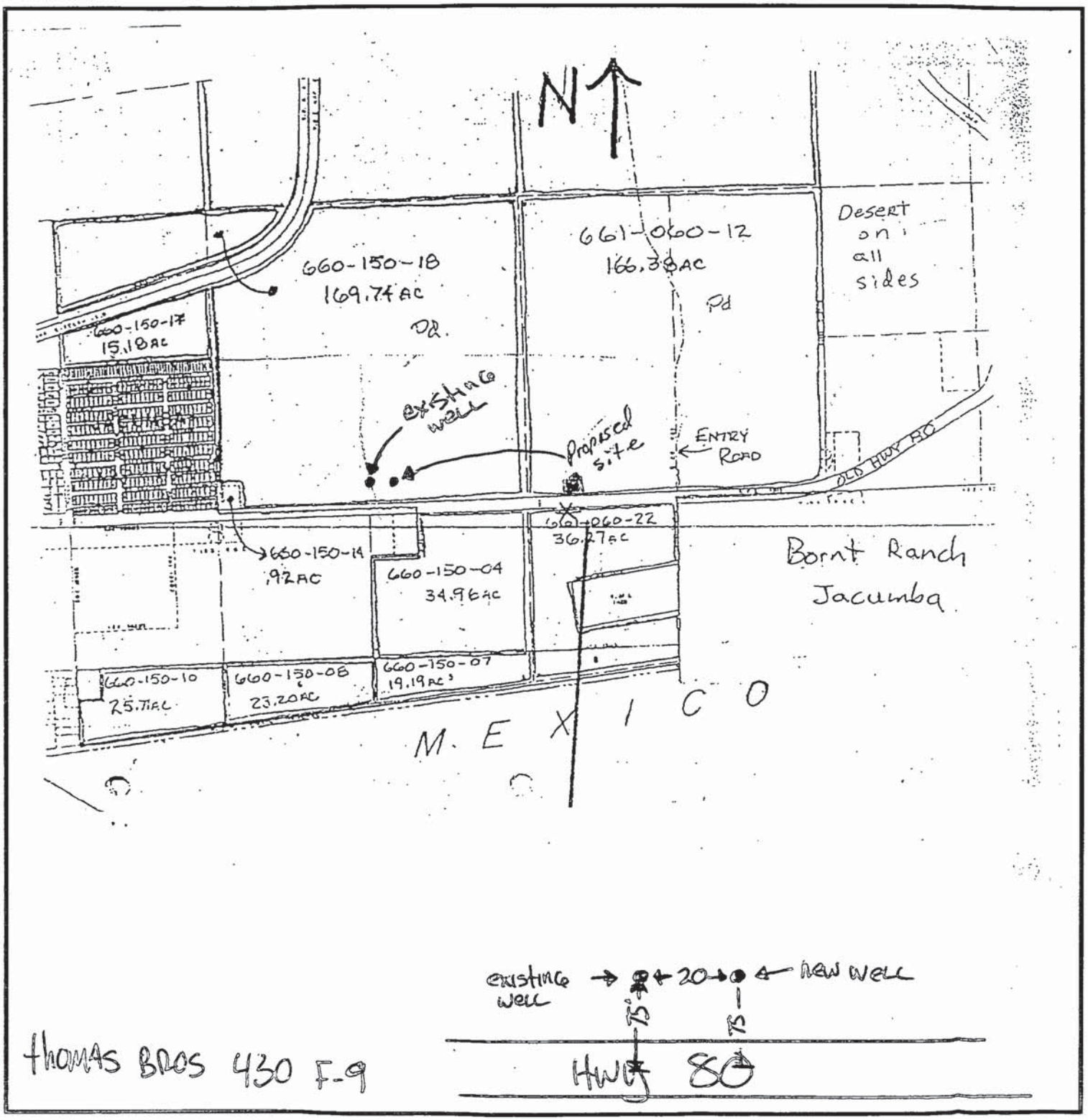
Specialist: _____ Date: 7-13-07

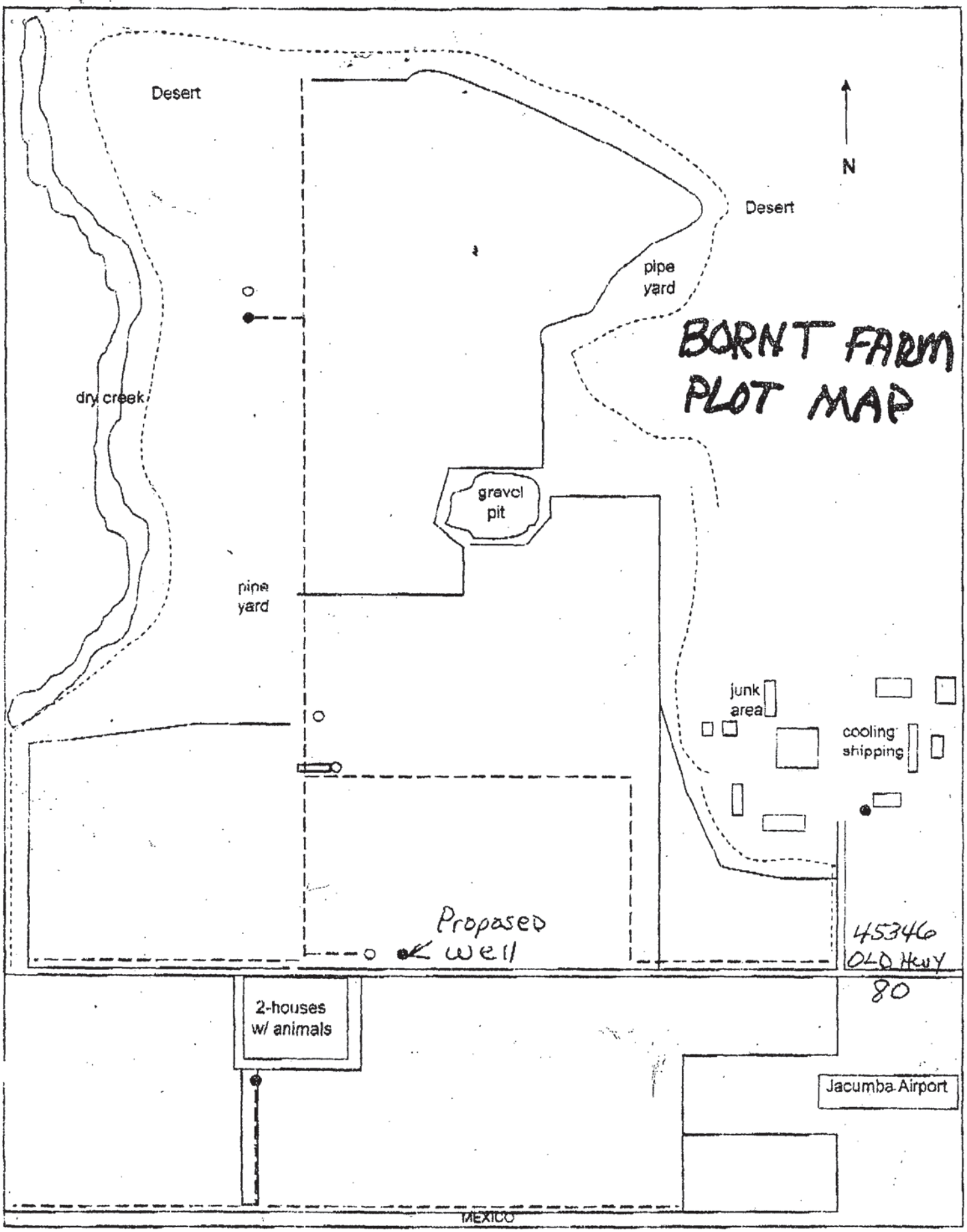
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LWEL-18415
Assessor's Parcel Number: 660-150-18

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.

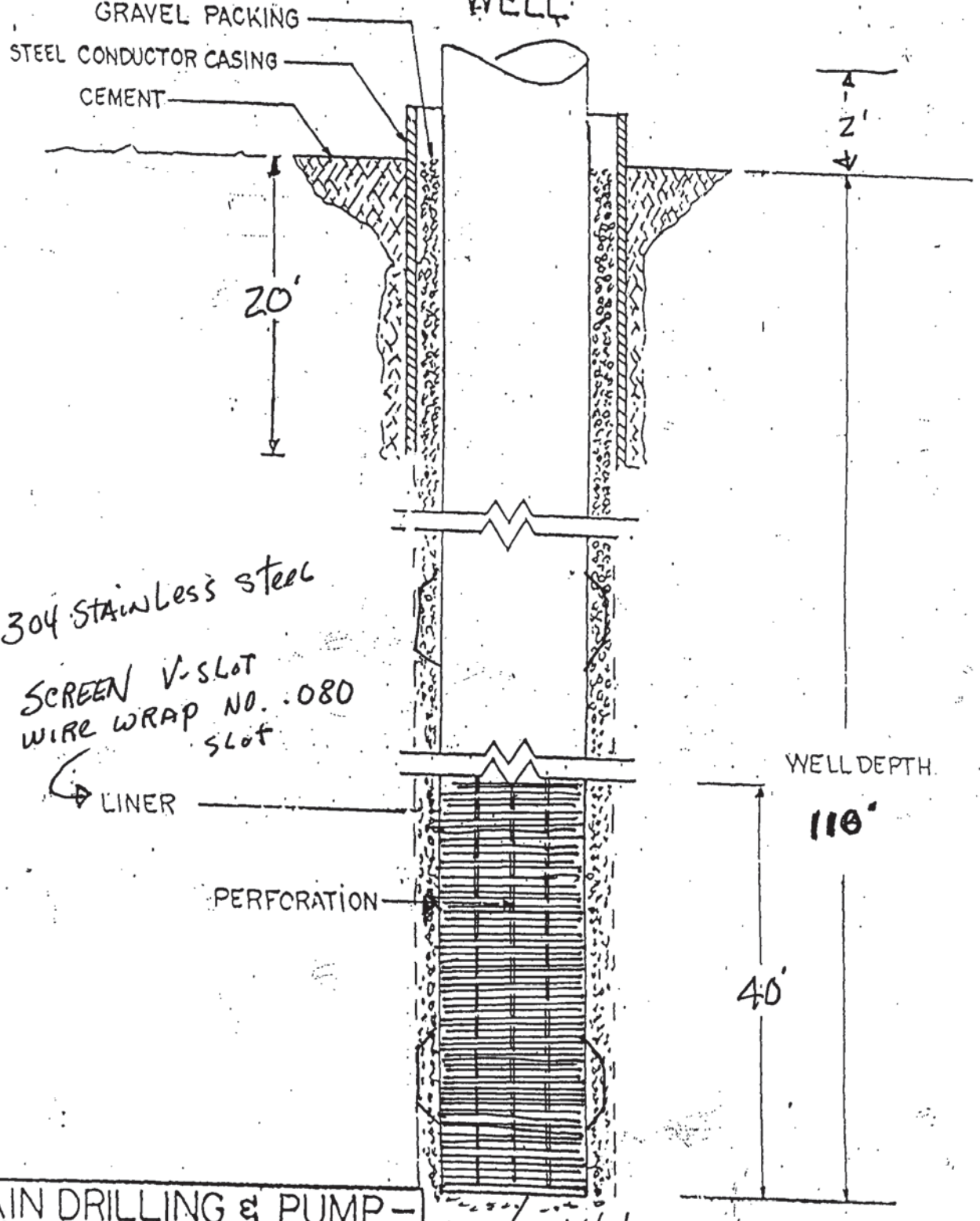



Desert
N
Desert
pipe yard
BORNT FARM PLOT MAP
dry creek
gravel pit
pipe yard
junk area
cooling shipping
Proposed well
45346 Old Hwy 80
2-houses w/ animals
Jacumba Airport
MEXICO

Lwel 18415

"AS BUILT" WELL

BORT FARMS



-FAIN DRILLING & PUMP-
12029 OLD CASTLE RD.
VALLEY CENTER CA.

STEEL CONDUCTOR 24" X 21'
STEEL LINER 14" X 113'
GRAVEL SIZE 5/16 X 7

BY Joe R. Fain 7/30/07
JOE FAIN-OWNER

Rec 9/24/07

QUADRUPLICATE
For Local Requirements

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 1089727

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Page 1 of 1
Owner's Well No. One 2007
Date Work Began 7/18/07, Ended 7/23/07
Local Permit Agency DEH
Permit No. EMBE 19415 Permit Date 7/13/07

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID Gel

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
		ALLUVIAL FILL AS FOLLOWS:
0	9	Sand, fine grained -- brown color
9	24	Clay - Dark color
24	70	Sand, fine grained
70	113	Sand, medium to coarse grained with some boulders

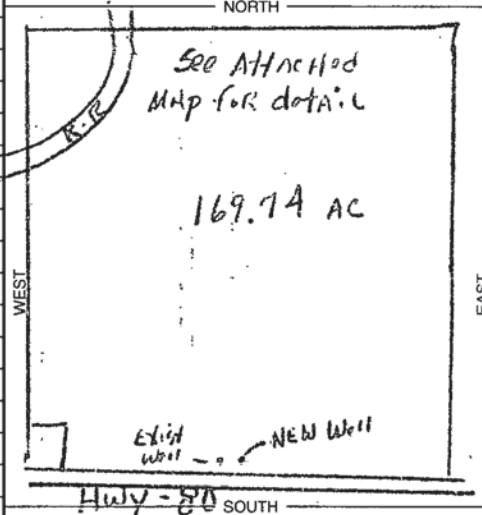
TOTAL DEPTH OF BORING 113 (Feet)
TOTAL DEPTH OF COMPLETED WELL 114 (Feet)

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

WELL LOCATION

Address Old Hwy 80
City Jacumba
County San Diego
APN Book 660 Page 150 Parcel 18
Township 18 S Range 8 E Section 8
Lat ___ DEG. ___ MIN. ___ SEC. N
Long ___ DEG. ___ MIN. ___ SEC. W

LOCATION SKETCH



*Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. **PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)
X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

USES (✓)
WATER SUPPLY
___ Domestic ___ Public
X Irrigation ___ Industrial
___ MONITORING
___ TEST WELL
___ CATHODIC PROTECTION
___ HEAT EXCHANGE
___ DIRECT PUSH
___ INJECTION
___ VAPOR EXTRACTION
___ SPARGING
___ REMEDIATION
___ OTHER (SPECIFY)

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 50+ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 40 (Ft.) & DATE MEASURED 7/23/07
ESTIMATED YIELD * 2000 (GPM) & TEST TYPE airlift
TEST LENGTH 6 (Hrs.) TOTAL DRAWDOWN 60 (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	32	X				Steel	23.5	.250	
0	73	24	X				Steel	13.5	.250	
73	113	24		X			Steel S.S. 304	13.5	.250	.080

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	113		pea	gravel	5/16x7

ATTACHMENTS (✓)
___ Geologic Log
X Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
✓ Other Site Map
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME FAIN DRILLING & PUMP CO INC (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
12029 Old Castle Rd. Valley Center, Ca 92082
ADDRESS CITY STATE ZIP
Signed [signature] 7-30-07 328287
C-57 LICENSED WATER WELL CONTRACTOR DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 05-03 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # W 20411
WELL COMPUTER # —
FEE: 462.
WATER DIST:

1. Property Owner: BORNT FARMS (Leasee) Phone: 760-356-2233
   2307 E. Hwy 98 (Mailing Address) HOLTVILLE (City) 92250 (Zip)
2. Well Location - Assessors Parcel Number 660-150-21
   OLD Hwy 80 (Site Address) JACUMBA (City) (Zip)
3. Well Contractor - Well Driller Joe EDWARDS Company Name: FAIN DRILLING
   12029 Old Castle Rd (Mailing Address) Valley CENTER (City) 92082 (Zip)
   Phone#: 760-749-0701 C-57#: 328287 ☐ Cash Deposit ☑ Bond Posted
4. Use: ☑ Private ☐ Public ☐ Industrial ☐ Cathodic ☑ Other AG-WELL ONLY
5. Type of Work: ☑ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd
6. Type of Equipment: Rotary
7. Depth of Well: Proposed: 300' Existing: 0
8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: Steel	☑ Yes ☐ No	☑ Yes ☐ No	
Depth: 300' ±	Depth: 20 ft.	From: 20 To: 300	From: 200 To: 300'
Diameter 16" in.	Diameter 24" in.	Type: #6	From: To:
Wall/Gauge: .250	Wall/Gauge: .250	Wall/Gauge:	From: To:

9. Annular Seal: Depth: 20 ft. Sealing Material: CEMENT
   Borehole diameter: 32 in. Conductor diameter: 24 in. Annular Thickness 4 in.
10. Date of Work: Start: Oct 26-09 Complete: Nov-8-09

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Joe R. Fain Date: Oct-21-09

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☑ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

Specialist: Date: 11-2-09

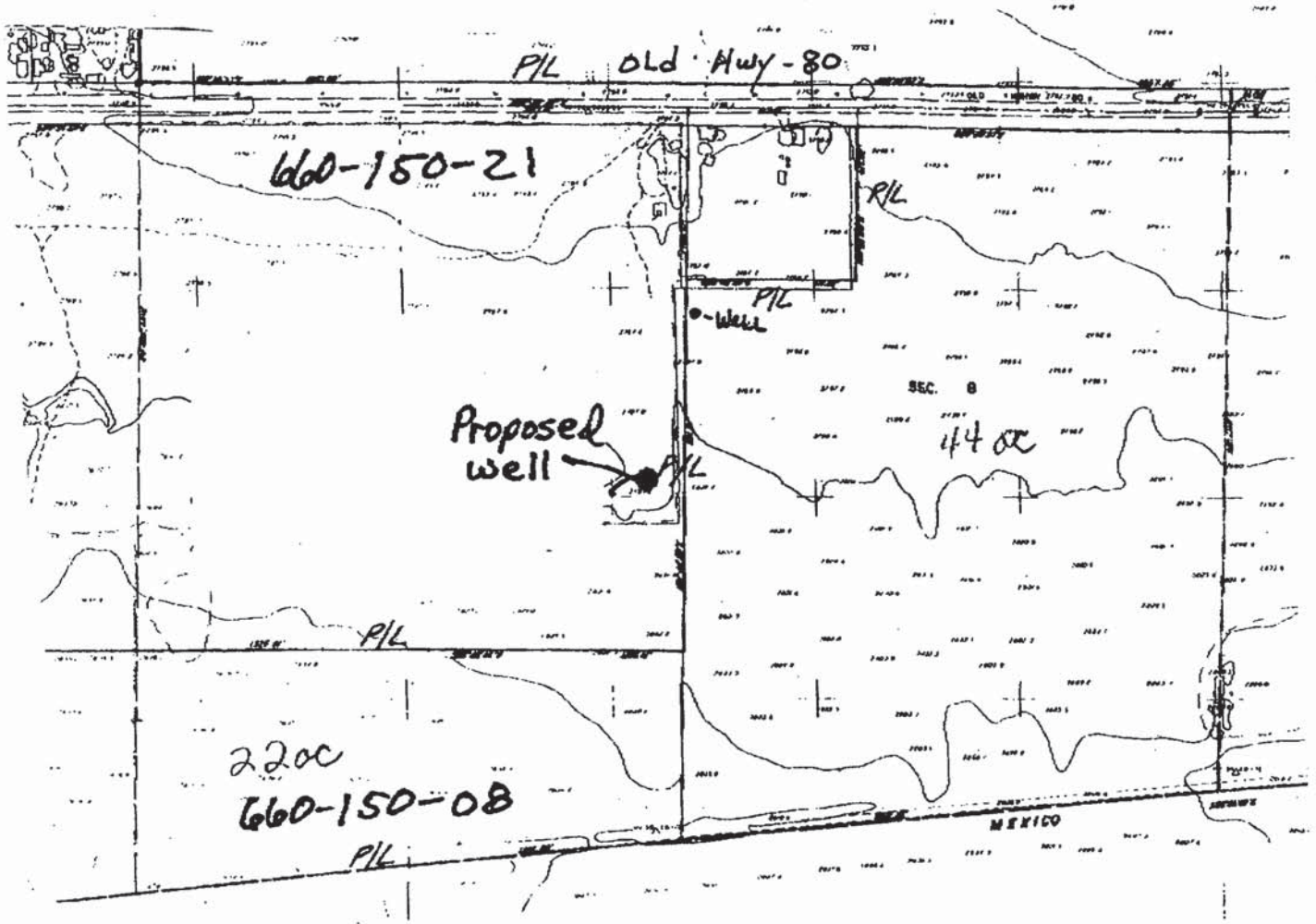
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LWEL-20411

Assessor's Parcel Number: 660-150-21

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, easements, water bodies or water courses, drainage pattern, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



BORING MAP

1" = 400 Ft.

N

Rec'd 9-8-11

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0135671

DWR Use Only – Do Not Fill In
State Well Number/Site Number
N / W
Latitude / Longitude
APN/TRS/Other

Page one of one

Owner's Well Number Test Hole

Date Work Began 11/04/2009 Date Work Ended 11/6/2009

Local Permit Agency DEH

Permit Number LWEL20411 Permit Date 11/2/09

Geologic Log

Orientation ⊙ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Direct Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
		Alluvial Fill As Follows:
0	10	Silty Sand
10	80	Sandy Clay W/ Small Aggregate
80	150	Clay W/ Small lenses of Aggregate
150	310	Multi Colored Meta Volcanics
		Test Hole Destroyed

Total Depth of Boring 310 Feet

Total Depth of Completed Well 0 Feet

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

Well Location

Address Old Hwy 80

City Jacumba County San Diego

Latitude 32 Deg. 36 Min. 905 Sec. N Longitude 116 Deg. 10 Min. 772 Sec. W

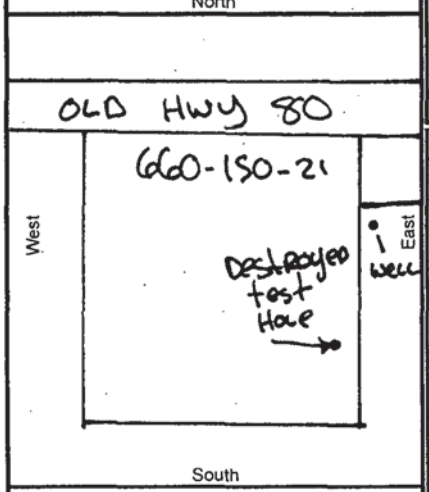
Datum _____ Decimal Lat. _____ Decimal Long. _____

APN Book 660 Page 150 Parcel 04

Township 18-s Range 8-e Section 8

Location Sketch

(Sketch must be drawn by hand after form is printed.)



Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

⊙ New Well
○ Modification/Repair
○ Deepen
○ Other
○ Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

○ Water Supply
☐ Domestic ☐ Public
☐ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
○ Monitoring
○ Remediation
○ Sparging
⊙ Test Well
○ Vapor Extraction
○ Other

Water Level and Yield of Completed Well

Depth to first water _____ (Feet below surface)

Depth to Static Water Level _____ (Feet) Date Measured _____

Estimated Yield * _____ (GPM) Test Type _____

Test Length _____ (Hours) Total Drawdown _____ (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
		NONE						

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	5	Fill	
5	25	Cement	
25	75	Bentonite	
75	310	Fill	

Attachments

☐ Geologic Log
☐ Well Construction Diagram
☐ Geophysical Log(s)
☐ Soil/Water Chemical Analyses
☑ Other Site Map

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name Fain Drilling & Pump Co., Inc.
Person, Firm or Corporation

12029 Old Castle Rd. Valley Center CA 92082
Address City State Zip

Signed Joe R. Fain 12/2/2009 328287
C-57 Licensed Water Well Contractor Date Signed C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT #: LWEL20435
WELL COMPUTER #
FEE: 462
WATER DIST:

(Lessee)

1. Property Owner: BORNT FARMS Phone: 619-766-4213
   2307 E. Hwy 98 (Mailing Address) Holtville (City) 92250 (Zip)
2. Well Location - Assessors Parcel Number 660-150-04
   Old Hwy 80 (Site Address) JACUMBA (City) (Zip)
3. Well Contractor - Well Driller Joe Edwards Company Name: Fain Drilling
   12029 old Castle Rd (Mailing Address) Valley Center (City) 92082 (Zip)
   Phone#: C-57#: ☐ Cash Deposit ☐ Bond Posted
4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other
5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd
6. Type of Equipment: Rotary
7. Depth of Well: Proposed: 200-300' Existing: 0
8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: Steel	☒ Yes ☐ No	☒ Yes ☐ No	
Depth: 200-300	Depth: 20 ft.	From: 20 To: 200'	From: 160 To: 200' ±
Diameter 14 in.	Diameter 24 in.	Type: Rea - #6	From: To:
Wall/Gauge: .250	Wall/Gauge: .250	Wall/Gauge:	From: To:

9. Annular Seal: Depth: 20 ft. Sealing Material: Cement
   Borehole diameter: 32 in. Conductor diameter: 24 in. Annular Thickness 4 in.
10. Date of Work: Start: 11-6-09 Complete: 11-12-09

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: J. R. Fain Date: 11-6-09

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

Specialist: Date: 11/10/09

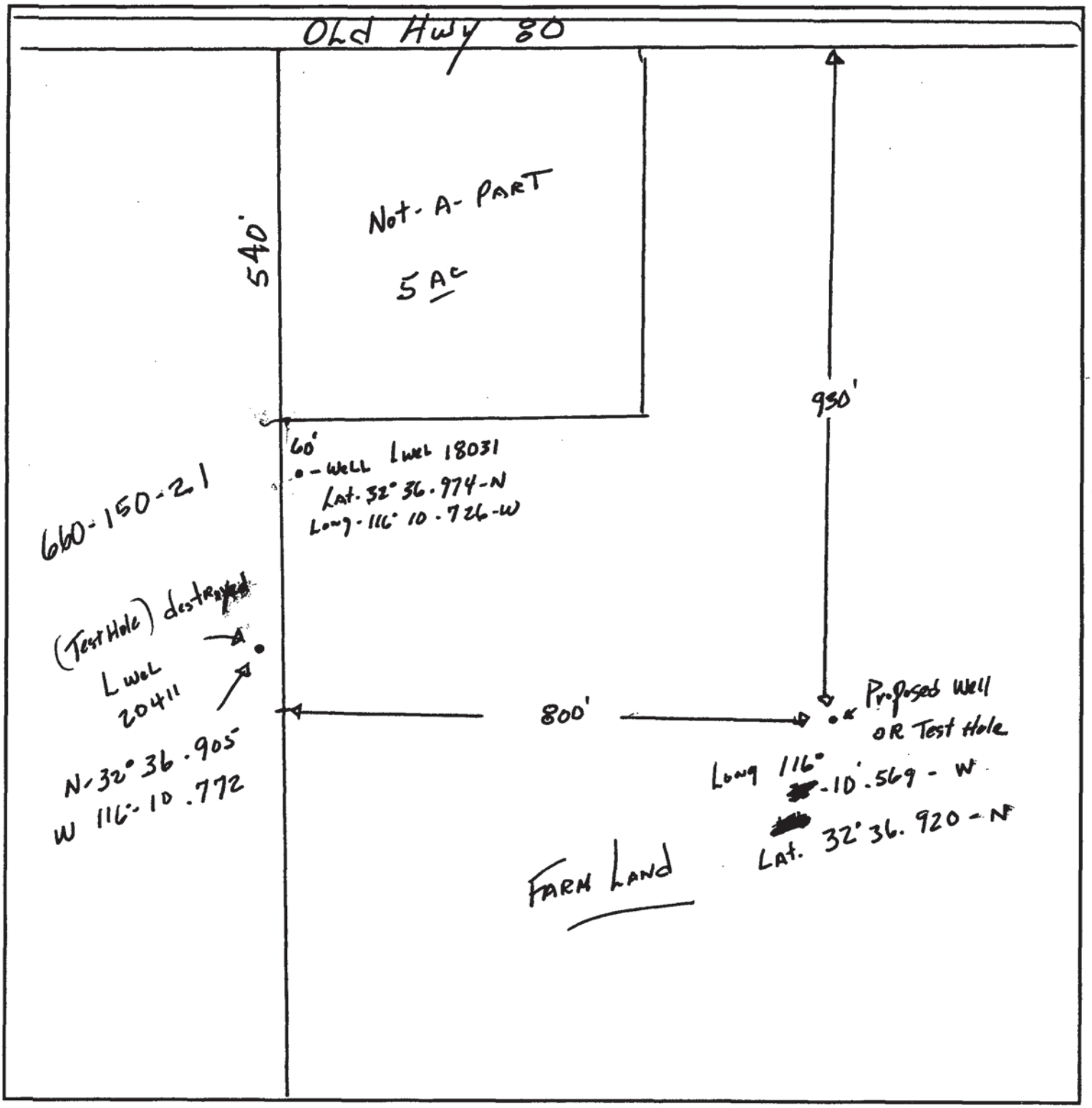
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: 20435

Assessor's Parcel Number: 660-150-04

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, easements, water bodies or water courses, drainage pattern, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



Field 9-8-11 OK

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California
Well Completion Report

Refer to Instruction Pamphlet

No. e0135668

Page one of one

Owner's Well Number Test Hole

Date Work Began 11/10/2009 Date Work Ended 11/12/2009

Local Permit Agency DEH

Permit Number LWEL20435 Permit Date 11/10/09

DWR Use Only – Do Not Fill In

State Well Number/Site Number

N W

Latitude Longitude

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Direct Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description (Describe material, grain size, color, etc)
		Alluvial Fill As Follows:
0	7	Silty Sand
7	68	Cemented Sand
68	81	Fine to Med Sand W/ Lenses of Clay
81	98	Cemented Sand & Gravel
98	138	Sticky Brown Clay
138	153	Grey Clay W/ Lenses of Small Aggregate
153	180	Grey Volcanics
		Test Hole Destroyed

Total Depth of Boring 180 Feet

Total Depth of Completed Well 0 Feet

Well Owner

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

Well Location

Address Old Hwy 80

City Jacumba County San Diego

Latitude 32 Deg. 36 Min. 920 Sec. N Longitude 116 Deg. 10 Min. 569 Sec. W

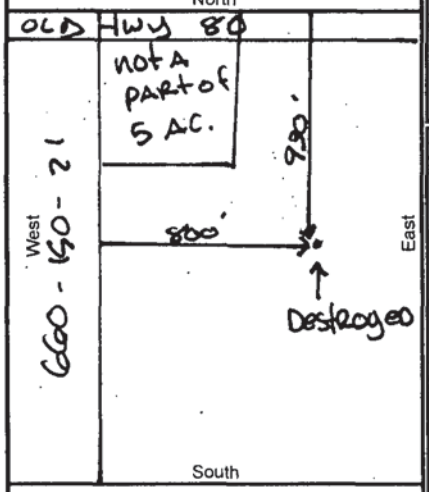
Datum Decimal Lat. Decimal Long.

APN Book 660 Page 150 Parcel 04

Township 18-s Range 8-e Section 8

Location Sketch

(Sketch must be drawn by hand after form is printed.)



Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. **Please be accurate and complete.**

Activity

◉ New Well
○ Modification/Repair
○ Deepen
○ Other
○ Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

○ Water Supply
☐ Domestic ☐ Public
☐ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
○ Monitoring
○ Remediation
○ Sparging
◉ Test Well
○ Vapor Extraction
○ Other

Water Level and Yield of Completed Well

Depth to first water (Feet below surface)

Depth to Static Water Level (Feet) Date Measured

Estimated Yield * (GPM) Test Type

Test Length (Hours) Total Drawdown (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
	NONE							

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	5	Fill	
5	25	Cement	
25	180	Fill	

Attachments

☐ Geologic Log
☐ Well Construction Diagram
☐ Geophysical Log(s)
☐ Soil/Water Chemical Analyses
☑ Other Site Map

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name Fain Drilling & Pump Co., Inc.
Person, Firm or Corporation

12029 Old Castle Rd. Valley Center CA 92082
Address City State Zip

Signed Joe R. Fain 12/16/2009 328287
C-57 Licensed Water Well Contractor Date Signed C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # EWEL 20450
WELL COMPUTER #
FEE:
WATER DIST:

1. Property Owner: "LESSEE" BORNT FARMS Phone: 619 746-4213
   2307 E. Hwy 98 (Mailing Address) Holtville (City) 92250 (Zip)
2. Well Location - Assessors Parcel Number 660-150-18
   N/of OLD Hwy 80 (Site Address) JACUMBA (City) 91934 (Zip)
3. Well Contractor - Well Driller Joe EDWARDS Company Name: FAIN DRILLING
   12029 Old Castle Rd (Mailing Address) Valley Center (City) 92082 (Zip)
   Phone#: 760-749-0701 C-57#: 328289 ☐ Cash Deposit ☒ Bond Posted
4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other
5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd
6. Type of Equipment: Rotary
7. Depth of Well: Proposed: 100' Existing: -0-
8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: STEEL	☒ Yes ☐ No	☒ Yes ☐ No	
Depth: 100	Depth: 20 ft.	From: 20 To: 100	From: 60 To: 160
Diameter 14 in.	Diameter 24 in.	Type:	From: To:
Wall/Gauge: .250	Wall/Gauge: .250	Wall/Gauge:	From: To:

9. Annular Seal: Depth: 20 ft. Sealing Material: Cement
   Borehole diameter: 32 in. Conductor diameter: 24 in. Annular Thickness 4+ in.
10. Date of Work: Start: 11-13-09 Complete: 11-18-09

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Joe R Fain Date: 11-13-09

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

Specialist: Date: 11-13-09

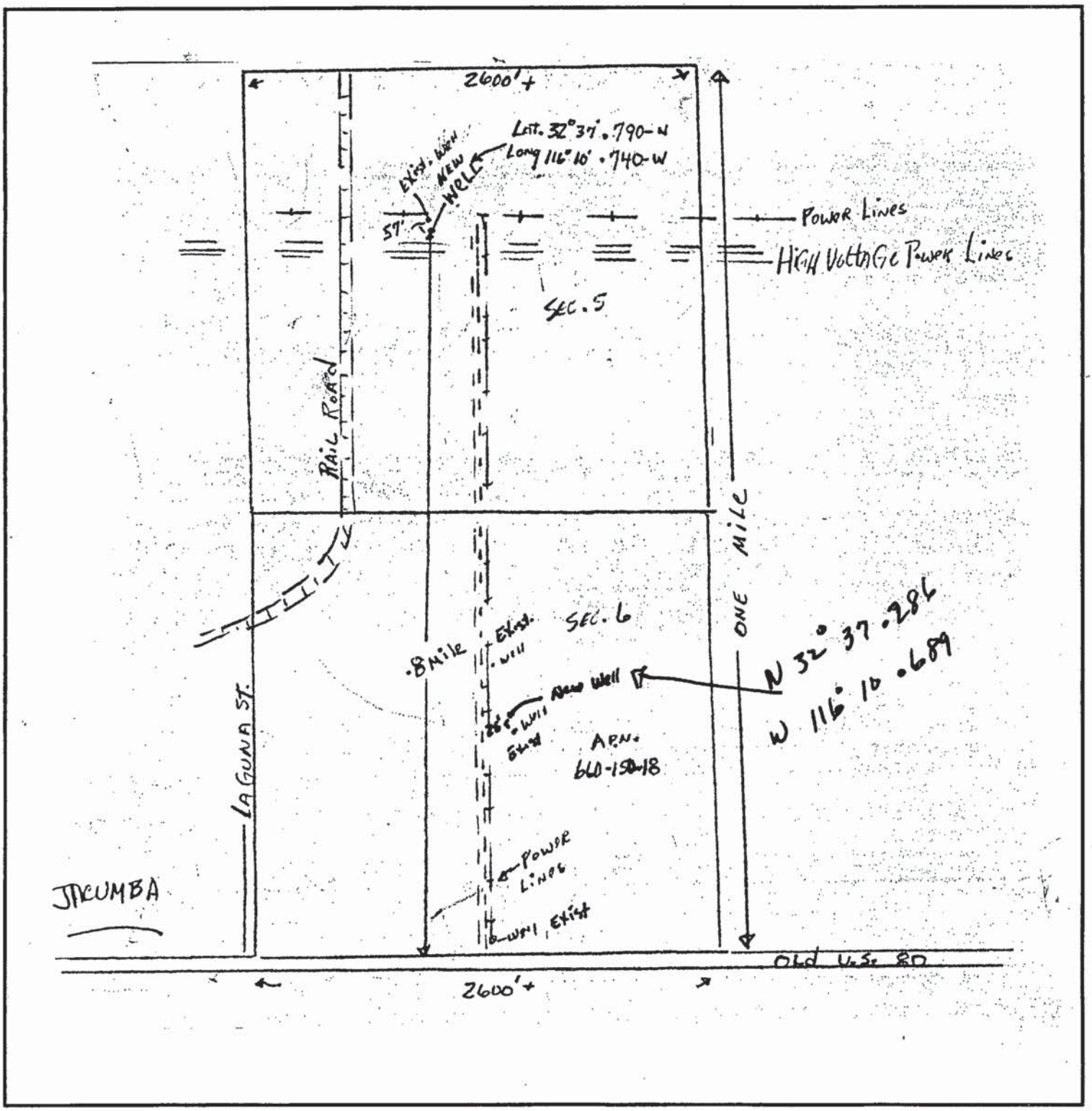
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: 20450

Assessor's Parcel Number: 660-150-18

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, easements, water bodies or water courses, drainage pattern, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

Page one of one

Owner's Well Number Test Hole

Date Work Began 11/13/2009 Date Work Ended 11/23/2009

Local Permit Agency DEH

Permit Number LWEL20450 Permit Date 11/13/09

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0135665

DWR Use Only – Do Not Fill In

State Well Number/Site Number

N W

Latitude Longitude

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Direct Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
		Alluvial Fill As Follows:
0	40	Fine to Med Grained Sand
40	80	Sandy Clay W/ Lenses of Small Aggregate
80	100	Sandy Clay
100	110	Meta Volcanics
		Test Hole Destroyed

Total Depth of Boring 110 Feet

Total Depth of Completed Well 0 Feet

The information in this grayed area has been blocked from public viewing pursuant to section 13752 of the Water Code and the Information Practice Act of 1977, to protect personal information.

