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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AUGUST 2020
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACRONYMS AND ABBREVIATIONS</td>
<td>V</td>
</tr>
<tr>
<td>EXECUTIVE SUMMARY</td>
<td>VII</td>
</tr>
<tr>
<td>1 INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>1.1 Purpose of the Report</td>
<td>1</td>
</tr>
<tr>
<td>1.2 Project Location</td>
<td>1</td>
</tr>
<tr>
<td>1.3 Project Description</td>
<td>1</td>
</tr>
<tr>
<td>1.4 Project Water Demand</td>
<td>3</td>
</tr>
<tr>
<td>1.5 Study Area</td>
<td>5</td>
</tr>
<tr>
<td>1.6 Applicable Groundwater Regulations</td>
<td>5</td>
</tr>
<tr>
<td>2 EXISTING CONDITIONS</td>
<td>9</td>
</tr>
<tr>
<td>2.1 Topographic and Hydrologic Setting</td>
<td>9</td>
</tr>
<tr>
<td>2.2 Climate</td>
<td>9</td>
</tr>
<tr>
<td>2.2.1 Precipitation</td>
<td>10</td>
</tr>
<tr>
<td>2.2.2 Evapotranspiration</td>
<td>13</td>
</tr>
<tr>
<td>2.3 Land Use</td>
<td>13</td>
</tr>
<tr>
<td>2.4 Geology and Soils</td>
<td>14</td>
</tr>
<tr>
<td>2.4.1 Geology</td>
<td>14</td>
</tr>
<tr>
<td>2.4.2 Soils</td>
<td>15</td>
</tr>
<tr>
<td>2.5 Hydrogeologic Units</td>
<td>17</td>
</tr>
<tr>
<td>2.6 Current Groundwater Demand</td>
<td>18</td>
</tr>
<tr>
<td>2.7 Hydrogeologic Inventory and Groundwater Level Trends</td>
<td>19</td>
</tr>
<tr>
<td>2.8 Water Quality</td>
<td>24</td>
</tr>
<tr>
<td>3 WATER QUANTITY IMPACTS ANALYSIS</td>
<td>27</td>
</tr>
<tr>
<td>3.1 50% Reduction of Groundwater Storage</td>
<td>27</td>
</tr>
<tr>
<td>3.1.1 Guidelines for Determination of Significance</td>
<td>27</td>
</tr>
<tr>
<td>3.1.2 Methodology</td>
<td>27</td>
</tr>
<tr>
<td>3.1.3 Significance of Impacts Prior to Mitigation</td>
<td>36</td>
</tr>
<tr>
<td>3.1.4 Mitigation Measures and Design Considerations</td>
<td>36</td>
</tr>
<tr>
<td>3.1.5 Conclusions</td>
<td>36</td>
</tr>
<tr>
<td>3.2 Well Interference and Groundwater Dependent Habitat</td>
<td>36</td>
</tr>
<tr>
<td>3.2.1 Guidelines for Determination of Significance</td>
<td>36</td>
</tr>
<tr>
<td>3.2.2 Aquifer Testing</td>
<td>38</td>
</tr>
<tr>
<td>3.2.3 Significance of Impacts Prior to Mitigation</td>
<td>44</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS (CONTINUED)

<table>
<thead>
<tr>
<th>Section</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2.4 Mitigation Measures and Design Considerations</td>
<td>45</td>
</tr>
<tr>
<td>3.2.5 Conclusions</td>
<td>45</td>
</tr>
<tr>
<td>4 WATER QUALITY IMPACT ANALYSIS</td>
<td>47</td>
</tr>
<tr>
<td>5 SUMMARY OF PROJECT IMPACTS AND MITIGATION</td>
<td>49</td>
</tr>
<tr>
<td>5.1 50% Reduction in Groundwater Storage</td>
<td>49</td>
</tr>
<tr>
<td>5.2 Well Interference</td>
<td>49</td>
</tr>
<tr>
<td>5.3 Groundwater-Dependent Habitat</td>
<td>50</td>
</tr>
<tr>
<td>5.4 Mitigation Measures</td>
<td>50</td>
</tr>
<tr>
<td>6 REFERENCES</td>
<td>51</td>
</tr>
<tr>
<td>7 LIST OF PREPARERS AND PERSONS AND ORGANIZATIONS CONTACTED</td>
<td>57</td>
</tr>
</tbody>
</table>

## APPENDICES

- **A** Construction and Operational Water Demand Estimates
- **B** Well Completion Information
- **C** Well #2 Aquifer Test AQTESOLV Data
- **D** Well #3 Aquifer Test Report
- **E** Groundwater Monitoring and Mitigation Report for the JVR Energy Park Project

## EXHIBITS

1. Annual Precipitation Data Jacumba Rain Gauge 1963 to 2011 | 12 |
2. Jacumba Valley Alluvial Aquifer Groundwater Level Data July 1955 to December 2018 | 23 |
TABLE OF CONTENTS (CONTINUED)

FIGURES

1 Regional Location..................................................................................................................................59
2 Vicinity Map.......................................................................................................................................61
3 Hydrologic Areas..................................................................................................................................63
4 Regional Mean Annual Precipitation.................................................................................................65
5 Current General Plan Land Use..........................................................................................................67
6 Regional Geologic Map.......................................................................................................................69
7 Soils Map...........................................................................................................................................71
8 Hydrogeologic Units............................................................................................................................73
9 On-Site and Off-Site Wells....................................................................................................................75
10 Potential Groundwater-Dependent Habitat......................................................................................77
11 Well #2 24-Hour Constant Rate Test: Well #2 Drawdown..............................................................79
12 Well #2 24-Hour Constant Rate Test: Well #1 Drawdown..............................................................81
13 Well #2 24-Hour Constant Rate Test: Well #2 Projected Drawdown............................................83
14 Well #2 24-Hour Constant Rate Test: Well #1 Projected Drawdown............................................85
15 Well #2 24-Hour Constant Rate Test: Well #2 Recovery...............................................................87
16 Well #2 24-Hour Constant Rate Test: Well #1 Recovery...............................................................89
17 Well #3 72-Hour Constant Rate Test: Well #3 Drawdown............................................................91
18 Well #3 72-Hour Constant Rate Test: Daley Well Hydrograph.....................................................93
19 Well #3 72-Hour Constant Rate Test: Well #3 and Daley Well Projected Drawdown....................95
20 Well #3 72-Hour Constant Rate Test: Daley Well Recovery............................................................97
21 Well #3 72-Hour Constant Rate Test: Well #3 Recovery...............................................................99

TABLES

1 Estimated Construction Water Demand.............................................................................................3
2 Estimated Operational Water Demand .............................................................................................4
3 Estimated Decommission and Dismantling Water Demand..........................................................4
4 Precipitation Data Recorded at Jacumba Rain Gauge.................................................................10
5 Rain Gauges in Project Area............................................................................................................11
6 CIMIS Zone 16 Reference Evapotranspiration..............................................................................13
7 Soil Units within the Contributing Watersheds.............................................................................15
<table>
<thead>
<tr>
<th>Page No.</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Jacumba Valley Alluvial Aquifer Existing Water Demands</td>
</tr>
<tr>
<td>9</td>
<td>Jacumba Valley Well Inventory</td>
</tr>
<tr>
<td>10</td>
<td>Jacumba Valley Alluvial Aquifer Groundwater Demand</td>
</tr>
<tr>
<td>11</td>
<td>Well Completion Information for Constraining Alluvial Saturated Thickness</td>
</tr>
<tr>
<td>12</td>
<td>Jacumba Valley Alluvial Aquifer 2018 Groundwater in Storage Estimate</td>
</tr>
<tr>
<td>13</td>
<td>Alluvial Aquifer Wells Within 0.5-Mile Radius of On-Site Proposed Project Wells</td>
</tr>
<tr>
<td>14</td>
<td>Well #2 Aquifer Test – AQTESOLV Estimated Aquifer Hydraulic Properties</td>
</tr>
<tr>
<td>15</td>
<td>Well #2 Distance Drawdown Calculations</td>
</tr>
<tr>
<td>16</td>
<td>Well #3 Distance Drawdown Calculations</td>
</tr>
</tbody>
</table>
ACRONYMS AND ABBREVIATIONS

<table>
<thead>
<tr>
<th>Acronym/Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
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<td>AC</td>
<td>alternating current</td>
</tr>
<tr>
<td>afy</td>
<td>acre-feet per year</td>
</tr>
<tr>
<td>amsl</td>
<td>above mean sea level</td>
</tr>
<tr>
<td>bgs</td>
<td>below ground surface</td>
</tr>
<tr>
<td>CIMIS</td>
<td>California Irrigation Management Information System</td>
</tr>
<tr>
<td>County</td>
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</tr>
<tr>
<td>ET</td>
<td>potential evapotranspiration</td>
</tr>
<tr>
<td>ETo</td>
<td>reference evapotranspiration</td>
</tr>
<tr>
<td>ft²/day</td>
<td>square feet per day</td>
</tr>
<tr>
<td>GMMP</td>
<td>Groundwater Monitoring and Mitigation Plan</td>
</tr>
<tr>
<td>gpm</td>
<td>gallons per minute</td>
</tr>
<tr>
<td>JCSD</td>
<td>Jacumba Community Services District</td>
</tr>
<tr>
<td>kV</td>
<td>kilovolt</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>operations and maintenance</td>
</tr>
<tr>
<td>Proposed Project</td>
<td>JVR Energy Park Project</td>
</tr>
<tr>
<td>SDG&amp;E</td>
<td>San Diego Gas &amp; Electric</td>
</tr>
<tr>
<td>µg/L</td>
<td>micrograms per liter</td>
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</table>
INTENTIONALLY LEFT BLANK
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 the proposed 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>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
<th>Total Estimated Water Demand (acre-feet)¹</th>
</tr>
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<tbody>
<tr>
<td>Site preparation (clearing, grubbing, grinding, and dust control)</td>
<td>Limited clearing and grubbing will be required for fallowed agricultural land at Jacumba Valley Ranch. Assume pre-weeding of soils with 1-inch of water over 570.5 acres.</td>
<td>48</td>
</tr>
<tr>
<td>Grading</td>
<td>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.</td>
<td>39</td>
</tr>
<tr>
<td>Concrete</td>
<td>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.</td>
<td>1</td>
</tr>
<tr>
<td>Dust abatement²</td>
<td>Value used from Jacumba Solar Construction Estimate: (6) 3,000-gallon water trucks per day</td>
<td>37</td>
</tr>
<tr>
<td>Other construction needs</td>
<td>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</td>
<td>15</td>
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<tr>
<td></td>
<td><strong>Total Construction Water Use</strong></td>
<td><strong>140</strong></td>
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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>
<thead>
<tr>
<th>Activity</th>
<th>Estimated Water Demand (acre-feet)</th>
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<tr>
<td>Panel washing (up to 4 times per year)</td>
<td>2.6</td>
</tr>
<tr>
<td>Landscape buffer</td>
<td>8.4</td>
</tr>
<tr>
<td>Total Water Use per Year</td>
<td>11</td>
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Table 2
Estimated Operational Water Demand

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>
<thead>
<tr>
<th>Activity</th>
<th>Total Estimated Water Demand (acre-feet)</th>
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<tbody>
<tr>
<td>Decommission Dust Abatement</td>
<td>40</td>
</tr>
<tr>
<td>Equipment Washing and Compaction</td>
<td>10</td>
</tr>
<tr>
<td>Total Water Use</td>
<td>50</td>
</tr>
</tbody>
</table>

Table 3
Estimated Decommission and Dismantling Water Demand
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

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

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

<table>
<thead>
<tr>
<th>Station</th>
<th>Location</th>
<th>Elevation (feet amsl)</th>
<th>Years of Operation</th>
<th>Average Annual Rainfall (inches)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boulevard 1</td>
<td>N 32°40', W 116°17&quot;</td>
<td>3,353</td>
<td>1924 to 1967</td>
<td>14.8</td>
<td>NOAA¹</td>
</tr>
<tr>
<td>Boulevard 2</td>
<td>N 32°40', W 116°18&quot;</td>
<td>3,600</td>
<td>1969 to 1994</td>
<td>17.0</td>
<td>NOAA</td>
</tr>
<tr>
<td>Tierra del Sol</td>
<td>N 32°39', W 116°19&quot;</td>
<td>4,000</td>
<td>1971 to 2017</td>
<td>10.8</td>
<td>County²</td>
</tr>
<tr>
<td>Jacumba</td>
<td>N 32°37', W 116°11&quot;</td>
<td>2,800</td>
<td>1963 to 2011</td>
<td>9.64</td>
<td>County³</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Month</th>
<th>Reference Evapotranspiration (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>1.55</td>
</tr>
<tr>
<td>February</td>
<td>2.52</td>
</tr>
<tr>
<td>March</td>
<td>4.03</td>
</tr>
<tr>
<td>April</td>
<td>5.7</td>
</tr>
<tr>
<td>May</td>
<td>7.75</td>
</tr>
<tr>
<td>June</td>
<td>8.7</td>
</tr>
<tr>
<td>July</td>
<td>9.3</td>
</tr>
<tr>
<td>August</td>
<td>8.37</td>
</tr>
<tr>
<td>September</td>
<td>6.3</td>
</tr>
<tr>
<td>October</td>
<td>4.34</td>
</tr>
<tr>
<td>November</td>
<td>2.4</td>
</tr>
<tr>
<td>December</td>
<td>1.55</td>
</tr>
<tr>
<td>Year</td>
<td>62.51</td>
</tr>
</tbody>
</table>