Well Location

Address Old Hwy 80

City Jacumba County San Diego

Latitude 32. 37 286 N Longitude 116. 10 689 W

Deg. Min. Sec. Deg. Min. Sec.

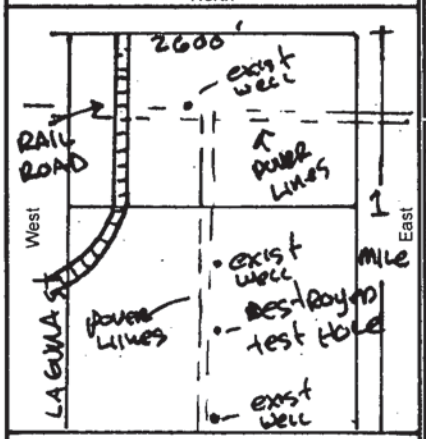
Datum Decimal Lat. Decimal Long.

APN Book 660 Page 150 Parcel 18

Township 18-s Range 8-e Section 8

Location Sketch

(Sketch must be drawn by hand after form is printed.)



Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. **Please be accurate and complete.**

Activity

◉ New Well
○ Modification/Repair
○ Deepen
○ Other
○ Destroy
Describe procedures and materials under "GEOLOGIC LOG".

Planned Uses

○ Water Supply
☐ Domestic ☐ Public
☐ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
○ Monitoring
○ Remediation
○ Sparging
◉ Test Well
○ Vapor Extraction
○ Other

Water Level and Yield of Completed Well

Depth to first water (Feet below surface)

Depth to Static Water Level (Feet) Date Measured

Estimated Yield * (GPM) Test Type

Test Length (Hours) Total Drawdown (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
	NONE							

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	5	Fill	
5	25	Cement	
25	110	Fill	

Attachments

☐ Geologic Log
☐ Well Construction Diagram
☐ Geophysical Log(s)
☐ Soil/Water Chemical Analyses
☑ Other Site Map

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name Fain Drilling & Pump Co., Inc.
Person, Firm or Corporation

12029 Old Castle Rd. Valley Center CA 92082
Address City State Zip

Signed Joe R. Fain 12/20/2009 328287
C-57 Licensed Water Well Contractor Date Signed C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

LEIGHTON AND ASSOCIATES, INC.
Geotechnical and Environmental Engineering Consultants

LIMITED EVALUATION OF LIQUEFACTION AND CONSOLIDATION POTENTIAL, PHASE 1, JACUMBA VALLEY RANCH DEVELOPMENT, SAN DIEGO COUNTY, CALIFORNIA

January 21, 1991

UPDATED EVALUATION OF CONSOLIDATION POTENTIAL, PHASE 1, JACUMBA VALLEY RANCH DEVELOPMENT, SAN DIEGO COUNTY, CALIFORNIA

February 27, 1991

Project No. 4900381-05

PREPARED FOR:

JACUMBA VALLEY PARTNERSHIP
2423 Camino Del Rio South, Suite 212
San Diego, California 92108

3934 MURPHY CANYON ROAD, SUITE B205, SAN DIEGO, CALIFORNIA 92123

(619) 292-8030 • (800) 447-2626
FAX (619) 292-0771

LEIGHTON AND ASSOCIATES, INC.
Geotechnical and Environmental Engineering Consultants

January 21, 1991

Project No. 4900381-05

To: Jacumba Valley Ranch
2423 Camino Del Rio South, Suite 212
San Diego, California 92108

Attention: Mr. Karl Turecek

Subject: Limited Evaluation of Liquefaction and Consolidation Potential, Phase 1, Jacumba Valley Ranch Development, San Diego County, California

Introduction

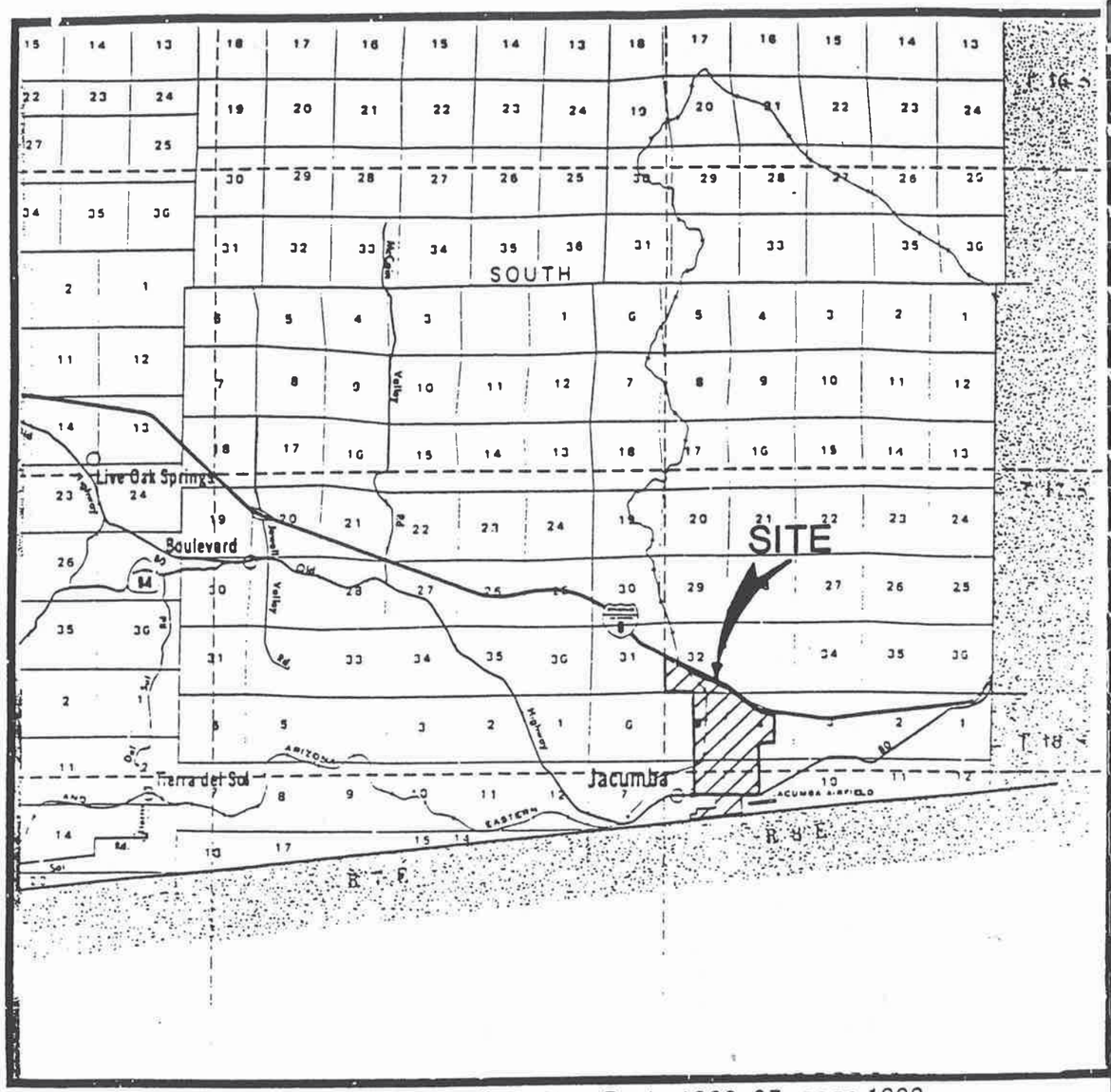
In accordance with your request, we have performed a limited geotechnical evaluation of the liquefaction and consolidation potential in the first phase of the proposed development. Plans for this phase include an 18-hole golf course, waste water treatment plant, hotel, school, congregate care center, and retail and commercial structures, along with associated streets, utilities, and drainage channels. We have concentrated our evaluation principally in areas underlain by alluvium (Qal and Qfn on Plate 1) as these are the areas thought most likely to be subject to liquefaction and consolidation. We understand that a maximum of 4 feet of fill is proposed in some areas. In addition, we have performed a limited evaluation of the soil in the drainage areas for use as structural fill and have evaluated drainage channel slope stability.

Accompanying Maps and Appendices

Figure 1 - Site Location Map - Page 2
Plate 1 - Geotechnical Map - In Pocket
Appendix A - References
Appendix B - Boring and Trench Logs
Appendix C - Laboratory Test Results

3934 MURPHY CANYON ROAD, SUITE B205, SAN DIEGO, CALIFORNIA 92123

(619) 292-8030 • (800) 447-2626
FAX (619) 292-0771



BASE MAP: Aerial-Foto Map Book, 1986-87, page 1009
Original by Aerial Graphics.

JACUMBA VALLEY RANCH

Figure 1

SITE LOCATION MAP

Project No. 4900381-05

LEIGHTON and ASSOCIATES INCORPORATED

0 2.2 4.4
scale miles

Scope of Services

Our scope of services to date has included:

- Logging and sampling 13 small-diameter borings and 6 backhoe trenches.
- Field and laboratory testing to evaluate pertinent engineering properties of the soil samples.
- Geotechnical evaluation of data obtained during our investigation.
- Preparation of this report presenting the results of our evaluation.

Field Investigation

On December 11 through 14, 1990, 13 small-diameter borings were excavated on site. The borings were excavated to a maximum depth of approximately 50 feet or until bedrock was encountered (whichever was shallower) with a truck-mounted Mobil B-61 drill rig with 8-inch hollow stem augers. The borings were sampled and logged by a geologist from our firm. Borings were sampled with a Standard Penetration Test (SPT) split spoon sampler and a Modified California ring sampler. Bulk and relatively undisturbed ring samples were collected for visual classification and laboratory testing. Ground water levels at the time of drilling are recorded on the logs. On December 18, 1990, 6 backhoe trenches were excavated on site by Jacumba Valley Ranch. The trenches were logged and sampled by a geologist from our firm. The approximate locations and logs of the borings and trenches are presented on Plate 1 and in Appendix B, respectively.

Seismicity

As discussed in our Land Use Feasibility Study (Appendix A, Reference 5), the seismic hazard thought most likely to impact the subject site is ground shaking produced by a large earthquake on one of the major active regional faults. A maximum probable event on the Elsinore fault (considered the design earthquake for this site) is expected to produce a peak horizontal bedrock acceleration of 0.30g and a repeatable ground acceleration of 0.20g. The effects of seismic shaking can be reduced by adhering to the Uniform Building Code or state-of-the-art design parameters of the Structural Engineers Association of California.

Liquefaction Potential

During an earthquake, ground shaking may cause loss of soil strength (liquefaction) in loose saturated sandy soils, resulting in excessive settlement damage and/or possible failure of surface structures. The likelihood of liquefaction depends on the intensity and duration of the ground shaking, the

soil characteristics, and the depth to ground water. A simplified analytical method, based on empirical correlations, relating the field occurrence of liquefaction to the earthquake magnitude and acceleration, cyclic shear resistance of the soils, and Standard Penetration Test (SPT) results (Appendix A, Reference 7) was used to evaluate the liquefaction potential of the recent alluvium (Qal) and older alluvium (Qfn). The formational materials (Tjl, Tja, Tmg) are not considered to have a significant liquefaction potential. The Geotechnical Map (Plate 1) shows the approximate extent of these units.

The ground water levels we encountered in our borings ranged from approximately 5 to 40 feet below the existing ground surface. We believe that these levels are likely to be significantly lower than historic high ground water conditions due to the ongoing drought. In our evaluation, we have assumed ground water levels 5 feet higher than those actually encountered.

The soils encountered in the upper portions of the alluvium were generally described as medium dense, silty fine to medium sand and stiff, sandy to clayey silt. Standard Penetration Test (SPT) blow count values (in the upper 30 feet) ranged from 19 to 49 with an average blow count of 31 blows per foot. Based on the results of our investigation, the calculated factor of safety against liquefaction is greater than 1.5, indicating a low potential for liquefaction at the site due to the design earthquake. Further, the addition of up to 4 feet of fill soils in selected areas across the site should reduce the potential for liquefaction in those areas receiving fill.

Dynamic Settlement

Dynamic settlement due to earthquake shaking was evaluated in the alluvial areas using the method described by Tokimatsu and Seed (Appendix A, Reference 9). The design earthquake (which has an estimated return period of 100 years) may induce a total settlement at the site on the order of 3/4 to 1 inch. Differential settlement of the alluvium due to earthquake-induced dynamic settlement is estimated to be on the order of 1/4 to 1/2 inch across 100 feet of ground surface. The addition of fill soils should reduce the potential for dynamic settlement.

Consolidation

Consolidation of soils is a relatively long-term process that may occur when pore pressures in soil of relatively low permeability (such as a silty or clayey soil) increase upon loading (due to additional fill placement, structures, etc.). Settlement of granular soils (sands and gravels) is the term used for the process of relatively short-term soil densification due to application of a load. Hydroconsolidation may also occur when a soil undergoes wetting or saturation after a load is applied. Consolidation, settlement, and hydroconsolidation may result in soil densification and ground subsidence.

The potential for long-term consolidation of the soils at the site is considered low due to the relatively high blow counts, the limited quantities of highly clayey materials encountered in our borings and trenches, and the relatively minor fill loads anticipated.

The potential for settlement of the existing granular alluvial soils was evaluated based on consolidation test results (Appendix C) and the assumption that no more than 4 feet of fill soils (above existing grades) will be added at the site. The building loads are assumed to be typical for this type of relatively light construction. Larger loads may be anticipated for the waste water treatment plant.

To reduce the potential for settlement, we recommend that portions of the alluvial soils under the proposed structures be removed and recompacted and that construction be delayed for a period of time after the addition of fill soils so that differential settlement may be reduced to tolerable limits. The following preliminary recommendations are based on a maximum total and differential settlement of 1 inch and 1/2 inch, respectively.

Type of Structure	Estimated Depth of Removal and Recompaction (feet below existing grade)
1- and 2-Story, School, Hotel Congregate Care, and Residential Structures	2 - 4
Waste Water Treatment Plant	3 - 5

The above values are preliminary and should be refined based on actual building loads and site-specific geotechnical investigations.

Thickness of Proposed Fill (above existing grade) in feet	Delay of Building Construction after Grading (months)
≤2	0
≤3	1
≤4	2

We do not believe these delays should pose significant constraints to construction provided that a phased construction approach can be accomplished.

To reduce the potential for hydroconsolidation of alluvial soils, the base of the removal area should be thoroughly wetted after removal of the existing soils and prior to recompaction. Specific grading recommendations will be provided in the geotechnical investigation reports.

Suitability of Material In Drainages for Use as Fill Soils

Based on our visual evaluation and laboratory testing of samples obtained from the five backhoe trenches located in the existing drainages, (one of the backhoe trenches was located outside of the drainage areas for purposes of evaluating rippability and other properties) this material should be generally suitable as structural fill. Visual evaluation generally indicates a very low expansion potential for the majority of this material. However, laboratory testing (Appendix C) indicates a medium expansion potential for the siltier portions. Soils with a medium expansion potential are generally not desirable within 3 feet of finish grade. The material generally varied from a fine sandy silt to a fine to coarse sand with gravels and cobbles. Scattered roots were noted in some of the near-surface soils. The clean, sandy portions may have a moderate to high erosion potential. This material is anticipated to have an adequate bearing capacity (for lighlty loaded structures) when compacted as fill soils.

Drainage Channel Slope Stability

We understand that unlined drainage channels are proposed to conduct storm water across the site. We further understand the proposed channel walls (up to 5 feet in height) are to be constructed at inclinations of approximately 5:1 (horizontal to vertical). Based on direct shear tests performed on remolded representative soil samples, these slopes should be grossly stable at the proposed inclinations. Channel erosion protection is generally under the purview of the civil engineer as evaluation of erosion and scour is based on water quantity and flow velocity. We have provided grain-size analyses of representative samples (Appendix C) for this evaluation. Clean, fine sand (without a significant portion of silt or clay to act as a binding agent) should be avoided in use as a channel liner unless adequately protected from erosion and scour.

Summary

Based on the results of our limited evaluation, it is our opinion that the proposed development is feasible from a geotechnical standpoint provided that the concerns presented herein are addressed into the project design.

We note that additional geotechnical investigation is recommended to provide site-specific foundation and grading recommendations.

If you have any questions regarding our report, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

LEIGHTON AND ASSOCIATES, INC.

Douglas F. Roff, CEG 1480
Project Geologist

Gene Custenborder, CEG 1319
Chief Geologist

Joseph G. Franzone, RCE 39552
Chief Engineer

DFR/GC/JGF/jss

Distribution: (6) Addressee
(6) Brian F. Mooney Associates
Attention: Mr. Brian F. Mooney

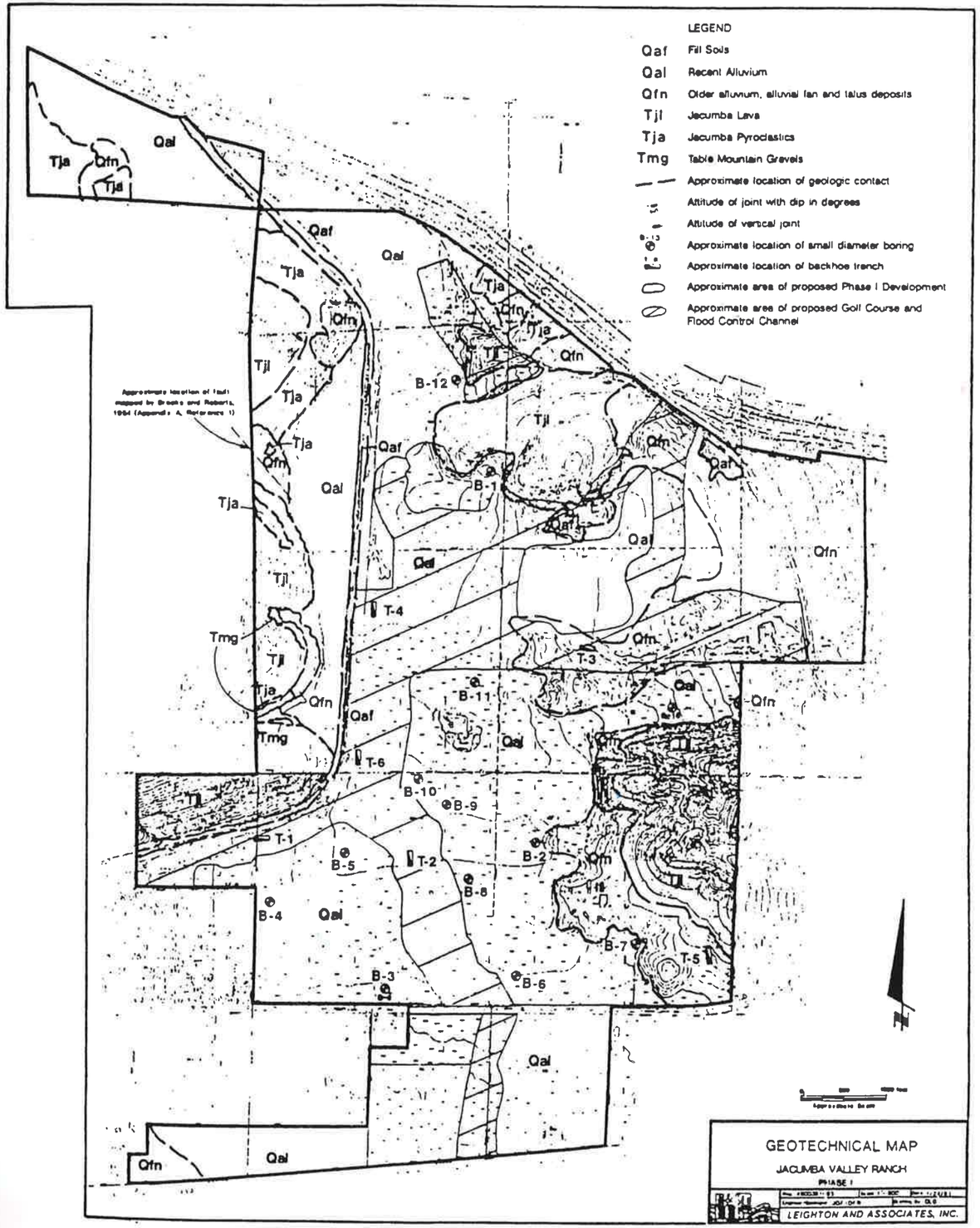

LEGEND
Qaf Fill Soils
Qal Recent Alluvium
Qfn Older alluvium, alluvial fan and talus deposits
Tjl Jacumba Lava
Tja Jacumba Pyroclastics
Tmg Table Mountain Gravels
Approximate location of geologic contact
Attitude of joint with dip in degrees
Attitude of vertical joint
Approximate location of small diameter boring
Approximate location of backhoe trench
Approximate area of proposed Phase I Development
Approximate area of proposed Golf Course and Flood Control Channel
Approximate location of fault mapped by Brooks and Roberts, 1984 (Appendix A, References 1)
B-1
B-2
B-3
B-4
B-5
B-6
B-7
B-8
B-9
B-10
B-11
B-12
T-1
T-2
T-3
T-4
T-5
T-6
GEOTECHNICAL MAP
JACUMBA VALLEY RANCH
PHASE I
LEIGHTON AND ASSOCIATES, INC.

Plate 1

APPENDIX A

REFERENCES

1. Brooks, B. and Roberts, E., 1954, Geology of the Jacumba Area, San Diego and Imperial Counties, California Division of Mines and Geology, Bulletin 170, Map Sheet 23.

2. Greensfelder, R.W., 1974, Maximum Credible Rock Acceleration from Earthquakes in California: California Division of Mines and Geology, Map Sheet 23.

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4. Jennings, C.W., 1975, Fault Map of California, California Division of Mines and Geology, California Geologic Data Map Series, Map No. 1.

5. Leighton and Associates, 1990, Geotechnical Land-Use Feasibility Study, Jacumba Valley Ranch Development, San Diego County, California, Project No. 4900381-01, dated April 27.

6. Ploessel, M.R., and Slosson, J.E., 1974, Repeatable High Ground Acceleration from Earthquakes: California Geology, Vol. 27, No. 9, P. 195-199.

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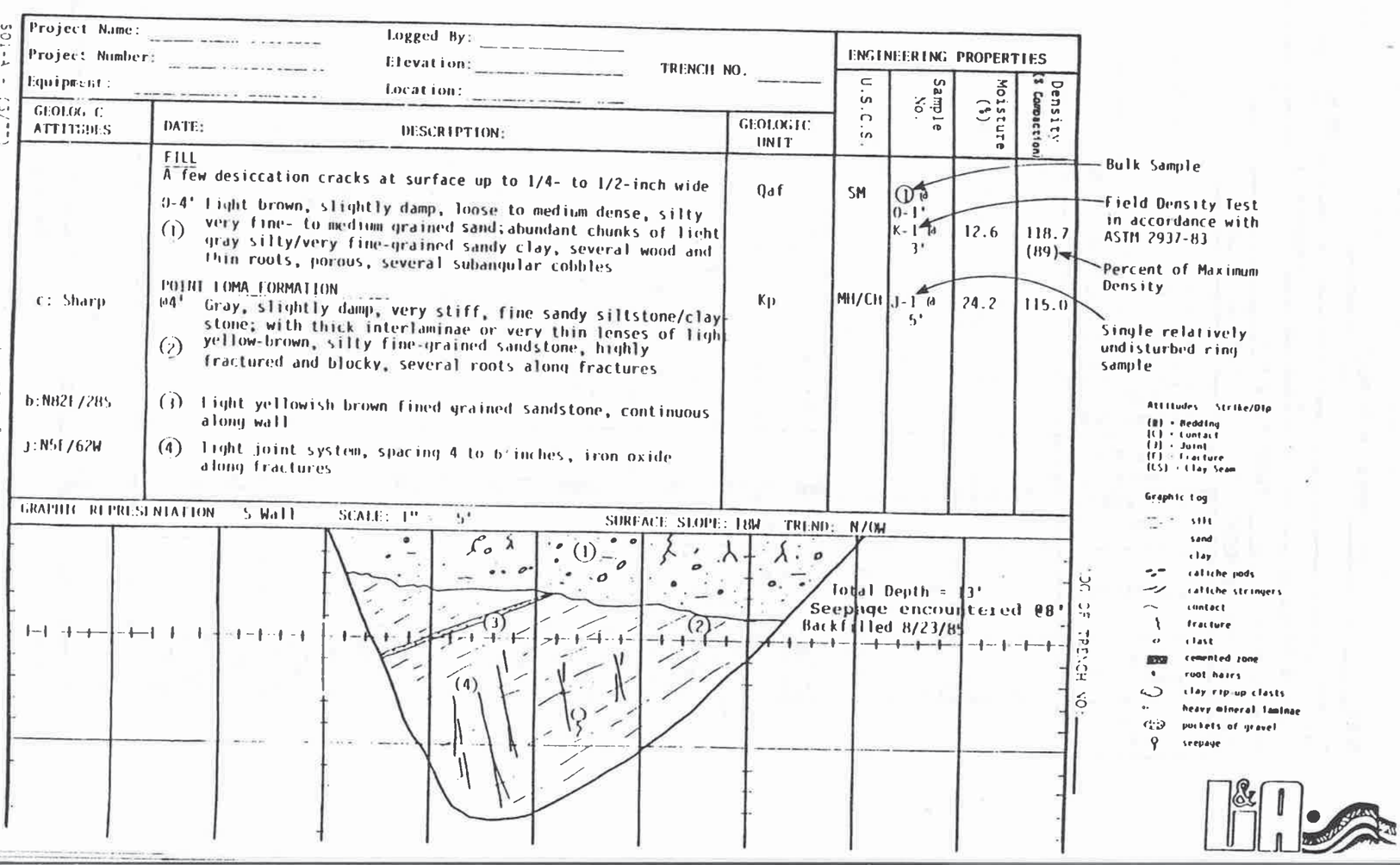
9. Tokimatsu and Seed, 1987, Evaluation of Settlement in Sands due to Earthquake Shaking, ASCE, Vol. 113, No. 8, August.

10. Weber, F.H., 1963, Geology and Mineral Resources of San Diego County, California, California Division of Mines and Geology, County Report 3.

EXPLANATION OF GEOTECHNICAL TRENCH LOG



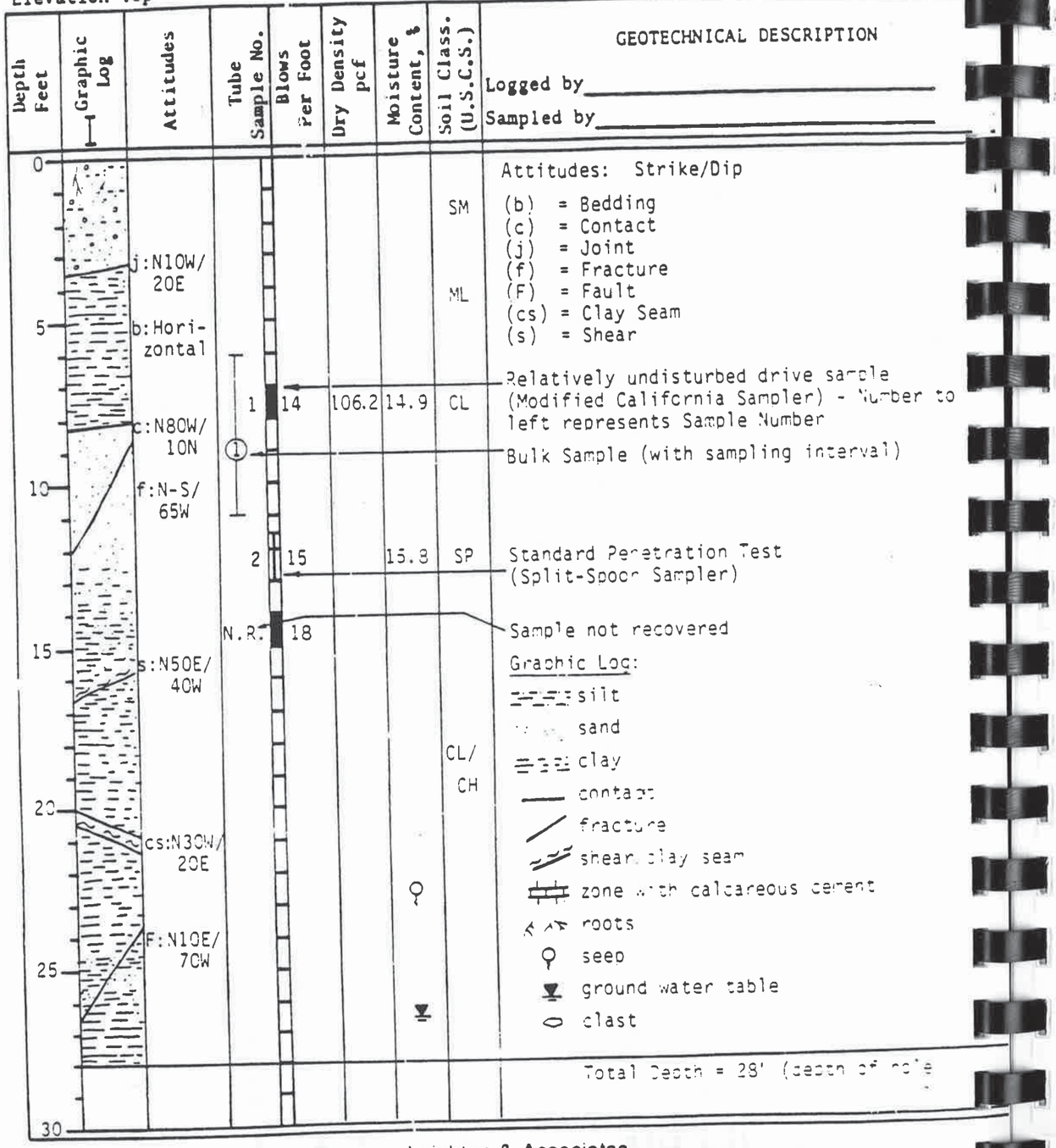
Date _____ Drill Hole No. _____ Sheet ___ of ___

Project _____ Job No. _____

Drilling Co. _____ Type of Rig _____

Hole Diameter _____ Drive Weight _____ Drop _____ in.

Elevation Top of Hole _____ Ref. or Datum _____



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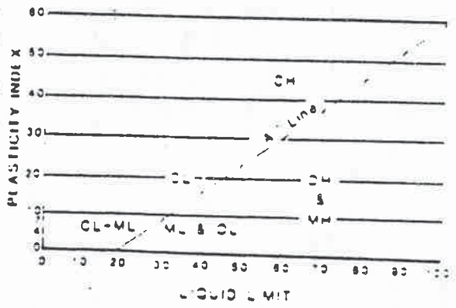
COARSE GRAINED SOILS (More than 1/2 of soil > no. 200 sieve size)	GRAVELS (More than 1/2 of coarse fraction > no. 4 sieve size)	GW	Well graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS (More than 1/2 of coarse fraction < no. 4 sieve size)	SW	Well graded sands or gravelly sands, little or no fines
		SP	Poorly graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS (More than 1/2 of soil < no. 200 sieve size)	SILTS & CLAYS LL < 50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS LL > 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils

CLASSIFICATION CHART
(Unified Soil Classification System)

CLASSIFICATION	RANGE OF GRAIN SIZES: U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL	3" to No. 4	76.2 to 4.76
coarse	3" to 3/4"	76.2 to 19.1
fine	3/4" to No. 4	19.1 to 4.76
SAND	No. 4 to No. 200	4.76 to 0.074
coarse	No. 4 to No. 10	4.76 to 2.00
medium	No. 10 to No. 40	2.00 to 0.420
fine	No. 40 to No. 200	0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

GRAIN SIZE CHART



PLASTICITY CHART

METHOD OF SOIL CLASSIFICATION

501-A - (3/77)

Leighton & Associates

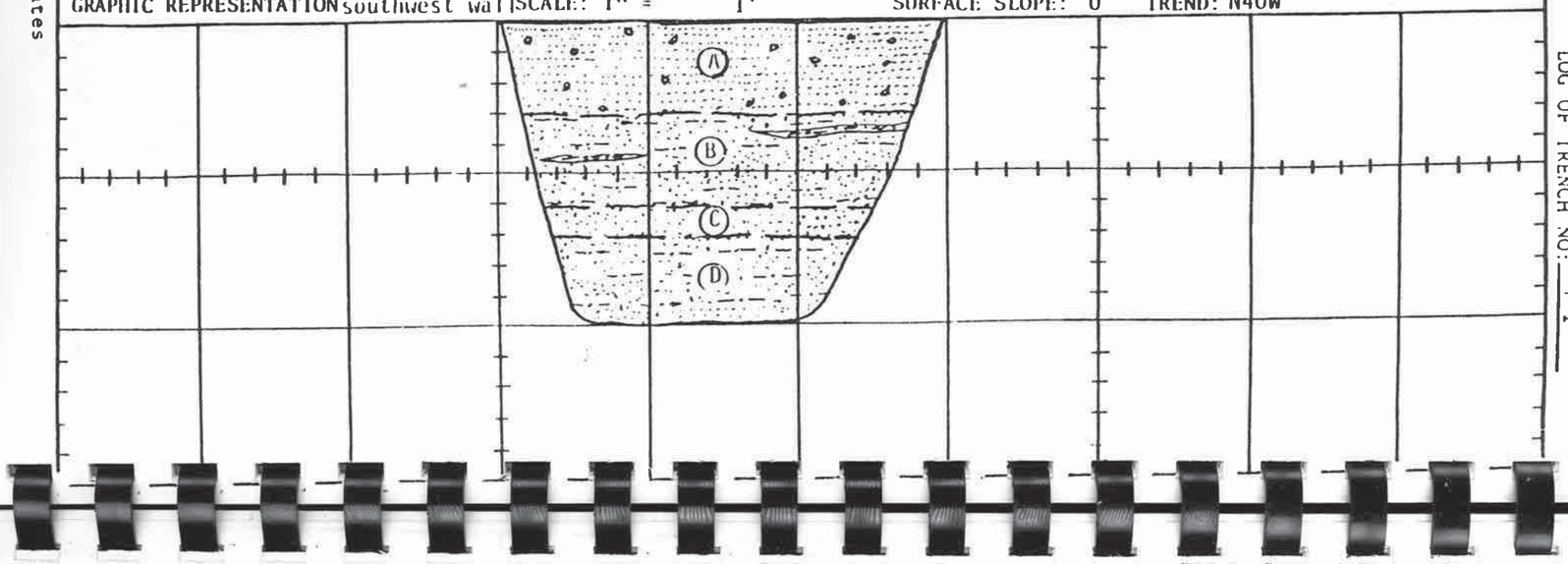
Project Name: Jacumba Valley Ranch
Project Number: 4900381-05
Equipment: Case 680C Backhoe

Logged By: DLL
Elevation: ±2,790'
Location: See Plate 1

TRENCH NO. T-1

GEOLOGIC ATTITUDES	DESCRIPTION	GEOLOGIC UNIT	ENGINEERING PROPERTIES: U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	DATE: 12/18/90					
	ALLUVIUM					
	(A) @0'-3': Gray-white, loose, dry, fine to very coarse sand; abundant pebbles, finely bedded		SW	(1) @ 0'-3'		
	(B) @3'-6': Dark brown, moist, medium dense, silty, fine to medium sand; few coarse-grained constituents, micaceous, some pods and discontinuous lenses of very silty, fine to medium sand		SM			
	(C) @6'-7': Dark brown, moist, medium dense, fine to coarse sand; micaceous		SW			
	(D) @7'-10': Dark brown, moist, medium dense, fine to medium sandy silt		ML	(2) @ 8'-10'		
	Total Depth = 10 feet No Ground Water Encountered at Time of Trenching Backfilled: 12/18/90					

GRAPHIC REPRESENTATION southwest wall SCALE: 1" = 1' SURFACE SLOPE: 0° TREND: N40W



LOG OF TRENCH NO: T-1

501-A - (3/77)

Leighton & Associates

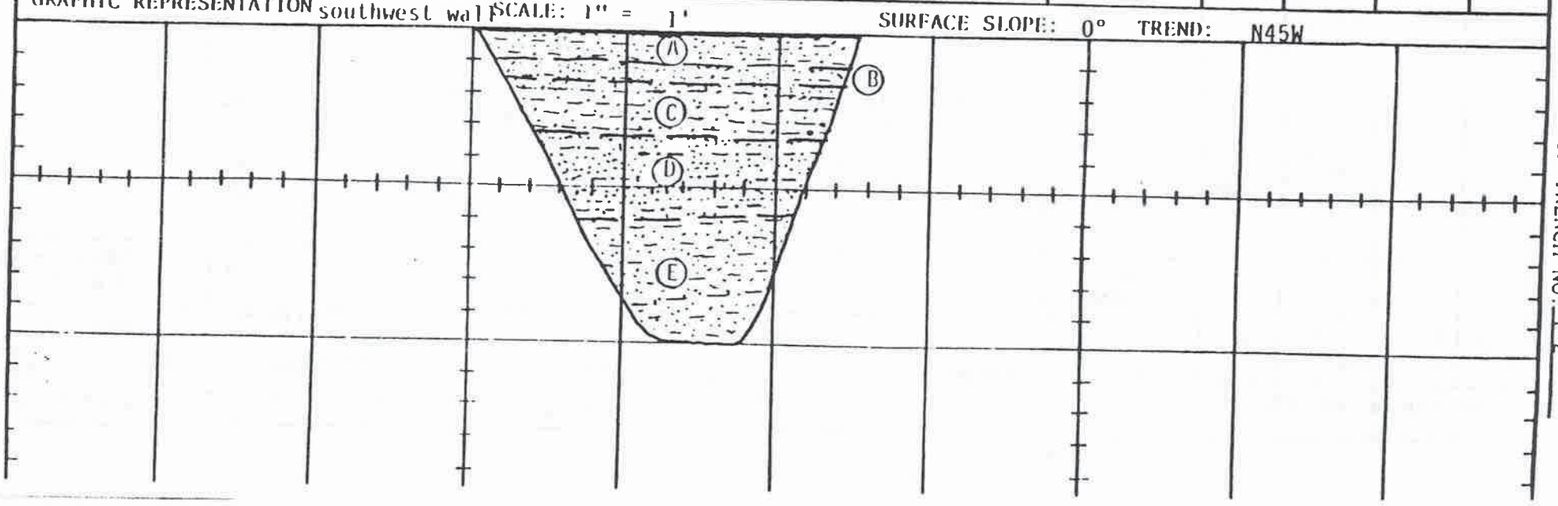
Project Name: Jacumba Valley Ranch
Project Number: 4900381-05
Equipment: Case 680C Backhoe

Logged By: DLL
Elevation: ±2,775'
Location: See Plate 1

TRENCH NO. T-2

GEOLOGIC ATTITUDES	DESCRIPTION	GEOLOGIC UNIT	ENGINEERING PROPERTIES: U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	DATE: 12/18/90					
	ALLUVIUM					
	(A) @0'-1': Dark brown and olive-brown, moist, medium dense, fine sandy silt/silty fine sand; sparse roots, slightly porous, micaceous	Qal	ML/SM	(1) @ 0'-3'		
	(B) @1'-1.4': Light brown, moist, medium dense, silty fine sand		SM			
	(C) @1.4'-3': Mottled dark olive-brown and brown, moist to wet, medium dense, fine sandy silt; few roots, abundant red-brown stringers (infilled borrows?), abundant caliche stringers		ML			
	(D) @3'-6': Mottled olive-brown and orange-brown, moist to wet, medium dense, fine sandy silt micaceous, slightly porous		ML	(2) @ 4'-6'		
	@6'-10': Becomes fine sandy silt/silty fine sand		ML/SM			
	Total Depth - 10 feet Ground Water Seepage Encountered at 6 feet at time of trenching					

GRAPHIC REPRESENTATION southwest wall SCALE: 1" = 1' SURFACE SLOPE: 0° TREND: N45W



LOG OF TRENCH NO: T-2

501-A - (3/77)

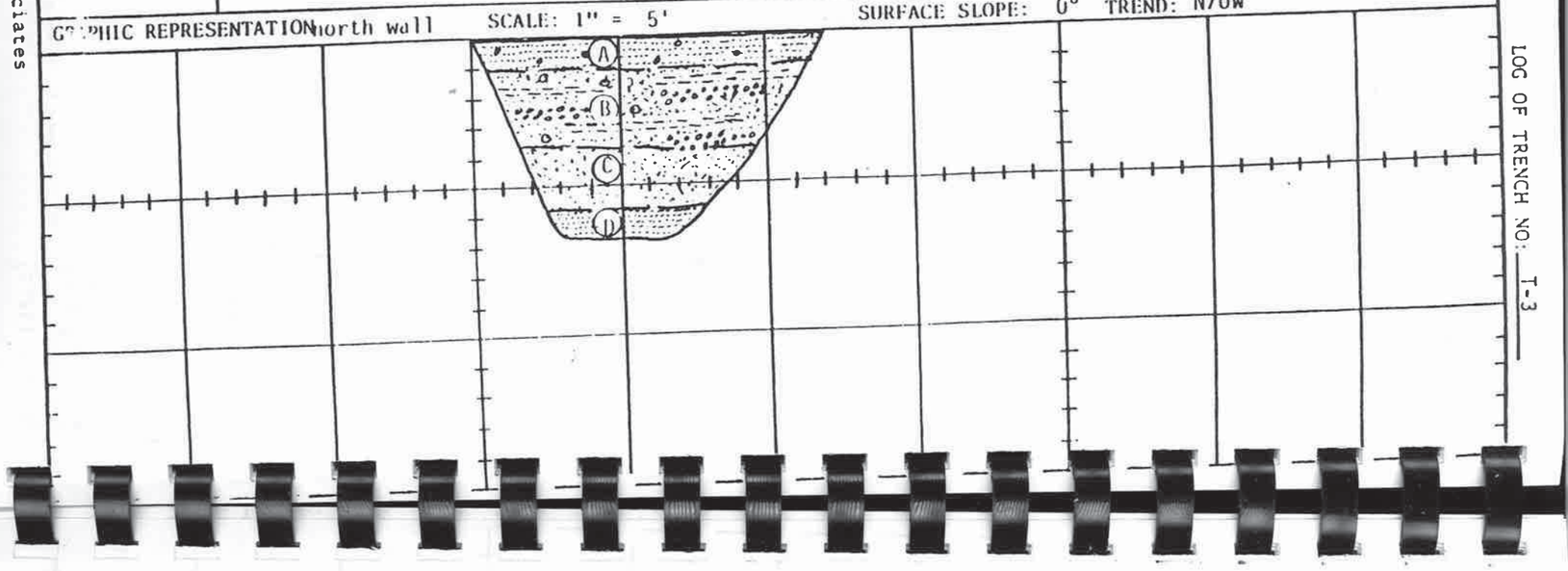
Project Name: Jacumba Valley Ranch
Project Number: 4900381-05
Equipment: Case 680C Backhoe

Logged By: DLL
Elevation: ±2,780'
Location: See Plate 1

TRENCH NO. T-3

GEOLOGIC ATTITUDES	DATE: 12/18/90 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	ALLUVIUM					
	(A) @0'-1': Gray-white, dry, loose, fine to very coarse sand; some pebbles, finely bedded	Qal	SM-SW	(1) @ 1'-3'		
	(B) @1'-3.5': Gray-brown, dry to damp, loose, fine to very coarse sand; few discontinuous silt layers approximately 1/2 inch thick, some discontinous sandy pebble lenses, rare clasts to 3 inch diameter			(2) @ 5'-7'		
	(C) @3.5'-6': Gray-brown, dry to damp, loose, fine to very coarse sand; few pebbles					
	(D) @6'-7': Gray-brown, dry to damp, loose, very coarse sand; finely bedded		SM-SP			
	Total Depth = 7 feet No Ground Water Seepage Encountered at Time of Trenching Backfilled: 12/18/90					

GRAPHIC REPRESENTATION north wall SCALE: 1" = 5' SURFACE SLOPE: 0° TREND: N70W



LOG OF TRENCH NO: T-3

Leighton & Associates

501-A - (3/77)

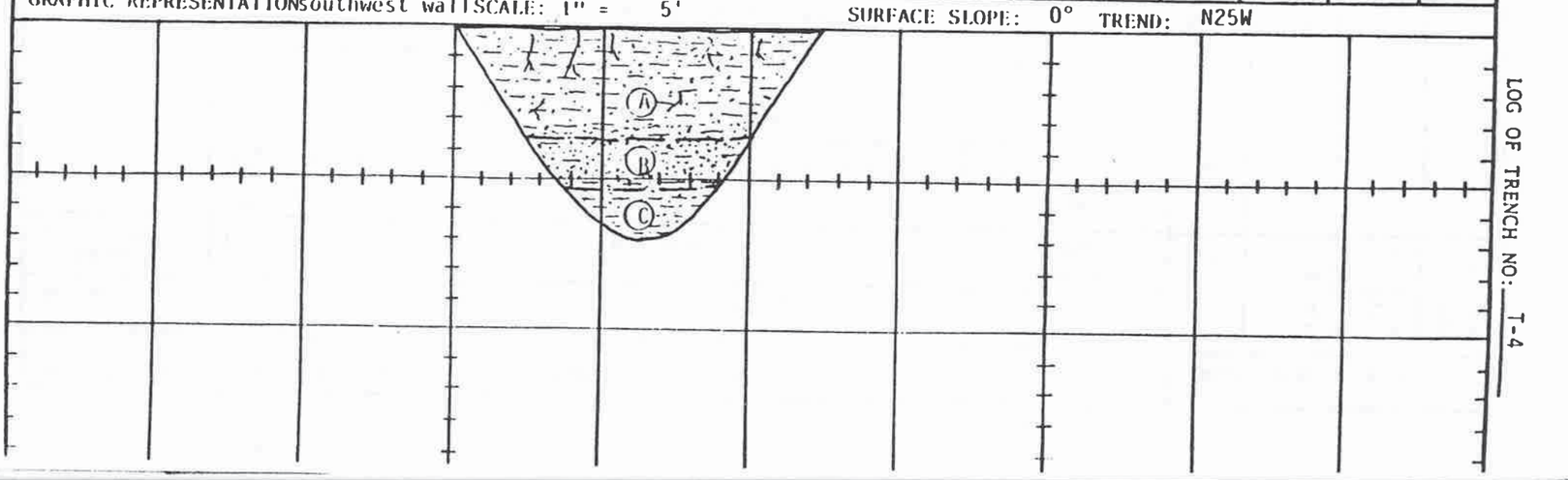
Project Name: Jacumba Valley Ranch
Project Number: 4900381-05
Equipment: Case 680C Backhoe

Logged By: DLL
Elevation: ±2,755'
Location: See Plate 1

TRENCH NO. T-4

GEOLOGIC ATTITUDES	DATE: 12/18/90 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	ALLUVIUM	Qal				
	(A) @0'-3.5': Dark brown to black, moist to wet, medium dense, fine to medium sandy silt; porous, abundant roots and rootlets, micaceous		ML	(1) @ 0'-3'		
	(B) @3.5'-5.5': Mottled dark olive-brown and brown, and orange brown, wet to saturated, dense, very silty fine sand/fine sandy silt; porous, few roots, some medium-coarse grained constituents		ML/SM			
	(C) @5.5'-7.0': Dark brown to olive-brown, saturated, medium dense, fine to medium sandy silt; micaceous		ML			
	Total Depth = 7 feet Ground Water Seepage Encountered at 4 feet at Time of Trenching Backfilled: 12/18/90					

GRAPHIC REPRESENTATION southwest wall SCALE: 1" = 5' SURFACE SLOPE: 0° TREND: N25W



LOG OF TRENCH NO: T-4

Leighton & Associates

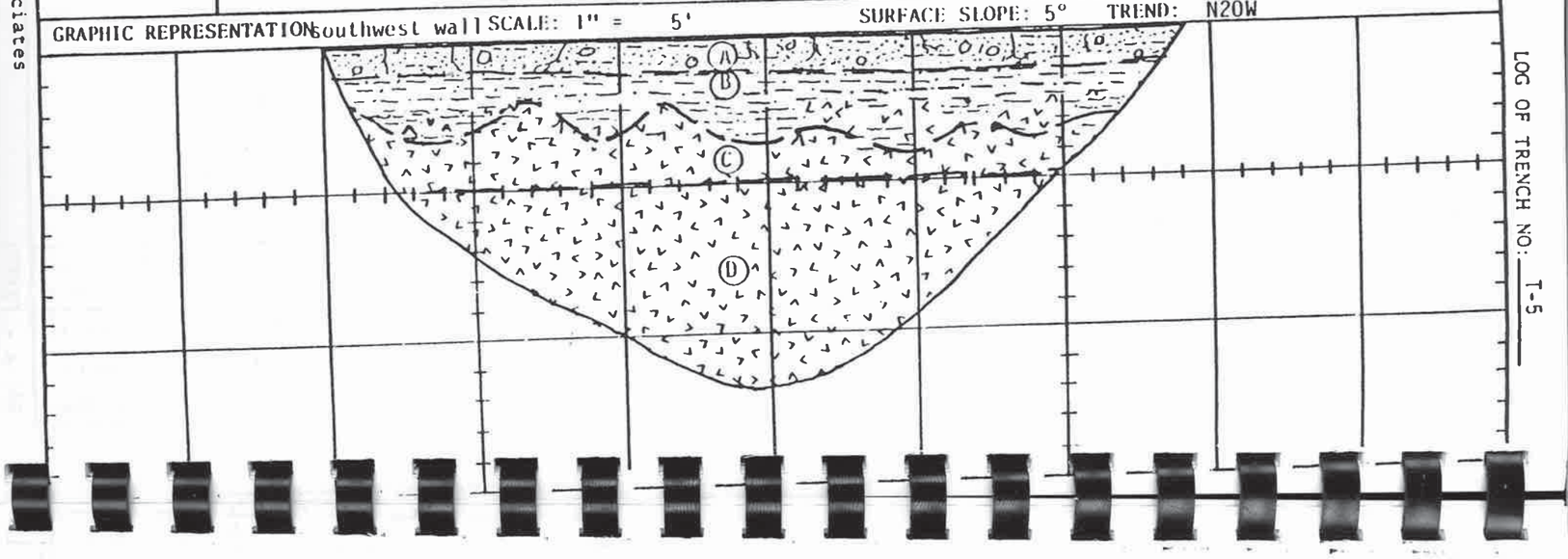
501-A - (3/77)

Leighton & Associates

Project Name: Jacumba Valley Ranch | Logged By: DLL
Project Number: 4900381-05 | Elevation: ±2,820' | TRENCH NO. T-5
Equipment: Link Belt LS 5800 Trackhoe | Location: See Plate 1

GEOLOGIC ATTITUDES	DATE: 12/18/90 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	TOPSOIL	Topsoil				
	(A) @0'-1': Brown, dry, loose, silty, fine to medium sand; abundant rootlets throughout, moderate amount of cobbles to 5-inch diameter, slightly porous, desiccated		SM			
	OLDER ALLUVIUM					
	(B) @1'-2': Brown, dry, loose to medium dense, fine to medium sandy silt; trace of clay, slightly desiccated	Qfn	ML	(1) @ 1'-2'		
	JACUMBA LAVA					
	(C) @2'-5': Mottled pinkish white, dry, dense rhyolitic tuff bed; intermixed with volcanic clasts and zones and pods of alluvium; very weathered, slightly desiccated, slightly friable	Tjl				

GRAPHIC REPRESENTATION Southwest wall SCALE: 1" = 5' SURFACE SLOPE: 5° TREND: N20W



LOG OF TRENCH NO: T-5

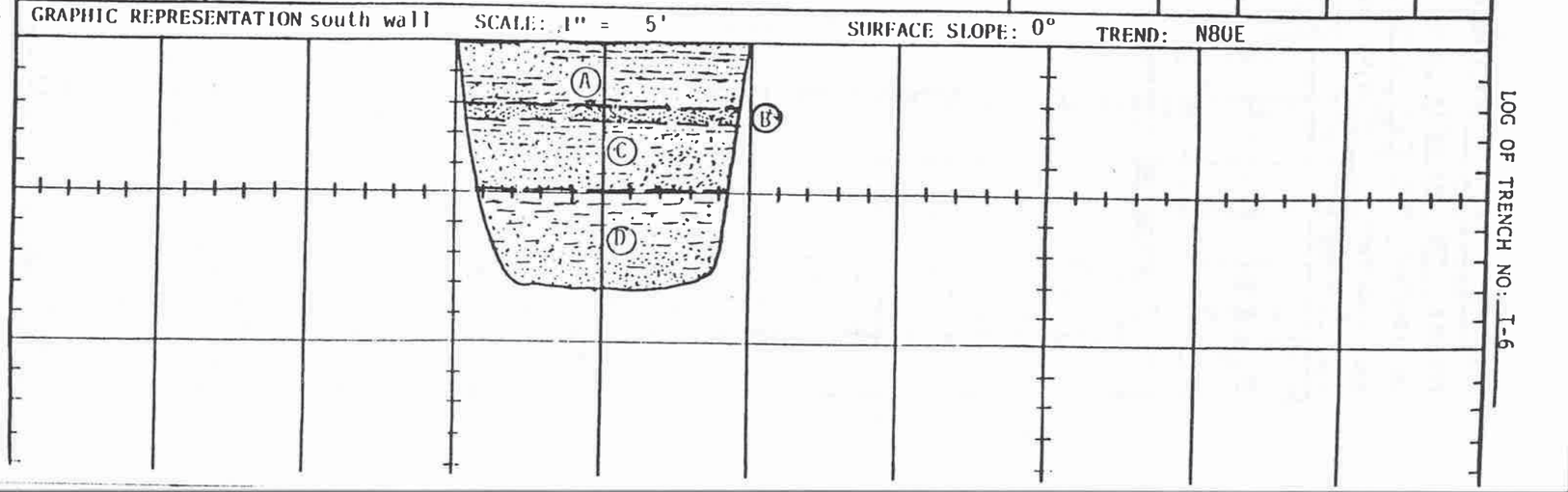
501-A - (3/77)

Leighton & Associates

Project Name: Jacumba Valley Ranch | Logged By: DLL
Project Number: 4900381-05 | Elevation: | TRENCH NO. T-6
Equipment: Case 680C Backhoe | Location:

GEOLOGIC ATTITUDES	DATE: DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	ALLUVIUM	Qal				
	(A) @0'-2': Alternating gray, dry, loose, fine to coarse sand and gray, dry, loose silt; silt layers 1/4-inch to 1-inch thick		ML & SM	(1) @ 2'-5'		
	(B) @2'-2.5': Gray, dry, loose, fine sand; finely laminated cross bedding, concoidal lenses of fine to coarse sand, manganese lamanae		SP			
	(C) @2.5'-5': Brown, damp, medium dense, silty fine to medium sand; grades to brown, damp, medium dense, fine to medium sand		SM & SW			
C: sharp, horizontal	(D) @5'-8': Dark brown, wet to saturated, medium dense, fine to medium sandy silt, grades to silty, fine sand; slightly porous, minor roothairs		ML & SW	(2) @ 5'-8'		
	Total Depth = 8 feet Ground Water Seepage Encountered at 7 feet					

GRAPHIC REPRESENTATION south wall SCALE: 1" = 5' SURFACE SLOPE: 0° TREND: N80E



LOG OF TRENCH NO: T-6

GEOTECHNICAL BORING LOG

Date 12/11/90 Drill Hole No. B-1 Sheet 1 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,760' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0								ALLUVIUM
5			1	22		23.8	ML	@5': Brown, dry, very stiff, slightly fine sandy silt
								@7': Becomes clayey
10			2	22		▽		@10': Dark brown, moist to wet, very stiff clayey silt slightly micaceous
15			3	28				@15': Dark brown, saturated, very stiff, clayey silt; some fine grains, rare pebbles
20			4	41			SC	@20': Dark brown, saturated, dense, clayey fine to coarse sand; numerous pebbles
25			5	37				@25': Dark brown, saturated, dense, slightly clayey fine to very coase sand; numerous pebbles to 1" diameter
30								

GEOTECHNICAL BORING LOG

Date 12/11/90 Drill Hole No. B-1 Sheet 2 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,760' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			6	38			SW	@30': Brown-gray, wet, dense, fine to coarse sand; numerous red, fine-grained volcanics
35			7	50/2"			SM/GM	@35': Brown, saturated, very dense, silty fine to very coarse sand/silty to sandy gravel (volcanic gravel) Refusal at 36.5 feet due to bedrock
40								Total depth = 36.5 feet Ground water encountered at 11 feet at time of drilling

GEOTECHNICAL BORING LOG

Date 12/11/90 Drill Hole No. B-2 Sheet 1 of 1

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,778' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0								ALLUVIUM
5			1	17		▽	SM	@5': Olive-brown, wet, medium dense, silty fine to medium sand; slightly micaceous
10			2	24			ML	@10': Olive-brown to light orange-brown, wet, medium dense, fine sandy silt, micaceous
15			3	28			ML/SM	@15': Mottled brown, olive-tan and orange brown, wet, medium dense, silty very fine sand/very fine sandy silt; few root hairs, micaceous
20			4	41			SM	@20': Mottled brown, olive-brown and orange-brown, wet, dense, silty fine sand; contact to brown, saturated, dense, sandy gravel
25			5	90/7"				JACUMBA LAVA @25': Mottled pinkish white, wet, very dense volcanic rock
30								Total depth = 27 feet (refusal on bedrock) Ground water encountered at 6 feet at time of drilling

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GEOTECHNICAL BORING LOG

Date 12/11/90 Drill Hole No. B-3 Sheet 1 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,790' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0								ALLUVIUM
5			1	31			SM	@5': Brown, moist, dense, silty fine sand few rootlets
10			2	30	102.4	21.2		@10': Mottled orange-brown and brown, wet dense, silty fine sand; few rootlets, slightly micaceous
15			3	35			ML/SM	@15': Mottled orange-tan and brown, wet, dense, silty very fine sand/very fine sandy silt; some carbon-stained flecks
20			4	61	98.3	31.5	ML	@20': Mottled orange-brown and brown, wet to saturated, very dense, fine sandy silt
25			5	39			SM	@25': Light brown, wet, dense, silty fine to medium sand; contact to dark brown, wet, dense, silty, fine sand; more silty than above contact
30								

500A (2/88) Leighton & Associates

GEOTECHNICAL BORING LOG

Date 12/11/90 Drill Hole No. B-3 Sheet 2 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,790' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			6	20	(N.R.)		SM	@30': Brown, saturated, medium dense, silty fine sand; slightly micaceous
35								
40			7	70			ML/ SM	@40': Mottled brown and orange-brown, wet, very dense, silty fine sand/fine sandy silt; slightly micacous, carbon-stained pods
45								
50			8	84	(N.R.)		SM	@50': Brown, saturated, dense, silty fine sand
55								Total depth = 51 feet Ground water encountered at 12 feet at time of drilling

500A (2/77)

Leighton & Associates

GEOTECHNICAL BORING LOG

Date 12/12/90 Drill Hole No. B-4 Sheet 1 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,786' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0								ALLUVIUM
5			1	41	98.2	18.6	SM	@5': Brown, moist, dense, silty fine to coarse sand; micaceous
								@7': Becomes siltier
10			2	33			SM & SW	@10': Dark brown, wet, dense, slightly silty fine to medium sand and gray, wet, fine to coarse sand; micaceous
15			3	78	106.4	24.5	SM	@15': Brown, saturated, very dense, silty, fine to medium sand
20			4	35				@20': Gray, wet, dense, slightly silty fine to coarse sand; some interbeds of brown, clayey silt (up to 2" thick)
25			5	36			CL SW	@25': Red-brown, wet, very stiff, silty clay/clayey silt; gradational contact with gray, saturated, dense, fine to coarse sand
30								

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GEOTECHNICAL BORING LOG

Date 12/12/90 Drill Hole No. B-4 Sheet 2 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,786' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			6	36	(N.R.)			
35								
40			7	82			SW	@40': Gray, saturated, very dense, fine to coarse sand
45							SM	@50': Light brown, saturated, dense to very dense, slightly silty, fine to medium sand
50			8	50				
								Total depth = 51.5 feet Ground water encountered at 9 feet at time of drilling
55								

500\ (2/--)

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GEOTECHNICAL BORING LOG

Date 12/12/90 Drill Hole No. B-5 Sheet 1 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,777' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0								ALLUVIUM
5			1	24		23.6	SM	@5': Mottled brown and red-brown, wet, medium dense, very silty fine sand; micaceous
10			2	26		▽	ML	@9': Becomes clayey @10': Mottled red-brown and brown, wet, very stiff, fine sandy silt; trace of clay, few carbonized flecks
15			3	41			CL-SM	@15': Mottled red-brown and brown, wet, dense interbedded silty clay/very silty fine sand; some carbonized thin (1/16" thick) beds, silty clay is finely laminated
20			4	49			SW	@20': Brown, wet, dense fine to medium sand; few coarse grains, micaceous
25			5	28			SM/ML SW	@25': Mottled red-brown, wet, medium dense, fine sandy silt/silty fine sand; trace of clay, some finely laminated clay layers. Sharp contact with brown, fine to medium sand with trace of silt (2 samples obtained
30								

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GEOTECHNICAL BORING LOG

Date 12/12/90 Drill Hole No. B-5 Sheet 2 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,777' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			6	38			ML-SM	@30': Mottled red-brown and brown, wet, dense, clayey silt to silty fine sand
35								
40			7	38			SW	@40': Brown, saturated, dense, fine to medium sand; trace of silt
45								
50			8	67				@50': Brown, saturated, very dense, fine to coarse sand; trace of silt
								Total depth = 51.5 feet Ground water encountered at 9 feet at time of drilling
55								

GEOTECHNICAL BORING LOG

Date 12/12/90 Drill Hole No. B-6 Sheet 1 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,788' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0								ALLUVIUM
5			1	19		8.5	SM	@5': Light brown, moist, medium dense, silty fine sand; micaceous
10			2	42	105.7	10.8 ▽		
15			3	48			SW	@15': Brown, wet, dense, fine to coarse sand; micaceous, trace of silt
20			4	76	(N.R.)			
25			5	20			CL/ML	@25': Mottled red-brown and brown, wet, very stiff, silty clay/clayey silt; trace of fine sand
30								

GEOTECHNICAL BORING LOG

Date 12/12/90 Drill Hole No. B-6 Sheet 2 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,788' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			6	47	93.7 (Partial recovery)	28.1		@30': Same as at 25'
35								
40			7	64 (N.R.)				
45								
50			8	47			CL/ ML	@50': Mottled olive-brown, wet, hard clayey silt/silty clay
								Total depth = 51.5 feet Ground water encountered at 11.5 feet at time of drilling
55								

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GEOTECHNICAL BORING LOG

Date 12/13/90 Drill Hole No. B-7 Sheet 1 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,792' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0								ALLUVIUM
5			1	26	97.5	11.8	SM	@5': Brown, damp to moist, medium dense, very silty, fine to medium sand; micaceous trace of clay, rare pebbles
10			2	22				@10': Light reddish brown, moist, medium dense, very silty fine to medium sand; slightly micaceous; trace of clay, moderate volcanic pebbles
15			3	43	112.1	15.2	SC/ SM	@15': Light reddish brown, moist, medium dense, clayey to silty, fine to coarse sand
20								JACUMBA LAVA
			4	66				@20': Mottled red, white and black, saturated, very dense, very weathered volcanic rock
25								
30			5	89 (N.R.)				

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GEOTECHNICAL BORING LOG

Date 12/13/90 Drill Hole No. B-7 Sheet 2 of 2-

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,792' Ref. or Datum mean sea level

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged by DLL Sampled by DLL
30			5	50/2" (N.R.)				@30': Black, slightly weathered basaltic volcanic rock
								Total depth = 33 feet Ground water encountered at 9 feet at time of drilling
35								

GEOTECHNICAL BORING LOG

Date 12/13/90 Drill Hole No. B-8 Sheet 1 of 2-

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,781' Ref. or Datum mean sea level

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged by DLL Sampled by DLL
0								ALLUVIUM
			1					
5			1	28	93.8	27.3	SM	@5': Olive-brown and orange-brown, wet, medium dense, silty fine sand; few rootle slightly micaceous
								▽
10			2	50			ML/SM	@10': Mottled orange-brown and olive-brow saturated, dense, silty fine sand/fine sandy silt; some carbonized thin (1/16" thick) layers
15			3	28	95.4	30.7	ML/SM	@15': Mottled orange-brown and olive-brown, saturated, clayey silt/silty clay; some carbonized flecks and staining, few medium-sized grains
20			4	48			SM	@20': Light brown and olive-brown, wet, dense, silty fine sand; micaceous, some brown, silty/clayey layers up to 1/2" thi.
25			5	34	113.9	16.8		@25': Light brown, wet, dense, slightly silty, fine to coarse sand
30								

GEOTECHNICAL BORING LOG

Date 12/13/90 Drill Hole No. B-8 Sheet 2 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,781' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			6	35			ML/MH	@30': Mottled olive, olive-brown, and orange-brown, wet, hard clayey silt, trace of fine sand, micaceous, some thin clay layers
35								
40			7	20 (N.R.)				
45								
50			8	100			SM	@50': Brown, wet, very dense, very silty, fine to medium sand; approximately 5 percent coarse grains, micaceous
55								Total depth = 51.5 feet Ground water encountered at 8.5 feet at time of drilling

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GEOTECHNICAL BORING LOG

Date 12/13/90 Drill Hole No. B-9 Sheet 1 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,774' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0							CL/ML	ALLUVIUM @0': Dark brown, moist to wet, very stiff, silty clay/clayey silt
5			1	20			CL/ML	@5': Mottled dark olive-brown and orange-brown, wet, very stiff, clayey silt/silty clay; trace of fine sand
10			2	24	(N.R.)			
15			3	72	74.0	36.9	CL	@15': Mottled orange-brown and brown, saturated, very dense, fine sandy clay
20			4	32			SM	@22': Brown, wet, dense, very silty fine sand; micaceous, sharp contact to red-brown and brown, silty clay/clayey silt
25			5	21	(N.R.)		CL/ML	

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GEOTECHNICAL BORING LOG

Date 12/13/90 Drill Hole No. B-9 Sheet 2 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,774' Ref. or Datum mean sea level

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged by DLL Sampled by DLL
30			6	46			ML/SM CL/ML	@30': Brown, wet, dense, silty very fine sand/very fine sandy silt; micaceous, grades to: orange-brown and brown, silty clay/clayey silt
35								
40			7	52	80.1	20.6	ML/CL	@40': Mottled olive-brown and orange-brown wet, hard, silty clay/clayey silt
45								
50			8	44			CL/SC	@50': Mottled orange-brown and brown, wet, dense, fine to medium sandy clay/clayey sand
								Total depth = 51.5 feet Ground water encountered at 7 feet at time of drilling
55								

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GEOTECHNICAL BORING LOG

Date 12/13/90 Drill Hole No. B-10 Sheet 1 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,770' Ref. or Datum mean sea level

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged by DLL Sampled by DLL
0								ALLUVIUM
5			1	23		▽	CL/ML	@5': Mottled olive-brown and orange-brown, wet, very stiff silty clay/clayey silt; micaceous trace of fine sand
10			2	29	88.7	34.2	ML/SM	@12': Mottled olive-brown and orange-brown saturated, medium dense, fine sandy silt/silty fine sand; micaceous
15			3	37			SM	@15': Mottled olive-brown and orange-brown wet, dense, silty fine sand; sample had one 3" thick layer of olive-brown and brown, laminated clay and silt
20			4	38	87.8	34.0	SC/SM	@20': Light brown, saturated, dense, silty and clayey fine to medium sand; micaceous
25			5	43			CL/SM	@25': Mottled olive-brown and red-brown wet, dense, fine sandy clay to silty clayey sand
30								

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GEOTECHNICAL BORING LOG

Date 12/13/90 Drill Hole No. B-10 Sheet 2 of 2-

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,770' Ref. or Datum mean sea level

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged by DLL Sampled by DLL
30			6	50/2"	(N.R.)			
35								
40			7	68			ML/ SM	@40': Brown, wet, very dense, very fine sandy silt/silty very fine sand
								Total depth = 41.5 feet Ground water encountered at 6 feet at time of drilling
45								

GEOTECHNICAL BORING LOG

Date 12/14/90 Drill Hole No. B-11 Sheet 1 of 2-

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,766' Ref. or Datum mean sea level

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged by DLL Sampled by DLL
0								ALLUVIUM
5			1	22		▽	ML	@5': Mottled olive-brown and orange-brown, wet, medium dense, fine sandy silt; micaceous, trace of clay
10			2	36	112.1	19.1	SM& CL	@10': Brown, saturated, dense, silty fine to coarse sand and brown, saturated stiff, slightly sandy clay
15			3	30			CL	@15': Mottled olive-brown and orange-brown, wet, very stiff to hard, fine sandy clay; micaceous
20			4	55	(N.R.)			
25			5	32				@25': Mottled red-brown and olive-brown, saturated, hard, slightly silty clay; numerous carbonized flecks, micaceous, some caliche stringers and pods
30								

GEOTECHNICAL BORING LOG

Date 12/14/90 Drill Hole No. B-11 Sheet 2 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,766' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			6	70 (N.R.)			CL	@30': Brown, saturated, hard, clay
35								
40			7	50/4"			SW	@40': Brownish gray, wet, very dense, fine to coarse sand
45								
50			8	50/3"	117.6	14.0	SC	@50': Light reddish brown, saturated, very dense, clayey, fine to coarse sand
55								Total depth = 51 feet Ground water encountered at 5 feet at time of drilling

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GEOTECHNICAL BORING LOG

Date 12/14/90 Drill Hole No. B-12 Sheet 1 of 1

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0							SM	ALLUVIUM @0': Brown, damp, medium dense, silty fine to coarse sand
5			1	20		8.4	SM/SW	@5': Brown, damp, medium dense, trace to slightly silty, fine to medium sand; few gravels, approximately 5 to 10 percent coarse grains
10			2	21				@10': Same as at 5' but fine to very coarse grained and wet
15			3	26			SW	@15': Gray-brown, wet, medium dense, fine to coarse sand
20			4	50/5"				JACUMBA LAVA @20': Red and black, very dense, weathered volcanic rock
25								Total depth = 22 feet (Refusal on Bedrock) Ground water encountered at 13.5 feet at time of drilling
30								

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GEOTECHNICAL BORING LOG

Date 12/14/90 Drill Hole No. B-13 Sheet 1 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,791' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0			1					ALLUVIUM
5			1	23		7.0	ML/SM	@5': Brown, damp, medium dense, fine sandy silty/silty fine sand; few pebbles
10			2	41		4.3	SW	@10': Brown, damp, dense, fine to medium sand; few thin (1/4" thick) silt layers, some pebbles More pebbles with depth
15			3	75		2.2		@15': Brown, damp, very dense, fine to coarse sand; some pebbles
20			4	50/4"		2.3		@18': Abundant pebbles to 2" diameter
25			5	30/6"		1.2	SM	@26': Becomes silty sand
30								

GEOTECHNICAL BORING LOG

Date 12/14/90 Drill Hole No. B-13 Sheet 2 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,791' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			6	38			SM	@30": Brown, damp, dense, silty fine to medium sand; rare pebbles, one 1/2" thick clay layer
35								
40			7	81			SW	@40': Brown, wet, very dense, fine to medium sand; few pebbles, approximatley 5 to 10 percent coarse grains
45								
50			8	34				@50': Same as at 40' but dense
55								Total depth = 51.5 feet Ground water encountered at 40 feet at time of drilling

APPENDIX C

LABORATORY TESTING PROCEDURES

Moisture and Density Tests: Moisture content and dry density determinations were performed on relatively undisturbed samples obtained from the test borings and/or trenches. The results of these tests are presented in the boring and/or trench logs. Where applicable, only moisture content was determined from "undisturbed" or disturbed samples.

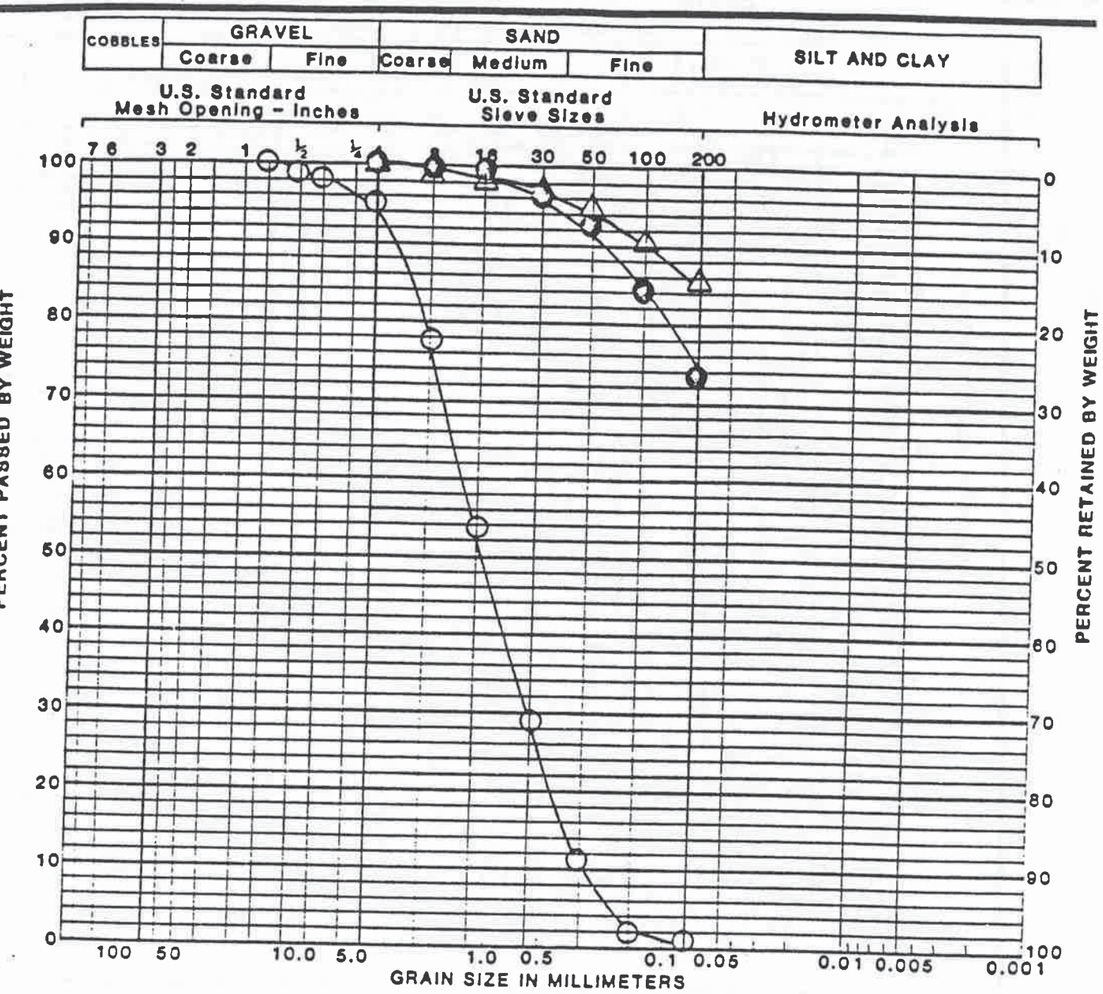
Classification Tests: Typical materials were subjected to mechanical grain-size analysis by wet sieving from U.S. Standard brass screens (ASTM D422-65). Hydrometer analyses were performed where appreciable quantities of fines were encountered. The data was evaluated in determining the classification of the materials. The grain-size distribution curves are presented in the test data and the Unified Soil Classification is presented in both the test data and the boring and/or trench logs.