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, 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
Groundwater Resources Investigation Report  
JVR Energy Park Project

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

<table>
<thead>
<tr>
<th>Map Unit, Soil Name</th>
<th>Acres (Percent of the Flat Creek Watershed)</th>
<th>Acres (Percent of the Boundary Creek Watershed)</th>
<th>Acres (Percent of the Walker Canyon – Carrizo Creek Watershed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AcG, Acid Igneous Rock Land</td>
<td>0 (0%)</td>
<td>2,237.66 (15.47%)</td>
<td>2,105.09 (31.49%)</td>
</tr>
<tr>
<td>CaB, Calpine coarse sandy loam, 2–5% slope</td>
<td>0 (0%)</td>
<td>14.39 (0.10%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>CaC, Calpine coarse sandy loam, 5–9% slope</td>
<td>0 (0%)</td>
<td>14.69 (0.10%)</td>
<td>264.68 (3.96%)</td>
</tr>
<tr>
<td>CaD2, Calpine coarse sandy loam, 9–15% slopes, eroded</td>
<td>0 (0%)</td>
<td>41.85 (0.29%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>
# Table 7

## Soil Units within the Contributing Watersheds

<table>
<thead>
<tr>
<th>Map Unit, Soil Name</th>
<th>Acres (Percent of the Flat Creek Watershed)</th>
<th>Acres (Percent of the Boundary Creek Watershed)</th>
<th>Acres (Percent of the Walker Canyon – Carrizo Creek Watershed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CeC, Carrizo very gravelly sand, 0–9% slope</td>
<td>0 (0%)</td>
<td>796.85 (5.51%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>InA, Indio silt loam, 0–2% slope</td>
<td>18.10 (30.33%)</td>
<td>0 (0%)</td>
<td>44.90 (0.67%)</td>
</tr>
<tr>
<td>InB, Indio silt loam, 2–5% slope</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>183.72 (2.75%)</td>
</tr>
<tr>
<td>IoA, Indio silt loam, saline, 0–2% slope</td>
<td>0 (0%)</td>
<td>0.02 (0.001%)</td>
<td>382.58 (5.72%)</td>
</tr>
<tr>
<td>LaE2, La Posta loamy coarse sand, 5–30% slopes, eroded</td>
<td>0 (0%)</td>
<td>1,854.48 (12.82%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>LcE2, La Posta rocky loamy coarse sand, 5–30% slope</td>
<td>0 (0%)</td>
<td>1,649.29 (11.40%)</td>
<td>43.92 (0.66%)</td>
</tr>
<tr>
<td>LdE, La Posta-Sheephead complex, 9–30% slopes</td>
<td>0 (0%)</td>
<td>2,339.43 (16.17%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>LdG, La Posta-Sheephead complex, 30–65% slopes</td>
<td>0 (0%)</td>
<td>258.21 (1.78%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Lu, Loamy alluvial land</td>
<td>0 (0%)</td>
<td>17.35 (0.12%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>MnB, Mecca coarse sandy loam, 2–5% slopes</td>
<td>4.86 (8.14%)</td>
<td>0 (0%)</td>
<td>62.83 (0.94%)</td>
</tr>
<tr>
<td>MvC, Mottsville loamy coarse sand, 2–9% slopes</td>
<td>0 (0%)</td>
<td>948.47 (6.56%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>MvD, Mottsville loamy coarse sand, 9–15% slopes</td>
<td>0 (0%)</td>
<td>65.60 (0.45%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>RaC, Ramona sandy loam, 5–9% slopes</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>168.35 (2.52%)</td>
</tr>
<tr>
<td>RaD2, Ramona sandy loam, 9–15% slopes, eroded</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>26.00 (0.39%)</td>
</tr>
<tr>
<td>RKA, Reiff fine sandy loam, 0-2% slopes</td>
<td>17.31 (29.00%)</td>
<td>0 (0%)</td>
<td>262.87 (3.93%)</td>
</tr>
<tr>
<td>RsC, Rositas loamy coarse sand, 2–9% slope</td>
<td>0 (0%)</td>
<td>152.95 (1.06%)</td>
<td>531.38 (7.95%)</td>
</tr>
<tr>
<td>RuG, Rough broken land</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>342.31 (5.12%)</td>
</tr>
<tr>
<td>SrD, Sloping gullied land</td>
<td>19.41 (32.53%)</td>
<td>12.55 (0.09%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>SvE, Stony land</td>
<td>0 (0%)</td>
<td>255.46 (1.77%)</td>
<td>933.88 (13.97%)</td>
</tr>
</tbody>
</table>
Table 7
Soil Units within the Contributing Watersheds

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

*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.  

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

<table>
<thead>
<tr>
<th>Groundwater Extraction Sources</th>
<th>Wells Names</th>
<th>Total Water Demand (acre-feet per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacumba Valley Ranch Water Co.</td>
<td>Well Km</td>
<td>5&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Jacumba Community Services District (JCSD) (potable)</td>
<td>Well 4</td>
<td>119.5&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>JCSD (non-potable)</td>
<td>Highland Center Well, Park Well</td>
<td>53.6&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Potential Domestic Wells</td>
<td>Private Domestic Wells</td>
<td>3&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Total Water Demand</strong></td>
<td></td>
<td><strong>181.1</strong></td>
</tr>
</tbody>
</table>

<sup>a</sup> 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.

<sup>b</sup> Estimated based on 0.5 afy for 239 potable Jacumba Community Services District connections.

<sup>c</sup> Maximum demand based on meter reads from February 2017 to February 2018.

<sup>d</sup> 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.

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<sup>2</sup> 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

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

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

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

- Reported pumping capacity provided by JCSD.
- Alluvial depth based on total depth of Well #4.
- Pumping rate based on airlifting by driller.
- 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 (Scotchkkote™) 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 Scotchkkote (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

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Historical Water Demand (afy)</th>
<th>Current Water Demand (afy)</th>
<th>Future Water Demand During Construction (afy)</th>
<th>Future Ongoing Water Demand for O&amp;M (afy)</th>
<th>Future Maximum Demand During Construction (acre-feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Site (Jacumba Valley Ranch; Bomnt Farms)</td>
<td>2,066; 741–995</td>
<td>0</td>
<td>140</td>
<td>11</td>
<td>140</td>
</tr>
<tr>
<td>Jacumba Valley Ranch Water Company</td>
<td>242</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Private Domestica</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>JCSD (Potable)</td>
<td>80–146b</td>
<td>119.5</td>
<td>0c</td>
<td>0c</td>
<td>0</td>
</tr>
<tr>
<td>JCSD (Non-Potable)</td>
<td>53.6</td>
<td>4d</td>
<td>4 (ongoing)d 290 (one-time use)e</td>
<td>4 (ongoing)d 7.3 (future O&amp;M)</td>
<td>294e</td>
</tr>
<tr>
<td><strong>Total Estimated Water Demand</strong></td>
<td><strong>2,212</strong></td>
<td><strong>131.5</strong></td>
<td><strong>302</strong></td>
<td><strong>19.3</strong></td>
<td><strong>302</strong></td>
</tr>
<tr>
<td><strong>Total Estimated Water Demand With Project</strong></td>
<td><strong>2,212</strong></td>
<td><strong>131.5</strong></td>
<td><strong>442</strong></td>
<td><strong>30.3</strong></td>
<td><strong>442</strong></td>
</tr>
</tbody>
</table>

Source: Barrett 1996; Dudek 2015; Trout, 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

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

— = 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

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

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 (Lwel 001506), and Wells J3 and J4 (Swenson 1981). Depth to water estimated from an average of the Highland Center Well (Lwel 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

<table>
<thead>
<tr>
<th>Well Name</th>
<th>Use</th>
<th>Distance from Well #2</th>
<th>Distance from Well #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacumba Valley Ranch Water Company Well Km</td>
<td>Public/Potable</td>
<td>2,453</td>
<td>3,548</td>
</tr>
<tr>
<td>Highland Center Well</td>
<td>Public/Non-Potable</td>
<td>1,817</td>
<td>4,835</td>
</tr>
<tr>
<td>Park Well</td>
<td>Public/Non-Potable</td>
<td>2,256</td>
<td>5,025</td>
</tr>
<tr>
<td>Border Patrol Well</td>
<td>Private/Inactive</td>
<td>1,892</td>
<td>6,235</td>
</tr>
</tbody>
</table>

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

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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):

\[
s = \frac{114.6 \ Q \ W(u)}{T}
\]

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:

\[
u = \frac{1.87r^2S}{Tt}
\]

- \( r \) = distance from pumping well (feet)
- \( S \) = coefficient of storage (dimensionless)
The W(u) function, known as the Theis well function, is equal to:

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

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 (ft²/day) and 26,410 ft²/day in Well #1, and 33,050 ft²/day and 28,310 ft²/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>
<thead>
<tr>
<th>Solution Method</th>
<th>Estimated Aquifer Hydraulic Properties Estimates</th>
<th>Residual Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Transmissivity (square feet per day)</td>
<td>Hydraulic Conductivity (feet per day)</td>
</tr>
<tr>
<td>Well #1 (Observation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theis</td>
<td>36,290</td>
<td>907</td>
</tr>
<tr>
<td>Neuman</td>
<td>26,410</td>
<td>660</td>
</tr>
<tr>
<td>Well #2 (Pumping)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theis</td>
<td>33,050</td>
<td>826</td>
</tr>
<tr>
<td>Neuman</td>
<td>28,310</td>
<td>708</td>
</tr>
</tbody>
</table>

**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 ft²/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 ft²/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

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

gpm = gallons per minute; u = a ratio of distance and storativity over transmissivity and time. See Section 3.2.2, 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 ft²/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 ft²/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 ft²/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

<table>
<thead>
<tr>
<th>Nearest Off-Site Well or Groundwater-Dependent Habitat</th>
<th>Distance from Pumping Well #2 (feet)</th>
<th>Drawdown After 90 Days in Feet at a Constant Pumping Rate of 352 gpm</th>
<th>Drawdown After 1 Year in Feet at a Constant Pumping Rate of 87 gpm</th>
<th>Drawdown After 5 Years in Feet at a Constant Pumping Rate of 17 gpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesquite Basque</td>
<td>140</td>
<td>3.66</td>
<td>0.0015</td>
<td>0.0004</td>
</tr>
<tr>
<td>Off-Site Groundwater Production Wells Greater than 0.5 Miles from Well #3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Well KM</td>
<td>3,548</td>
<td>0.15</td>
<td>0.9356</td>
<td>0.17</td>
</tr>
</tbody>
</table>
Table 16
Well #3 Distance Drawdown Calculations

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

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...
Groundwater Resources Investigation Report
JVR Energy Park Project

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.
6 REFERENCES


Devine, B. 2019. “Jacumba Community Services District Service Connections.” Personal communication from B. Devine (General Manager Jacumba Community Services District).