Direct Shear Tests: Direct shear tests were performed on selected remolded and/or undisturbed samples which were soaked for a minimum of 24 hours under a surcharge equal to the applied normal force during testing. After transfer of the sample to the shear box, and reloading the sample, pore pressures set up in the sample due to the transfer were allowed to dissipate for a period f approximately 1 hour prior to application of shearing force. The samples were tested under various normal loads, a different specimen being used for each normal load. The samples were sheared in a motor-driven, strain-controlled, direct-shear testing apparatus at a strain rate of 0.05 inch per minute. After a travel of 0.300 inch of the direct shear machine, the motor was stopped and the sample was allowed to "relax" for approximately 15 minutes. The "relaxed" and "peak" shear values were recorded. It is anticipated that, in a majority of samples tested, the 15 minutes relaxing of the sample is sufficient to allow dissipation of pore pressures set up in the samples due to application of shearing force. The relaxed values are therefore judged to be a good estimation of effective strength parameters. The test results were plotted on the "Direct Shear Summary".

Maximum Density Tests: The maximum dry density and optimum moisture content of typical materials were determined in accordance with ASTM D1557-78 (five layers). The results of these tests are presented in the test data.

Expansion Index Tests: The expansion potential of selected materials was evaluated by the Expansion Index Test, U.B.C. Standard No. 29-2. Specimens are molded under a given compactive energy to approximately the optimum moisture content and approximately 50 percent saturation or approximately 90 percent relative compaction. The prepared 1-inch thick by 4-inch diameter specimens are loaded to an equivalent 144 psf surcharge and are inundated with tap water until volumetric equilibrium is reached. The results of these tests are presented in the test data.

Consolidation Tests: Consolidation tests were performed on selected, relatively undisturbed samples recovered from the sampler. Samples were placed in a consolidomter and loads were applied in geometric progression. The percent consolidation for each load cycle was recorded as the ratio of the amount of vertical compression to the original 1-inch height. The consolidation pressure curves are presented in the test data. Where applicable, time-rates of consolidation were also recorded. A plot of these rates can be used to estimate time of consolidation.



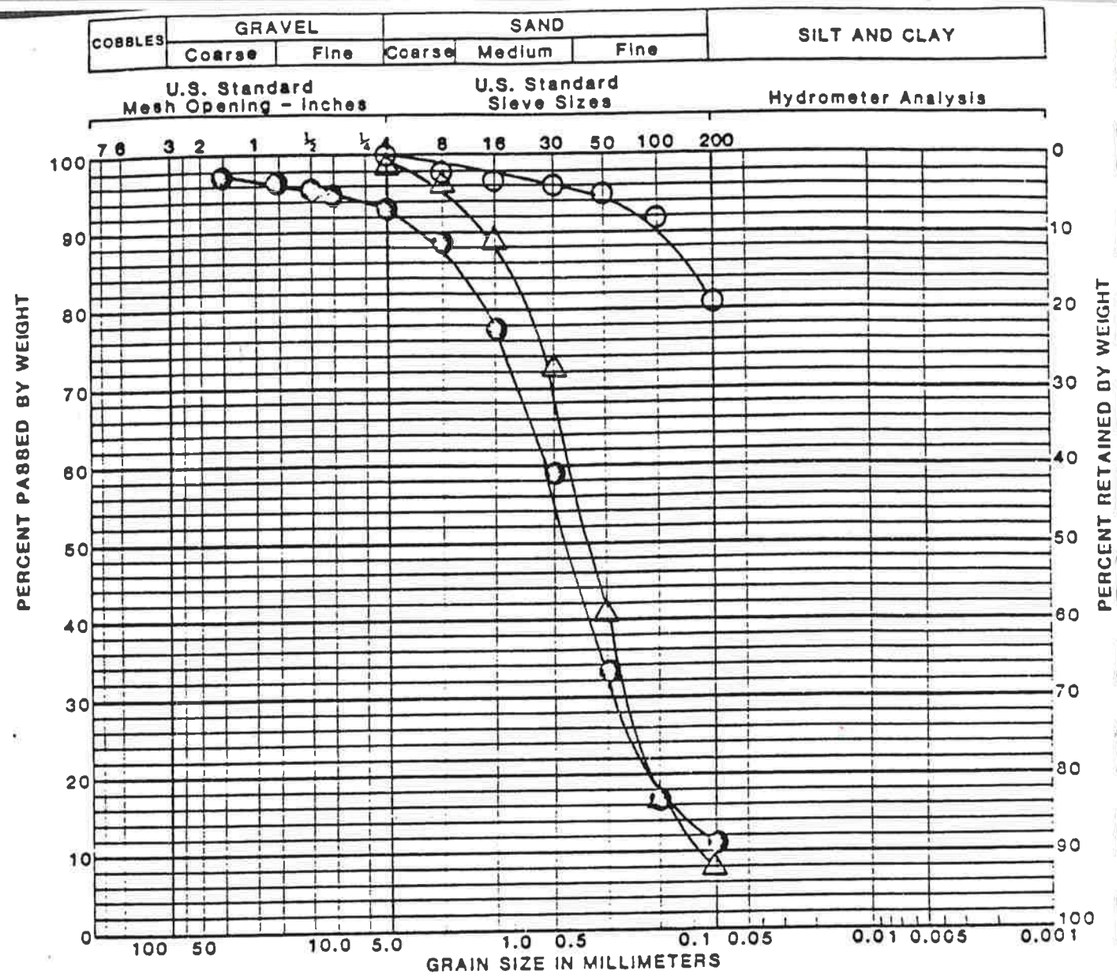
SYMBOL	SAMPLE LOCATION	LL*	PL*	PI*	SOIL TYPE
○	T-1 (1) @ 0 - 3'				SW
●	T-1 (2) @ 8' - 10'				ML
△	T-2 (1) @ 0 - 3'				ML

*LL Liquid Limit
*PL Plastic Limit
*PI Plasticity Index

Based on ASTM D422-72

Project No. 4900381-05
JACUMBA VALLEY RANCH

GRAIN SIZE ANALYSIS



SYMBOL	SAMPLE LOCATION	LL*	PL*	PI*	SOIL TYPE
○	T-2 (2) @ 4' - 6'				ML
●	T-3 (1) @ 1' - 3'				SM-SW
△	T-3 (2) @ 5' - 7'				SM-SW

*LL Liquid Limit
*PL Plastic Limit
*PI Plasticity Index

Based on ASTM D422-72

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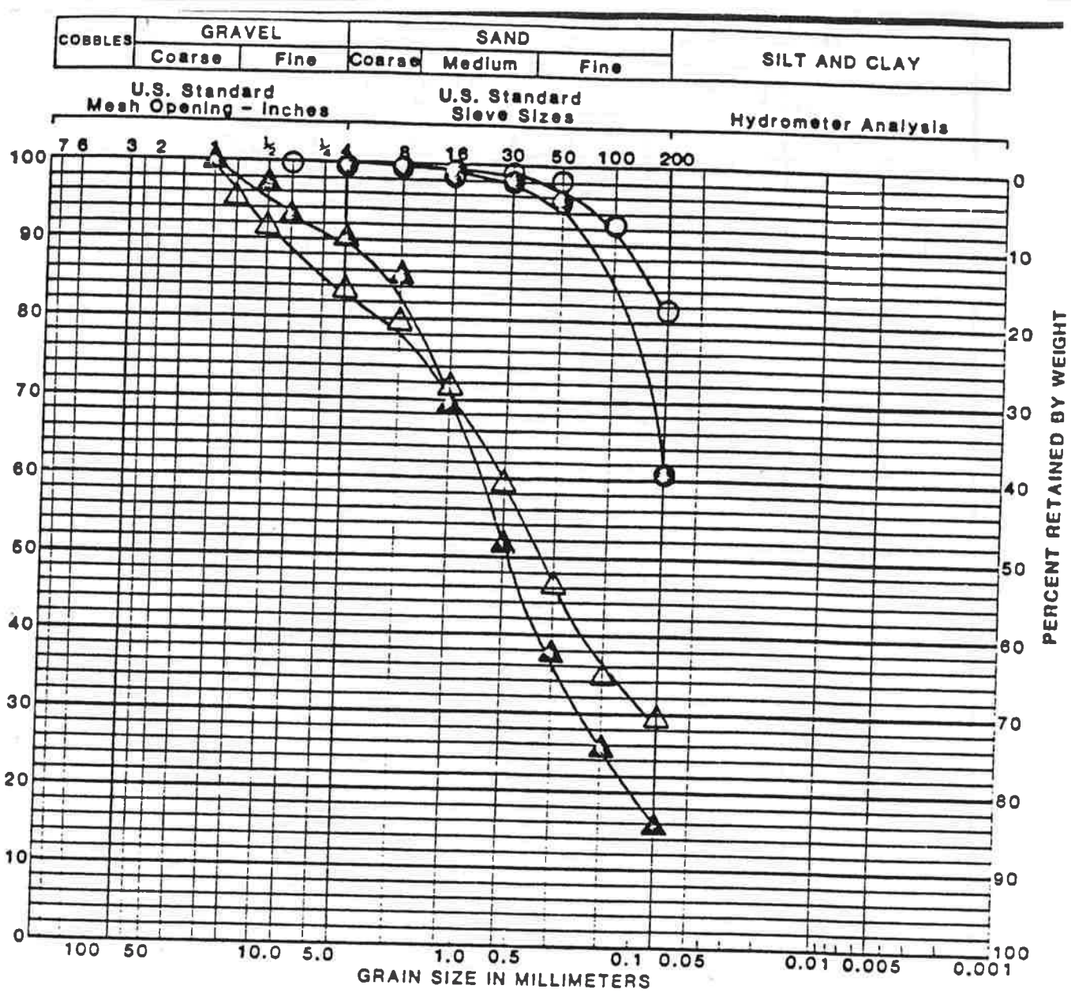
Project No. 4900381-06
JACUMBA VALLEY RANCH

GRAIN SIZE ANALYSIS



SYMBOL	SAMPLE LOCATION	LL*	PL*	PI*	SOIL TYPE
○	B-2 (2) @ 10'-11.5'				ML
●	B-3 (4) @ 20'-21.5'				ML
△	B-7 (3) @ 15'-16'				SC/SM
▲	B-8 (5) @ 25'-26'				SM

*LL Liquid Limit
*PL Plastic Limit
*PI Plasticity Index

Based on ASTM D422-72

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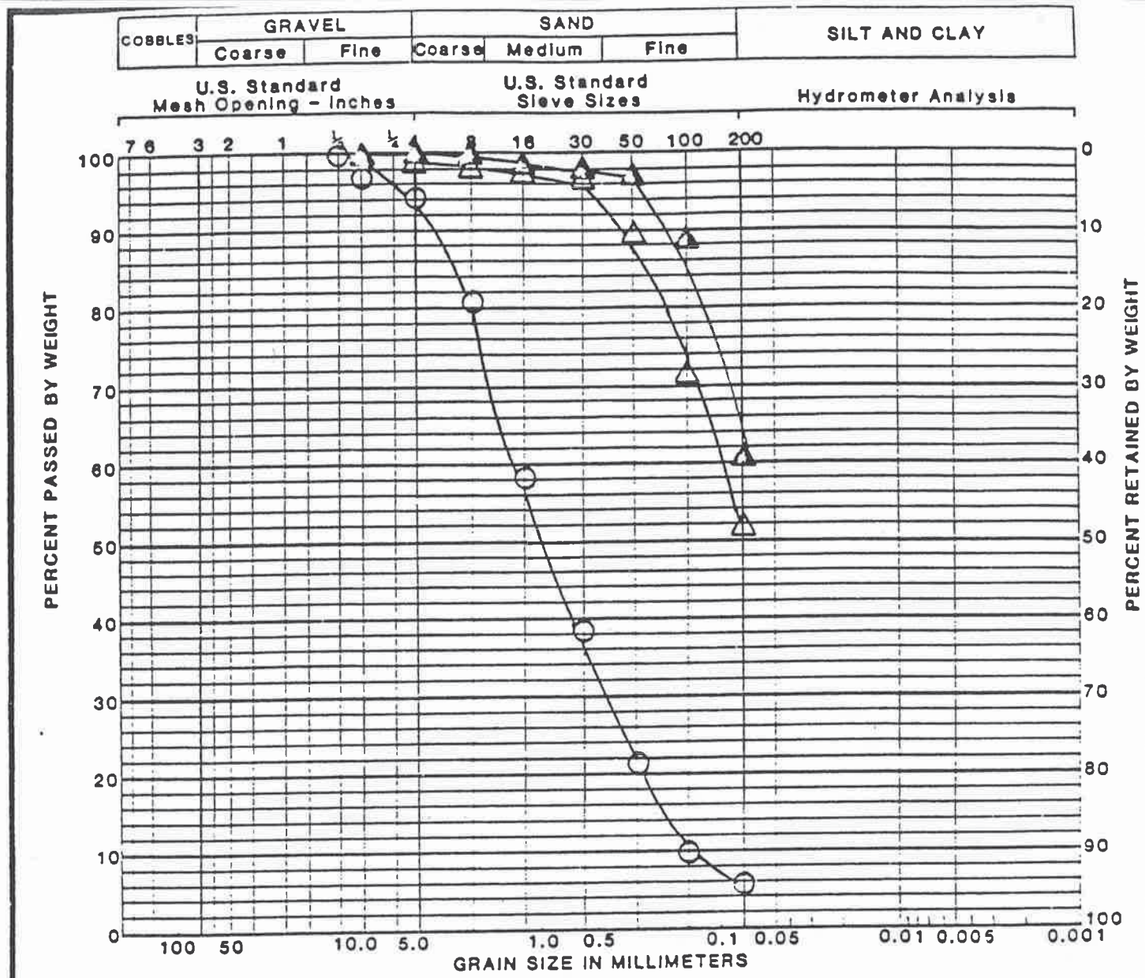
Project No. 4900381-06
JACUMBA VALLEY RANCH

GRAIN SIZE ANALYSIS



SYMBOL	SAMPLE LOCATION	LL*	PL*	PI*	SOIL TYPE
△	B-9 (4) @ 20'- 21.5'				CL
▲	B-11 (1) @ 5'-6.5'				ML
○	B-12 (3) @ 15'-16.5'				SW

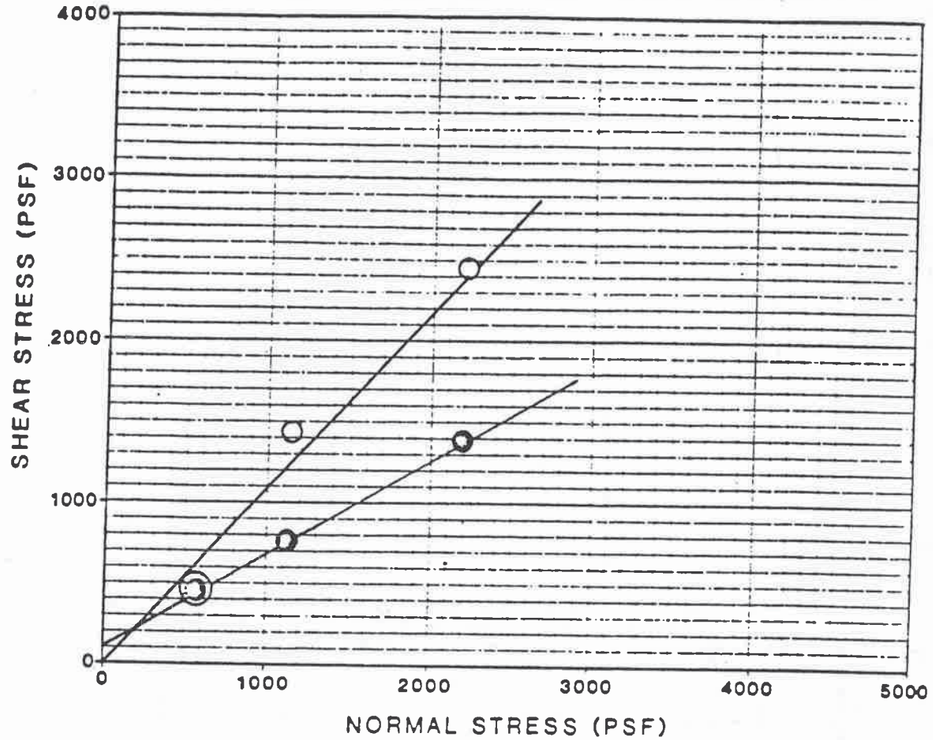
*LL Liquid Limit
*PL Plastic Limit
*PI Plasticity Index

Based on ASTM D422-72

LEIGHTON and ASSOCIATES L&A

Project No. 4900381-05
JACUMBA VALLEY RANCH

GRAIN SIZE ANALYSIS



DESCRIPTION	SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH (FEET)	COHESION (PSF)	FRICTION ANGLE	SOIL TYPE
Remolded to 90% of Maximum Dry	○	T-1	1	0 - 3'	0	48°	SW
Density at Opt Moisture Content	●	T-2	1	0 - 3'	130	30°	SM-ML

Based on ASTM D3080-79

LEIGHTON and ASSOCIATES L&A

Project No. 4900381-05
JACUMBA VALLEY RANCH

DIRECT SHEAR TEST RESULTS

EXPANSION INDEX TEST RESULTS

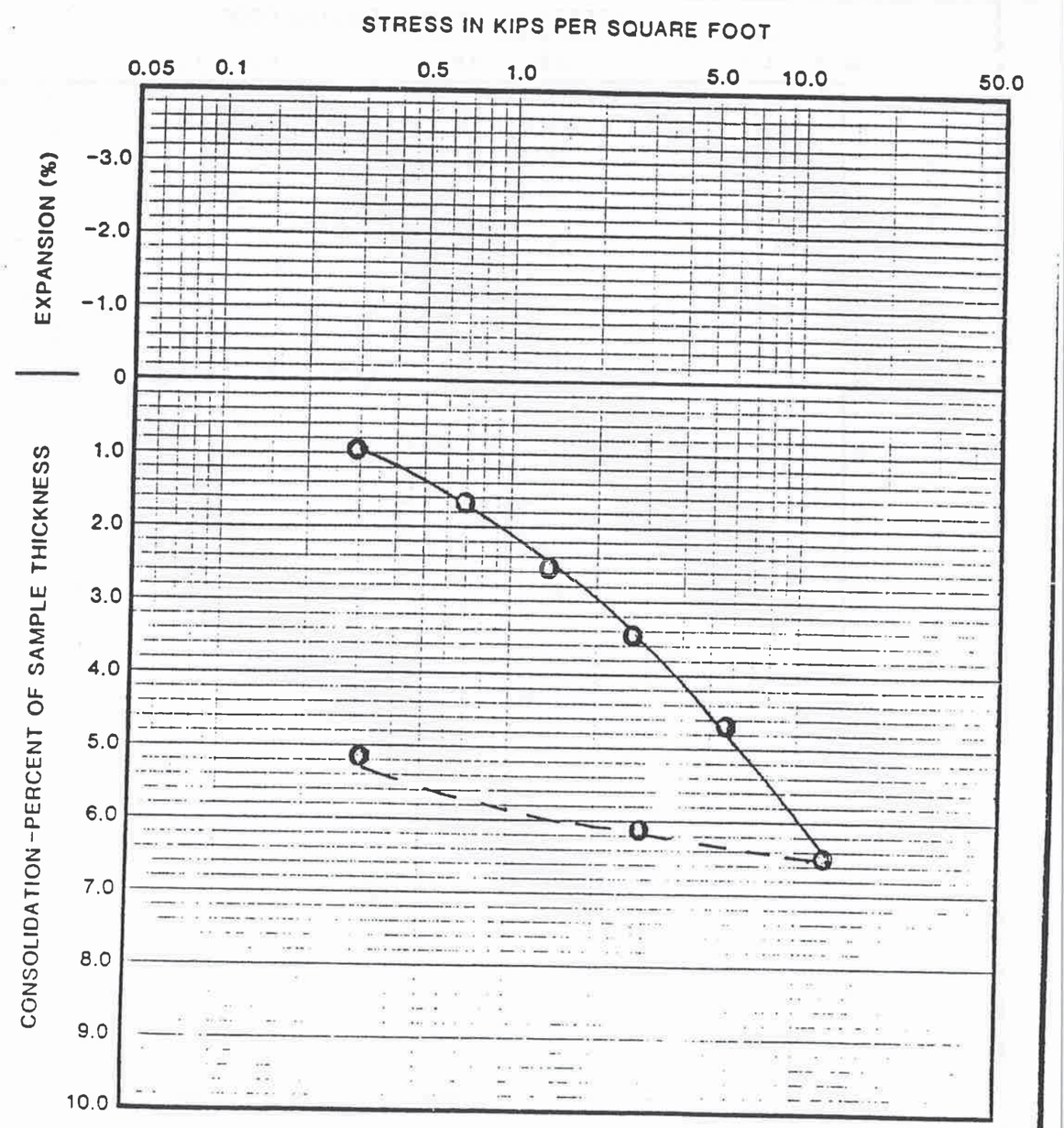
SAMPLE NO.	SAMPLE LOCATION	INITIAL MOISTURE (%)	COMPACTED DRY DENSITY (PCF)	FINAL MOISTURE (%)	VOLUMETRIC SWELL (%)	EXPANSION INDEX	EXPANSIVE POTENTIAL
(2)	T-2 @ 4'-6'	14.0	96.6	31.3	6.6	66	Medium
(1)	T-4 @ 0'-3'	11.5	104.6	24.0	5.1	51	Medium

MAXIMUM DENSITY TEST RESULTS

SAMPLE NO.	LOCATION	MAXIMUM DRY DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)
(1)	T-1 @ 0'-3'	115.5	14.5
(1)	T-2 @ 0'-3'	107.0	20.0
(2)	T-2 @ 4'-6'	110.0	14.0

Project No.4900381-05
JACUMBA VALLEY RANCH

EXPANSION INDEX AND MAXIMUM DENSITY TEST RESULTS

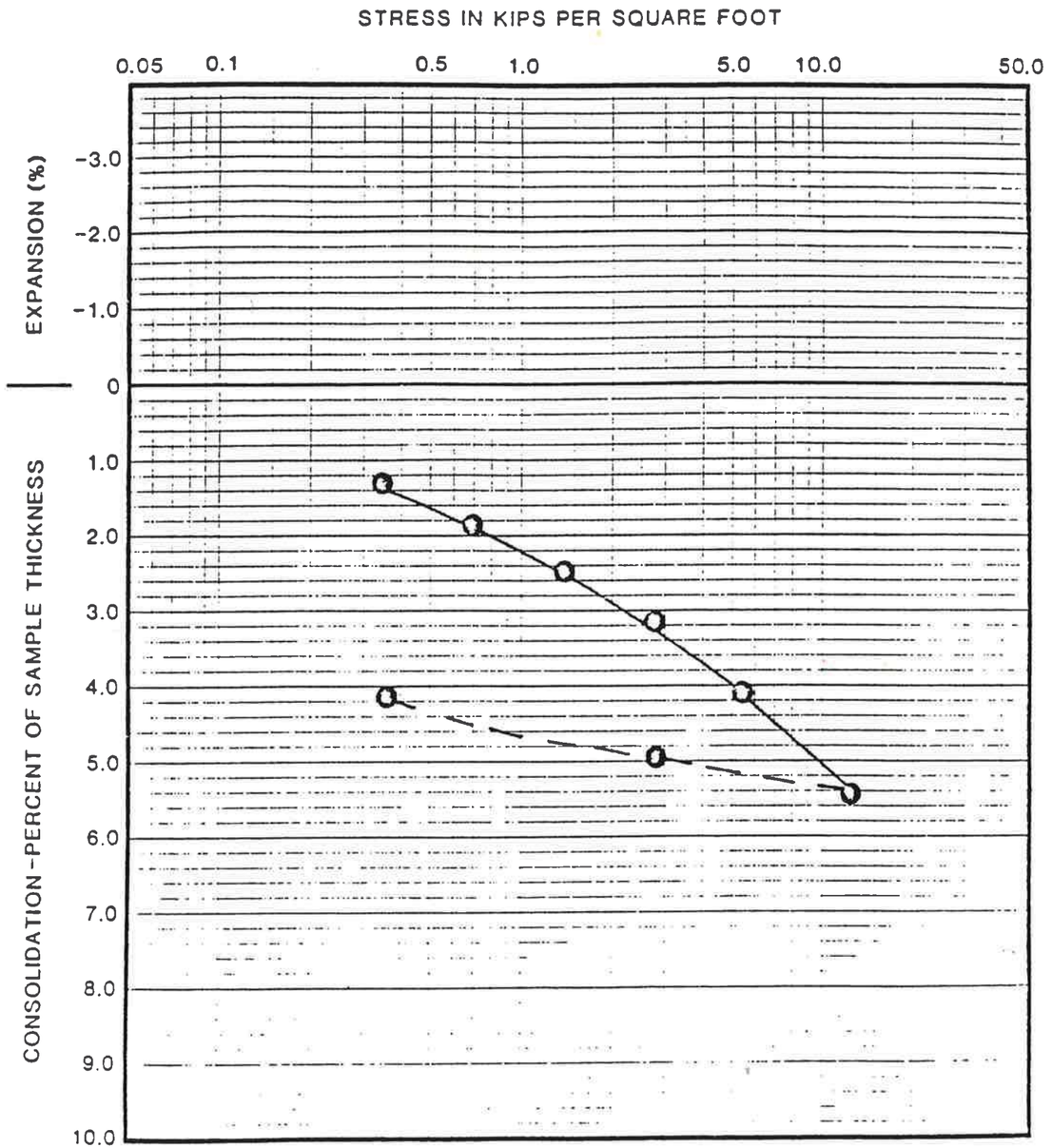


O FIELD MOISTURE
● SATURATED
—— LOADING
– – – REBOUND

BORING NO.: B-3
SAMPLE NO.: 2
DEPTH (FT): 10-11
SOIL TYPE: SM

Project No. 4900381-05
JACUMBA VALLEY RANCH

CONSOLIDATION TEST RESULTS



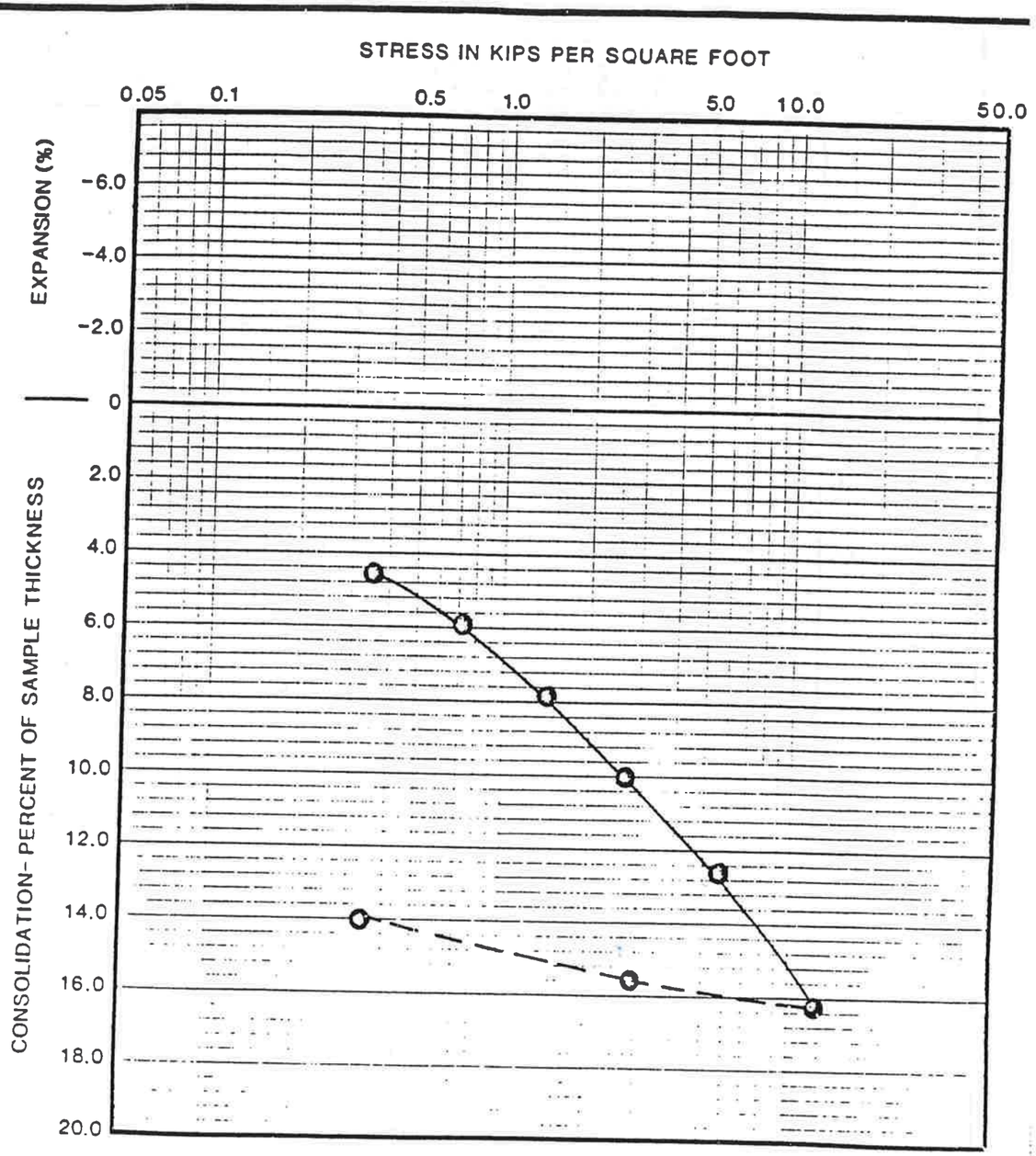
○ FIELD MOISTURE
● SATURATED
—— LOADING
– – – REBOUND

BORING NO.: B-6
SAMPLE NO.: 2
DEPTH (FT): 5-11
SOIL TYPE: ML

LEIGHTON AND ASSOCIATES

Project No. 4900361-05
JACUMBA VALLEY RANCH

CONSOLIDATION TEST RESULTS



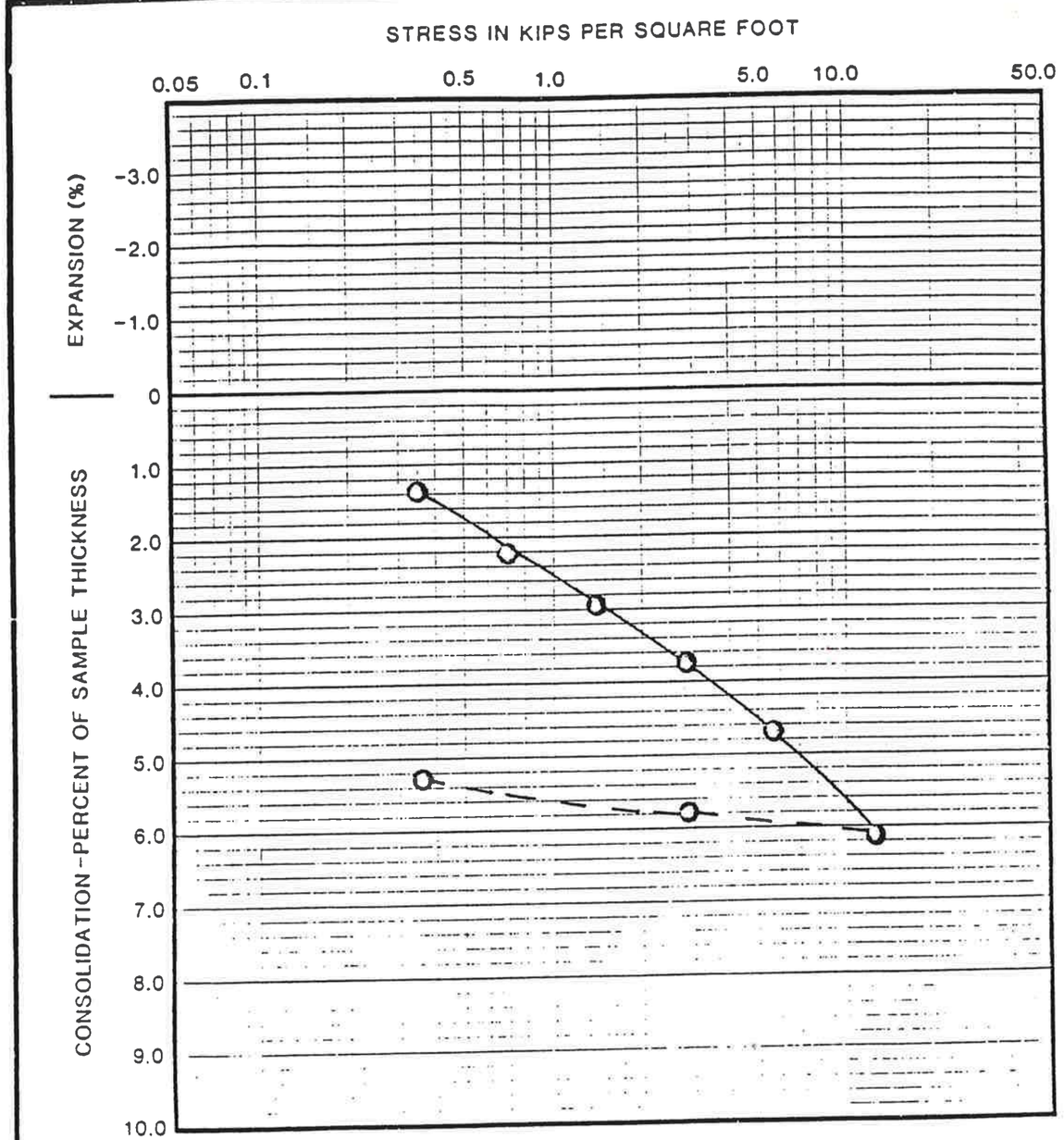
○ FIELD MOISTURE
● SATURATED
—— LOADING
– – – REBOUND

BORING NO.: B-10
SAMPLE NO.: 2
DEPTH (FT): 10-11'
SOIL TYPE: CL/ML

LEIGHTON AND ASSOCIATES

Project No. 4900361-05
JACUMBA VALLEY RANCH

CONSOLIDATION TEST RESULTS



CELEBRATING 30 years & 1961 OF SERVICE

LEIGHTON AND ASSOCIATES, INC.

Geotechnical and Environmental Engineering Consultants

MAR 0 7 1991

February 27, 1991

Project No. 4900381-05

To: Jacumba Valley Ranch
2423 Camino del Rio South, Suite 212
San Diego, California 92108

Attention: Mr. Karl Turecek

Subject: Updated Evaluation of Consolidation Potential, Phase 1, Jacumba Valley Ranch Development, San Diego County, California

Reference: Leighton and Associates, Inc., 1991, Limited Evaluation of Liquefaction and Consolidation Potential, Phase 1, Jacumba Valley Ranch Development, San Diego County, California, Project No. 4900381-05, dated January 21

In accordance with your request, we performed an updated evaluation of the consolidation potential at the subject development. We understand that fills in Residential Area A are proposed to be up to approximately 20 feet thick (above existing grades). Our referenced report provided recommendations based on your previous assumption that the thickness of additional fill would be approximately 4 feet. In order to evaluate the consolidation potential due to the weight of the proposed fill soils (up to 20 feet thick), we have performed laboratory time-rate consolidation tests on ring samples collected as part of our previous study. We chose representative samples near the areas of proposed fills as shown on the computer printout prepared by F.J. Willert Contracting Company, Inc. Based on our laboratory data (attached), we recommend the following delays after the completion of grading until the construction of settlement-sensitive structures in order to reduce the total and differential settlement to approximately 1 inch and 1/2 inch, respectively.

Thickness of Proposed Fill Above Existing Grade (feet)	Delay of Construction after Grading (months)
≤ 2	0
≤ 3	1
≤ 4	2
≤ 5	3
≤10	4
≤15	6
≤20	8

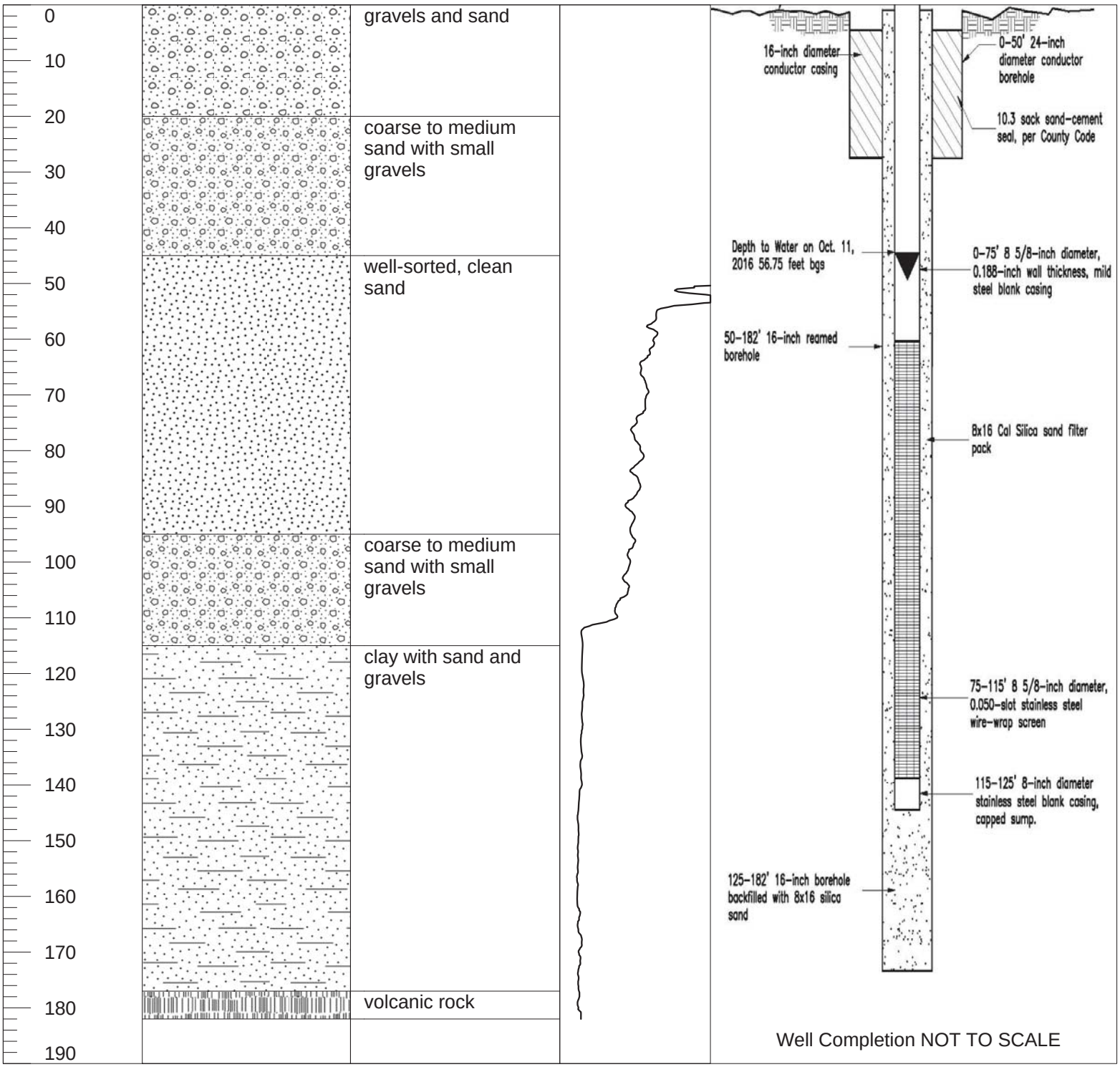
Maximum settlement of the existing soils below the areas of thickest proposed fill soils (approximately 20 feet thick) is estimated to range from 4 to 6 inches.

3934 MURPHY CANYON ROAD, SUITE B205, SAN DIEGO, CALIFORNIA 92123

(619) 292-8030 • (800) 447-2626
FAX (619) 292-0771

DUDEK

LOG OF JCSD HIGHLAND CENTER WELL



Project Name: Highland Center Well
Project Number: 9286
Drilling Company: Fain Drilling and Pump Company
Drilling Method: Mud Rotary
Drilling Start Date: September 28, 2016
Drilling Finish Date: September 29, 2016
Pilot Borehole Diameter: 15.75-inch
Total Borehole Depth: 182 feet

Boring Location: Jacumba Hot Springs, CA

Latitude: 32°37'2.94"N
Longitude: 116°11'4.19"W
Surface Elevation (ft msl): 2,805'

Additional Information:

prepared October 2016

Logs from wells that penetrate the alluvium in the center of the valley are presented in Table 3. See Figure 8 (page 28) for the location of the wells.

The alternating layers of clay and gravelly sand in the well logs appear to be lacustrine deposits. Similar deposits, of rhythmic layers of silty-clay and fine to medium sand, occur in the stream cut banks at the north end of Jacumba Valley. There are abundant small gastrapod shells in these deposits. Above the lacustrine sediments the well records generally show a fining upward trend.

The wells on the western edge of Jacumba penetrate the alluvium to a depth of 18 meters (County of San Diego, Department of Public Health, personal communication, 1980).

Well J3A		Well J4	
Depth (Meters)	Lithology	Depth (Meters)	Lithology
- 9.1	Clay and silt	-12.2	Layers of clay and gravel
-15.2	Coarse sand and gravel	-18.3	Gravel and boulders

In general, the lithology of the Quaternary alluvium varies both with depth and laterally, as would be expected in an alluviated valley in the arid southwest.

Table 3

Logs for Wells J1 and J2[a] and Wells K1 and K2[b]

Depth (Meters)	Lithology	Depth (Meters)	Lithology
	Well J1		Well J2
0-3.0	Soil and clay	0-3.0	Soil and clay
-11.6	Clay	-11.6	Clay
-12.2	Fine sand	-12.2	Fine sand
-15.2	Medium sand	-15.2	Medium sand
-26.8	Coarse sand and small gravel	-26.8	Coarse sand and small gravel
-30.5	Coarse sand and coarse gravel	-30.5	Coarse sand and small gravel
-36.6	Layers clay and coarse sand	-36.6	Layers clay and coarse sand
-37.8	Volcanic formation	-42.7	Layers clay and coarse sand
	Well K1		Well K2
0-1.5	Clay and topsoil	0-6.1	Clay and silt
-9.1	Silt and fine sand	-6.4	Cobbles
-12.2	Fine sand	-12.2	Fine sand
-13.7	Sand	-13.7	Sand
-15.2	Boulders and sand	-15.2	Rocks and sand
-19.2	Sand and gravel	-21.3	Sand and gravel
-19.5	Black silt and clay	-28.0	Rocks and sand
-20.7	Sand and gravel	-31.4	Large rocks and sand
-21.3	Black silt and clay		
-29.9	Sand and gravel		

Table 3 (Continued)

Depth (Meters)	Lithology	Depth (Meters)	Lithology
	Well K1		Well K2
-31.4	Boulders and cobbles		
-32.3	Sand and gravel		
-33.5	Red clay		

[a]Taken from County of San Diego, Department of Public Health, personal communication, 1980.

[b]Taken from William Ketchum, personal communication, 1980.

ORIGINAL
File with DWR

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 1089727

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Page 1 of 1
Owner's Well No. One - 2007
Date Work Began 7/18/07, Ended 7/23/07
Local Permit Agency DEH
Permit No. LWEL 18415 Permit Date 7/13/07

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID Gel

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
		ALLUVIAL FILL AS FOLLOWS:
0	9	Sand, fine grained - brown color
9	24	Clay - Dark color
24	70	Sand, fine grained
70	113	Sand, medium to coarse grained with some boulders

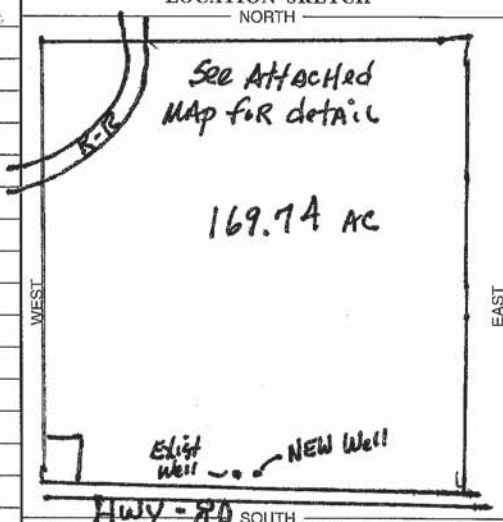
TOTAL DEPTH OF BORING 113 (Feet)
TOTAL DEPTH OF COMPLETED WELL 114 (Feet)

WELL OWNER

WELL LOCATION

Address Old Hwy 80
City Jacumba
County San Diego
APN Book 660 Page 150 Parcel 18
Township 18 S Range 8 E Section 8
Lat ___ DEG. ___ MIN. ___ SEC. N
Long ___ DEG. ___ MIN. ___ SEC. W

LOCATION SKETCH



*Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. **PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

USES (✓)

WATER SUPPLY
X Domestic ___ Public
X Irrigation ___ Industrial
MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 50+ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 40 (Ft.) & DATE MEASURED 7/23/07
ESTIMATED YIELD * 2000 (GPM) & TEST TYPE airlift
TEST LENGTH 6 (Hrs.) TOTAL DRAWDOWN 60 (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	32	X				Steel	23.5	.250	
0	73	24	X				Steel	13.5	.250	
73	113	24		x			Steel S.S. 304	13.5	.250	.080

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	X			
20	113		pea	gravel	5/16x7

ATTACHMENTS (✓)

___ Geologic Log
X Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
✓ Other Site Map

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME FAIN DRILLING & PUMP CO INC (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
12029 Old Castle Rd. Valley Center, Ca 92082
ADDRESS CITY STATE ZIP
Signed Joe R. Fain C-57 LICENSED WATER WELL CONTRACTOR
7-30-07 DATE SIGNED
328287 C-57 LICENSE NUMBER

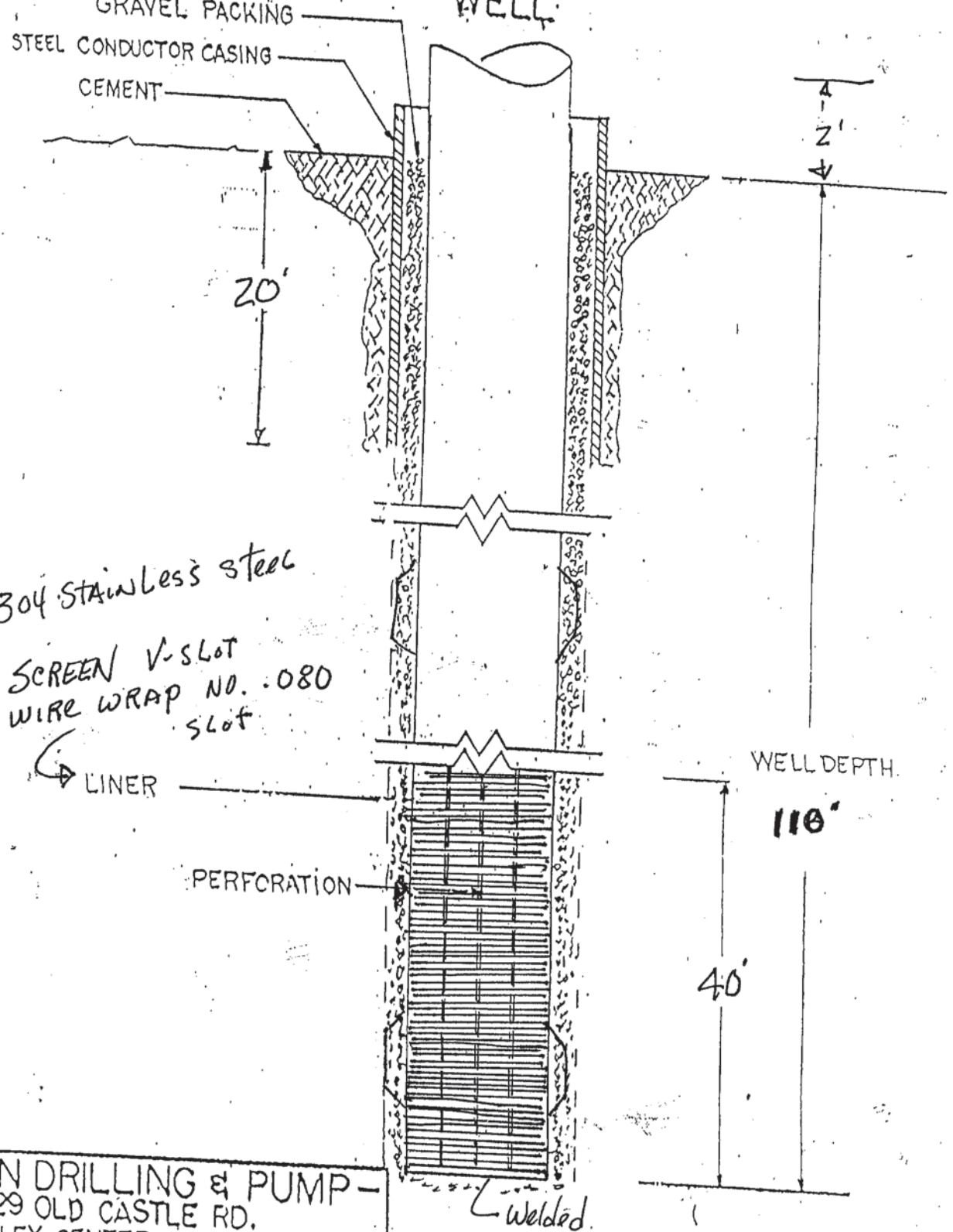
DWR 188 REV. 05-03
IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM
OSP 03 78836

1089727

Lwel 18415

"AS Built"

WELL

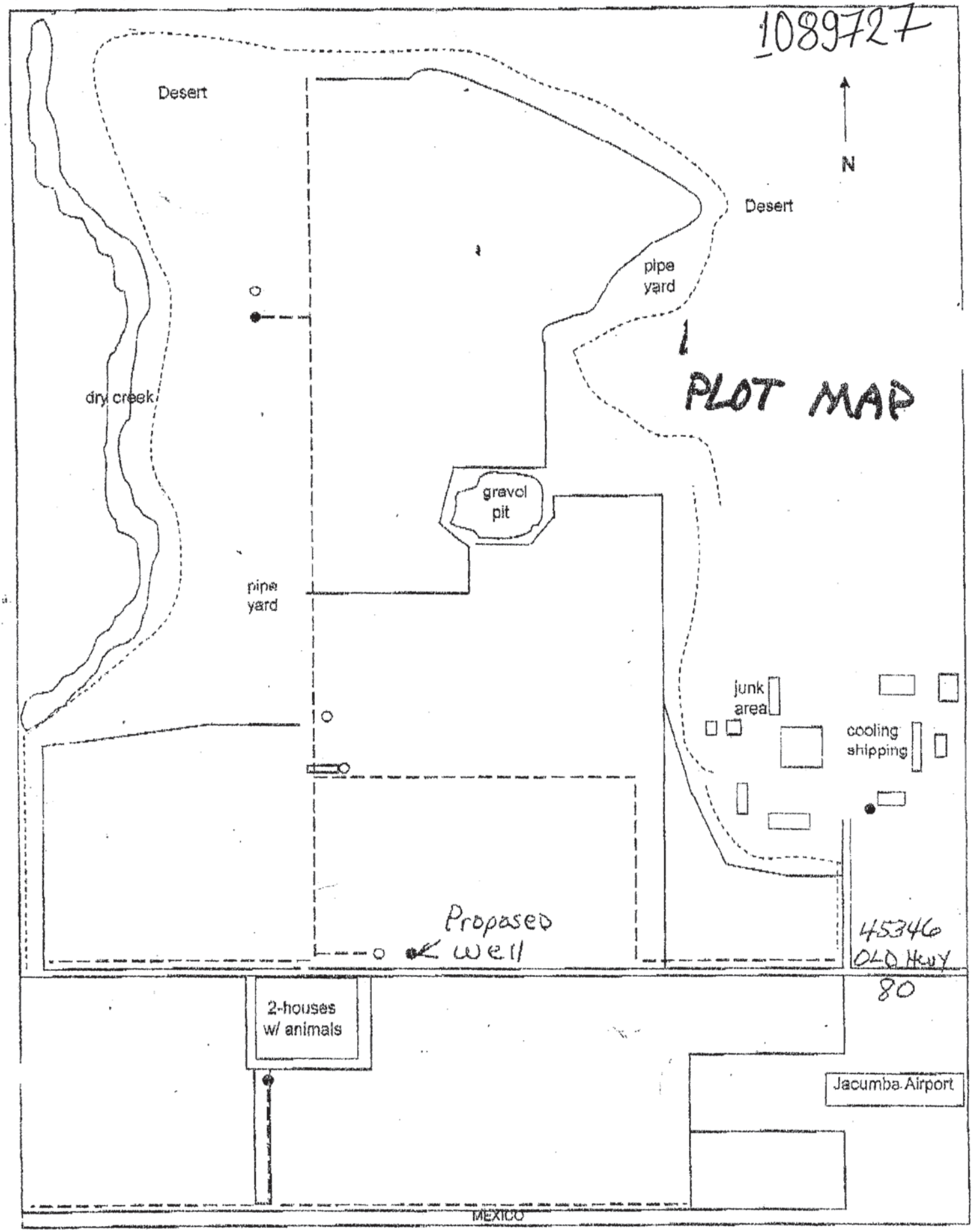


-FAIN DRILLING & PUMP-
12029 OLD CASTLE RD.
VALLEY CENTER CA.

STEEL CONDUCTOR 24" X 21'
STEEL LINER 14" X 113'
GRAVEL SIZE 5/16 X 7

BY: Joe R. Fain 7/30/07
JOE FAIN-OWNER

1089727



PLOT MAP

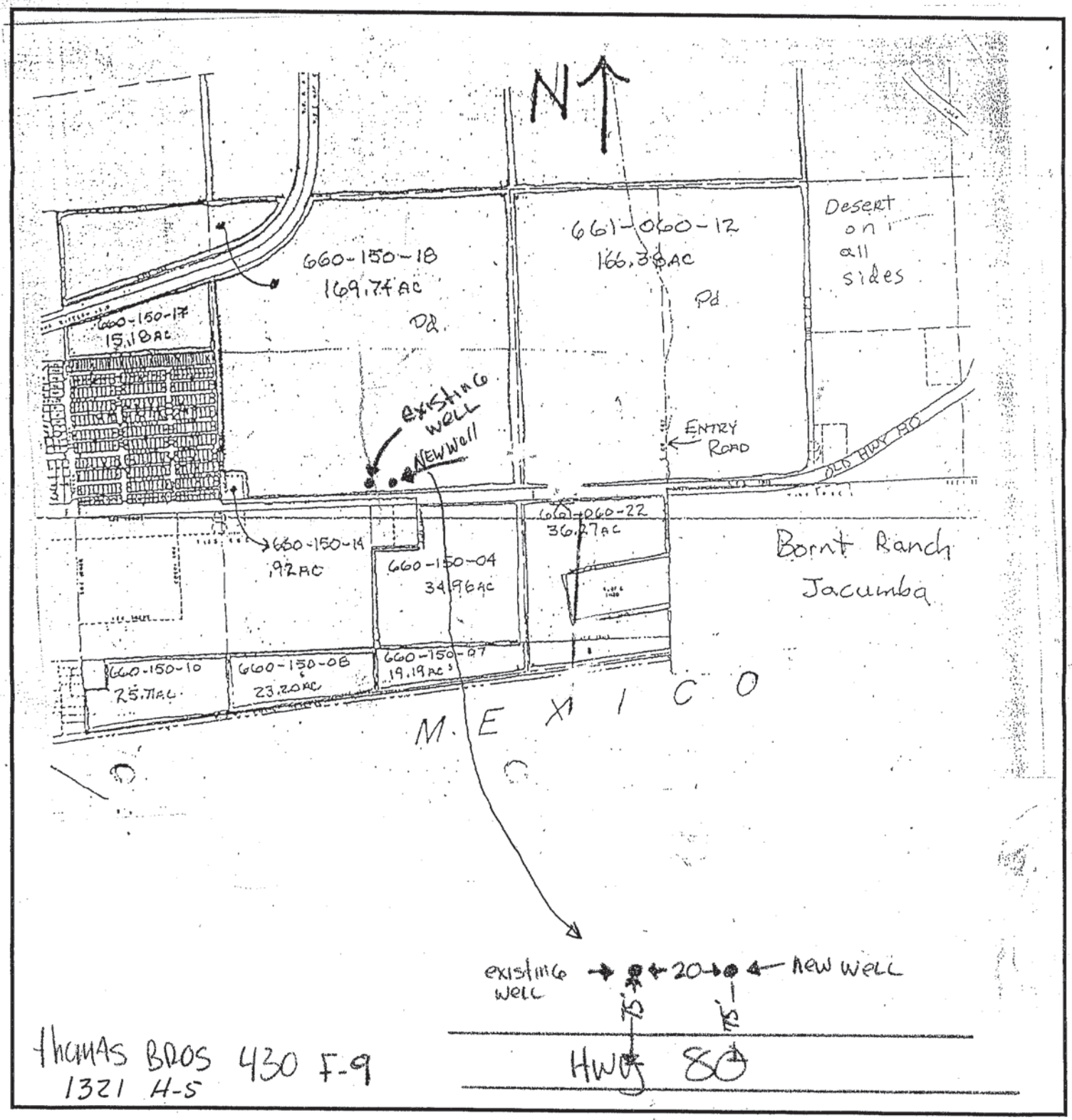
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LWEL-18415
Assessor's Parcel Number: 660-150-18

1089727

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



Thomas Bros 430 F-9
1321 H-5

Owner's Copy

Page 1 of 1

Owner's Well No. Old

Date Work Began 1/17/05, Ended 1/25/05

Local Permit Agency SDC

Permit No. 16619 Permit Date 1/25/05

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 0909529

OWN USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD Rotary FLUID Gel

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	11	Clayy sand and silt fine grains
11	36	Gray clayy sand fine to coarse medium grained
36	76	Coarse sand and gravel
76	90	sandstone, coarse with gravel and boulders
90	112	Clay weathered rock

TOTAL DEPTH OF BORING 112 (Feet)

TOTAL DEPTH OF COMPLETED WELL 100 (Feet)

WELL OWNER

Name Bornt Fatso

Mailing Address 2307 East Hwy 98

City Holeville CA 92250

WELL LOCATION

Address n/o Hwy 80 & East Hwy 98

City Jacumba

County San Diego

APN Book 660 Page 020 Parcel 05

Township 18-S Range 8-E Section 5

Lat 32 DEG. 37 MIN. 790 SEC. N

Long 116 DEG. 10 MIN. 740 SEC. W

LOCATION SKETCH

NORTH

WEST EAST

SOUTH

Rail Road

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR

___ Deepen

___ Other (Specify)

___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

USES (✓)

WATER SUPPLY

___ Domestic ___ Public

X Irrigation ___ Industrial

___ MONITORING

___ TEST WELL

___ CATHODIC PROTECTION

___ HEAT EXCHANGE

___ DIRECT PUSH

___ INJECTION

___ VAPOR EXTRACTION

___ SPARGING

___ REMEDIATION

___ OTHER (SPECIFY)

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 12 (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL 9 (Ft.) & DATE MEASURED 1-26-05

ESTIMATED YIELD * 2000 (GPM) & TEST TYPE Air Lift

TEST LENGTH 4 (Hrs.) TOTAL DRAWDOWN 90 (Ft.)

** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	20	32	X				Steel A-53	23.5	.250	
0	40	22	X				Steel A-139	13.5	.250	
40	100	22		X			304 S.S.	13.5	.150	.080

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	20	✓			
0	100				5/4 x 7

ATTACHMENTS (✓)

___ Geologic Log

X Well Construction Diagram

___ Geophysical Log(s)

___ Soil/Water Chemical Analyses

X Other Site map

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Pain Drilling & Pump Co. Inc.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 12029 Old Gaelic Rd. Valley Center CA 92082
CITY STATE ZIP

Signed [signature]
C-57 LICENSED WATER WELL CONTRACTOR

1-27-05
DATE SIGNED

C-57 LICENSE NUMBER 329229

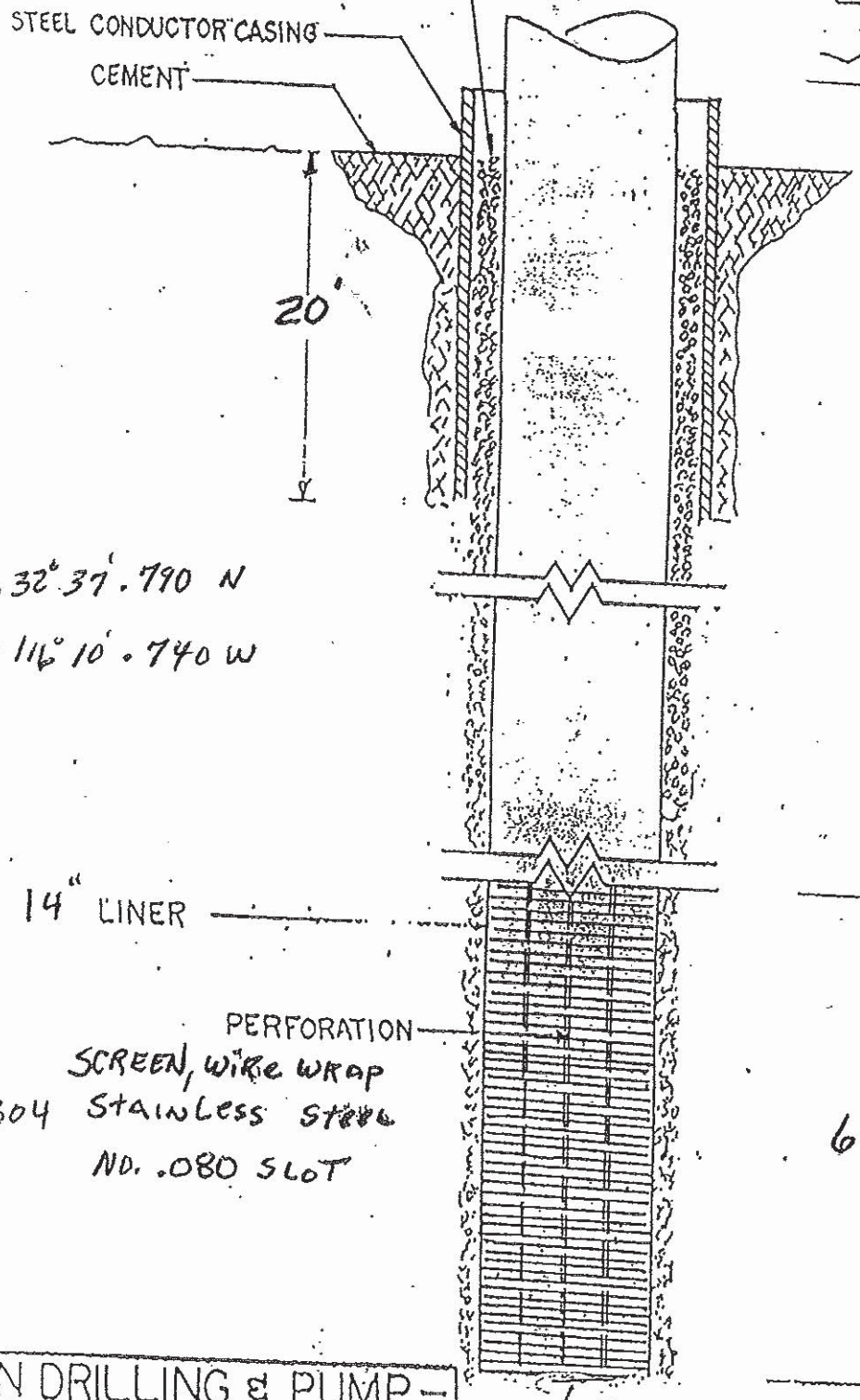
DWR 188 REV. 05-03

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

"AS BUILT" WELL

BORN T. FARMS

JACUMBA CA.



Lat. 32° 37'. 790 N

Long 116° 10'. 740 W

SCREEN, WIRE WRAP
304 Stainless Steel
NO. .080 SLOT

-FAIN DRILLING & PUMP-
12029 OLD CASTLE RD.
VALLEY CENTER CA.

STEEL CONDUCTOR 24" X 20'
STEEL LINER 14" X 100'
GRAVEL SIZE 5/16 X 7

BY: 1-26-05

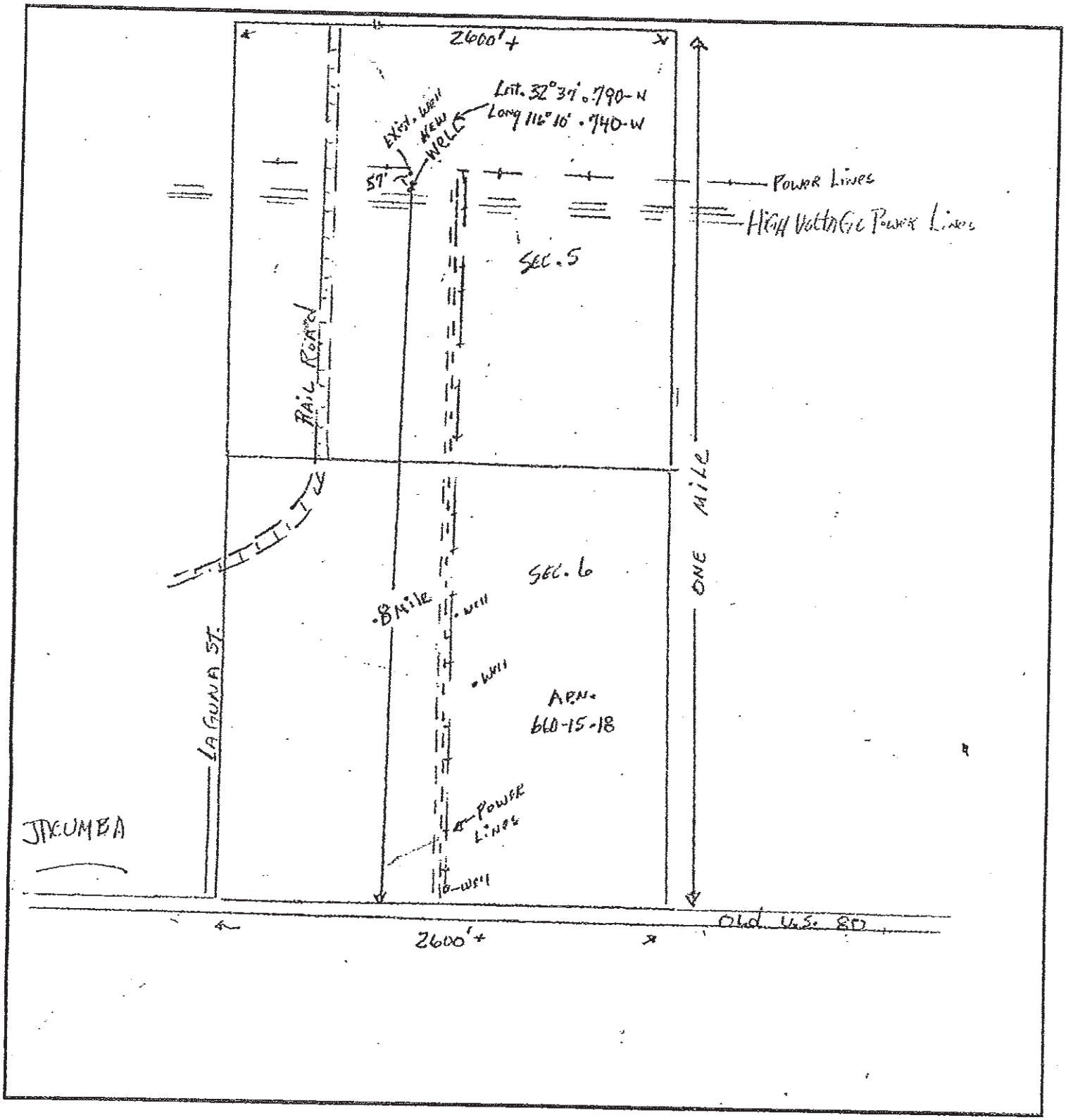
JOE FAIN-OWNER

NTY OF SAN DIEGO
PARTMENT OF ENVIRONMENTAL HEALTH

Control #Used 16419
Assessor's Parcel Number: 660-020-05

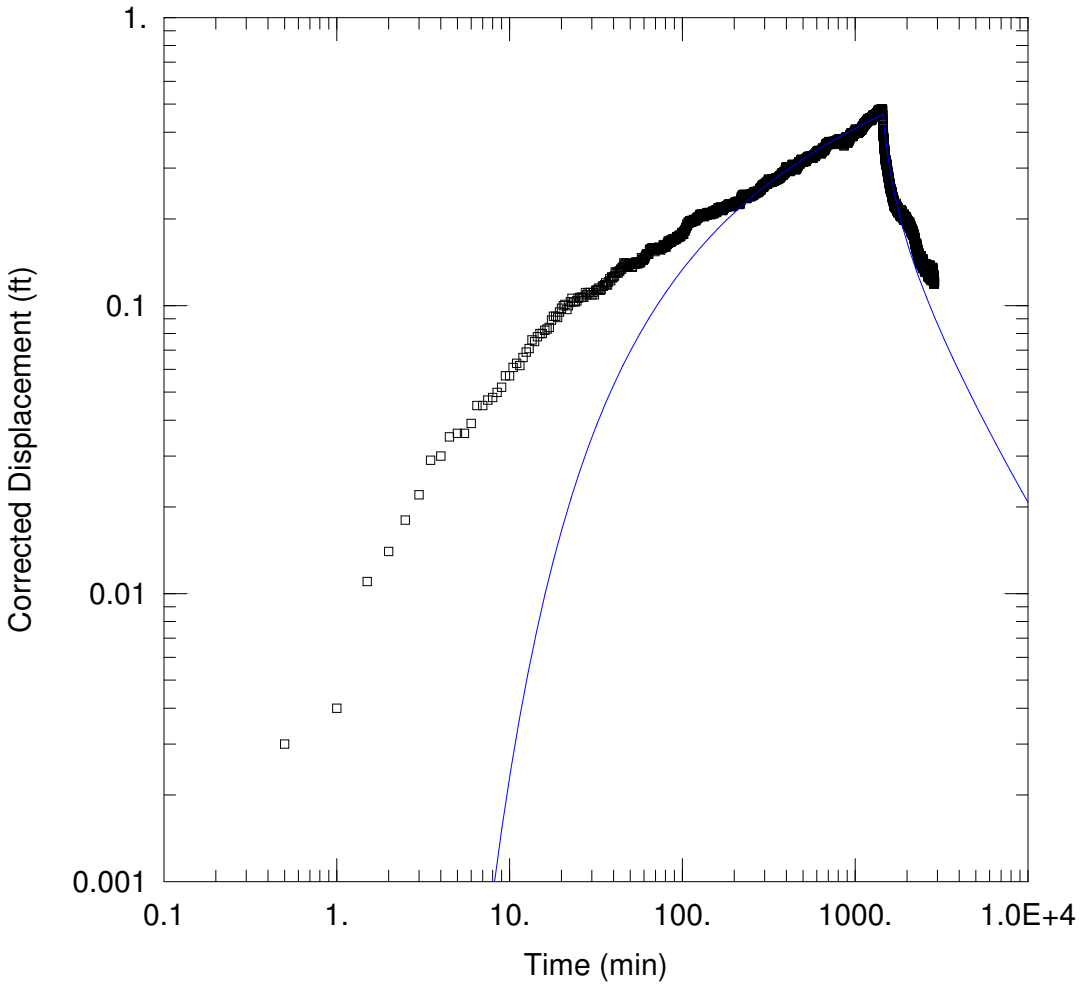
LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.



APPENDIX C

Well #2 Aquifer Test AQTESOLV Data



WELL TEST ANALYSIS

Data Set: P:\...\Well1_CurveMatching.aqt
Date: 01/09/19 Time: 14:59:52

PROJECT INFORMATION

Company: Dudek
Location: Jacumba
Test Well: Well 2
Test Date: 12/14/2018

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Well 2	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
▫ Well 1	305	0

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 3.629E+4 ft^2/day
S = 0.02876
Kz/Kr = 1.
b = 40. ft

Diagnostic Statistics

Estimation complete! Parameter change criterion (ETOL) reached.