Groundwater Resources Investigation Report
JVR Energy Park Project


Groundwater Resources Investigation Report
JVR Energy Park Project


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 Manager, Jacumba Community Services District, assisted with background information and data for this report.
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FIGURE 1
Regional Location
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SOURCE: ESRI
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Hydrologic Areas

SOURCE: USGS

FIGURE 3
Groundwater Resources Investigation - JVR Energy Project
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Regional Mean Annual Precipitation

**Mean Annual Precipitation (Inches)**
- 3.5 in.
- 4.5 in.
- 8 in.
- 9 in.
- 11 in.
- 13 in.
- 14 in.
- 18 in.

*Note: Hatched area precipitation data inferred from Swenson, 1981 isohyetal lines*

**SOURCE:** County of San Diego; SANDAG; Swenson, 1981
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Current General Plan Land Use

Groundwater Resources Investigation - JVR Energy Project

FIGURE 5

SOURCE: SANDAG, SanGIS
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**Geologic Units (CGS 2012)**
- Late Holocene (Surficial Deposits)
  - Qa, Alluvial Valley Deposits
- Middle to Early Pleistocene
  - Qvot, Very Old Terrace Deposits
- Tertiary Units (Bedrock)
  - Qa, Alluvial Valley Deposits
  - Tss, Coarse-Grained Tertiary Age Formations
- 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 granitic rocks, Cretaceous
  - MZ, Sedimentary, Mesozoic
- Geologic Contacts (GSA 2005)
  - Location accurate

**SOURCE:** USGS; GSA; Swenson, 1981

**FIGURE 6**
Regional Geologic Map
Groundwater Resources Investigation - JVR Energy Park
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 loamy coarse sand, 5 to 30 percent slopes, 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
- RaA, 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 slopes
- ToE2, Tollhouse rocky coarse sandy loam, 5 to 30 percent slopes, eroded
INTENTIONALLY LEFT BLANK
Hydrogeologic Units

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

FIGURE 8

Hydrogeologic Units

source: Swenson, 1981; DWR; CGS 2012

*Note: Aquifer thickness wells include Swenson, 1981 study wells and wells with available completion information.
On-site Groundwater Wells
- Production
- Inactive
- Shallow Monitoring Well

JCSD Groundwater Wells
- Active Non-Potable
- Active Non-Potable Fractured Rock
- Active Potable
- Inactive Potable Fractured Rock

Off-site Groundwater Wells
- Active Private
- Inactive
- Monitoring
Groundwater Resources Investigation Report
JVR Energy Park Project

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Potential Groundwater-Dependent Habitat

**Vegetation**
- Big Sagebrush Scrub
- Desert Saltbush Scrub
- Developed
- Disturbed Habitat
- Non-Vegetation Channel
- Sonoran Mixed Woody Scrub
- Sonoran Mixed Woody and Succulent Scrub

**Potential Groundwater-Dependent Habitat**
- Desert Sink Scrub
- Mesquite Bosque

**source**: Dudek 2019

**Figure 10**

Potential Groundwater-Dependent Habitat

Groundwater Resources Investigation - JVR Energy Park
Figure 11. Well #2 24-Hour Constant Rate Test: Well #2 Drawdown

- Average Pumping Rate = 317 GPM

Pump Off at 24 Hours
Figure 12. Well #2 24-Hour Constant Rate Test: Well #1 Drawdown

Pump Off at 24 Hours
Figure 13. Well #2 24-Hour Constant Rate Test: Well #2 Projected Drawdown

Projected Drawdown at 90 Days = 3.6 feet
Projected Drawdown at 1 Year = 3.8 feet
Projected Drawdown at 5 Years = 4.0 feet

Average Pumping Rate = 317 gpm
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Figure 14. Well #2 24-Hour Constant Rate Test: Well #1 Projected Drawdown

Projected Drawdown at 5 Years = 2.17 feet
Projected Drawdown at 1 Year = 1.81 feet
Projected Drawdown at 90 Days = 1.49 feet

Well #2 pumping at an average rate of 317 gpm
Figure 15. Well #2 24-Hour Constant Rate Test: Well #2 Recovery

Projected residual drawdown at $t/t' = 1$ is 0.02 feet.
Figure 16. Well #2 24-Hour Constant Rate Test: Well #1 Recovery

Projected residual drawdown at t/t' = 1 is 0.01 feet
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Figure 17. Well #3 72-Hour Constant Rate Test: Well #3 Drawdown

- Drawdown (Feet)
- Elapsed Time (Minutes)

Average Pumping Rate = 350 gpm

Pump Off at 72 Hours

Source: Geosyntec 2012
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

Average Well #3 Pumping Rate = 350 gpm

Well #3 Projected Drawdown at:
- 90 Days = 11.1 feet
- 1 Year = 12.7 feet
- 5 Years = 14.5 feet

Daley Well Projected Drawdown at:
- 90 Days = 8.0 feet
- 1 Year = 9.5 feet
- 5 Years = 11.4 feet

Source: Geosyntec 2012
Figure 20. Well #3 72-Hour Constant Rate Test: Daley Well Recovery

Projected residual drawdown at \( t/t' = 1 \) is 0.5 feet

Source: Geosyntec 2012
Figure 21. Well #3 72-Hour Constant Rate Test: Well #3 Recovery

Projected residual drawdown at $t/t' = 1$ is 0.5 feet

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**

<table>
<thead>
<tr>
<th>Project: JVR Energy Park, Jacumba Hot Springs, San Diego County, California</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject: PRELIMINARY ESTIMATE Construction Water Demand Prepared May 8, 2020</td>
</tr>
</tbody>
</table>

### 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 | acres |
| Total water to clear, grub, grind and pre-wet | 15,492,586 | gallons |
| Conversion to gallons per acre-foot | 325,851 |
| **Total water to clear, grub, grind and pre-wet** | 48 | acres-foot |
| Input expected duration to clear, grub and grind | 90 | days |
| Water demand to clear, grub and grind | 0.53 | acres-foot/day |
| Water demand to clear, grub and grind | 172,140 | gallons/day |

### Estimated Mass grading

| Input quantity of on-site fill used to balance site | 264,000 | cubic yards |
| Input optimum moisture content | 9 | % |
| Input observed moisture content | 2.0 | % |
| Input dry unit weight of on-site fill | 115 | pounds per cubic foot (PCF) |
| Weight of water to reach saturation | 8.050 | PCF |
| Water required to hydrate and gain compaction | 29 | gallons/cubic yard (GAL/CY) |
| Input contingency to account for evaporation during summer months | 1.667 | |
| Water required to hydrate and gain compaction | 48 | gallons/cubic yard (GAL/CY) |
| Water for grading | 12,785,294 | gallons |
| Conversion to gallons per acre-foot | 325,851 |
| **Water required for grading** | 39.2 | acres-foot |
| Input quantity of Scrapers (CAT 627H @ 24 cubic yards per load) | 4 | units |
| Volume per haul | 96 | cubic yards/unit |
| Time per haul | 10 | minutes |
| Hauls per hour | 6 | units/hour |
| Grading Rate | 576 | cubic yards/hour (CY/Hr) |
| Grading Rate for each work day | 4,608 | cubic yards/day (CY/DAY) |
| Time to complete grading (work days) | 90 | days |
| Water demand to complete mass grading | 0.44 | acres-foot/day |
| Water demand to complete mass grading | 142,059 | gallons/day |

### Estimated Water Use for Concrete

| Quantity of concrete for concrete pad foundations | 5594 | cubic yards |
| Rate of water use for concrete hydration | 40 | gallons/cubic yard (GAL/CY) |
| Total water use for concrete pad foundations (Substation + inverters) | 225,957 | gallons |
| **Total water use for concrete pad foundations (Substation + inverters)** | 0.7 | acres-foot |

### Dust Control

| Number of Construction Days after clearing/grubbing/grinding | 365 | Days |
| Typical Rate of Water Use | 30,000 | gallons/day |
## Draft Preliminary Construction Water Demand Estimation Sheet

<table>
<thead>
<tr>
<th>Approx. No. High Wind Days over Period (Based on Boulevard Met Data)</th>
<th>27</th>
<th>High Wind Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of Water Use on Windy Days (Average Winds &gt; 15 MPH)</td>
<td>54,000</td>
<td>GAL/DAY</td>
</tr>
<tr>
<td>Total water use for high wind days</td>
<td>1,458,000</td>
<td>GAL</td>
</tr>
<tr>
<td>Total Water Use for Daily Dust Control</td>
<td>12,138,000</td>
<td>GAL</td>
</tr>
<tr>
<td><strong>Total Water Use for Daily Dust Control</strong></td>
<td>37.3</td>
<td>ACRE-FT</td>
</tr>
<tr>
<td><strong>Additional Miscellaneous Items</strong></td>
<td>13.1</td>
<td>ACRE-FT</td>
</tr>
<tr>
<td>Fire Protection Requirements</td>
<td>30,000</td>
<td>GAL</td>
</tr>
<tr>
<td>Noxious Weed Mitigation</td>
<td>624,000</td>
<td>GAL</td>
</tr>
<tr>
<td>Quarter-mile underground Gen-Tie Line</td>
<td>13,200</td>
<td>GAL</td>
</tr>
<tr>
<td>Hydroseeding</td>
<td>4,279,050</td>
<td>GAL</td>
</tr>
<tr>
<td><strong>Total Estimated Construction Demand</strong></td>
<td>45,588,087</td>
<td>Gallons</td>
</tr>
<tr>
<td><strong>Total Project Water Usage</strong></td>
<td>139.9</td>
<td>ACRE-FT</td>
</tr>
</tbody>
</table>

## Draft Preliminary Operation and Maintenance Water Demand Estimation Sheet

<table>
<thead>
<tr>
<th>Number of panels</th>
<th>300,000</th>
<th>panels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel rating</td>
<td>300</td>
<td>watts</td>
</tr>
<tr>
<td>Project size</td>
<td>90</td>
<td>MW</td>
</tr>
<tr>
<td>Panel type</td>
<td>72</td>
<td>cells per panel</td>
</tr>
<tr>
<td>Panel height</td>
<td>6.42</td>
<td>feet</td>
</tr>
<tr>
<td>Panel width</td>
<td>3.25</td>
<td>feet</td>
</tr>
<tr>
<td>Panel area</td>
<td>21</td>
<td>square feet</td>
</tr>
<tr>
<td>Project panel area</td>
<td>6,259,500</td>
<td>square feet</td>
</tr>
<tr>
<td>Project panel area</td>
<td>695,500</td>
<td>square yards</td>
</tr>
<tr>
<td>Per wash water demand</td>
<td>0.3</td>
<td>gallons per square yard</td>
</tr>
<tr>
<td>Per wash water demand</td>
<td>208,650</td>
<td>gallons</td>
</tr>
<tr>
<td>Washes per year</td>
<td>4</td>
<td>washes per year</td>
</tr>
<tr>
<td>Gallons per year</td>
<td>834,600</td>
<td>gallons</td>
</tr>
<tr>
<td>Panel Washing Water Demand</td>
<td>2.6</td>
<td>acre-feet per year</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Landscape Buffer</th>
<th>5.39</th>
<th>acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIMIS Zone 16 Reference Evapotranspiration (Eto)</td>
<td>5.21</td>
<td>feet</td>
</tr>
<tr>
<td>Crop Coefficient (expressed as percentage of Eto)</td>
<td>0.3</td>
<td>percent</td>
</tr>
<tr>
<td>Landscape Buffer Water Demand</td>
<td>8.4</td>
<td>acre-feet per year</td>
</tr>
</tbody>
</table>
## Draft Preliminary Operation and Maintenance Water Demand Estimation Sheet

<table>
<thead>
<tr>
<th>Project: JVR Energy Park, Jacumba Hot Springs, San Diego County, California</th>
</tr>
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<tbody>
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</tr>
</tbody>
</table>

| Total Estimated Operational Water Use | 11.0 | acre-feet per year |

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APPENDIX B

Well Completion Information
COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES

WELL PERMIT APPLICATION

APN 614 100 20
Control # 6/0 26/83

<table>
<thead>
<tr>
<th>TYPE OF WORK (Check)</th>
<th>USE (Check)</th>
<th>EQUIPMENT (Check)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Well</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repair or Modification</td>
<td></td>
<td>Rotary Mud</td>
</tr>
<tr>
<td>Time Extension</td>
<td>Agricultural</td>
<td>Cable Tool</td>
</tr>
<tr>
<td>Destruction</td>
<td>Industrial</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other</td>
</tr>
</tbody>
</table>

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

PROPOSED CASING
Type PVC Depth FULL Diameter 6 1/2 Wall or Gage 240

PROPOSED SEALING ZONE(S)
From --- to --- Feet
From --- to --- Feet
From --- to --- Feet

SEALING MATERIAL (Check)
Neat Cement Grout |
Sand Cement Grout |
Bentonite Clay |
Concrete |

OTHER SPECIFY:

DATE OF WORK
Start MAY 10
Completion MAY 20

NAME OF WELL OWNER
WILLIAM KLETZLER
LOCATION OF WELL
Interstate 8
Sec Map (JACUMAG)

NAME OF WELL DRILLER
FRANK MURPHY
COMPANY
MURPHY'S WELL DRILLING

DISPOSITION OF APPLICATION
FOR HEALTH OFFICERS USE ONLY

☑ APPROVED

☑ 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.

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.

None

HEALTH OFFICER
5/17/80

APPLICATION'S SIGNATURE
5/17/80

DHS:EHP-731 (3/85) Page 1 of 2
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.
WATER WELL DRILLERS REPORT

No. 341230

State Well No. __________________
Other Well No. __________________

Notice of Intent No. __________________
Local Permit No. or Date: U-02-683

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.

(2) LOCATION OF WELL (See instructions):
County: SAN DIEGO Owner's Well Number __________________
Well address different from above: JACUMBA VALLEY RANCH __________________
Township: 17 5 Range: 8 E Section: 3 5
Distance from cities, roads, railroads, fences, etc.: SIDE MAP

(3) TYPE OF WORK:
New Well [ ] Deepening [ ]
Reconstruction [ ]
Reconditioning [ ]
Horizontal Well [ ]
Deactivation [ ] (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic [ ]
Irrigation [ ]
Industrial [ ]
Test Well [ ]
Municipal [ ]
Other [ ]
(Descibe)

(5) EQUIPMENT:
Rotary [ ] No. _______ Reverse [ ]
Cable [ ] Air [ ]
Other [ ]

(6) CASING INSTALLED:
Steel [ ] Plastic [ ] Other [ ]
Color [ ]

(7) CASING INSTALLED:
Type of installation or size of section:
From ft. To Dia. Gage or Wall

(8) PERFORATIONS:

(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 [ ] D. CEMENT [ ]

(10) WATER LEVELS:
Depth of first water, if known APPROX. 24 ft.
Standing level after well completion APPROX. 41 ft.