Aquifer Model: Unconfined
Solution Method: Theis

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	
T	3.629E+4	103.2	+/- 202.3	351.5	ft^2/day
S	0.02876	0.0001907	+/- 0.0003737	150.8	
Kz/Kr	1.	not estimated			
b	40.	not estimated			ft

C.I. is approximate 95% confidence interval for parameter
t-ratio = estimate/std. error
No estimation window

K = T/b = 907.2 ft/day (0.3201 cm/sec)
Ss = S/b = 0.0007189 1/ft

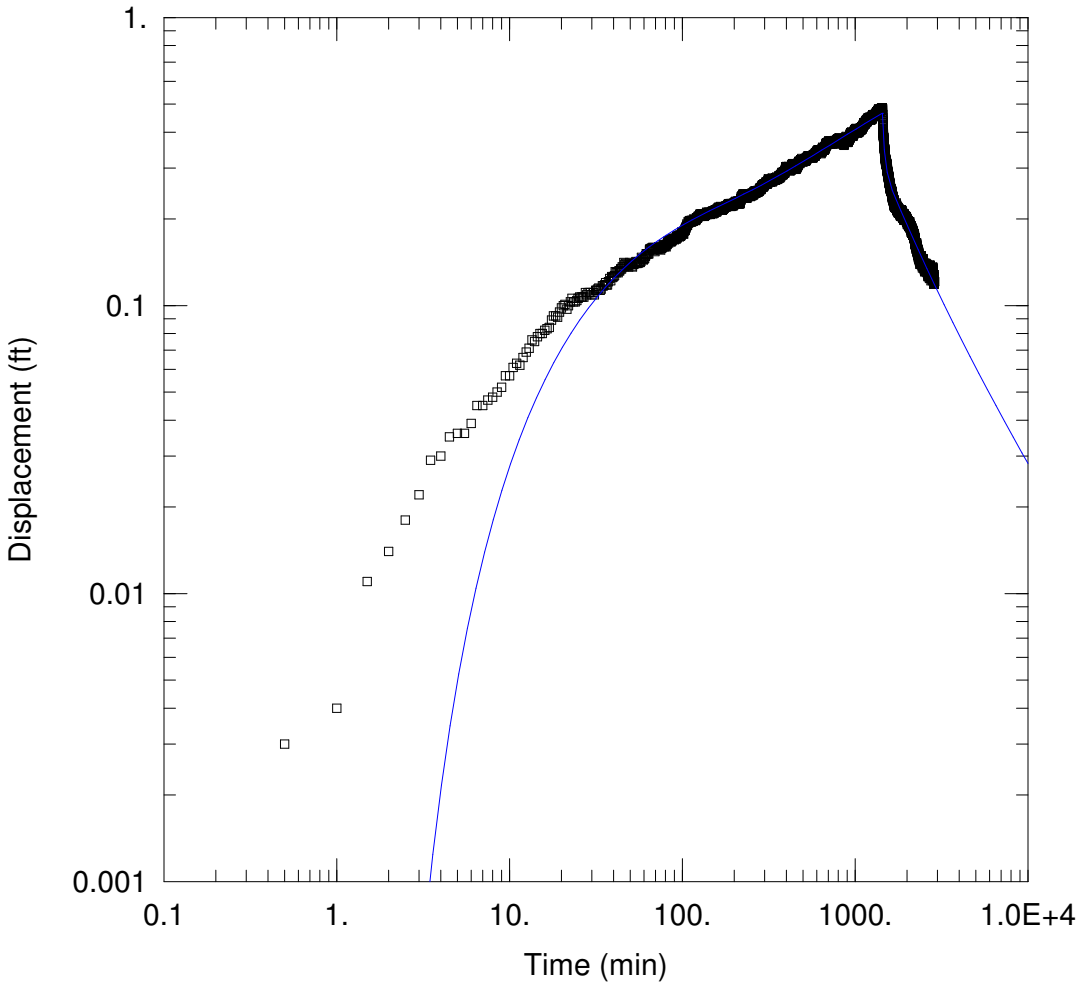
Parameter Correlations

	T	S
T	1.00	-0.81
S	-0.81	1.00

Residual Statistics

for weighted residuals

Sum of Squares . . . . . 3.952 ft^2
Variance . . . . . 0.0006863 ft^2
Std. Deviation . . . . . 0.0262 ft
Mean . . . . . 0.008754 ft
No. of Residuals 5760
No. of Estimates 2



WELL TEST ANALYSIS

Data Set: P:\...\Well1_CurveMatching.aqt
Date: 02/12/19 Time: 09:57:48

PROJECT INFORMATION

Company: Dudek
Location: Jacumba
Test Well: Well 2
Test Date: 12/14/2018

AQUIFER DATA

Saturated Thickness: 40. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Well 2	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
▫ Well 1	305	0

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 2.641E+4 ft^2/day
S = 0.00826
Sy = 0.04672
ß = 0.2076

Diagnostic Statistics

Estimation complete! Parameter change criterion (ETOL) reached.

Aquifer Model: Unconfined
Solution Method: Neuman

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	
T	2.641E+4	62.34	+/- 122.2	423.7	ft^2/day
S	0.00826	6.918E-5	+/- 0.0001356	119.4	
Sy	0.04672	0.0002334	+/- 0.0004574	200.2	
ß	0.2076	0.0009584	+/- 0.001878	216.6	

C.I. is approximate 95% confidence interval for parameter
t-ratio = estimate/std. error
No estimation window

K = T/b = 660.4 ft/day (0.233 cm/sec)
Ss = S/b = 0.0002065 1/ft

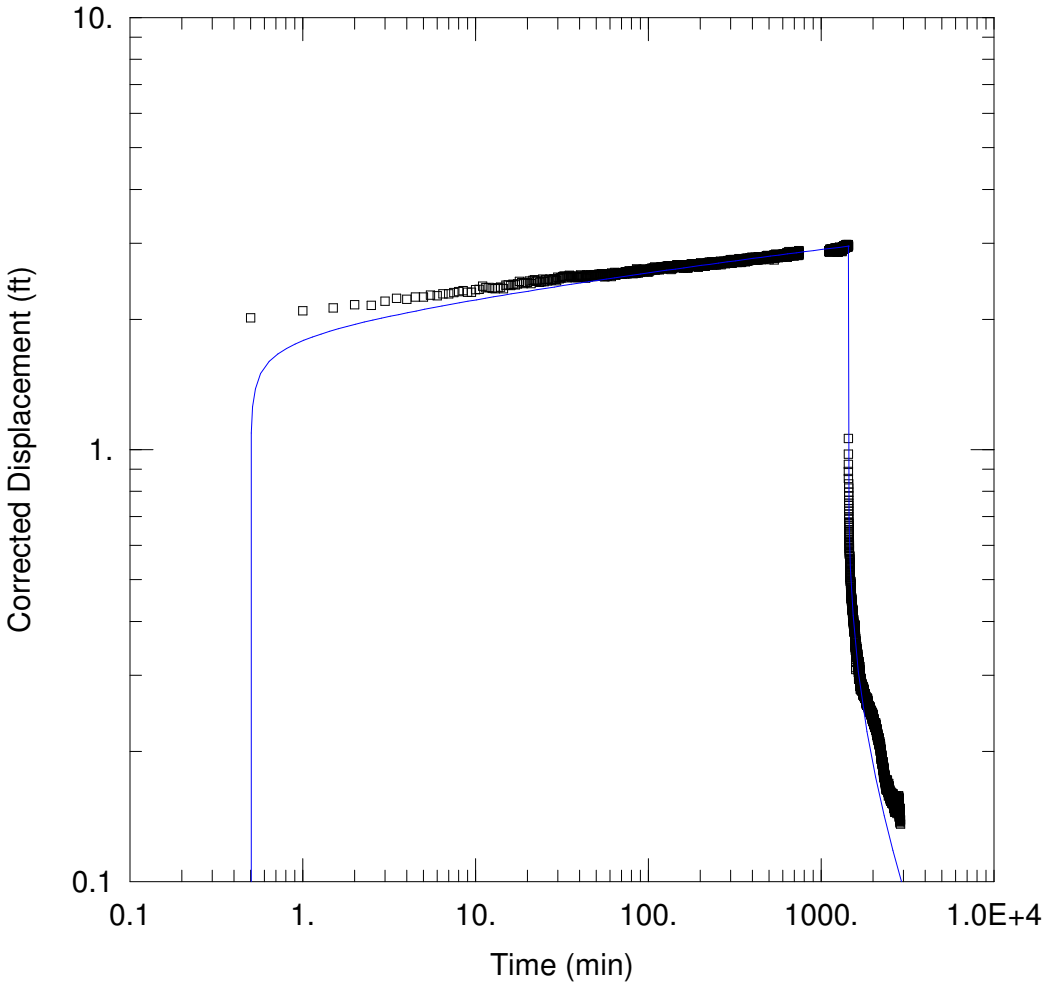
Parameter Correlations

	T	S	Sy	ß
T	1.00	-0.31	-0.95	0.02
S	-0.31	1.00	0.11	-0.69
Sy	-0.95	0.11	1.00	0.11
ß	0.02	-0.69	0.11	1.00

Residual Statistics

for weighted residuals

Sum of Squares . . . . . 0.3775 ft^2
Variance . . . . . 6.558E-5 ft^2
Std. Deviation . . . . . 0.008098 ft
Mean . . . . . -0.0002177 ft
No. of Residuals 5760
No. of Estimates 4



WELL TEST ANALYSIS

Data Set: P:\...\Well2_CurveMatching.aqt
Date: 01/09/19 Time: 15:02:12

PROJECT INFORMATION

Company: Dudek
Location: Jacumba
Test Well: Well 2
Test Date: 12/14/2018

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Well 2	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
▫ Well 2	0	0

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 3.305E+4 ft^2/day
S = 0.000136
Kz/Kr = 1.
b = 40. ft

Diagnostic Statistics

Estimation complete! RSS criterion (RTOL) reached.

Aquifer Model: Unconfined
Solution Method: Theis

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	
T	3.305E+4	107.4	+/- 210.6	307.6	ft^2/day
S	0.000136	7.934E-6	+/- 1.555E-5	17.14	
Kz/Kr	1.	not estimated			
b	40.	not estimated			ft

C.I. is approximate 95% confidence interval for parameter
t-ratio = estimate/std. error
No estimation window

K = T/b = 826.3 ft/day (0.2915 cm/sec)
Ss = S/b = 3.399E-6 1/ft

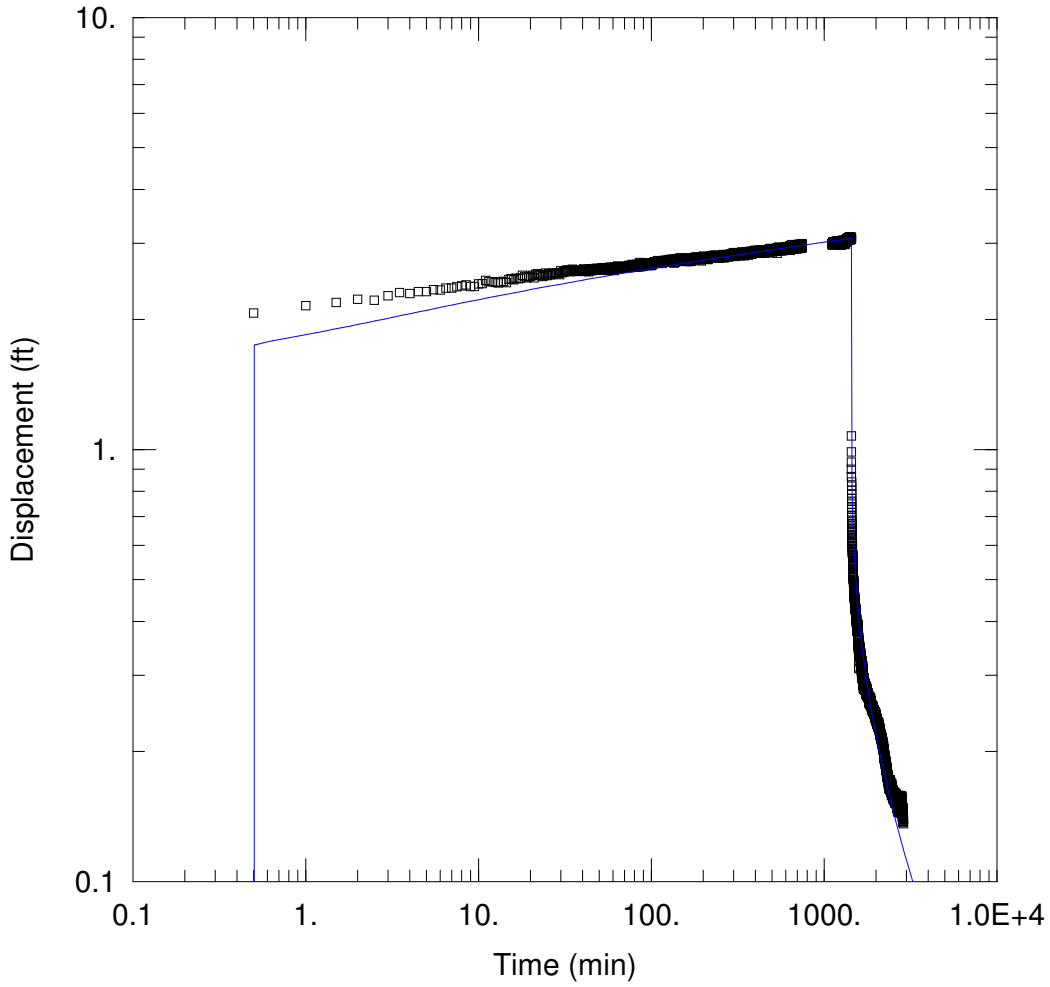
Parameter Correlations

	T	S
T	1.00	-0.99
S	-0.99	1.00

Residual Statistics

for weighted residuals

Sum of Squares . . . . . 11.52 ft^2
Variance . . . . . 0.002314 ft^2
Std. Deviation . . . . . 0.04811 ft
Mean . . . . . 0.01864 ft
No. of Residuals 4980
No. of Estimates 2



WELL TEST ANALYSIS

Data Set: P:\...\Well2_CurveMatching_Neuman.aqt
Date: 02/13/19 Time: 11:40:44

PROJECT INFORMATION

Company: Dudek
Location: Jacumba
Test Well: Well 2
Test Date: 12/14/2018

AQUIFER DATA

Saturated Thickness: 40. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Well 2	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
▫ Well 2	0	0

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 2.831E+4 ft^2/day
Sy = 0.001
S = 1.0E-10
ß = 1.0E-5

Diagnostic Statistics

Estimation complete! Parameter change criterion (ETOL) reached.

Aquifer Model: Unconfined
Solution Method: Neuman

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	
T	2.831E+4	93.	+/- 182.3	304.4	ft^2/day
S	1.0E-10	0.0002303	+/- 0.0004513	4.343E-7	
Sy	0.001	0.0002364	+/- 0.0004633	4.23	
ß	1.0E-5	3.438E-6	+/- 6.739E-6	2.908	

C.I. is approximate 95% confidence interval for parameter
t-ratio = estimate/std. error
No estimation window

K = T/b = 707.8 ft/day (0.2497 cm/sec)
Ss = S/b = 2.5E-12 1/ft

Parameter Correlations

	T	S	Sy	ß
T	1.00	-0.01	-0.21	0.05
S	-0.01	1.00	-0.98	-0.69
Sy	-0.21	-0.98	1.00	0.67
ß	0.05	-0.69	0.67	1.00

Residual Statistics

for weighted residuals

Sum of Squares . . . . . 14.1 ft^2
Variance . . . . . 0.002833 ft^2
Std. Deviation . . . . . 0.05322 ft
Mean . . . . . 0.003024 ft
No. of Residuals 4980
No. of Estimates 4

APPENDIX D

Well #3 Aquifer Test Report

Prepared for

Jacumba Valley Ranch, LLC
2423 Camino Del Rio South, #212
San Diego, California 92108

JACUMBA VALLEY RANCH PROPERTY WELL #3 AQUIFER TEST REPORT JACUMBA, CA

November 2012

Prepared by

10875 Rancho Bernardo Road, Suite 200
San Diego, California 92127
(858) 674-6559

Geosyntec consultants

engineers | scientists | innovators

Project Number: SC0636

Prepared for
Jacumba Valley Ranch, LLC
2423 Camino Del Rio South, #212
San Diego, California 92108

JACUMBA VALLEY RANCH PROPERTY
WELL #3 AQUIFER TEST REPORT
JACUMBA, CA

November 2012

Prepared by
Geosyntec Consultants
10875 Rancho Bernardo Road, Suite 200
San Diego, California 92127
(858) 674-6559

_____ _____11/27/2012__
Veryl Wittig Date
California Professional Geologist No. 7115
California Certified Hydrogeologist No. 723

Project Number: SC0636

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FIGURES

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APPENDICES

1. INTRODUCTION

1.1 Terms of Reference

This report was prepared by Geosyntec Consultants, Inc. (Geosyntec) for Jacumba Valley Ranch, LLC (JVR) based on our understanding of the proposed use of groundwater as a source of construction water for the SDG&E East County Substation Project (ECSP). This report documents the activities performed to conduct a 72-hour constant-rate aquifer test on Well #3 on the JVR property (San Diego Assessor's Parcel No. 660-020-05-00; the site) located in Jacumba, California, to evaluate the use of Well #3 as a source of construction water. This report was prepared by Mr. Ryan Gray, PG and has been reviewed by Mr. Veryl Wittig, PG, CHG, in accordance with the peer review policy of the firm.

1.2 Background

It is our understanding that the site production well (Well #3) is proposed for use during construction. The total estimated Project water demand over the 16 month construction period is approximately 153 acre-feet. Construction activities are projected to require pumping at a rate of up to 350 gpm, 24-hours per day for limited periods over a duration of 6 months to meet the peak water demands during grading construction for the East County (ECO) Substation (up to approximately 500,000 gallons per day). Construction water use will increase during the first month of grading activities to the peak demand that will take place over a period of approximately four months. Water use will taper off to approximately 100,000 gallons per day after about 6 months and will continue at a lower rate for the remaining 12 months of the ECSP. This report conservatively evaluates the effect of groundwater pumping at the peak rate continuously 24 hours per day for a period of 6 months (approximately 276 acre-feet, which exceeds the anticipated total Project demand).

1.3 Site Location

The site is located in southeastern San Diego County in the community of Jacumba, approximately 74 miles east of San Diego (Figure 1). The area immediately surrounding the site consists of open, native land, agricultural, and rural residential properties. The site has historically been used for agricultural purposes, though current operations consist of an aggregate washing facility in the northeastern portion of the site.

Numerous wells exist on the large parcels which comprise the site. The following 4 wells were selected for the constant-rate aquifer test based on their anticipated yield and accessibility (Figure 2): Well #3 (pumping well), Daley Well (observation well; approximately 60 feet north), Mid-Valley Well (observation well; approximately 0.6 miles south), and Well #2 (observation well; approximately 0.85 miles south). Due to the age of the agricultural wells onsite, construction details were only available for Well #3.

This production well was constructed with 14-inch steel casing to a total depth of 100 feet below ground surface (ft bgs), with a 60 foot screened interval reaching the total depth of the well. Based on the total depths measured in the observation wells (Table 1) it is assumed that all wells are hydraulically connected to the unconfined alluvial aquifer within which Well #3 is screened. It is our understanding that no domestic supply water wells (not owned or operated by JVR) exist within 0.5 miles of the groundwater production well proposed for use during construction.

1.4 Objectives

The objectives of the work described herein were to provide JVR with the professional services necessary to prepare a groundwater study to assess the existing condition and proposed use of the underlying groundwater/aquifer and all existing onsite wells (with owner's permission). The objectives of the groundwater study are to:

- Evaluate aquifer properties and aquifer storage;
- Estimate short- and long-term well water supplies from the proposed pumping well;
- Document the proposed pumping well (Well #3) is capable of producing the total amount of water to be supplied for construction;
- Estimate of short- and long-term impacts from the use of Well #3 on local groundwater production (short-term extraction for construction water and ongoing O&M water), and on other wells in the Project area; and
- Assess the potential for subsidence brought on by Project-related water use in the area.

To achieve the project objectives, Geosyntec performed the following scope of work:

- Performed ambient groundwater monitoring;
- Conducted a 72-hour constant-rate aquifer test;
- Performed analysis of aquifer test data; and
- Prepared this Report.

2. GEOLOGIC AND HYDROGEOLOGIC CONDITIONS

2.1 General

The site lies in the Jacumba Valley Groundwater Basin (Basin Number 7-47) located in the southeastern Peninsular Ranges. The average annual rainfall for this area ranges from approximately 14 to 16 inches, with main water bearing deposits located in the alluvium and the Table Mountain Formation (DWR, 2004).

The Holocene alluvium is an unconfined aquifer consisting mostly of gravel, sand, and clay, which are estimated to range from 100 feet to 150 feet thick. Wells completed in these deposits can reportedly produce more than 1,000 gpm with a specific yield estimated to range from 5% up to 25% (DWR, 2004).

The Table Mountain Formation is Tertiary age and consists of medium- to coarse-grained sandstone and conglomerate that unconformably overlies crystalline basement rocks (DWR, 2004). This unit lies below and is separated from the Holocene alluvium by Tertiary age Jacumba volcanics, which creates semi-confined to confined conditions in the lower aquifer (DWR, 2004). The Table Mountain Formation is estimated to be up to 600 feet thick with a specific yield estimated to range from 5% to 10% (DWR, 2004).

Numerous studies indicate the groundwater in storage in the alluvial aquifer ranges from approximately 3,200 to 16,000 acre/feet (DWR, 2004). Groundwater storage in the Table Mountain Formation aquifer has been estimated to range from 84,000 to 169,000 acre/feet (DWR, 2004). In 2009, the County of San Diego, Department of Planning and Land Use (DPLU), prepared a County wide General Plan Update Report which estimated the basin wide storage to be approximately 32,600 acre-feet throughout the approximate 16,000 acres which comprise the basin (DPLU, 2009).

The Jacumba Valley Groundwater Basin is be recharged through infiltration of water from the Boundary Creek and Flat Creek drainages (DWR, 2004). Recharge has been estimated to range from approximately 1,456 acre-feet per year (DPLU, 2009) to 2,700 acre-feet per year (DWR, 2004). Groundwater usage within the basin has been estimated to be 165 acre-feet per year (DPLU, 2009). Based on these data and current conditions, which are substantially similar to those present during the cited studies, the rate of recharge to the Jacumba Valley Groundwater Basin exceeds the use.

2.2 Groundwater Elevations and Flow Direction

Groundwater levels were measured in each groundwater well prior to transducer deployment on 6 November 2012 (Table 1). The depth to groundwater in supply wells at the site ranged from 41.44 ft bgs in the Daley Well to 60.24 ft bgs in Well #2. Based on pre-aquifer test groundwater elevations, groundwater flow beneath the site is estimated to be northerly, with a hydraulic gradient ranging from approximately 0.001 to 0.005 feet per foot (ft/ft) (Figure 2).

3. AQUIFER TESTING AND ANALYSIS

3.1 Constant-Rate Discharge Test

From 6 November to 10 November 2012, a constant-rate aquifer test was performed to address the aquifer test objectives. The aquifer test consisted of an ambient phase, pumping phase, and recovery phase. Data obtained from the constant-rate aquifer test are provided electronically in Appendix A. The following procedures for each phase of data collection were used during the constant-rate discharge test.

3.1.1 Ambient Phase

Prior to the start of the pumping test, Geosyntec deployed pressure transducers in the Daley Well and the Mid-Valley Well and measured each well's total depth and depth to groundwater (Table 1). After synchronizing each transducer and confirming the transducers were recording correctly, collection of ambient groundwater level data was performed for an approximate 24-hour period.

Current groundwater uses at the site consist of pumping from Well #3 at approximately 450 gpm for 8 to 10 hours per day, 5 days per week. Pumping in Well #3 was halted 4 days prior to commencing the ambient monitoring phase.

Data collection during the ambient monitoring phase was performed at 10 minute (linear) at the two closest observation wells (Daley Well and Mid-Valley Well). Manual water level measurements were collected at the start and end of the ambient data collection phase and transducer data was downloaded prior to the start of the pumping phase of the test. Manual water level measurements were also obtained in Well #2, where no transducer was deployed. Ambient monitoring of the pumping well (Well #3) was not performed because of ongoing modifications to the depth and configuration of the sounding tube at this location. Based on the proximity to the nearest observation well (Daley well, 60 ft north) it is believed that data from this location were representative of pre-pumping conditions in the vicinity of Well #3.

3.1.2 Pumping Phase

At the conclusion of the ambient monitoring period, Geosyntec deployed a pressure transducer in Well #3, and each transducer was synchronized and re-programmed to begin data collection a few seconds prior to the start of the pump test as follows:

- Pumping well (Well #3): Logarithmic data collection.
- Observation wells (Daley Well and Mid-Valley Well): Linear data collection (10 minute intervals).

During the operation of the constant-rate pumping test, manual measurement of the water levels in the observation wells (including Well #2) were performed at regular intervals and the discharge rates were frequently recorded. Minor adjustments to the pump discharge rate were made to maintain a relatively consistent target discharge rate of 350 gpm.

3.1.3 Recovery Phase

At the end of the 72-hour pumping period final manual water level measurements were obtained and data from each transducer was downloaded. Prior to pump shutdown each transducer was synchronized and re-programmed to begin data collection a few seconds prior to the end the pumping phase as follows:

- Pumping well: Logarithmic data collection.
- Observation wells: Linear data collection.
    - Daley Well: 5 minute intervals at the Daley well.
    - Mid-Valley Well: 10 minute intervals.

Manual measurements consistent with the frequencies performed during the pumping phase were conducted until adequate recovery data was collected from each location where drawdown was observed.

3.2 Analysis of Aquifer Test Data

3.2.1 Observed and Projected Drawdown

At the conclusion of the pumping test, measured levels of drawdown ranged from 4.07 feet in the Daley well (northern observation well) to 7.30 feet in Well #3 (pumping well). No groundwater elevation changes outside of diurnal variations were observed in either of the southern observation wells, indicating that the 72-hour aquifer test had no influence on wells outside of 0.5 miles from the pumping well. Following review of the 72-hour drawdown data, the projected 6-month drawdown for the Daley Well and Well #3 are estimated to range from approximately 9 feet to 12 feet, respectively (Figure 3).

Therefore, based on the static groundwater depth in Well #3 (approximately 42 ft bgs), the projected drawdown after 6 months of pumping at a continuous rate of 350 gpm (12 feet), and the reported pump inlet depth (approximately 86 ft bgs) the groundwater depth at 6 months of operation is estimated to be 54 ft bgs. Taking into account the maximum range of historical seasonal groundwater fluctuations (approximately 17 ft; Appendix B) in this area [DPLU, 2009], the total depth to groundwater in Well #3 could reach a levels of 71 ft bgs. Therefore, the available data indicates that Well #3 is capable of providing both short- and long-term water resources for Project construction.

A summary of the 72-hour observed and 6-month projected drawdowns are provided in Table 2. A graphical representation of the drawdown data obtained from Well #3 and the Daley Well, along with their respective 6-month projected drawdowns are provided on Figure 3.

3.2.2 Aquifer Properties

Drawdown data collected from the Daley Well and recovery data collected from Well #3 were analyzed using Aqtesolv™ software to calculate the aquifer transmissivity (T) and hydraulic conductivity (K) in the vicinity of the pumping well (Appendix C, Figures C-1 and C-2). Results of drawdown data analysis in the Daley Well using the Cooper-Jacob method estimated a transmissivity value of approximately 8,779 square feet per day (ft^2/day). Results of recovery data analysis in Well #3 using the Theis Approximation method estimated a transmissivity of 12,950 ft^2/day. These results were calculated using an aquifer thickness equivalent to 58 ft. (the saturated thickness of the screened interval of Well #3 at the start of testing), these transmissivity values equate to hydraulic conductivity (K = T/b) values ranging from approximately 151 feet per day (ft/day) to 223 ft/day, respectively.

Storage in the alluvial aquifer has been estimated to range from 3,200 acre-feet to 16,000 acre-feet (DWR, 2004). Based on the estimated current domestic demand [165 acre-feet per year (DPLU, 2009)], estimated minimal annual basin recharge of approximately 1,456 acre-feet per year (DPLU, 2009), and the projected peak temporary 6-month project demand (276 acre-feet), adequate water storage in the alluvial aquifer is available to meet existing demand and temporary project construction needs without adversely affecting the aquifer conditions in the short- or long-term.

Specific yield was estimated using the late-time drawdown data in the Cooper-Jacob Method (Figure B-3). A specific yield of 0.2349 (23.49 percent) was estimated from the Daley Well drawdown data, consistent with previously calculated values for the alluvial aquifer (DWR, 2004).

3.3 Aquifer Impact Analysis

Based on the aquifer test data and the 6-month projected drawdown data, Well #3 is a viable source for providing the projected water quantities for the 6-month project during construction. Using the projected 6-month drawdown data from Well #3 and the Daley Well (Figure 2), the estimated extent of the 6-month cone of depression resulting from the Project's temporary groundwater pumping activities was plotted (Figure 4).

Based on the projected aquifer drawdown, the temporary drawdown in the alluvial aquifer resulting from pumping to support the maximum construction water use rate over 6 months is expected to be limited to an area less than 300 feet surrounding the Well #3.

The limited extent of anticipated temporary drawdown and the absence of private domestic wells (not under the control of JVR) within this radius indicate that no permanent impacts to the aquifer or adverse effects to offsite domestic supply wells are anticipated to result during the proposed groundwater pumping activities.

Furthermore, the range of drawdown expected occur during the duration of Project activities (approximately 9.0 to 12.0 ft), are within the reported range of historical seasonal groundwater fluctuations in the Jacumba area [DPLU, 2009]. Therefore, pumping activities associated with the project are not expected to promote subsidence outside of any normal ranges that may occur in this area due to seasonal water level fluctuations.

4. SUMMARY AND CONCLUSIONS

4.1 Aquifer Testing

Drawdown data collected from the Daley Well and recovery data collected from Well #3 were analyzed using Aqtesolv™ software to calculate the aquifer transmissivity (T) and hydraulic conductivity (K) in the vicinity of the pumping well (Figures C-1 and C-2). Results of data analysis estimated transmissivity values of ranging from approximately 8,779 ft^2/day in the Daley Well to 12,950 ft^2/day in Well #3. These transmissivity values equate to hydraulic conductivity values of approximately 151 feet per day (ft/day) and 223 ft/day, respectively. A specific yield of 0.2349 (23.49 %) was estimated using the late time data in the Cooper-Jacob Method (Figure C-3).

The most recent study for the Jacumba Valley Groundwater Basin estimates groundwater in storage to be approximately 32,600 acre-feet (DPLU, 2009), though studies specific to the alluvial aquifer have estimated groundwater in storage to range from 3,200 acre-feet to 16,000 acre-feet (DWR, 2004), with an estimated minimum recharge of 1,456 acre-feet per year (DPLU, 2009). Based on these data and the estimated cumulative demand during project activities (165 acre-feet per year existing demand and projected 276 acre-feet temporary maximum project demand), there is adequate water storage and recharge in the alluvial aquifer to meet existing demand and temporary project construction needs without adversely affecting the aquifer conditions in the short- or long-term.

4.2 Aquifer Impact Analysis

Based on the data collected during the 72-hour constant-rate aquifer test at JVR production Well #3 and the apparent surplus of groundwater storage, the current pump configuration and aquifer conditions are adequate to support the proposed volume (276-acre-feet), extraction rate (350 gpm), and duration of maximum water use required by the Project (6 months). Following the short period of maximum water demand, lower volumes will be required (approximately 100,000 gallons per day) for Project related activities. These reduced volumes will lessen the horizontal and vertical limits of aquifer drawdown for Project activities to levels similar to those induced by JVRs current operations. Therefore, the groundwater pumping activities are not anticipated to cause adverse short- or long-term impacts to the aquifer, or nearby (within 0.5 miles) supply wells for the duration of the Project. Furthermore, the drawdown induced during the 6-months of maximum demand for Project construction is within reported historical seasonal groundwater fluctuations for the Jacumba area, and is not expected to induce subsidence outside of any normal occurrences.

5. RECOMMENDATIONS

This report documents the procedures and results of the 72-hour constant-rate aquifer test performed on Well #3 at the site located in Jacumba, California. The available data indicate that current pump and aquifer conditions are capable of supplying sufficient water and no adverse effects to the aquifer or surrounding supply wells are anticipated to result from the proposed pumping activities. Routine (monthly) monitoring of groundwater levels is recommended during project construction to document water levels in the accessible wells on the JVR property and monitor variations attributable to pumping in support of Project construction and seasonal groundwater fluctuation.

6. REFERENCES

DPLU (Department of Planning and Land Use), 2009. *County of San Diego Department of Planning and Land Use General Plan Update Groundwater Study, Figure 2-58*. May 18, 2009.

DWR (Department of Water Resources). 2004. *Hydrologic Region Colorado River, Jacumba Valley Groundwater Basin; California's Groundwater Bulletin 118.* February 27, 2004. Accessed 14 November 2012, at: http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/7-47.pdf

TABLES

Table 1
Summary of Static Groundwater Depths and Well Characteristics
Jacumba Valley Ranch Property
Jacumba, California

Geosyntec consultants

Well	Gauging Date	Approximate Elevation (ft msl)	Height of Reference Point (ft above ground)	Depth to Water (ft toc)	Depth to Water (ft bgs)	Approximate Groundwater Elevation (ft msl)	Total Depth (ft bgs)	Pump Inlet Depth (ft bgs)
Well #3	11/6/2012	2765	2.33[1]	44.24	41.91	2,723.09	100[2]	86.00
Daley Well	11/6/2012	2765	2.21	43.65	41.44	2,723.56	147.99	NA
Mid-Valley Well	11/6/2012	2789	1.71	52.73	51.02	2,737.98	89.99	NA
Well #2	11/6/2012	2800	1.46	61.70	60.24	2,739.76	112.77	NA

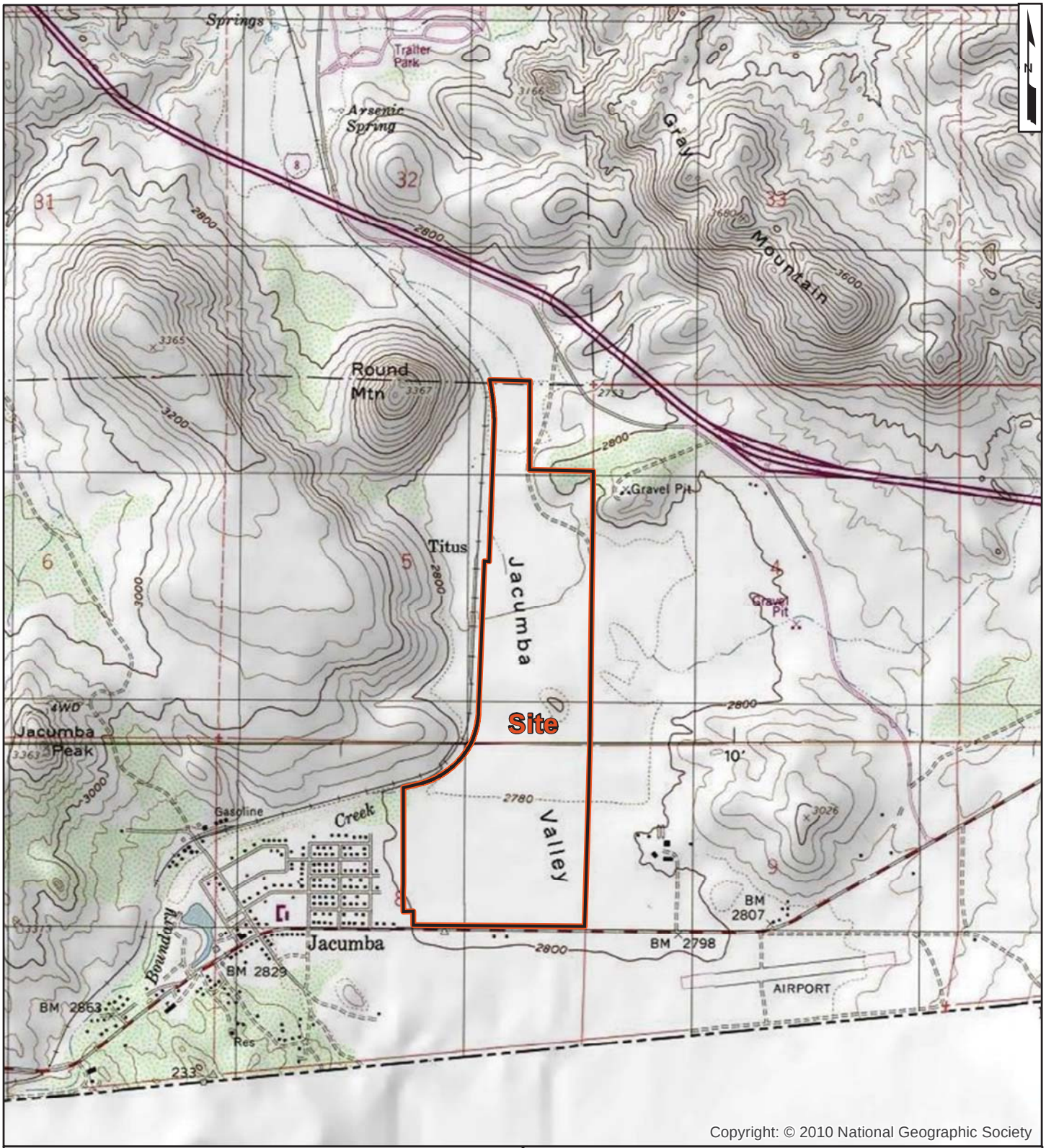
Notes:
1 - Measured before modifications to sounding tube.
2 - Obtained from construction log (Appendix A).
ft msl - feet above mean sea level (estimated based on online resources).
ft - feet
ft bgs - feet below ground surface
ft toc - feet below top of casing
NA - Not Applicable

Geosyntec consultants

Table 2
Summary of Observed and Projected Drawdown Data
Jacumba Valley Ranch Property
Jacumba, California

Constant Rate Discharge Test				
Parameter	**Pumping Well**	**Observation Well**		
	Well #3*	**Daley Well**	**Mid-Valley Well**	**Well #2**
Maximum Drawdown (ft) (72-Hours)	7.3	4.07	0	0
Projected Drawdown (ft) (6-Months)	12	9	0	0
Approx. Distance From Pumping Well	0	60 feet	0.6 Miles	0.85 Miles

FIGURES



2,000 1,000 0 2,000 Feet

Site Vicinity and Location Map

Jacumba Valley Ranch Property
Jacumba, California

Geosyntec consultants

San Diego	November 2012	Figure 1

Document Path: P:\GIS\ECO\JVR_SiteMap.mxd

600 300 0 600 Feet

Legend

- Groundwater Monitor Well (Groundwater Elevation in Feet Above Mean Sea Level)
- 2738 — Groundwater Elevation Countour (Contour Interval = 2 ft)
- 0.005 — Approximate Groundwater Flow Direction and Hydraulic Gradient (ft/ft)
- Approximate Property Boundary

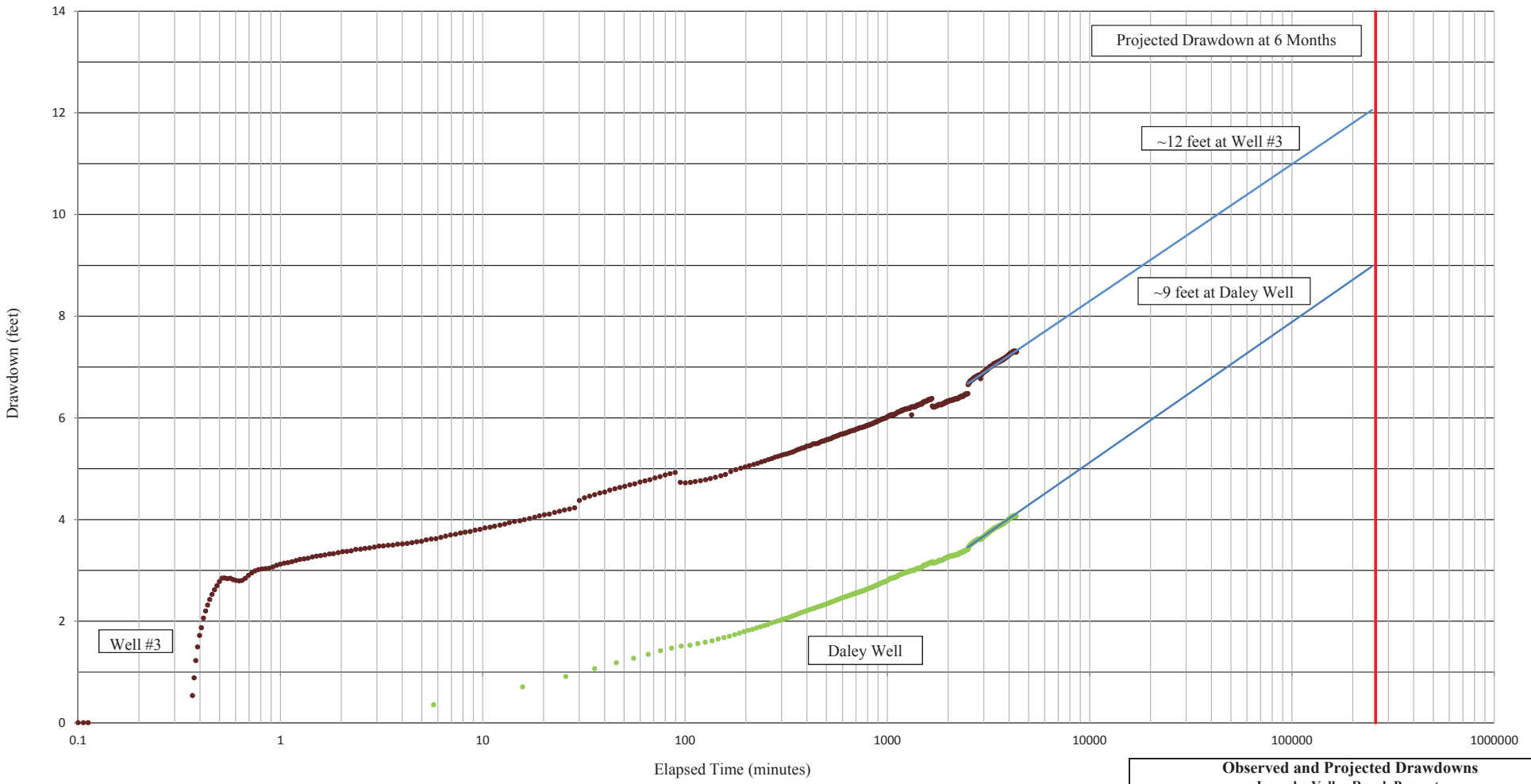
Groundwater Elevations and Flow Direction, 6 November 2012

Jacumba Valley Ranch Property
Jacumba, California

Geosyntec consultants

San Diego | November 2012

Figure 2

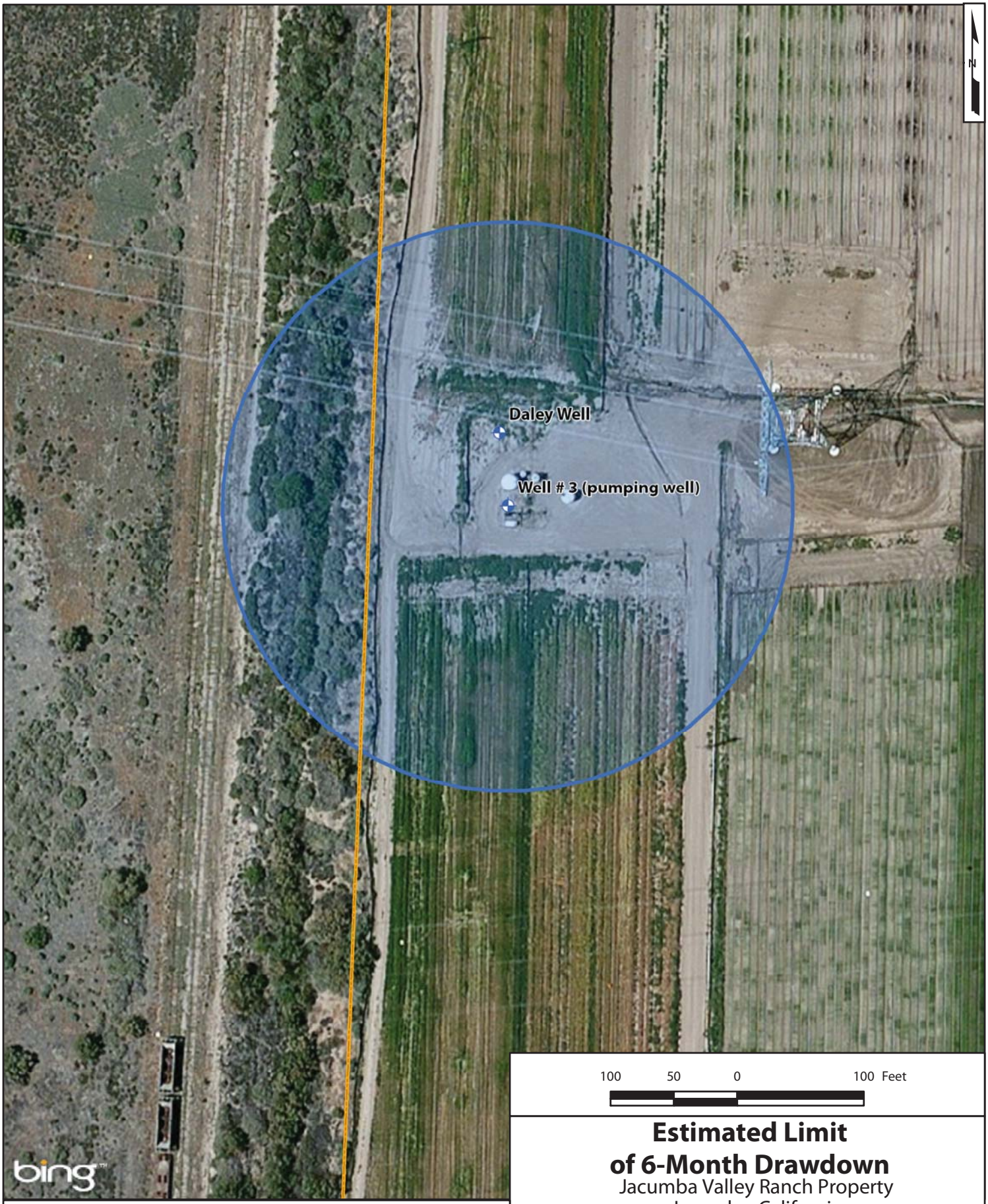


Observed and Projected Drawdowns
Jacumba Valley Ranch Property
Jacumba, California

Geosyntec consultants

SC0636 | November 2012

Figure 3



100 50 0 100 Feet

Estimated Limit of 6-Month Drawdown

Jacumba Valley Ranch Property
Jacumba, California

Legend

- Groundwater Well
- Estimated Limit of Projected Groundwater Drawdown
- Site Boundary

Geosyntec consultants

San Diego | November 2012

Figure 4

APPENDIX A

Constant-Rate Aquifer Test Data

APPENDIX B

DPLU GP Update Report Excerpts

Table C-37
Jacumba Valley Basin
Groundwater in Storage Calculations

600 Units were not on GP Update Map for Specific Plan Area - Included additional 300 afy manually in the calculations

Size (Acres)	16039
Modeled Maximum GW in Storage (AF)	32601
Modeled Average GW Recharge (AFY)	1456

Scenario	Estimated GW Demand (AFY)	Estimated Average GW in Storage	Estimated Minimum GW in Storage
Existing Conditions	165	100%	99%
Current General Plan Buildout	2295	54%	1%
Referral Map Buildout	1259	91%	74%
Draft Land Use Map Buildout	1258	91%	74%
Hybrid Map Buildout	1258	91%	74%
Environmentally Superior Buildout	1008	93%	81%
Cumulative Impacts Buildout	1258	91%	74%

Note: Future predicted change in the amount of groundwater in storage for scenarios is based upon historical precipitation from July 1971 to June 2005. Scenarios with estimated groundwater in storage at or below 50% at any time are considered to have a potentially significant impact to groundwater resources.
AF - Acre-Feet
AFY- Acre-Feet Per Year
GW - Groundwater

Change of GW in Storage - Referral Map Buildout

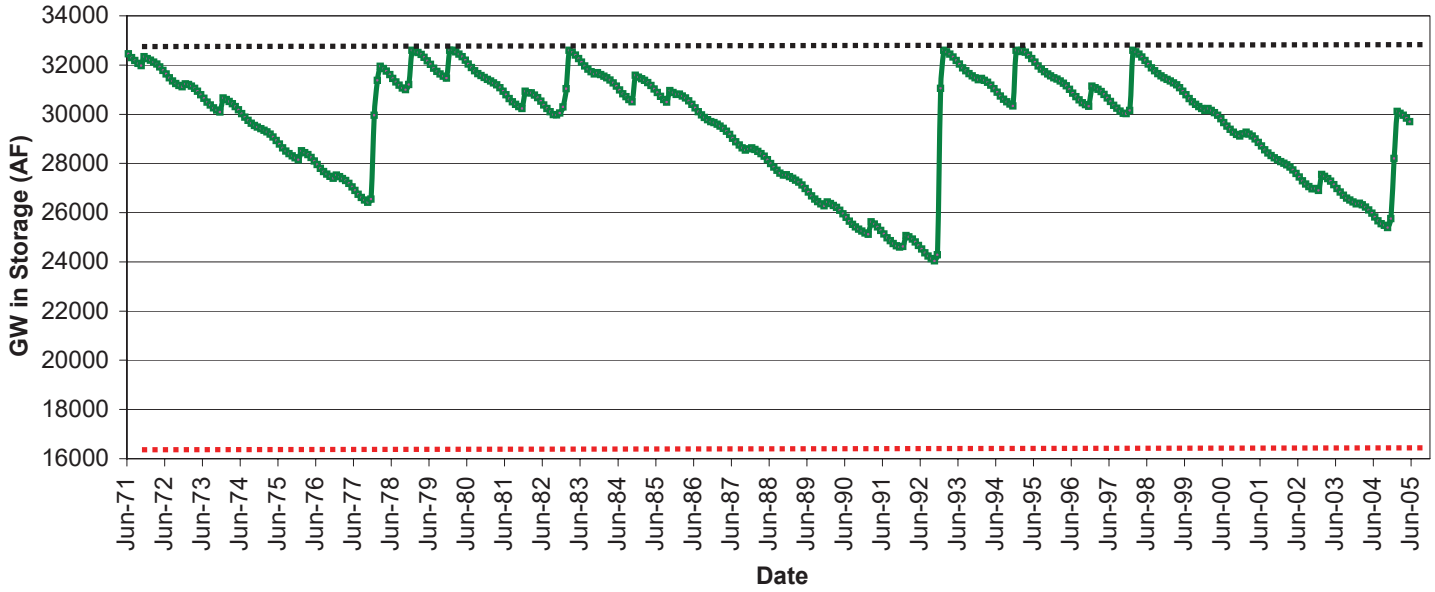
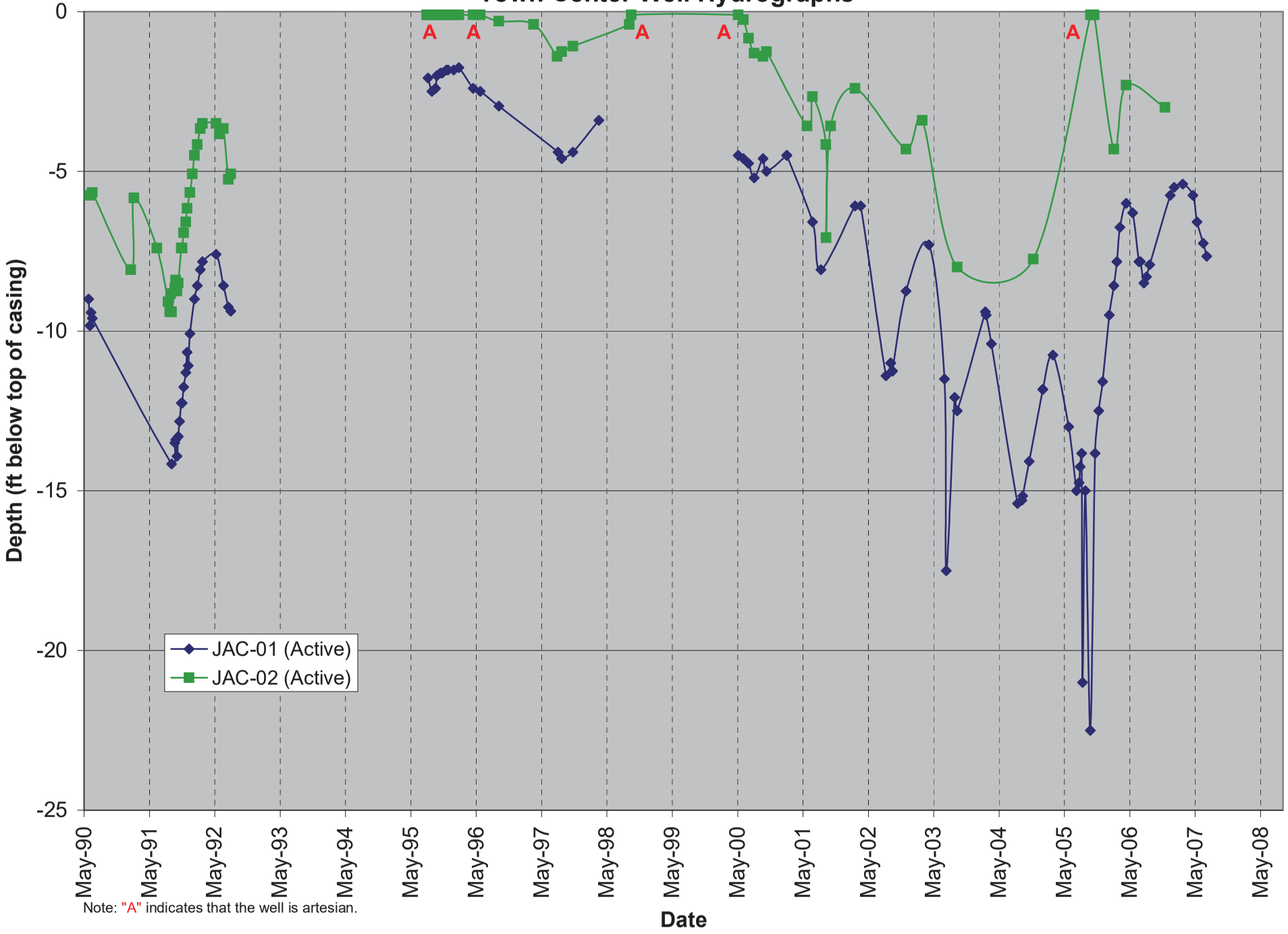


Figure 2-58: Jacumba Community Sponsor Group Town Center Well Hydrographs



Note: "A" indicates that the well is artesian.

APPENDIX C

Aqtesolv™ Output Reports

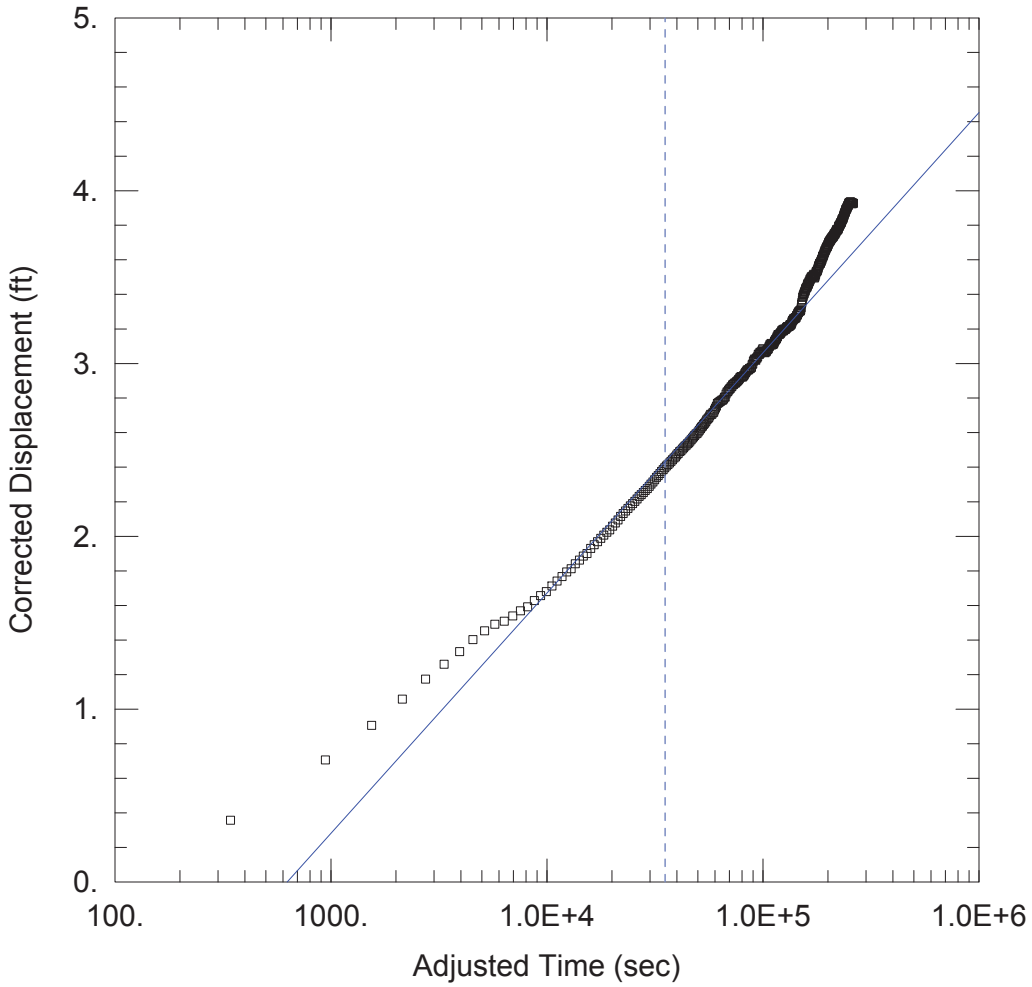


FIGURE C-1

Data Set: Q:\SC0636 JVR Aquifer Test\AQTESOLV\Daley Well.Drawdown.Figure C-1.aqt
Date: 11/21/12 Time: 10:35:10

PROJECT INFORMATION

Company: Geosyntec Consultants
Client: JVR
Project: SC0636
Location: Jacumba
Test Well: Well #3
Test Date: 11/7/2012

AQUIFER DATA

Saturated Thickness: 58. ft Anisotropy Ratio (Kz/Kr): 1.174E-5

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Well #3	0	0
Daley Well	60	0

Observation Wells

Well Name	X (ft)	Y (ft)
▫ Daley Well	60	0

SOLUTION

Aquifer Model: Unconfined Solution Method: Cooper-Jacob

T = 8778.5 ft^2/day S = 0.03976

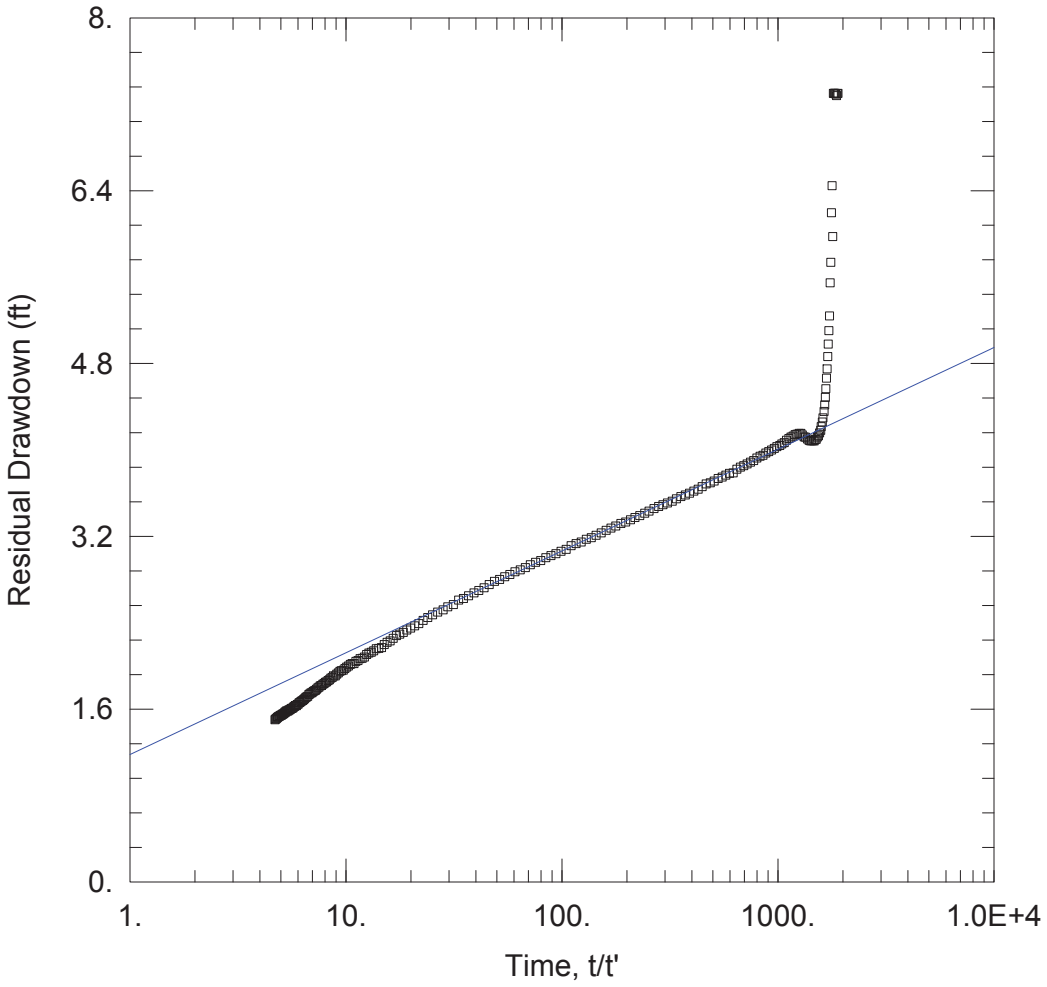


FIGURE C-2

Data Set: Q:\SC0636 JVR Aquifer Test\AQTESOLV\Well#3.Figure C-2.aqt
Date: 11/21/12 Time: 10:28:57

PROJECT INFORMATION

Company: Geosyntec Consultants
Client: JVR
Project: SC0636
Location: Jacumba
Test Well: Well #3
Test Date: 11/7/2012

AQUIFER DATA

Saturated Thickness: 58. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Well #3	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
▫ Well #3	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 1.295E+4 ft^2/day S/S' = 0.05601

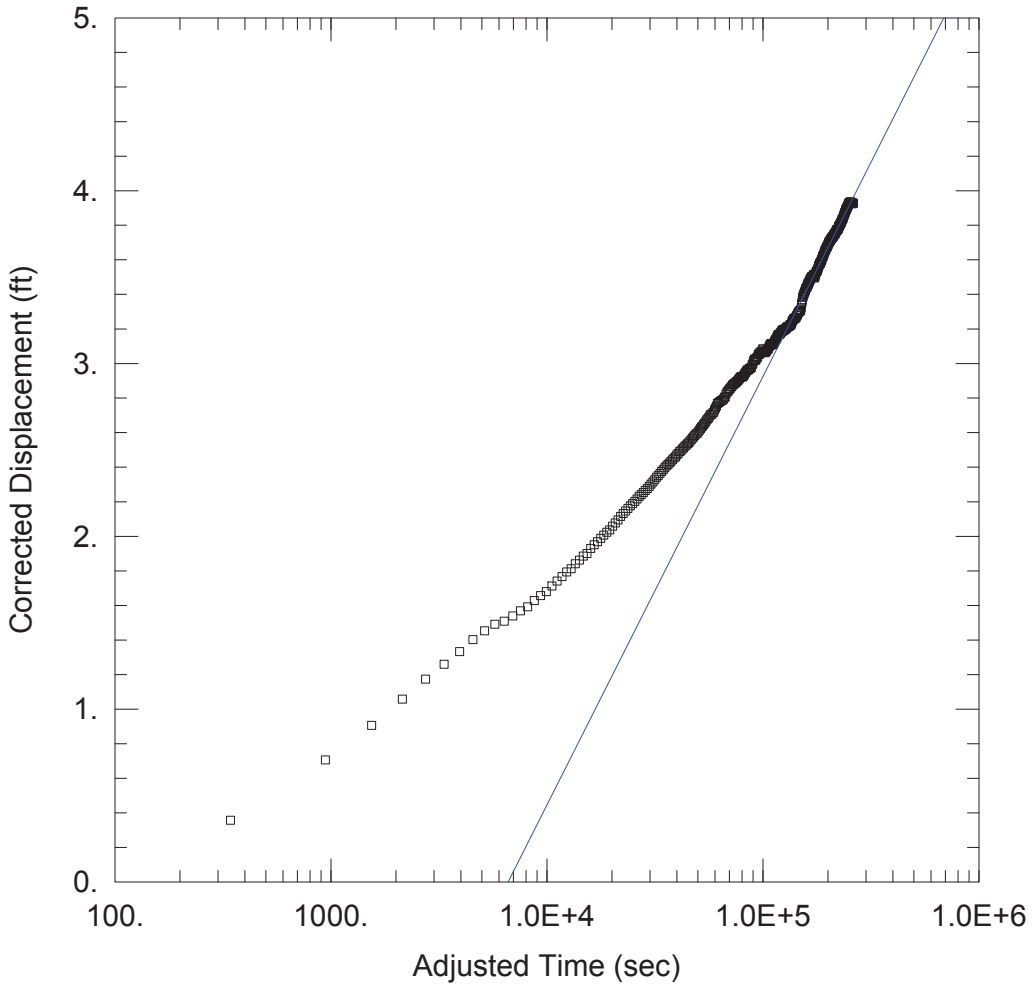


FIGURE C-3

Data Set: Q:\SC0636 JVR Aquifer Test\AQTESOLV\Daley Well.Drawdown.Figure C-3.aqt
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PROJECT INFORMATION

Company: Geosyntec Consultants
Client: JVR
Project: SC0636
Location: Jacumba
Test Well: Well #3
Test Date: 11/7/2012

AQUIFER DATA

Saturated Thickness: 58. ft Anisotropy Ratio (Kz/Kr): 1.174E-5

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Well #3	0	0
Daley Well	60	0

Observation Wells

Well Name	X (ft)	Y (ft)
▫ Daley Well	60	0

SOLUTION

Aquifer Model: Unconfined Solution Method: Cooper-Jacob

T = 4923.3 ft^2/day S = 0.2349

APPENDIX E

Groundwater Monitoring and Mitigation Report for the JVR Energy Park Project

Groundwater Monitoring and Mitigation Plan
for the JVR Energy Park Project
Jacumba Hot Springs, San Diego County, California

Lead Agency:

County of San Diego
Planning and Development Services
5510 Overland Avenue
San Diego, California 92123
Contact: Bronwyn Brown

Project Proponent:

JVR Energy Park LLC
17901 Van Karman Avenue, Suite 1050
Irvine, California 92614
Contact: Patrick Brown

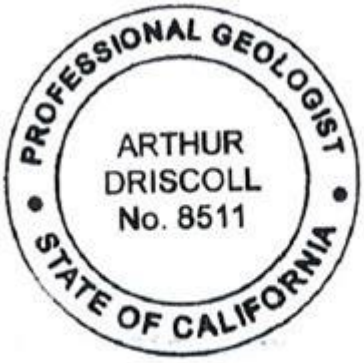
Prepared by:

DUDEK
605 Third Street
Encinitas, California 92024
Contact: Trey Driscoll

July 2020

SIGNATURE PAGE

This draft Groundwater Monitoring and Mitigation Plan for the JVR Energy Park Project has been prepared under the direction of a professional geologist licensed in the State of California in accordance with Business and Professions Code Sections 6735, 7835, and 7835.1, and consistent with professional standards of practice.



Arthur Storer Driscoll, III (Trey)
PG No. 8511, CHG No. 936

TABLE OF CONTENTS

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1 INTRODUCTION

The proposed JVR Energy Park Project (Proposed Project) is proposing the use of two on-site groundwater wells to supply water for construction, operations and maintenance, and decommissioning and dismantling of a 90-megawatt photovoltaic solar facility and 20-megawatt battery energy storage system. Dudek has prepared this Groundwater Monitoring and Mitigation Plan to provide protection of nearby groundwater-dependent habitat and to limit groundwater level decline in off-site groundwater wells caused by groundwater extraction by the Proposed Project.

As described in the Groundwater Resources Investigation Report for JVR Energy Park (Groundwater Investigation) (Dudek 2020), the Proposed Project is proposing to extract 140 acre-feet of groundwater for approximately 1 year of construction, 11 acre-feet per year for ongoing operations and maintenance, and 50 acre-feet for decommissioning and dismantling from on-site Well #2 and Well #3 (Figure 1, Well Interference and Potential Groundwater-Dependent Habitat).

Well #2 is located within Assessor's Parcel Number 660-150-18, located on the north side of Old Highway 80. Well #3 is located on the adjacent parcel to the north on Assessor's Parcel Number 660-020-02 (Figure 1). Both wells are located within the Project site.

The results of the Groundwater Investigation indicate that short-term pumping of Well #2 and Well #3 would result in a less-than-significant impact to groundwater storage. Additionally, the Groundwater Investigation analyzed the effects of Proposed Project pumping over a 90-day, 1-year, and 5-year period. Under the most conservative scenario (90 days of continuous groundwater extraction at a pumping rate of 352 gallons per minute), drawdown from Proposed Project pumping at the nearest off-site well and groundwater-dependent habitat would be 1.08 feet from pumping Well #2 and 3.66 feet from pumping Well #3 (Dudek 2020). Based on the findings of the Groundwater Investigation, the Proposed Project is unlikely to draw down the groundwater table to the detriment of groundwater-dependent habitat, which is typically a drop of 3 feet or more from historical low groundwater levels, or cause a significant impact to off-site groundwater users, which is typically a drop of 5 feet or more.[1]

This Groundwater Monitoring and Mitigation Plan establishes protective groundwater drawdown thresholds for off-site well interference and groundwater-dependent habitat. This Groundwater Monitoring and Mitigation Plan also describes the monitoring, mitigation, and reporting procedures by which the County of San Diego Planning and Development Services (PDS) can validate that the conditions and criteria for the Proposed Project's groundwater extraction activities are continually being upheld. A 5-year monitoring period is proposed to assess the impact of groundwater extractions.

[1] Current groundwater levels near Well #2 and Well #3 are at least 12 feet higher than the historical low groundwater level recorded in the Jacumba Valley alluvial aquifer. Well #2 and Well #3 pumping for the Proposed Project is not expected to draw down the groundwater table greater than 3 feet from the historical low.

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2 ESTABLISHMENT OF GROUNDWATER THRESHOLDS

According to the County of San Diego Guidelines for Determining Significance and Report Format Content Requirements – Groundwater Resources, Proposed-Project-related groundwater extraction would incur a significant well interference impact if, after a 5-year projection of drawdown, the results indicate a decrease in water level of 5 feet or more in the off-site wells (County of San Diego 2007). If site-specific data indicates alluvium or sedimentary rocks exist, which substantiate a saturated thickness greater than 100 feet in off-site wells, a decrease in saturated thickness of 5% or more in the off-site wells would be considered a significant impact (County of San Diego 2007). The County of San Diego's Guidelines for Determining Significance and Report Format and Content Requirements – Biological Resources defines a project-related drawdown of 3 feet below historical low groundwater levels as causing a significant impact to riparian habitat of a groundwater-sensitive natural community (County of San Diego 2010). The thresholds established below incorporate these guidelines and represent a basis for monitoring and mitigating potential groundwater impacts related to the Proposed Project.

2.1 Potential Off-Site Well Interference

As described in the Groundwater Investigation, alluvial aquifer production wells identified near Well #2 and Well #3 include Well Km, the Highland Center Well, the Park Well, and the Border Patrol Well (Figure 1). Additionally, monitoring wells identified near Well #2 and Well #3 include the Daley Well and the Central Irrigation Well.[2] These four production wells, Well #2 and Well #3, and two monitoring wells should be included in the groundwater-monitoring network.

The Highland Center Well, the Park Well, and Well #2 are already included in a groundwater-monitoring network for Jacumba Solar operations and maintenance groundwater extraction, and are equipped with pressure transducers. Pressure transducer data from these wells and manual measurements will be included in the Groundwater Monitoring and Mitigation Plan (Appendix A). The pressure transducers record the groundwater level in the wells at sub-daily, 15-minute intervals; the level is confirmed periodically through manual groundwater-level measurements recorded with a sounder.

Well Km is operated by the Jacumba Valley Ranch Water Company, which operates as a transient non-community water system. The Border Patrol Well, an inactive well with unknown condition, is enclosed in a locked pump house. The Proposed Project should identify and contact the owners of Well Km and the Border Patrol Well to attempt to gain access for ongoing groundwater level monitoring. If access is granted to monitor these wells, a pressure transducer should be installed

[2] Additional groundwater monitoring wells are identified in the Groundwater Investigation near Well #2 and #3, but these have been properly destroyed in accordance with County of San Diego and state requirements by the Jacumba Community Services District (JCSD) as part of its Domestic Water Supply System Improvements project. JCSD Wells #1, #2, #3, and #5 were properly destroyed.

in both wells. Manual measurements should be recorded periodically to confirm groundwater level measurement accuracy.

Groundwater wells that should be included in the groundwater-monitoring network and their distance to Well #2 and Well #3 are indicated in Table 1 and depicted in Figure 1.

Table 1
Alluvial Aquifer Wells Within 0.5-Mile Radius of Extraction Wells

Well Name	Owner/Status	Distance from Well #2 (feet)	Distance Well #3 (feet)
Production			
Well Km[a]	Small Water System/Active	2,453	3,548
Highland Center Well	JCSD/Active	1,817	4,835
Park Well	JCSD/Active	2,256	5,025
Border Patrol Well[a]	Federal/Inactive	1,892	6,235
Monitoring			
Daley Well	JVR/NA	4,460	60
Central Irrigation Well	JVR/NA	2,692	2,713

NA = Not applicable; JCSD = Jacumba Community Services District; JVR = Jacumba Valley Ranch

[a] Well Km and the Border Patrol Well are privately owned wells that will need access granted by their respective well owners before monitoring can occur.