(11) WELL TESTS:
Was well test made? Yes [ ] No [ ]
If yes, by whom? ____________________
Type of test: Pump [ ] Water level [ ]
Depth to water at start of test ______ ft.
At end of test ______ ft.
Discharge ______ gal/min after ______ hours
Water temperature ______
Chemical analysis made? Yes [ ] No [ ]
If yes, by whom? ____________________
Was electric log made? Yes [ ] No [ ]
If yes, by whom? ____________________

(12) WELL LOG:
Total depth 81 ft. Completed depth 75 ft.
Formation (Describe by color, character, size or material):
0 - 24' CLAY - RUST BROWN
24 - 55' CORSE SANDO
55 - 65' BROKEN GRAVEL
65 - 75' BLACK SANDO

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge.
Signed ____________________ Date: 5-10-1990

WELL DRILLER'S ADDRESS:
Name: ____________________
Address: PO Box 111
City: JACUMBA CA ZIP 92034
License No. 505834 Date of this report 5-23-90

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge.
Signed ____________________ Date: 5-10-1990

WELL DRILLER'S ADDRESS:
Name: ____________________
Address: PO Box 111
City: JACUMBA CA ZIP 92034
License No. 505834 Date of this report 5-23-90
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

1. Property Owner: BORNT FARMS
   Phone: 760-356-2233
   Mailing Address: 2307 EAST HWY 98
   City: Holtville
   Zip: 92250

2. Well Location - Assessors Parcel Number: 660-020-05
   Site Address: OLD HWY 80
   City: Jacumba
   Zip: 91934

3. Well Contractor - Well Driller: Joe Edwards
   Company Name: FAIR DRILLING
   Mailing Address: 12029 OLD CASTLE RD
   City: Valley Center
   Zip: 92082
   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
   Type: Steel A-139-B
   Depth: 100
   Diameter: 14 in.
   Wall/Gauge: 2.50

   Conductor Casing
   ☐ Yes ☐ No
   Depth: 20 ft.
   Diameter: 24 in.
   Wall/Gauge: 2.50

   Filter/Filter Material
   ☐ Yes ☐ No
   From: 20 To: 100
   Type: Pea Gravel
   Wall/Gauge: 2.50

   Perforations
   55.304 Stainless Wire Wrap Screen
   From: 40 To: 100

9. Annular Seal: Depth:
   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: [Signature]
Date: 1-26-05

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: [Signature]
Date: 1-26-05
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.
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.
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

1. Property Owner: BORNT FARMS
   2301 EAST HWY 98
   Holtville CA 92250
   Phone: 619-766-4213

2. Well Location - Assessors Parcel Number: 661-060-22
   Old Hwy 80
   Jacumba

3. Well Contractor - Well Driller: Joe Edwards
   12029 Old Castle Rd
   Valley Center 92082
   Phone: 760-749-0701

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: 

8. Proposed:
   Casing
   Type: Steel
   Depth: 120' Diameter: 14" in.
   Wall/Gauge: .250
   Conductor Casing
   Depth: 20' Diameter: in.
   Wall/Gauge: 
   Filter/Filler Material
   Depth: 60' From: 20' To: 120' Type: 
   Wall/Gauge: 
   Perforations
   Depth: 60' From: To:

9. Annular Seal: Depth: 2.0 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: 
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: 
Date: 5/19/06
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.
WELL COMPLETION REPORT

STATE OF CALIFORNIA

Owner's Well No. TEST WELL
Date Work Began 5/26/06
Local Permit Agency DEH

Permit No. 17243 Permit Date 5/19/06

DEG.

ORIENTATION (±)

VERTICAL HORIZONTAL ANGLE (SPECIFY)

DESCRIPTION
Describe material, grain size, color, etc.

DEPTH FROM SURFACE

FL. TO FL.

0 8 Loose silty sand - brown color
6 17 Clayey sand
17 43 Medium to coarse sand - brown color
45 75 Medium to coarse sand and gravel - sub-rounded to sub-rounded, partly cemented - red to purple color
75 108 Clayey sand and gravel aggregated - purple color
108 120 Hard, cemented aggregates - purple color

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

WELL LOCATION

Address
City
County
APN Book 001 Page 000 Parcel 22
Township Range 18S
Section 9

LOCATION SKETCH

OLD HWY 80

MEXICO

SOUTH

EAST

W

ACTIVITY (±)

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
CATHODIC PROTECTION
HEAT EXCHANGE
DIRECT PUMP
INJECTION
VAPOR EXTRACTION
SPARGING
REMEDiation
OTHER (SPECIFY)

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 60 (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 well's long-term yield.

DEEP FROM SURFACE

BORE
HOLE DIAM. (Inches)

FL. TO FL.

TYPE (±)
MATERIAL / GRADE
INTERNAL DIAMETER (IN.
THICKNESS
SLOT SIZE IF ANY (IN.

FL. TO FL.

Casing (S)

DEEP FROM SURFACE

ANNULAR MATERIAL

TYPE

FL. TO FL.

CE- NENT (±)
BEN- TONITE (±)
FILL (±)
FILTER PACK (TYPE/SIZE)

FL. TO FL.

0 20 X
0 20 120 X

CERTIFICATION STATEMENT

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

NAME: Brian Drilling & Pump Co Inc

12029 Old Castle Rd. Valley Center, Ca 92082

ADDRESS
CITY
STATE
ZIP

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

DWR 185 REV. 05-03

C-57 LICENSED WATER WELL CONTRACTOR

DATE SIGNED: 7/5/06

C-57 LICENSE NUMBER: 717450
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

1. Property Owner: **BORNT FARMS**
   2307 EAST HWY 98
   Holtville, CA 92250
   Phone: 619-766-4213

2. Well Location - Assessors Parcel Number: 660-150-04
   **OLD HWY 80**
   **JACUMBA**

3. Well Contractor - Well Driller: **Joe Edwards**
   12029 OLD CASTLE RD
   Valley Center, CA 92082
   Phone#: 760-749-0401
   C-57#: 38287
   □ Cash Deposit □ Bond Posted

4. Use: [x] Private  □ Public  □ Industrial  □ Cathodic  □ Other AG-wel

5. Type of Work: [x] New  □ Reconstruction  □ Destruction  Time Extension: □ 1st □ 2nd

6. Type of Equipment: [ ] Rotary

7. Depth of Well: Proposed: 100'  Existing: 0'

8. Proposed:
   - Casing
     Type: Steel-A-129  □ Yes  □ No
     Depth: 100'  Diameter: 14 in.
     Wall/Gauge: 250
   - Conductor Casing
     Depth: 20'  Diameter: 24 in.
     Wall/Gauge: 250
   - Filter/Filler Material
     Type:  From: 20'  To: 100'  From: 50'  To: 90'
   - Perforations
     From:  To:

9. Annular Seal: Depth: 20'  Sealing Material: CEMENT
   Borehole diameter: 32'  Annular Thickness 4'  in.
   Conductor diameter: 24'  in.


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: 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: [Signature]
Date: 8/4/06
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.

[Diagram showing location details including coordinates and dimensions]
Gravel Packing
Steel Conductor Casing
Cement

14" Liner
Perforation
Screen
Wire Wrap No. 0.80 Slot
304 Stainless Steel

Welded Plate Bottom

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

WELL DEPTH
94'
40'

BY: [Signature] 8-5-06
JOE FAIN - OWNER
**WELL COMPLETION REPORT**

**STATE OF CALIFORNIA**

Refer to Instruction Pamphlet No. 1085057

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**WELL LOCATION**

Address: Old Hwy 86

City: Jacumba

County: San Diego

APN Book: 660 Page: 150 Parcel: 04

Township: 32S Range: 4W Section: 9

Lat: 32°16'07" N Long: 116°10'726 W

**ACTIVITY (X):**

- NEW WELL
- MODIFICATION/REPAIR
- Other (Specify: )

**USES (X):**

- WATER SUPPLY
- Domestic
- Public Irrigation
- Industrial

- MONITORING
- TEST WELL
- CATHOLIC PROTECTION
- HEAT EXCHANGE
- DIRECT PUSH
- INJECTION
- VAPOR EXTRACTION
- SPARING
- REMEDIATION
- OTHER (SPECIFY: )

---

**WATER LEVEL & YIELD OF COMPLETED WELL**

**Depths:**

- Depth to water: 57 feet below surface
- Depth of static water: 38 feet & date measured: 8/2/06
- Estimated yield: 1000 GPM & test type: airlift
- Test length: 4 hrs., total drawdown: 40 feet

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

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**DEPT OF BORING / FEET**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Borehole Diameter (inches)</th>
<th>Type (X)</th>
<th>Casing ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>20</td>
<td>Steel</td>
<td>23.5</td>
</tr>
<tr>
<td>0</td>
<td>50</td>
<td>Steel</td>
<td>13.5</td>
</tr>
<tr>
<td>50</td>
<td>96</td>
<td>Steel</td>
<td>13.5</td>
</tr>
</tbody>
</table>

**DEPT FROM SURFACE / ANNUAL MATERIAL**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Casing ($)</th>
<th>Annular Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>20</td>
<td>5/16x7</td>
</tr>
<tr>
<td>0</td>
<td>96</td>
<td></td>
</tr>
</tbody>
</table>

---

**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

ADDRESS: 12029 Old Castle Ed, Valley Center, Ca 92082

CITY: 85-06 STATE: 32 ZIP: 2087

DATE: 07-27-06

C-57 LICENSE NUMBER: 07-004839

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**ATTACHMENTS (X):**

- Geologic Log
- Well Construction Diagram
- Geophysical Log(s)
- Soil/Water Chemical Analyses
- Other Site map

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

1. Property Owner: BORUT FARMS
   2301 EAST HWY 98
   Holtville, CA 92250
   Phone: 619-766-4213
   Mailing Address: 2301 EAST HWY 98
   City: Holtville
   Zip: 92250

2. Well Location - Assessor's Parcel Number: 660-150-18
   OLD HWY 80
   JACUMBA
   City: JACUMBA
   Zip: 92032

3. Well Contractor - Well Driller: JOE EDWARDS
   12029 OLD CASTLE RD
   VALLEY CENTER
   Phone: (760) 749-0701
   C-57#: 328287
   Company Name: FAM DRILLING
   Zip: 92082

4. Use:  X Private  □ Public  □ Industrial  □ Catholic  □ Other
5. Type of Work:  X New  □ Reconstruction  □ Destruction  Time Extension:  □ 1st  □ 2nd
6. Type of Equipment:  ROTARY
7. Depth of Well: Proposed: 110'
     Existing: 20'
8. Proposed:
   Casing
   Type: STEEL  □ Yes  □ No
   Depth: 110'  □ Yes  □ No
   Diameter: 14'' in.  □ Yes  □ No
   Wall/Gauge: .250  □ Yes  □ No
   Conductor Casing
   Diameter: 24'' in.
   Wall/Gauge: .250
   Filter/Filter Material
   Perforations
   From: 20 To: 120
   From: 70 To: 110
   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: 7-19-07  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: [Signature]
Date: 7-13-07

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)
X 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: 7-13-07
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.
As Built

Bert Farms

Well

Gravel Packing

Steel Conductor Casing

Cement

20'

Welded Plate Bottom

500 Wall x 14" dia.

304 Stainless Steel

Screen V-Slot

Wire Wrap No. 080 Slot:

Liner

Perforation

Well Depth

110'

40'

Fain Drilling & Pump
12029 Old Castle Rd.
Valley Center CA.

Steel Conductor 24" x 21'
Steel Liner 14" x 113'
Gravel Size 5/4 x 7

BY [Signature]
Joe Fain-Owner

7/20/09
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**

- City: Jacumba
- County: San Diego
- APN Book: 660
- Page: 150
- Parcel: 18
- Township: 18 S
- Range: 6 E
- Section: 8

**WATER LEVEL & YIELD OF COMPLETED WELL**

- Depth to First Water: 50 ft.
- Depth of Static Water Level: 40 ft.
- Date Measured: 7/23/07
- Estimated Yield: 2000 gpm & Test Type: airlift
- Test Length: 6 hr.
- Total Drawdown: 60 ft.