Static groundwater-level measurements should be collected at each of the wells in the groundwater-monitoring network, if accessible, prior to the start of construction. Baseline groundwater levels should be established for Well Km, the Border Patrol Well, the Daley Well, and the Central Irrigation Well, provided the wells are accessible for monitoring.

Pre-construction baseline conditions for the Jacumba Valley alluvial aquifer were determined on January 18, 2017, which consisted of manually measuring groundwater levels and installing new pressure transducers into monitoring network wells. The County of San Diego PDS has requested that the baseline conditions established in January 2017 for the Highland Center Well, Park Monitoring Well, and JVR Well 2 be carried over to future projects. Baseline conditions from January 2017 for groundwater level threshold and current groundwater levels are presented in Table 2. Jacumba Community Services District Well 4 is not used as part of the mitigation plan for this Proposed Project due to its distance from the Project site.

Table 2
Baseline Conditions, Groundwater Level Threshold, and Current Groundwater Levels

Well ID	Baseline Groundwater Level Measurement (Feet BTOC) [a]	Threshold Condition (Drawdown, Feet)	Groundwater Level Threshold (Feet BTOC)	Current Groundwater Level Measurement (Feet BTOC / Date)
Highland Center Well	55.05	N/A	N/A	56.75 / May 12, 2020
Park Monitoring Well	57.71	N/A	N/A	59.18 / May 12, 2020
Gas Station Well	64.25	N/A	N/A	65.67 / May 12, 2020
JVR Well 2	55.40	N/A	N/A	59.27 / May 12, 2020
Central Irrigation Well	48.09	52.89	4.80 feet below baseline condition	48.09 / May 12, 2020

Source: Dudek 2020
Major Use Permit (MUP) established threshold conditions per MUP PDS2014-MUP-14-041 Sections 15, 29, and 30
BTOC = below top of casing; N/A = not applicable (no water level thresholds identified in the MUP)
[a] Measured on January 18, 2017

To protect off-site well users and comply with County of San Diego Guidelines, a maximum drawdown of 5 feet below the baseline groundwater levels will be allowed in accessible production wells. The nearest off-site production well is Well Km. If Well Km is not accessible for groundwater level monitoring, a maximum drawdown of 4.80 feet at the Central Irrigation Well below the groundwater level baseline will be allowed.[3]

If Well Km is accessible, a maximum drawdown of 5 feet at off-site production wells, Well Km, the Highland Center Well, the Park Well, and the Border Patrol Well, if accessible, should be established from the baseline groundwater level measurements.[4] Baseline groundwater level measurements and groundwater level thresholds for the Gas Station Well were established in January 2017 and are provided in Table 2.

Results of the off-site well interference analysis detailed in the Groundwater Investigation conclude that well interference is not anticipated to result in a significant impact. A groundwater-monitoring program will be implemented to establish a groundwater level baseline in the nearest off-site production wells or monitoring wells where applicable, and characterize change in groundwater levels due to Proposed Project groundwater extraction.

[3] Maximum drawdown measurements below baseline groundwater levels for monitoring wells in the absence of accessibility to Well Km were calculated based on groundwater extraction from Well #2 at a pumping rate of 1,850 gallons per minute for 90 days using the Theis drawdown equation (Driscoll 1986) with a transmissivity value of 26,410 square feet per day and a storativity value of 0.00826; equivalent to 5 feet of estimated drawdown at Well Km.

[4] The Jacumba Community Services District may supply groundwater for commercial sale to various renewable energy projects. If groundwater extraction for these projects occurs at the same time as Proposed Project groundwater extraction, thresholds at the Highland Center Well and the Park Well should not be applied to the Proposed Project because declining groundwater levels will be caused by pumping Jacumba Community Services District extraction wells, not from Proposed Project pumping.

2.2 Groundwater-Dependent Habitat

Groundwater-dependent vegetation habitat, mapped as mesquite bosque, is located approximately 1,820 feet from Well #2 and 140 feet from Well #3 (Figure 1). According to the Groundwater Investigation, the estimated drawdown at the nearest groundwater-dependent habitat after 90 days of Proposed Project groundwater extraction is 1.08 feet from pumping Well #2 and 3.66 feet from pumping Well #3. Current groundwater levels near Well #2 and Well #3 are at least 12 feet higher than the historical low groundwater level recorded in the Jacumba Valley alluvial aquifer. Based on this analysis, the Proposed Project is unlikely to draw down the groundwater table to the detriment of groundwater-dependent habitat, typically a drop of 3 feet or more from historical low groundwater levels.

Since historical groundwater-level measurements are available for groundwater wells on the Project site, a groundwater-dependent threshold can be applied in select wells. Historical well K1, located near the Central Irrigation Well, had a recorded historic low groundwater level of 60.7 feet below ground surface (bgs) in 1979 (Swenson 1981). Historical well K3, located near Well #2, had a recorded historical low groundwater level of 69.9 feet bgs in 1979 (Swenson 1981). Monitoring of the groundwater-dependent habitat would be required in the event that static groundwater levels in the Central Irrigation Well and Well #2 drop 3 feet below historical low groundwater levels, equivalent to 63.7 feet bgs and 72.9 feet bgs, respectively.[5] Groundwater-dependent habitat procedures are described in Section 3.2, Groundwater-Dependent Habitat Monitoring.

[5] Well #2 may be used as a groundwater extraction well for the Proposed Project. If Well #2 is regularly pumped, groundwater-level measurements may not be representative of static conditions. If a static groundwater-level measurement cannot be collected, the threshold for groundwater-dependent habitat should not be applied to Well #2.

3 MONITORING PROCEDURES AND MITIGATION CRITERIA

The groundwater-level monitoring, and if necessary groundwater-dependent habitat monitoring, procedures and mitigation criteria are outlined below and will be followed during pumping at Well #2 and Well #3. The groundwater monitoring program defined herein will be carried out under the direction of a Professional Geologist or Professional Engineer licensed in the State of California.

3.1 Groundwater Production and Groundwater Level Monitoring

Pressure transducers will be maintained in a network of four groundwater wells (the Daley Well, the Central Irrigation Well, the Highland Center Well, and the Park Well), as well as both Proposed Project production wells (Well #2 and Well #3). Additionally, Well Km and the Border Patrol Well will be included if property access is granted. The pressure transducers will be programed to record the water level sub-daily at 15-minute intervals. In addition, ambient barometric pressure and temperature will be recorded at 15-minute intervals with a barometric logger. Manual groundwater-level measurements may be required for Well Km and the Border Patrol Well if pressure transducers cannot be fitted in the wells due to lack of appropriately sized port or sounding tube.

Transducer data will be downloaded at all the instrumented wells for 1 month prior to the onset of Proposed-Project-related groundwater extraction. Transducer data will also be downloaded monthly during periods of pumping for construction water supply to the Proposed Project. Cumulative groundwater usage will be monitored at Well #2 and Well #3 using an instantaneous flow meter. Flow rate and volume measurements will be recorded daily during pumping for the Proposed Project.

3.2 Groundwater-Dependent Habitat Monitoring

The following monitoring program will be carried out for groundwater-dependent habitat if static groundwater levels in the Central Irrigation Well or Well #2 drop below the established threshold. The goal would be to determine if the Proposed Project's use of groundwater is affecting groundwater-dependent habitat.

3.2.1 Monitoring

Baseline data will be collected within a 0.5-mile radius of Well #2 and Well #3 (study area) (Figure 1). Potentially affected native trees within the study area will be evaluated for overall physical condition and attributes. The trees will be inventoried by an International Society of Arboriculture–Certified Arborist or Registered Professional Forester with specific experience evaluating riparian dominant species.

The baseline monitoring evaluations will include the following:

- Establishment of 18 equidistant plots or transects within the mesquite bosque and desert sink scrub habitat within 0.5 miles of Well #2 and Well #3. Sample plots/transects will include the range of existing habitat conditions, including elevation, slope and aspect, and proximity to roads and other land uses.
- Tagging of trees and recording species, tag number, trunk diameter at breast height (inches), height (feet), and dominance (i.e., whether the tree is under the canopy of another tree or forms the uppermost canopy) will occur. Slope, aspect, and elevation of each tree location, existing understory species (including proportion of natives to exotics); presence of debris and litter; and soil type, depth, and parent material will be noted for each tree or plot/transect.
- Assessment of tree status will occur, including documentation of the following:
    - Diameter at breast height measured at 4.5 feet aboveground (according to standard practices)
    - Number of stems
    - Overall tree height (based on ocular estimates)
    - Tree crown spread (measurement in each cardinal direction, based on ocular estimate)
    - Overall tree health condition (good, fair, poor, dead)
    - Overall tree structural condition (good, fair, poor, dead)
    - Pest presence (type, extent—minimal, moderate, high)
    - Disease presence (type, extent—minimal, moderate, high)
    - Other specific comments
- Assessment of seedling establishment and sapling tree densities and conditions.
- The data collection procedure will include full data collection at each plot/transect so that consistency is maintained among sampling plots.
- Creation of database using GIS or similar application.

3.3 Groundwater Mitigation Criteria

The following mitigation criteria will be established to protect groundwater resources and groundwater-dependent habitat in the Project area:

- If the groundwater levels in Well Km, the Highland Center Well, the Park Well, and the Border Patrol Well drop 5 feet below the baseline groundwater level as a result of pumping Well #2 or Well #3, groundwater extraction at from Well #2 and Well #3 will cease for Proposed Project water supply until the groundwater level at the well that experienced the threshold exceedance has increased above the threshold and remained there for at least 30 continuous days. Additionally, written permission from County of San Diego PDS must be obtained before production for the Proposed Project may be resumed. If Well Km is not accessible, than the well interference threshold will be 4.80 feet at the Central Irrigation Well below baseline groundwater level measurements to not exceed the maximum drawdown of 5 feet at Well Km.
- If static groundwater levels drops more than 63.7 feet below ground surface in the Central Irrigation Well or 72.9 feet below ground surface in Well #2, then monitoring of the groundwater-dependent habitat will be triggered.
- If the groundwater levels exceed 3 feet below historical low groundwater levels (63.7 feet bgs in the Central Irrigation Well and 72.9 feet bgs in Well #2) and the arborist or forester finds evidence of deteriorating riparian habitat health, there may be a temporary or permanent cessation of pumping at the Well #2 and/or Well #3.

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4 REPORTING REQUIREMENTS

A groundwater monitoring report will be completed by a Professional Geologist or Professional Engineer licensed in the State of California and will be submitted to County of San Diego PDS annually no later than 28 days following the end of the calendar year. Groundwater monitoring reports should be submitted for 5 years after Proposed Project construction has commenced. After 5 years, County of San Diego PDS should determine if continuous reporting is required based on the effects of groundwater extraction from the previous 5 years. The annual reports will include the following information:

- Groundwater level hydrographs and tabulated groundwater level data for each accessible well in the groundwater-monitoring network.
- Tabulated groundwater production volumes from Well #2 and Well #3.
- Documentation of any changes in well pumping or groundwater well conditions for wells in the groundwater-monitoring network.
- Documentation of groundwater-dependent habitat monitoring, if necessary, as described in Section 3.2.

If the baseline groundwater levels at the wells included in the groundwater monitoring network are exceeded by 5 feet, County of San Diego PDS will be notified via letter and email within 1 working day of the exceedance, or immediately after the exceedance is recognized. Additionally, if groundwater level thresholds at the off-site wells are exceeded by their respective thresholds, pumping of Well #2 and Well #3 will cease and County of San Diego PDS will be notified via letter and email within 1 working day, or immediately after the exceedance is recognized.

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5 REFERENCES

County of San Diego. 2007. *County of San Diego, Guidelines for Determining Significance and Report Format and Content Requirements: Groundwater Resources*. Land Use and Environment Group, Department of Planning and Land Use, Department of Public Works. March 19, 2007.

County of San Diego. 2010. *County of San Diego, Guidelines for Determining Significance: Biological Resources*. Land Use and Environment Group, Department of Planning and Land Use, Department of Public Works. Fourth Revision. September 15, 2010.

Driscoll, Fletcher G. 1986. *Groundwater and Wells*. St Paul, Minn: Johnson Division.

Dudek. 2020. *Draft Groundwater Resources Investigation Report JVR Energy Park.* Prepared for JVR Energy Park LLC. February 2019.

Swenson, G.A. 1981. *Master's Thesis San Diego State University – The Groundwater Hydrology of Jacumba Valley, California and Baja California*.

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6 LIST OF PREPARERS

This Groundwater Monitoring and Mitigation Plan was prepared Dudek Hydrogeologist Trey Driscoll, PG, CHG, a County-approved hydrogeologist, and Dudek Hydrogeologist Hugh McManus. Dudek Arborist Michael S. Huff prepared the monitoring program for the groundwater-dependent habitat.

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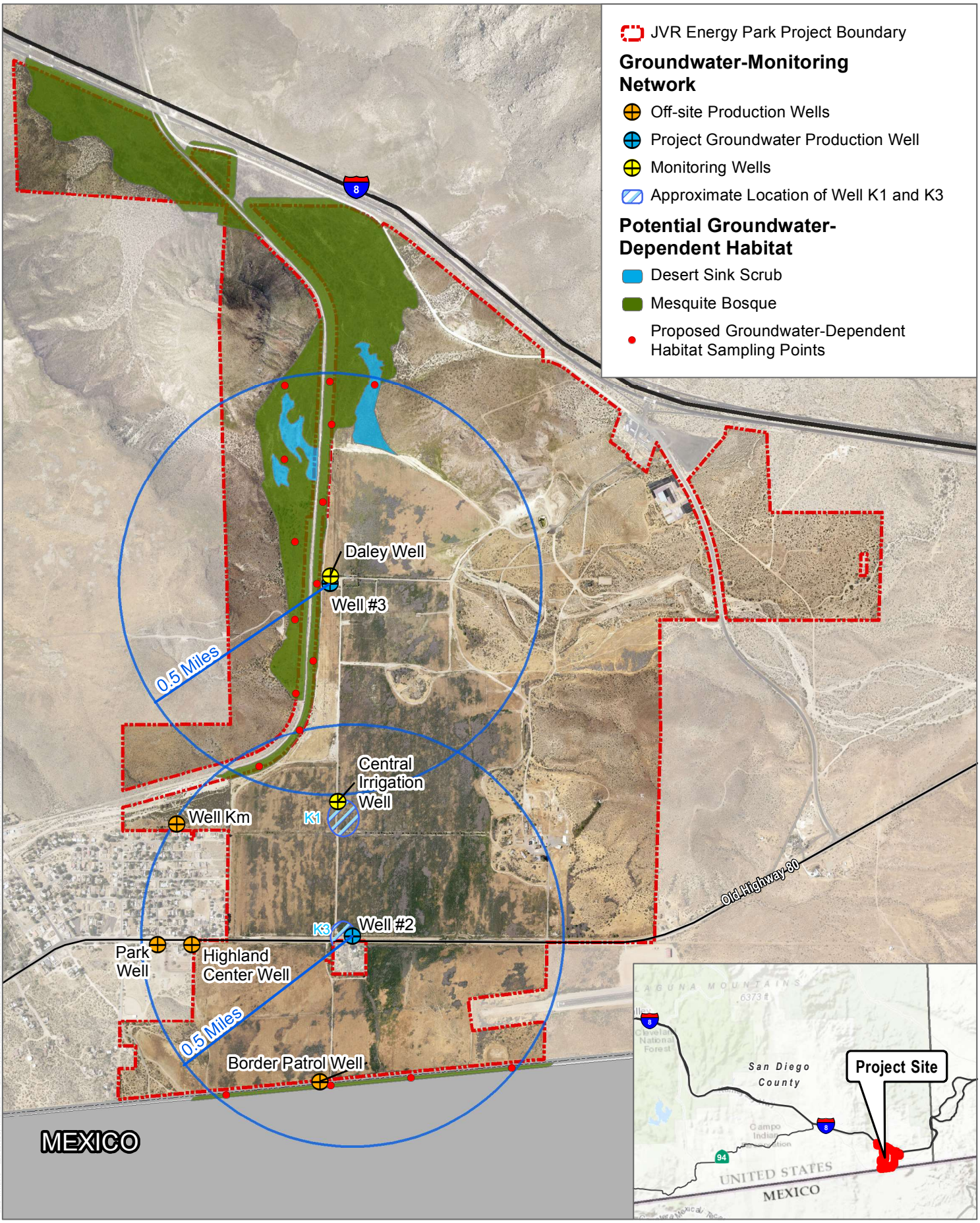

SOURCE: Dudek 2019

FIGURE 1

Well Interference and Potential Groundwater-Dependent Habitat

Groundwater Mitigation And Monitoring Plan - JVR Energy Park

DUDEK

0 0.25 0.5 Miles

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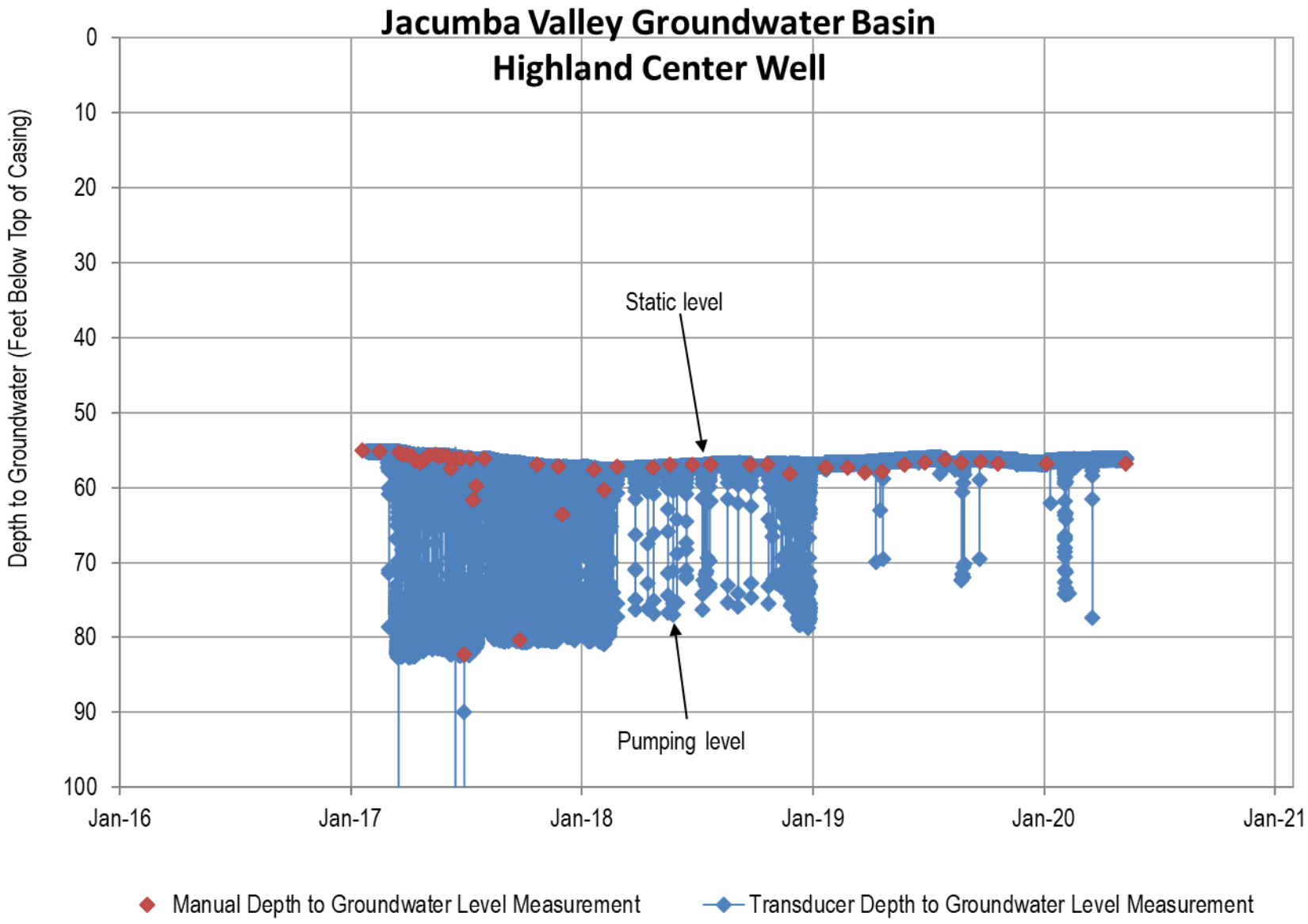
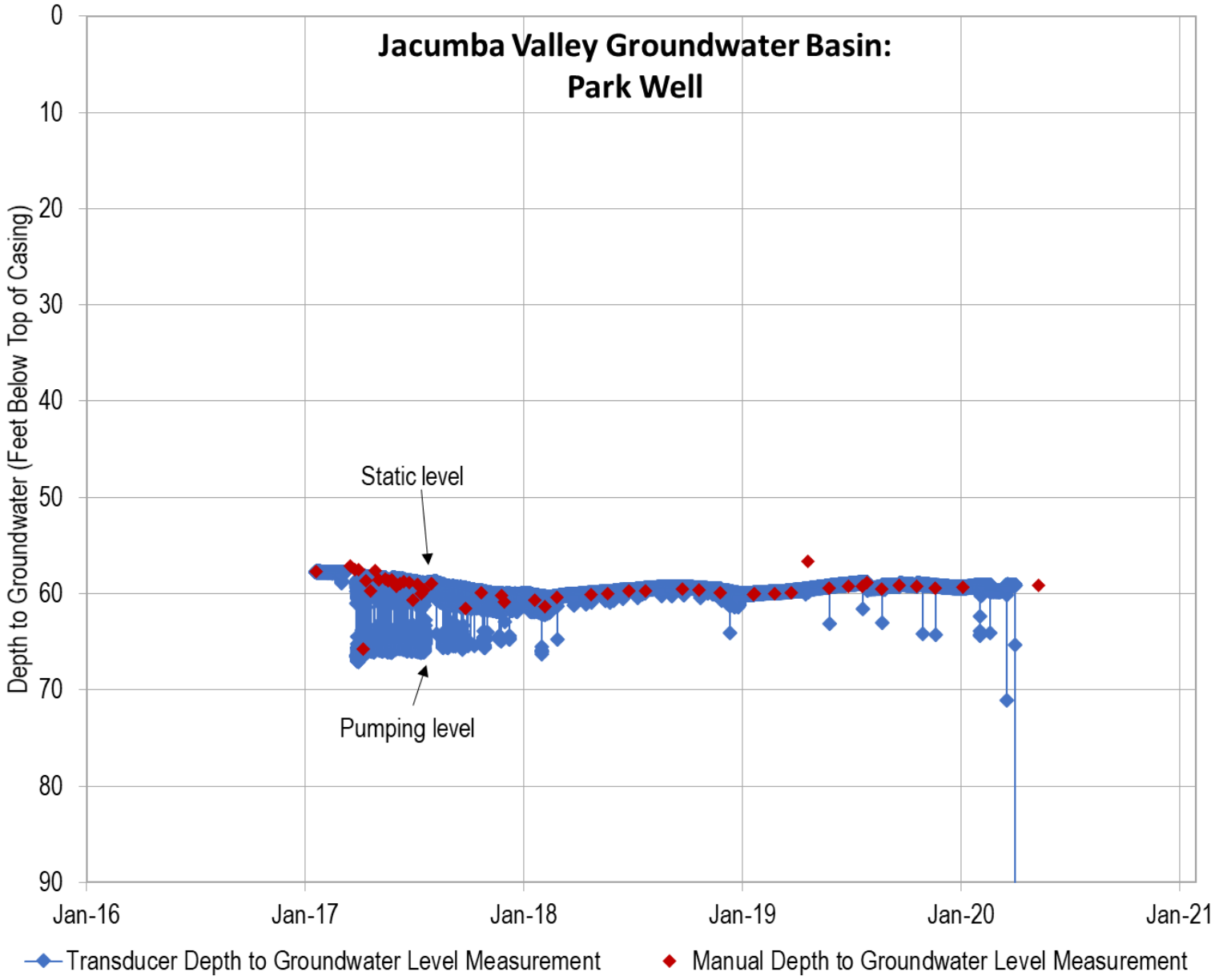
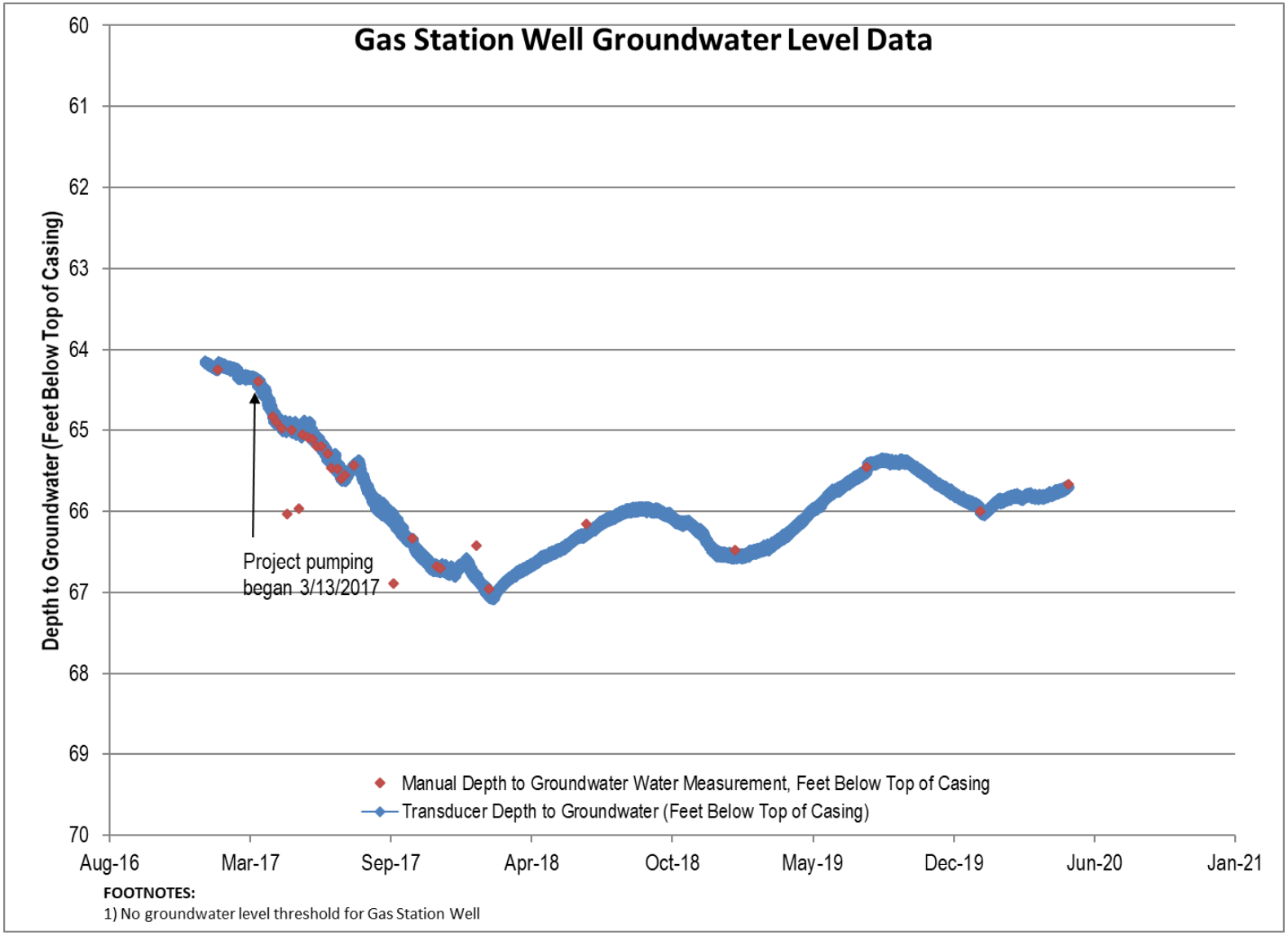
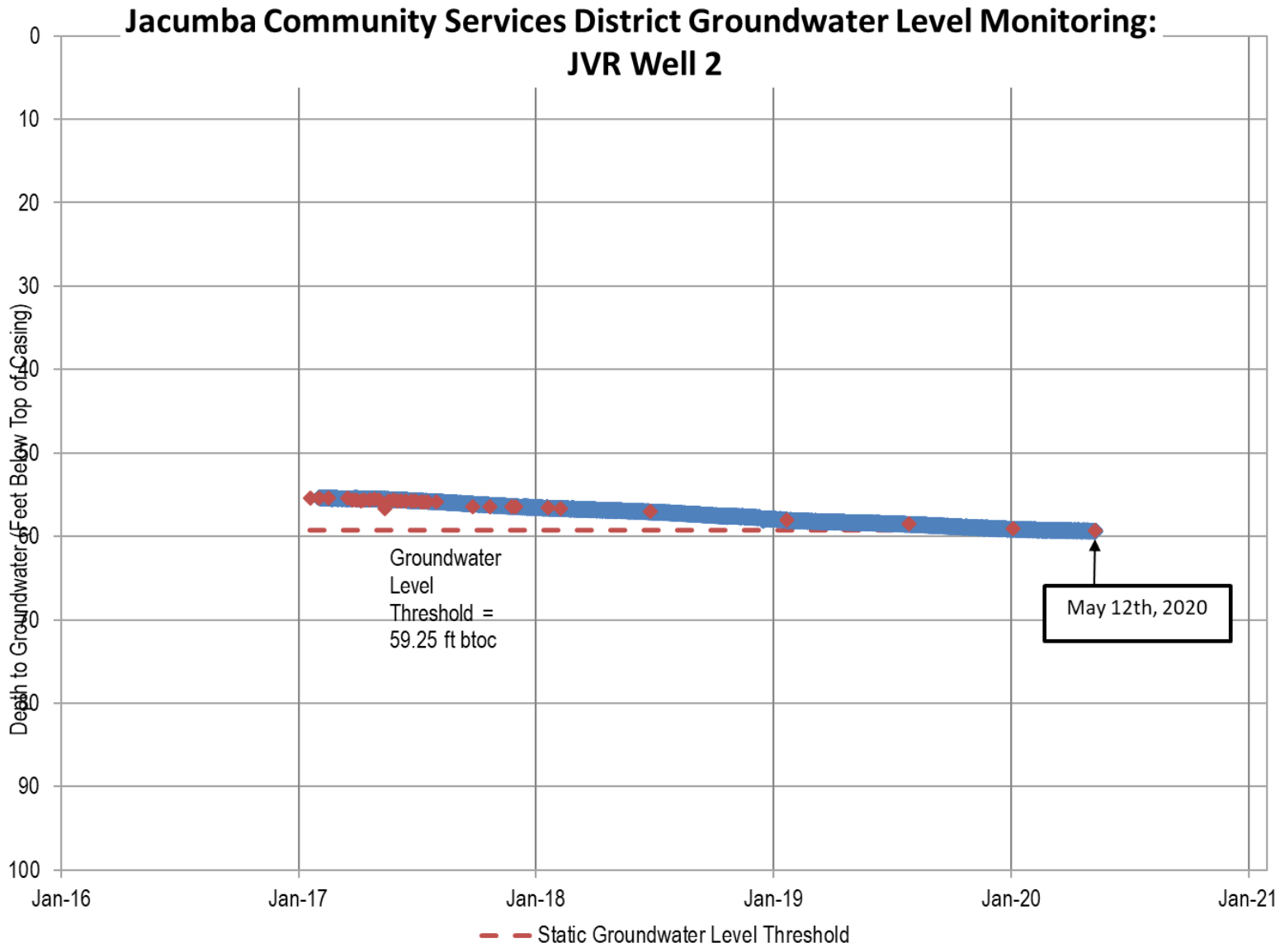
APPENDIX A

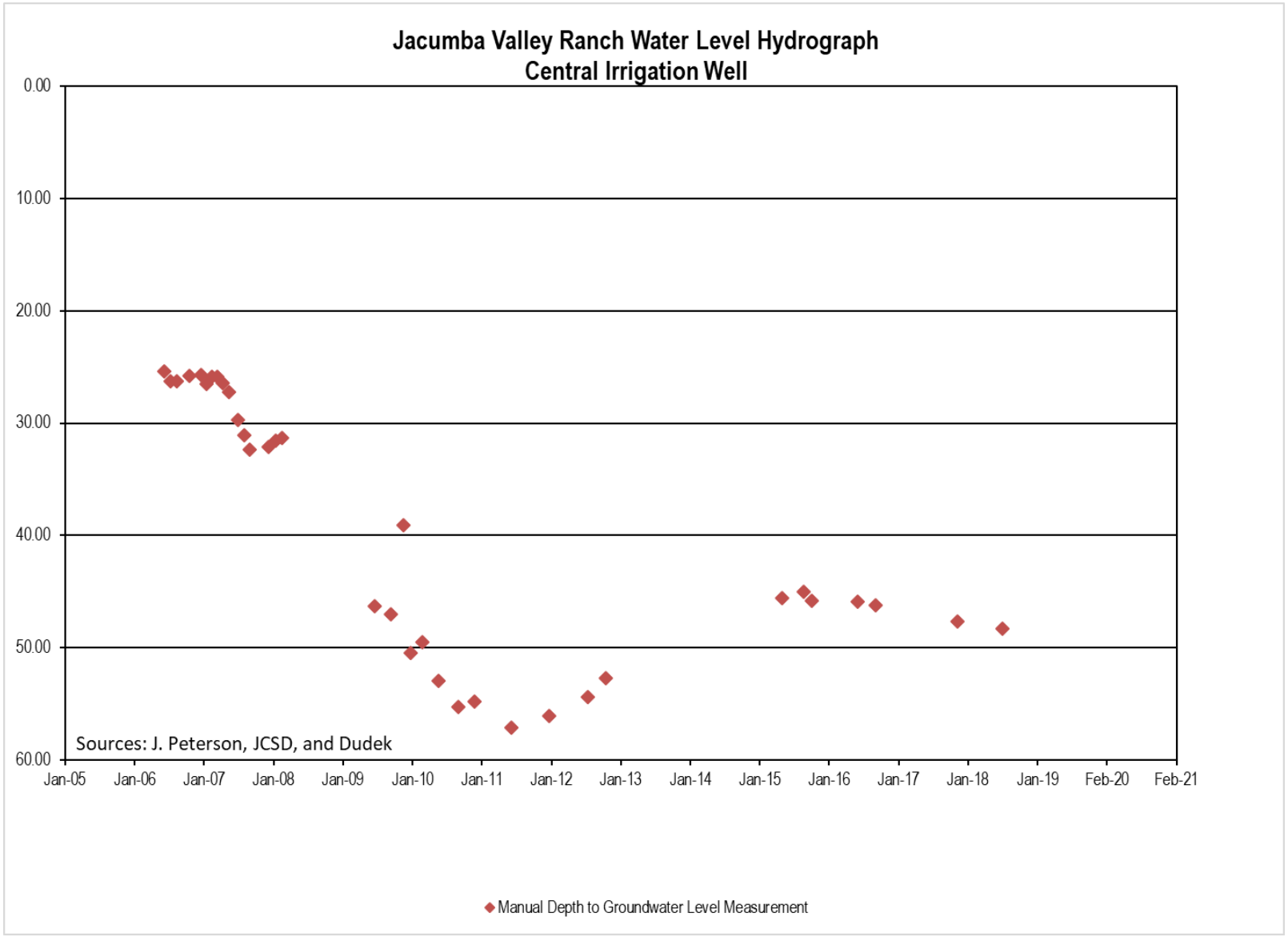
Groundwater Level Hydrographs


Jacumba Valley Groundwater Basin
Highland Center Well
Depth to Groundwater (Feet Below Top of Casing)
0
10
20
30
40
50
60
70
80
90
100
Static level
Pumping level
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Manual Depth to Groundwater Level Measurement
Transducer Depth to Groundwater Level Measurement


Jacumba Valley Groundwater Basin:
Park Well
Depth to Groundwater (Feet Below Top of Casing)
0
10
20
30
40
50
60
70
80
90
Static level
Pumping level
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Transducer Depth to Groundwater Level Measurement
Manual Depth to Groundwater Level Measurement


Gas Station Well Groundwater Level Data
Depth to Groundwater (Feet Below Top of Casing)
60
61
62
63
64
65
66
67
68
69
70
Aug-16
Mar-17
Sep-17
Apr-18
Oct-18
May-19
Dec-19
Jun-20
Jan-21
Project pumping
began 3/13/2017
Manual Depth to Groundwater Water Measurement, Feet Below Top of Casing
Transducer Depth to Groundwater (Feet Below Top of Casing)
FOOTNOTES:
1) No groundwater level threshold for Gas Station Well


Jacumba Community Services District Groundwater Level Monitoring:
JVR Well 2
Depth to Groundwater (Feet Below Top of Casing)
0
10
20
30
40
50
60
70
80
90
100
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Groundwater Level Threshold = 59.25 ft btoc
May 12th, 2020
Static Groundwater Level Threshold


Jacumba Valley Ranch Water Level Hydrograph
Central Irrigation Well
0.00
10.00
20.00
30.00
40.00
50.00
60.00
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Feb-20
Feb-21
Sources: J. Peterson, JCSD, and Dudek
Manual Depth to Groundwater Level Measurement

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