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

**Casing (s)**

<table>
<thead>
<tr>
<th>Depth from Surface (ft)</th>
<th>Bore-Hole Dia. (Inches)</th>
<th>Material/Grade</th>
<th>Internal Diameter (Inches)</th>
<th>Gauge or Wall Thickness (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20</td>
<td>32</td>
<td>Steel</td>
<td>23.5</td>
<td>.250</td>
</tr>
<tr>
<td>0-73</td>
<td>24</td>
<td>Steel</td>
<td>13.5</td>
<td>.250</td>
</tr>
<tr>
<td>73-113</td>
<td>24</td>
<td>Steel S.S.</td>
<td>13.5</td>
<td>.250</td>
</tr>
</tbody>
</table>

**ANNULAR MATERIAL TYPE**

- 0-20: Pea Gravel 5/16

**CERTIFICATION STATEMENT**

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

**NAME:** J. L. Jam

**ADDRESS:** 12029 Old Castle Rd. Valley Center, CA 92082

**SIGNATURE:**

**DATE:** 7-30-07

**CITY:** 32828

**STATE:** CA

**ZIP:** 92082

**DWR 188 REV. 05-03**

**IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM.**
1. Property Owner: **Bernt Farms (Lessee)**
   Phone: 760-356-2233
   **2307 E. Hwy 98**
   Holtville 92250
   **OLD Hwy 80**
   **JACUMBA**
   **660-150-21**

2. Well Location - Assessors Parcel Number
   **660-150-21**
   **12029 OLD CASTLE RD**
   **92082**
   **C-57#: 328287**
   **Cash Deposit**
   **Bond Posted**

3. Well Contractor - Well Driller: **Joe Edwards**
   Company Name: **Pain Drilling**
   **12029 OLD CASTLE RD**
   Valley Center 92082
   **760-749-0701**

4. Use: [ ] Private  [ ] Public  [ ] Industrial  [ ] Catholic  [ ] Other  [ ] AGW-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: [ ]

8. Proposed:
   **Casing**
   Type: **Steel**
   Depth: **300'**
   Diameter: **16"**
   Wall/Gauge: **250**

   **Conductor Casing**
   Depth: **20**
   Diameter: **24"**
   Wall/Gauge: **250**

   **Filter/Filler Material**
   Type: **# 60**

   **Perforations**
   From: **200** To: **300**
   From: **200** To: **300**

9. Annular Seal: Depth: **20**
   Sealing Material: **Cement**
   Borehole diameter: **32**
   Conductor diameter: **24**
   Annular Thickness: **4**

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: **[Signature]**
Date: **Oct 26-09**

---

**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: **[Signature]**
Date: **11-2-09**
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.
**Well Completion Report**

*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.*

**Geologic Log**

<table>
<thead>
<tr>
<th>Depth from Surface</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Silty Sand</td>
</tr>
<tr>
<td>10</td>
<td>Sandy Clay W/ Small Aggregate</td>
</tr>
<tr>
<td>80</td>
<td>Clay W/ Small lenses of Aggregate</td>
</tr>
<tr>
<td>150</td>
<td>Multi Colored Meta Volcanics</td>
</tr>
</tbody>
</table>

Test Hole Destroyed

**Water Level and Yield of Completed Well**

- Total Depth of Boring: 310 Feet
- Total Depth of Completed Well: 0 Feet

**Casings**

<table>
<thead>
<tr>
<th>Depth from Surface (Feet)</th>
<th>Borehole Diameter (Inches)</th>
<th>Type</th>
<th>Material</th>
<th>Wall Thickness (Inches)</th>
<th>Outside Diameter (Inches)</th>
<th>Screen Type</th>
<th>Slot Size (If Any)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Annular Material**

- Depth from Surface (Feet)
- Fill Description

<table>
<thead>
<tr>
<th>Depth from Surface (Feet)</th>
<th>Fill Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Fill</td>
</tr>
<tr>
<td>5</td>
<td>Ceramic</td>
</tr>
<tr>
<td>25</td>
<td>Bentonite</td>
</tr>
<tr>
<td>75</td>
<td>Fill</td>
</tr>
</tbody>
</table>

**Attachments**

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

**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.

Address: 12029 Old Castle Rd

City: Valley Center

State: CA

Zip: 92082

License: C-57

Date Signed: 12/2/2009

*IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM*
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

1. Property Owner: Boren Farms
   2301 E. Hwy 98
   Holtville 92250
   Phone: 619-766-4213

2. Well Location - Assessors Parcel Number: 660-150-04
   Old Hwy 90
   Jacumba

3. Well Contractor - Well Driller: Joe Edwards
   12029 Old Castle Rd
   Valley Center 92082
   Company Name: Fair Drilling

4. Use: □ Private  □ Public  □ Industrial  □ Catholic  □ 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: □

8. Proposed:
   Casing
   Type: Steel
   Depth: 200-300
   Diameter: 14 in.
   Wall/Gauge: .250
   Conductor Casing
   Depth: 20 ft.
   Diameter: 24 in.
   Wall/Gauge: .250
   Filter/Filter Material
   Type: 20
   Perforations
   From: 160 To: 200
   Sealing Material: Cement
   Annular Seal: Depth: 20 ft.
   Sealing Material: Cement
   Borehole diameter: 32 in.
   Conductor diameter: 24 in.
   Annular Thickness: 4 in.

9. 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: __________________________ 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
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.
State of California
Well Completion Report
No. e0135668

Owner's Well Number  Test Hole No.
DWR Use Only — Do Not Fill In
State Well Number/Site Number
Latitude N W
Longitude
APN/TRS/Other

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° 36' 920" N  Longitude 116° 10' 569' W
Datum  Decimal Lat.  Decimal Long.
APN Book 860  Page 150  Parcel 04
Township 16-s  Range 8-e  Section 8

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

Activity
○ New Well
○ Modification/Repair
○ Deepen
○ Other
○ Destroy
○ Describe procedures and materials
○ "DEEP DRILLING"

Planned Uses
○ Water Supply
○ Domestic  ○ Public
○ Irrigation  ○ Industrial
○ Catholic 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.

Total Depth of Boring 180 Feet
Total Depth of Completed Well 0 Feet

Depth from Surface  Borehole Diameter Material Wall Thickness Outside Diameter Screen Type Slot Size if Any
Feet  Feet (Inches)  (Inches)  (Inches)  Type  (Inches)
0 5  Fill
5 25  Cement
25 180  Fill

Casings

Annular Material

Attachments

Certification Statement
1. the undersigned, certifies that this report is complete and accurate to the best of my knowledge and belief
Name  Fain Drilling & Pump Co., Inc.
Address  1209 Old Castle Rd
City  Valley Center  CA  92082
State  Zip

Signed  12/16/2009  322827
Licensed Water Well Contractor
Date Signed  0-57 License Number

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM
**COUNTY OF SAN DIEGO**  
**DEPARTMENT OF ENVIRONMENTAL HEALTH**  
**WELL PERMIT APPLICATION**

1. **Property Owner:** Boren Farms  
   **Address:** 2307 E. Hwy 98  
   **City:** Holtville  
   **Zip:** 92250  
   **Phone:** 760-4213

2. **Well Location - Assessors Parcel Number:** 660-150-18  
   **Site Address:** N/0 Old Hwy 80  
   **City:** Jacumba  
   **Zip:** 91934

3. **Well Contractor - Well Driller:** Joe Edwards  
   **Company Name:** Fain Drilling  
   **Address:** 12029 Old Castle Rd  
   **City:** Valley Center  
   **Zip:** 92082  
   **Phone:** 760-749-0701  
   **C-57#:** 328287  
   **Cash Deposit:** Yes  
   **Bond Posted:** No

4. **Use:** Private  
   **Public:** No  
   **Industrial:** No  
   **Catholic:** Yes  
   **Other:** No

5. **Type of Work:** New  
   **Reconstruction:** No  
   **Destruction:** No  
   **Time Extension:** 1st  
   **2nd:** No

6. **Type of Equipment:**  
   **Rotary:** Yes  
   **Existing:** No

7. **Depth of Well:**  
   **Proposed:** 100'  
   **Existing:** 0'

8. **Proposed:**  
   **Casing Type:** Steel  
   **Conductor Casing:** Yes  
   **Filler/Filler Material:** Yes  
   **Perforations:**  20 ft.  
   **Depth:** 100'  
   **Diameter:** 14 in.  
   **Wall/Gate:** 250

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:**  
**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
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.
Well Completion Report
State of California

Owner's Well Number: Test Hole
Date Work Began: 11/13/2009
Date Work Ended: 11/23/2009
Local Permit Agency: DEH
Permission Number: WEL 20450

Geologic Log
Orientation: Vertical
Drilling Method: Direct Rotary
Drilling Fluid: Bentonite mud

Depth from Surface  | Description
--- | ---
0 40 | Alluvial Fill As Follows:
40 60 | Fine to Med Grained Sand
80 100 | Sandy Clay W/ Lenses of Small Aggregate
100 110 | Meta Volcanics

Test Hole Destroyed

Well Location
Address: Old Hwy 80
City: Jacumba
County: San Diego
Latitude: 32° 37' 28" N
Longitude: 116° 10' 58" W
Datum: Undated
APN Book: 660
Page: 150
Parcel: 18
Township: 18 S
Range: 6 E
Section: 8

Location Sketch
(Activity)
New Well
Modification/Repair
Deepen
Other
Destroy

Planned Uses
Water Supply
Domestic
Public
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 _______ (Feet below surface)
Water Level _______ (Feet) Date Measured
Estimated Yield _______ (GPM) Test Type
Test Length _______ (Hours) Total Drawdown _______ (Feet)

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

Casings
Depth from Surface  | Borehole Diameter (Inches)  | Type  | Material  | Wall Thickness (Inches)  | Outside Diameter (Inches)  | Screen Type  | Slot Size if Any (Inches)
--- | --- | --- | --- | --- | --- | --- | ---
0 | 15 | Fill
5 | 25 | Cement
25 | 110 | Fill

Annular Material
Depth from Surface  | Fill  | Description
--- | --- | ---
0 | 15 | Fill
5 | 25 | Cement
25 | 110 | Fill

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

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.
Address: 12029 Old Castle Rd.
City: Valley Center
State: CA
Zip: 92082
Date: 12/20/2009
License Number: C-57

If additional space is needed, use next consecutively numbered form.
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
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 I, 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,
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 (Qa1 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
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-51 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 10, 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 shearing 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 (Qa) and older alluvium (QfN). The formational materials (TJ, Tja, Tng) 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.

<table>
<thead>
<tr>
<th>Type of Structure</th>
<th>Estimated Depth of Removal and Recompack (feet below existing grade)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- and 2-Story, School, Hotel</td>
<td>2 - 4</td>
</tr>
<tr>
<td>Congregate Care, and</td>
<td></td>
</tr>
<tr>
<td>Residential Structures</td>
<td></td>
</tr>
<tr>
<td>Waste Water Treatment Plant</td>
<td>3 - 5</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Thickness of Proposed Fill (above existing grade) in feet</th>
<th>Delay of Building Construction after Grading (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤2</td>
<td>0</td>
</tr>
<tr>
<td>≤3</td>
<td>1</td>
</tr>
<tr>
<td>≤4</td>
<td>2</td>
</tr>
</tbody>
</table>

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 recomposition. 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 riprability 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 siltiest 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 lightly 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.
APPENDIX A

REFERENCES


EXPLANATION OF GEOTECHNICAL TRENCH LOG

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Logged By:</th>
<th>TRENCH NO.</th>
<th>ENGINEERING PROPERTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bulk Sample</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Field Density test</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>in accordance with</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ASTM 7931-83</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Percent of Maximum</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Density</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Single relatively</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>undisturbed ring sample</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GEOL. ATTACHES</th>
<th>DATE:</th>
<th>DESCRIPTION:</th>
<th>GEOL. UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>FILL</td>
<td>Qaf</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A few desiccation cracks at surface up to 1/4&quot; to 1/2&quot;-inch wide</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0-0.4&quot; light brown, slightly damp, loose, to medium dense, silty</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>very fine to medium sand, abundant chunks of light</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>dark gray, very fine to medium sand clay, several wood and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>thin roots, pebbles, several semicircular cobbles</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>RIGHT FORMATION</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0&quot; gray, slightly damp, very stiff, fine sandy siltstone/clay</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>stone, with thick interlayer or very thin lenses of light</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>yellow-brown, silty fine-grained sandstone, highly</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>fractured and bumpy, several roots along fractures</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>LAYEL 1/2/5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1&quot; light yellowish brown fine grained sandstone, continuous</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>along wall</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>light joint system, spacing 4 to 6&quot; inches, iron oxide</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>along fractures</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SCALE: 1&quot; 1&quot;</td>
<td></td>
</tr>
</tbody>
</table>

GRAPH REPRESENTATION: SCALE: 1" 1" 1/2" 1/2"
**GEOTECHNICAL DESCRIPTION**

Logged by: [Name]
Sampled by: [Name]

**Attitudes:**
- (b) bedding
- (c) contact
- (j) joint
- (f) fracture
- (cs) clay seam
- (s) shear

**Sample:** Relatively undisturbed drive sample (Modified California Sampler) - Number to represent sample number. Bulk Sample (with sampling interval).

**Classification Chart**

**Soil Classifications:**
- **Clay:** plastic clays
- **Silt:** fine silts
- **Sand:** coarse silts
- **Gravel:** fine gravels
- **Cobble:** medium gravels
- **Boulder:** coarse gravels

**Plasticity Chart:**

**Range of Grain Sizes:**

- **Grain Size:**
  - **CL:** clay
  - **CH:** clayey silt
  - **CL:** clayey silty silt
  - **CH:** silty clay

**Classification System:**

- **Organic Soils:**
  - **ML:** organic soils
  - **OL:** organic soils
  - **MH:** organic soils

**SOIL CLASSIFICATION**

**METHOD OF SOIL CLASSIFICATION**
Project Name: Jacumba Valley Ranch  
Logged By: DLL  
Elevation: 12,790'  
TRENCH NO: T-1  
Equipment: Case 600C Backhoe  
Location: See Plate 1

**GEOLGIC ATTITUDES**

<table>
<thead>
<tr>
<th>DATE: 12/18/90</th>
<th>DESCRIPTION:</th>
<th>GEOLOGIC UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ALLUVIUM</td>
<td></td>
</tr>
<tr>
<td>A 80'-3':</td>
<td>Gray-white, loose, dry, fine to very coarse sand; abundant pebbles, finely bedded</td>
<td></td>
</tr>
<tr>
<td>B 83'-6':</td>
<td>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</td>
<td></td>
</tr>
<tr>
<td>C 86'-7':</td>
<td>Dark brown, moist, medium dense, fine to coarse sand; micaceous</td>
<td></td>
</tr>
<tr>
<td>D 87'-10':</td>
<td>Dark brown, moist, medium dense, fine to medium sandy silt</td>
<td></td>
</tr>
</tbody>
</table>

Total Depth = 10 feet  
No Ground Water Encountered at Time of Trenching  
Backfilled: 12/18/90

---

Project Name: Jacumba Valley Ranch  
Logged By: DLL  
Elevation: 12,775'  
TRENCH NO: T-2  
Equipment: Case 600C Backhoe  
Location: See Plate 1

**GEOLGIC ATTITUDES**

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<th>DESCRIPTION:</th>
<th>GEOLOGIC UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ALLUVIUM</td>
<td></td>
</tr>
<tr>
<td>A 80'-1':</td>
<td>Dark brown and olive-brown, moist, medium dense, fine sandy silt/silty fine sand; sparse roots, slightly porous, micaceous</td>
<td></td>
</tr>
<tr>
<td>B 81'-4':</td>
<td>Light brown, moist, medium dense, silty fine sand</td>
<td></td>
</tr>
<tr>
<td>C 81.4'-3':</td>
<td>Mottled dark olive-brown and brown, moist to wet, medium dense, fine sandy silt; few roots, abundant red-brown stringers (infilled burrows?), abundant caliche stringers</td>
<td></td>
</tr>
<tr>
<td>D 83'-6':</td>
<td>Mottled olive-brown and orange-brown, moist to wet, medium dense, fine sandy silt micaceous, slightly porous</td>
<td></td>
</tr>
<tr>
<td>E 86'-10':</td>
<td>Becomes fine sandy silt/silty fine sand</td>
<td></td>
</tr>
</tbody>
</table>

Total Depth = 10 feet  
Ground Water Seepage Encountered at 6 feet at time of trenching
Project Name: Jacumba Valley Ranch
Logged By: DLL
Elevation: 12,700'
Location: See Plate 1
Equipment: Case 680C Backhoe

GEOLOGIC ATTITUDES
DATE: 12/18/90
DESCRIPTION:

ALLUVIUM
A 0' - 1': Gray-white, dry, loose, fine to very coarse sand; some pebbles, finely bedded
B 0' - 3.5': Gray-brown, dry to damp, loose, fine to very coarse sand; few discontinuous silt layers approximately 1/2 inch thick, some discontinuous sandy pebble lenses, rare clasts to 3 inch diameter
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

Total Depth = 7 feet
No Ground Water Seepage Encountered at Time of Trenching
Backfilled: 12/18/90

GEOLOGIC UNIT
Qa1

ENGINEERING PROPERTIES

50.4.1 (3/77)

LOG OF TRENCH NO. T-3

LOG OF TRENCH NO. T-4
Project Name: Jacumba Valley Ranch  Logged By: DLL  Elevation: 12820'  TRENCH NO. T-5
Project Number: 4909361-05  Location: See Plate
Equipment: Link Belt LS 5600 Trackhoe

GEOLIGIC ATTITUDES  DATE: 12/18/90  DESCRIPTION:

1. **TOPSOIL**  00'-1': Brown, dry, loose, silty, fine to medium sand; abundant rootlets throughout, moderate amount of cobbles to 5-inch diameter, slightly porous, desiccated

2. **OLDER ALLUVIUM**  01'-2': Brown, dry, loose to medium dense, fine to medium sandy silt; trace of clay, slightly desiccated

3. **JACUMBA LAVA**  02'-5': Mottled pinkish white, dry, dense rhyolitic tuff bed; intermixed with volcanic clasts and zones and puds of alluvium; very weathered, slightly desiccated, slightly friable

---

Project Name: Jacumba Valley Ranch  Logged By: DLL  Elevation: 12820'  TRENCH NO. T-6
Project Number: 4909361-02  Location: See Plate
Equipment: Case 600C Backhoe

GEOLIGIC ATTITUDES  DATE:  DESCRIPTION:

1. **ALLUVIUM**  00'-2': Alternating gray, dry, loose, fine to coarse sand and gray, dry, loose silt; silt layers 1/4-inch to 1-inch thick

2. **UDA**  02'-2.5': Gray, dry, loose, fine sand; finely laminated cross bedding, concoidal lenses of fine to coarse sand, manganese lamamce

3. **UDA**  02.5'-5.5': Brown, damp, medium dense, silty fine to medium sand; grades to brown, damp, medium dense, fine to medium sand

4. **UDA**  05'-8': Dark brown, wet to saturated, medium dense, fine to medium sandy silt, grades to silty, fine sand; slightly porous, minor root hairs

Total Depth = 8 feet
Ground Water Seepage Encountered at 7 feet

---

GRAPHIC REPRESENTATION southwest wall SCALE: 1" = 5'  SURFACE SLOPE: 5°  TREND: N20E

LOG OF TRENCH NO. T-6
GEOTECHNICAL BORING LOG

Date 12/11/90  Drill Hole No. 8-1
Project Jacumba Valley Ranch
Job No. 4900381-05
Drilling Co. Layne Environmental
Type of Rig Mobile 8-61

Hole Diameter 8" Drive Weight 140 lbs.  Drop 30 in.
Elevation Top of Hole 52760' Ref. or Datum mean sea level

Elevation of Borehole

<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>Attitides</th>
<th>Tube Sample No.</th>
<th>Dry Density</th>
<th>Moisture</th>
<th>Soil Class (U.S.C.S.)</th>
<th>Sampled by</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>22</td>
<td>23.8 ML</td>
<td></td>
<td></td>
<td>Dll</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
<td>22</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>15</td>
<td>3</td>
<td>28</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>20</td>
<td>4</td>
<td>41</td>
<td></td>
<td></td>
<td></td>
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<td>5</td>
<td>37</td>
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<tr>
<td>30</td>
<td></td>
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</tr>
</tbody>
</table>

Logged by: DLL

ALLUVIUM

05': Brown, dry, very stiff, slightly fine sandy silt
07': Becomes clayey

010': Dark brown, moist to wet, very stiff clayey silt slightly micaceous

015': Dark brown, saturated, very stiff, clayey silt; some fine grains, rare pebbles

020': Dark brown, saturated, dense, clayey fine to coarse sand; numerous pebbles

025': Dark brown, saturated, dense, slightly clayey fine to very coarse sand; numerous pebbles to 1" diameter

Total depth = 36.5 feet
Ground water encountered at 11 feet at time of drilling
<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>Graphic Log</th>
<th>Attitudes</th>
<th>Tube No.</th>
<th>Sample No.</th>
<th>Blows per Foot</th>
<th>Dry Density (pcf)</th>
<th>Moisture Content (%)</th>
<th>Soil Class (U.C.S.C.)</th>
<th>Logged by</th>
<th>Sampled by</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>5</td>
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<td>25</td>
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<td>5</td>
<td>50/7</td>
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</tr>
</tbody>
</table>

**ALLUVIUM**

05': Olive-brown, wet, medium dense, silty fine to medium sand; slightly micaeous

**JACUMBA LAVA**

025': Mottled pinkish white, wet, very dense volcanic rock

Total depth = 27 feet (refusal) on refusal ground water encountered at 6 feet at time of drilling.

---

**ALLUVIUM**

05': Brown, moist, dense, silty fine sand; few rootlets

010': Mottled orange-brown and brown, wet, dense, silty fine sand; few rootlets, slightly micaeous

015': Mottled orange-tan and brown, wet, dense, silty very fine sand/very fine sandy silt; some carbon-stained flecks

020': Mottled orange-brown and brown, wet to saturated, very dense, fine sandy silt

025': Light brown, wet, dense, silty fine to medium sand; contact to dark brown, wet, dense, silty, fine sand; more silt than above contact
**GEOTEchnical BORING LOG**

**Date** 12/11/90  
**Drill Hole No.** 8-3  
**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

<table>
<thead>
<tr>
<th>Depth Feet</th>
<th>Graphic Log</th>
<th>Attitudes</th>
<th>Tube No.</th>
<th>Blows</th>
<th>Blows Per Foot</th>
<th>Dry Densitypcf</th>
<th>Moisture Content</th>
<th>Soil Class</th>
<th>Soil Class (USCS)</th>
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</table>

**Total depth:** 51 feet  
**Ground water encountered at 12 feet at time of drilling**

---

**GEOTEchnical BORING LOG**

**Date** 12/12/90  
**Drill Hole No.** 8-4  
**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

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<th>Depth Feet</th>
<th>Graphic Log</th>
<th>Attitudes</th>
<th>Tube No.</th>
<th>Blows</th>
<th>Blows Per Foot</th>
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<td>015'</td>
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<td>020'</td>
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**ALLUVIUM**

- 05': Brown, moist, dense, silty fine to coarse sand/micaceous  
- 07': Becomes silty  
- 010': Dark brown, wet, dense, slightly silty fine to medium sand and gray, wet, fine to coarse sand/micaceous  
- 015': Brown, saturated, very dense, silty fine to medium sand  
- 020': Gray, wet, dense, slightly silty fine to coarse sand; some interbeds of brown clayey silt (up to 2" thick)  
- 025': Red-brown, wet, very stiff, silty clay/clayey silt; gradational contact: gray, saturated, dense, fine to coarse sand
**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

<table>
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<th>Depth (Feet)</th>
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<th>Attitudes</th>
<th>Tube No.</th>
<th>Bore Diameter</th>
<th>Blows Per Foot</th>
<th>Dry Density,pcf</th>
<th>Moisture Content,%</th>
<th>Soil Classification (CSS)</th>
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**GEOTECHNICAL DESCRIPTION**

Logged by: DLL  
Sampled by: DLL

040': Gray, saturated, very dense, fine to coarse sand

050': Light brown, saturated, dense to very dense, slightly silty, fine to medium sand

Total depth = 51.5 feet  
Ground water encountered at 9 feet at time of drilling

**Leighton & Associates**

---

**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

<table>
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<th>Tube No.</th>
<th>Bore Diameter</th>
<th>Blows Per Foot</th>
<th>Dry Density,pcf</th>
<th>Moisture Content,%</th>
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<td>26</td>
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<td>09': Becomes clayey</td>
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<td>3</td>
<td>41</td>
<td></td>
<td></td>
<td></td>
<td>010': Mottled red-brown and brown, wet, very stiff, fine sandy silt; trace of clay, few carbonized flecks</td>
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<td>4</td>
<td>49</td>
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<td></td>
<td>015': Mottled red-brown and brown, wet, dense interbedded silty clay/very, silty fine sand; some carbonized thin (1/16&quot; thick) beads, silty clay is finely laminated</td>
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<tr>
<td>25</td>
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<td>5</td>
<td>28</td>
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<td></td>
<td></td>
<td>020': Brown, wet, dense fine to medium sand; few coarse grains, micaceous</td>
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<td>30</td>
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<td></td>
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<td></td>
<td>025': 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</td>
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</tbody>
</table>

**Leighton & Associates**
### GEOTECHNICAL DESCRIPTION

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<th>Blows</th>
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<th>Soil Class (USCS)</th>
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</tbody>
</table>

- **830'**: Mottled red-brown and brown, wet, dense, clayey silt to silty fine sand.
- **840'**: Brown, saturated, dense, fine to medium sand; trace of silt.
- **950'**: 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.

---

### GEOTECHNICAL DESCRIPTION

<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>Graphic Log</th>
<th>Attitudes</th>
<th>Tube No.</th>
<th>Blows</th>
<th>Per Foot</th>
<th>Dry Density (pcf)</th>
<th>Moisture Content (%)</th>
<th>Soil Class (USCS)</th>
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<td>DLL</td>
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</tbody>
</table>

- **0.5':** Light brown, moist, medium dense, silty fine sand; micaceous.
- **915':** Brown, wet, dense, fine to coarse sand; micaceous, trace of silt.
- **025':** Mottled red-brown and brown, wet, very stiff, silty clay/clayey silt; trace of fine sand.
**GEOTECHNICAL BORING LOG**

**Date:** 12/13/90  
**Drill Hole No.:** 8-6

<table>
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<th>Attitudes</th>
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<th>Sample No.</th>
<th>Blows</th>
<th>Dry Density (pcf)</th>
<th>Moisture Content (%)</th>
<th>Soil Class &amp; Description</th>
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*Geotechnical Description*

Logged by: DLL  
Sampled by: DLL

- **030′:** Same as at 25′

---

**Elevation Top of Hole:** 12.786′  
**Ref. or Datum:** Mean Sea Level

---

**JACUMBA VALLEY RANCH**

**Date:** 12/13/90  
**Drill Hole No.:** 8-7

<table>
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<th>Attitudes</th>
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<th>Sample No.</th>
<th>Blows</th>
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<th>Moisture Content (%)</th>
<th>Soil Class &amp; Description</th>
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</table>

*Geotechnical Description*

Logged by: DLL  
Sampled by: DLL

- **05′:** Brown, damp to moist, medium dense, very silty, fine to medium sand; nicaceous trace of clay, rare pebbles
- **010′:** Light reddish brown, moist, medium dense, very silty fine to medium sand; slightly nicaceous; trace of clay, moderate volcanic pebbles
- **015′:** Light reddish brown, moist, medium dense, clayey to silty, fine to coarse sand
- **020′:** Motteled red, white and black, saturated, very dense, very weathered volcanic rock

---

**JACUMBA LAVA**

**Elevation Top of Hole:** 12.792′  
**Ref. or Datum:** Mean Sea Level

---

**Leighton & Associates**
### GEOLOGICAL BORING LOG

**Date:** 12/13/90  
**Drill Hole No.:** B-7  
**Project:** Jacumba Valley Ranch  
**Job No.:** J900381-05  
**Drilling Co.:** Layne Environmental  
**Type of Rig:** Mobile B-61  
**Hole Diameter:** 8"  
**Drive Weight:** 140 lbs.  
**Drop:** 30 in.  
**Elevation Top of Hole:** 22,781'  
**Ref. or Datum:** Mean Sea Level

#### GEOTECHNICAL DESCRIPTION

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<th>Depth Feet</th>
<th>Sample No.</th>
<th>Tube Blows/Per Foot</th>
<th>Dry Density (U.S.C.S.)</th>
<th>Moisture Content</th>
<th>Soil Class</th>
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<th>Sampled by</th>
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</tr>
</tbody>
</table>

- **030':** Black, slightly weathered basaltic volcanic rock
- **Total depth = 33 feet.
  Ground water encountered at 9 feet at time of drilling**

#### ALLUVIUM

- **05':** Olive-brown and orange-brown, wet, medium dense, silty fine sand; few rootlet slightly micaeous
- **010':** Mottled orange-brown and olive-brown saturated, dense, silty fine sand; fine sandy silt; some carbonized thin (1/16") thick) layers  
- **015':** Mottled orange-brown and olive-brown, saturated, clayey silt/silty clay; some carbonized flecks and staining, few medium-sized grains
- **020':** Light brown and olive-brown, wet, dense, silty fine sand; micaeous, silt brown, silty/clayey layers up to 1.2" thick
- **025':** Light brown, wet, dense, slightly silty, fine to coarse sand
<table>
<thead>
<tr>
<th>Depth Feet</th>
<th>Graphic Log</th>
<th>Attitudes</th>
<th>Tube No.</th>
<th>Sample No.</th>
<th>Blows</th>
<th>Dry Density, pf</th>
<th>Moisture Content, %</th>
<th>Soil Class. (U.S.C.S.)</th>
<th>Logged by</th>
<th>Sampled by</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td>DLL</td>
<td>DLL</td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td>7</td>
<td>20</td>
<td></td>
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<td></td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td>100</td>
</tr>
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<td>45</td>
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<td></td>
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<td></td>
<td></td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>015'</td>
<td>015'</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>022'</td>
<td>022'</td>
<td></td>
</tr>
</tbody>
</table>

**GEOTEchnical Description**

- 30': Mottled olive, olive-brown, and orange-brown, wet, hard clayey silt, trace of fine sand, micaceous, some thin clay layers
- 015': Mottled orange-brown and brown, saturated, very dense, fine sandy clay
- 022': Brown, wet, dense, very silty fine sand; micaceous, sharp contact to recrystallized brown and brown, silty clay/clayey silt

---

**Graphical Log**

- Elevation Top of Hole: 22,774' Ref. or Datum mean sea level

**Geotechnical Boring Log**

- Date: 12/13/90
- Project: Jacumba Valley Ranch
- Drilling Co.: Layne Environmental
- Type of Rig: Mobile B-61

**Drill Hole No.: B-8**

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

**Drill Hole No.: B-9**

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

**Elevation Top of Hole:** 22,774' Ref. or Datum mean sea level
<table>
<thead>
<tr>
<th>Depth Feet</th>
<th>Graphic Log</th>
<th>Attitudes</th>
<th>Tube No.</th>
<th>Blows Per Foot</th>
<th>Moisture Content</th>
<th>Dry Density (pcf)</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td></td>
<td>6</td>
<td>46</td>
<td></td>
<td>ML/SM</td>
<td></td>
<td>030' Brown, wet, dense, silty very fine sand/very fine sandy silt; micaceous, grades to: orange-brown and brown, silty clay/clayey silt</td>
</tr>
<tr>
<td>35</td>
<td></td>
<td>7</td>
<td>52</td>
<td>80.1</td>
<td>20.6 ML</td>
<td></td>
<td>040' Mottled olive-brown and orange-brown; wet, hard, silty clay/clayey silt</td>
</tr>
<tr>
<td>40</td>
<td></td>
<td>8</td>
<td>44</td>
<td></td>
<td>CL/ML</td>
<td></td>
<td>050' Mottled orange-brown and brown; wet, dense, fine to medium sandy clay/clayey sand</td>
</tr>
<tr>
<td>45</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total depth = 51.5 feet</td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>Ground water encountered at 7 feet at time of drilling</td>
</tr>
<tr>
<td>55</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>Depth Feet</th>
<th>Graphic Log</th>
<th>Attitudes</th>
<th>Tube No.</th>
<th>Blows Per Foot</th>
<th>Moisture Content</th>
<th>Dry Density (pcf)</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>1</td>
<td>23</td>
<td>CL/ML</td>
<td></td>
<td>05' Mottled olive-brown and orange-brown; wet, very stiff silty clay/clayey silt; micaceous trace of fine sand</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td>2</td>
<td>29</td>
<td>SM</td>
<td></td>
<td>09' Mottled olive-brown and orange-brown; very wet, dense, silty fine sand; sample nec one 3&quot; thick layer of olive-brown and brown, laminated clay and silt</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td>3</td>
<td>37</td>
<td>SC/SM</td>
<td></td>
<td>09' Mottled olive-brown and orange-brown; very wet, dense, silty fine sand; sample nec one 3&quot; thick layer of olive-brown and brown, laminated clay and silt</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td>4</td>
<td>38</td>
<td>SM</td>
<td></td>
<td>09' Mottled olive-brown and orange-brown; very wet, dense, silty fine sand; sample nec one 3&quot; thick layer of olive-brown and brown, laminated clay and silt</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td>5</td>
<td>43</td>
<td>CL/ML</td>
<td></td>
<td>09' Mottled olive-brown and red-brown; wet, dense, fine sandy clay to silt, clayey sand</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depth (Ft)</td>
<td>Graphic Log</td>
<td>Attitudes</td>
<td>Sample No.</td>
<td>Blows Per Foot</td>
<td>Dry Density (psf)</td>
<td>Moisture Content (USCS)</td>
<td>Logged by</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
<td>-----------</td>
<td>------------</td>
<td>----------------</td>
<td>-------------------</td>
<td>------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td>6</td>
<td>50/2&quot; (N.R.)</td>
<td></td>
<td></td>
<td>DLL</td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
<td>7</td>
<td>68</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>ML/SM</td>
<td>040&quot; : Brown, wet, very dense, very fine sandy silt/silty very fine sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>040&quot; : Brown, wet, very dense, very fine sandy silt/silty very fine sand</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>05&quot; : Mottled olive-brown, wet, medium dense, fine sandy silt, micaceous, trace of clay</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>010&quot; : Brown, saturated, dense, silty fine to coarse sand and brown, saturated stiff, slightly sandy clay</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>015&quot; : Mottled olive-brown and orange-brown, wet, very stiff to hard, fine sandy clay, micaceous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>025&quot; : Mottled red-brown and olive-brown, saturated, hard, slightly silty clay; numerous carbonized flecks, micaceous, some calcite stringers and pocks</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Leighton & Associates
**GEOTEchnical Boring Log**

**Date:** 12/14/90  
**Drill Hole No.:** B-12  
**Project:** Jacumba Valley Ranch  
**Job No.:** 4900361-05  
**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

---

**Geotechnical Description**

Logged by: DLL  
Sampled by: DLL

<table>
<thead>
<tr>
<th>Depth</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows</th>
<th>Per Foot</th>
<th>Dry Density</th>
<th>Moisture Content</th>
<th>Soil Classification</th>
<th>(Class)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>SM</td>
<td>1</td>
<td>20</td>
<td>8.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>SM</td>
<td>2</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>SW</td>
<td>3</td>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>SW</td>
<td>4</td>
<td>50/5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total depth = 51 feet**  
Ground water encountered at 5 feet at time of drilling.

---

**Geotechnical Boring Log**

**Date:** 12/14/90  
**Drill Hole No.:** B-11  
**Project:** Jacumba Valley Ranch  
**Job No.:** 4900361-05  
**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

---

**Geotechnical Description**

Logged by: DLL  
Sampled by: DLL

<table>
<thead>
<tr>
<th>Depth</th>
<th>Graphic</th>
<th>Log</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows</th>
<th>Per Foot</th>
<th>Dry Density</th>
<th>Moisture Content</th>
<th>Soil Classification</th>
<th>(Class)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6</td>
<td>CL</td>
<td>030': Brown, saturated, hard, clay</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>SW</td>
<td>040': Brownish gray, wet, very dense, fine to coarse sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>8</td>
<td>SC</td>
<td>050': Light reddish brown, saturated, very dense, clayey, fine to coarse sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total depth = 51 feet**  
Ground water encountered at 5 feet at time of drilling.
GEOTECHNICAL BORING LOG

Date: 12/14/20
Project: Jacumba Valley Ranch
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 ft

Depth | Graphic Log | Attitudes | Tube No. | Sample No. | Bore Feet | Dry Density | Moisture Content | Soil Class (U.S.C.S.) |
------|-------------|-----------|----------|------------|-----------|-------------|-------------------|---------------------|
0     |             |           |          |            |           |             |                   |                     |
5     |             |           |          |            |           |             |                   |                     |
10    |             |           |          |            |           |             |                   |                     |
15    |             |           |          |            |           |             |                   |                     |
20    |             |           |          |            |           |             |                   |                     |
25    |             |           |          |            |           |             |                   |                     |
30    |             |           |          |            |           |             |                   |                     |
35    |             |           |          |            |           |             |                   |                     |
40    |             |           |          |            |           |             |                   |                     |
45    |             |           |          |            |           |             |                   |                     |
50    |             |           |          |            |           |             |                   |                     |
55    |             |           |          |            |           |             |                   |                     |
60    |             |           |          |            |           |             |                   |                     |

Logged by: DLL
Sampled by: DLL

ALLUVIUM

05': Brown, damp, medium dense, fine sandy silty/silty fine sand; few pebbles

SOIL

010': Brown, damp, dense, fine to medium sand; few thin (1/4" thick) silt layers, some pebbles

More pebbles with calcrete

015': Brown, damp, very dense, fine to coarse sand; some pebbles

018': Abundant pebbles to 2" diameter

026': Becomes silty sand

SM 030": Brown, damp, dense, silty fine to medium sand; rare pebbles, one 1/2" thick clay layer

SW 040": Brown, wet, very dense, fine to medium sand; few pebbles, approximately 5 to 10 percent coarse grains

SM 050": Same as at 40' but dense

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 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 consolidometer 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.
### Expansion Index Test Results

<table>
<thead>
<tr>
<th>SAMPLE NO.</th>
<th>SAMPLE LOCATION</th>
<th>INITIAL MOISTURE (%)</th>
<th>COMPACTED DRY DENSITY (PCF)</th>
<th>FINAL MOISTURE (%)</th>
<th>VOLUMETRIC SWELL (%)</th>
<th>EXPANSION INDEX</th>
<th>EXPANSIVE POTENTIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>T-2 @ 4'-6&quot;</td>
<td>14.0</td>
<td>96.6</td>
<td>31.3</td>
<td>6.6</td>
<td>66</td>
<td>Medium</td>
</tr>
<tr>
<td>②</td>
<td>T-4 @ 0'-3&quot;</td>
<td>11.5</td>
<td>104.6</td>
<td>24.0</td>
<td>5.1</td>
<td>51</td>
<td>Medium</td>
</tr>
</tbody>
</table>

### Maximum Density Test Results

<table>
<thead>
<tr>
<th>SAMPLE NO.</th>
<th>LOCATION</th>
<th>MAXIMUM DRY DENSITY (PCF)</th>
<th>OPTIMUM MOISTURE CONTENT (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>T-1 @ 0'-3&quot;</td>
<td>115.5</td>
<td>14.5</td>
</tr>
<tr>
<td>①</td>
<td>T-2 @ 0'-3&quot;</td>
<td>107.0</td>
<td>20.0</td>
</tr>
<tr>
<td>②</td>
<td>T-2 @ 4'-6&quot;</td>
<td>110.0</td>
<td>14.0</td>
</tr>
</tbody>
</table>

---

**Project No:** 4500381-05  
**Location:** Jacumba Valley Ranch

---

**Expansion Index and Maximum Density Test Results**

**Consolidation Test Results**

- Field Moisture: Boring No. 3-3
- Saturated: Sample No. 2
- Loading: Depth (FT): 10-11
- Rebound: Soil Type: SM
CONSOLIDATION TEST RESULTS

- FIELD MOISTURE
  - BORING NO.: 1-5
  - SATURATED
  - SAMPLE NO.: 2
  - LOADING
  - DEPTH (FT): 10-11
  - SOIL TYPE: CLAY

CONSOLIDATION TEST RESULTS

- FIELD MOISTURE
  - BORING NO.: 5-10
  - SATURATED
  - SAMPLE NO.: 2
  - LOADING
  - DEPTH (FT): 10-11
  - REBOUND
  - SOIL TYPE: CLAY
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)

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Delay of Construction after Grading (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 2</td>
<td>0</td>
</tr>
<tr>
<td>≤ 3</td>
<td>1</td>
</tr>
<tr>
<td>≤ 4</td>
<td>2</td>
</tr>
<tr>
<td>≤ 5</td>
<td>3</td>
</tr>
<tr>
<td>≤ 10</td>
<td>4</td>
</tr>
<tr>
<td>≤ 15</td>
<td>6</td>
</tr>
<tr>
<td>≤ 20</td>
<td>8</td>
</tr>
</tbody>
</table>

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.
## Lithology

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Lithology Graphic</th>
<th>Lithology Description</th>
<th>Resistivity Ohm-m</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>gravels and sand</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>coarse to medium sand with small gravels</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>well-sorted, clean sand</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td>coarse to medium sand with small gravels</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td>clay with sand and gravels</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td>volcanic rock</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td></td>
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</tr>
<tr>
<td>80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>110</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>120</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>130</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>140</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>150</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>160</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>170</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>180</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>190</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Additional Information:

**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'
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 gastropod 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).

<table>
<thead>
<tr>
<th>Well J3A</th>
<th>Well J4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth (Meters)</td>
<td>Depth (Meters)</td>
</tr>
<tr>
<td>Lithology</td>
<td>Lithology</td>
</tr>
<tr>
<td>- 9.1 Clay and silt</td>
<td>-12.2 Layers of clay and gravel</td>
</tr>
<tr>
<td>-15.2 Coarse sand and gravel</td>
<td>-18.3 Gravel and boulders</td>
</tr>
</tbody>
</table>

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\(^b\)

<table>
<thead>
<tr>
<th>Depth (Meters)</th>
<th>Lithology</th>
<th>Depth (Meters)</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well J1</td>
<td></td>
<td>Well J2</td>
<td></td>
</tr>
<tr>
<td>0-3.0</td>
<td>Soil and clay</td>
<td>0-3.0</td>
<td>Soil and clay</td>
</tr>
<tr>
<td>-11.6</td>
<td>Clay</td>
<td>-11.6</td>
<td>Clay</td>
</tr>
<tr>
<td>-12.2</td>
<td>Fine sand</td>
<td>-12.2</td>
<td>Fine sand</td>
</tr>
<tr>
<td>-15.2</td>
<td>Medium sand</td>
<td>-15.2</td>
<td>Medium sand</td>
</tr>
<tr>
<td>-26.8</td>
<td>Coarse sand and small gravel</td>
<td>-26.8</td>
<td>Coarse sand and small gravel</td>
</tr>
<tr>
<td>-30.5</td>
<td>Coarse sand and coarse gravel</td>
<td>-30.5</td>
<td>Coarse sand and small gravel</td>
</tr>
<tr>
<td>-36.6</td>
<td>Layers clay and coarse sand</td>
<td>-36.6</td>
<td>Layers clay and coarse sand</td>
</tr>
<tr>
<td>-37.8</td>
<td>Volcanic formation</td>
<td>-42.7</td>
<td>Layers clay and coarse sand</td>
</tr>
<tr>
<td>Well K1</td>
<td></td>
<td>Well K2</td>
<td></td>
</tr>
<tr>
<td>0-1.5</td>
<td>Clay and topsoil</td>
<td>0-6.1</td>
<td>Clay and silt</td>
</tr>
<tr>
<td>-9.1</td>
<td>Silt and fine sand</td>
<td>-6.4</td>
<td>Cobbles</td>
</tr>
<tr>
<td>-12.2</td>
<td>Fine sand</td>
<td>-12.2</td>
<td>Fine sand</td>
</tr>
<tr>
<td>-13.7</td>
<td>Sand</td>
<td>-13.7</td>
<td>Sand</td>
</tr>
<tr>
<td>-15.2</td>
<td>Boulders and sand</td>
<td>-15.2</td>
<td>Rocks and sand</td>
</tr>
<tr>
<td>-19.2</td>
<td>Sand and gravel</td>
<td>-21.3</td>
<td>Sand and gravel</td>
</tr>
<tr>
<td>-19.5</td>
<td>Black silt and clay</td>
<td>-28.0</td>
<td>Rocks and sand</td>
</tr>
<tr>
<td>-20.7</td>
<td>Sand and gravel</td>
<td>-31.4</td>
<td>Large rocks and sand</td>
</tr>
<tr>
<td>-21.3</td>
<td>Black silt and clay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-29.9</td>
<td>Sand and gravel</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3 (Continued)

<table>
<thead>
<tr>
<th>Depth (Meters)</th>
<th>Lithology</th>
<th>Depth (Meters)</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Well K1</td>
<td></td>
<td>Well K2</td>
</tr>
<tr>
<td>-31.4</td>
<td>Boulders and cobbles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-32.3</td>
<td>Sand and gravel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-33.5</td>
<td>Red clay</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\)Taken from County of San Diego, Department of Public Health, personal communication, 1980.

\(^b\)Taken from William Ketchum, personal communication, 1980.
**WELL COMPLETION REPORT**

**STATE OF CALIFORNIA**

**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

**GEOLOGIC LOG**

<table>
<thead>
<tr>
<th>DEPTH FROM SURFACE (ft)</th>
<th>ORIENTATION</th>
<th>METHOD</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>VERTICAL</td>
<td>Rotary</td>
<td>Alluvial Fill as follows:</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td>Sand, fine grained - brown color</td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
<td>Clay - Dark color</td>
</tr>
<tr>
<td>70</td>
<td></td>
<td></td>
<td>Sand, fine grained</td>
</tr>
<tr>
<td>113</td>
<td></td>
<td></td>
<td>Sand, medium to coarse grained with some boulders</td>
</tr>
</tbody>
</table>

**WATER LEVEL & YIELD OF COMPLETED WELL**

- **Depth of First Water**: 50 ft
- **Depth of Static Water Level**: 40 ft
- **Date Measured**: 7/23/07
- **Estimated Yield**: 2000 gpm
- **Airlift**
- **Test Type**: Other

**TOTAL DEPTH OF BORING**: 113 ft

**TOTAL DEPTH OF COMPLETED WELL**: 114 ft

**CASING (D) ($)**

<table>
<thead>
<tr>
<th>DEPTH FROM SURFACE (ft)</th>
<th>TYPE</th>
<th>MATERIAL</th>
<th>INTERNAL DIAMETER (inches)</th>
<th>GAUGE OR WALL THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>20</td>
<td>Steel</td>
<td>23.5</td>
<td>.250</td>
</tr>
<tr>
<td>0</td>
<td>73</td>
<td>Steel</td>
<td>13.5</td>
<td>.250</td>
</tr>
<tr>
<td>73</td>
<td>113</td>
<td>Steel S.S.</td>
<td>13.5</td>
<td>.250</td>
</tr>
<tr>
<td>304</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ANNULAR MATERIAL**

<table>
<thead>
<tr>
<th>DEPTH FROM SURFACE (ft)</th>
<th>TYPE</th>
<th>MYERS TONTE</th>
<th>FILL</th>
<th>FILTER PACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>20</td>
<td>X</td>
<td></td>
<td>pea gravel 5/16x7</td>
</tr>
<tr>
<td>20</td>
<td>113</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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

**ADDRESS**: 12029 Old Castle Rd. Valley Center, Ca 92082

**DATE**: 9-30-07

**LICENSE NUMBER**: 328287

**SIGNATURE**:

**ATTACHMENTS**

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

**ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.**
Gravel Packing
Steel Conductor Casing
Cement

20'

304 Stainless Steel
Screen V-Slot
Wire Wrap No. 0.080 Slot

Liner
Perforation

Welded Plate Bottom
500 Wall X 14" dia.

Fain Drilling & Pump
12029 Old Castle Rd.
Valley Center CA.

Steel Conductor 24" X 21'
Steel Liner 14" X 113'
Gravel Size 5/4 X 7

By: Joe P. Fain 7/30/77
Joe Fain – Owner
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.
**WELL COMPLETION REPORT**

**State of California**

**Well Completion Report**

**Owner's Copy**

**Date Work Began:** 4/7/65  
**Ended:** 4/25/65

**Local Permit Agency:**  
**Permit No.:** 14649  
**Permit Date:** 4/25/65

**Owner's Well No.:**

---

**Geologic Log**

<table>
<thead>
<tr>
<th>Depth from Surface (ft)</th>
<th>Description</th>
<th>Drilling Method</th>
<th>Rotary Fluid</th>
<th>Guel</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Clayey sand and silt fine gravel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Gray clayey sand fine to coarse sand grainy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>Coarse sand and gravel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>76</td>
<td>Sand fine to coarse with gravel and sandstone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>112</td>
<td>Clay weathered rock</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Activity:**

**New Well**

**Modification/Repair:**

- Deepen
- Other (Specify)

**Uses:**

- Domestic
- Industrial

**Cathode 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:**

**Estimated Yield:** 2000 gpm

**Test Length:** 200 ft  
**(M) Total Drawdown:** 40 ft

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

---

**Casing (s)**

<table>
<thead>
<tr>
<th>Depth from Surface (ft)</th>
<th>Bore Hole Dia. (inches)</th>
<th>Type ( )</th>
<th>Material / Grade</th>
<th>Internal Diameter (inches)</th>
<th>Cause or Wall Thickness</th>
<th>Slot Size (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3</td>
<td>X</td>
<td>Spun A-53</td>
<td>21.5</td>
<td>-25D</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>2</td>
<td></td>
<td>Spun A-59</td>
<td>11.5</td>
<td>-25.0</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>2</td>
<td>V</td>
<td>Spun 4-5</td>
<td>12.0</td>
<td>1.00</td>
<td>0.80</td>
</tr>
</tbody>
</table>

---

**Annular Material**

<table>
<thead>
<tr>
<th>Depth from Surface (ft)</th>
<th>Cement Benite ( )</th>
<th>Fill ( )</th>
<th>Filter Pack (Type/Size)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2.0</td>
<td>1.00</td>
<td>5/7</td>
</tr>
</tbody>
</table>

---

**Attachments:**

- Geologic Log
- Geophysical Log(s)
- Soil/Water Chemical Analysis
- Other (Specify)

**Attachment 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:**

**Address:**  
12929 Old Castle Rd, Valley Center, Ca 92082

**CITY:**  
**STATE:**  
**ZIP:**

**License Number:**

**Signature:**

**Date Signed:** 4/25/65

**If Additional Space Is Needed, Use Next Consecutively Numbered Form**
"AS BUILT" WELL

BORNT FARMS
JACUMBA CA.

Lat. 32° 37' 790 N
Long 116° 10' 740 W

14" LINER

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

WELL DEPTH
100'

60'

STEEL CONDUCTOR 24" X 20'
STEEL LINER 14" X 100'
GRAVEL SIZE 5/4 X 7

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

BY
1-26-05
JOE FAIN-OWNER
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

PROJECT INFORMATION

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

WELL DATA

<table>
<thead>
<tr>
<th>Pumping Wells</th>
<th>Observation Wells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well Name</td>
<td>X (ft)</td>
</tr>
<tr>
<td>Well 2</td>
<td>0</td>
</tr>
</tbody>
</table>

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

\[ T = 3.629\times10^4 \text{ ft}^2/\text{day} \]
\[ S = 0.02876 \]
\[ b = 40 \text{ ft} \]
Diagnostic Statistics

Estimation complete! Parameter change criterion (ETOL) reached.

Aquifer Model: Unconfined
Solution Method: Theis

Estimated Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Std. Error</th>
<th>Approx. C.I.</th>
<th>t-Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>3.629E+4</td>
<td>103.2</td>
<td>+/- 202.3</td>
<td>351.5 ft²/day</td>
</tr>
<tr>
<td>S</td>
<td>0.02876</td>
<td>0.0001907</td>
<td>+/- 0.0003737</td>
<td>150.8 ft²/day</td>
</tr>
<tr>
<td>Kz/Kr</td>
<td>1.</td>
<td>not estimated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>40.</td>
<td>not estimated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>T</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>1.00</td>
<td>-0.81</td>
</tr>
<tr>
<td>S</td>
<td>-0.81</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Residual Statistics

for weighted residuals

Sum of Squares . . . . . 3.952 ft²
Variance . . . . . . . . . . . . . . . 0.0006863 ft²
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

<table>
<thead>
<tr>
<th>Pumping Wells</th>
<th>Observation Wells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well Name</td>
<td>X (ft)</td>
</tr>
<tr>
<td>Well 2</td>
<td>0</td>
</tr>
</tbody>
</table>

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

\[ T = 2.641 \times 10^4 \text{ ft}^2/\text{day} \]
\[ S = 0.00826 \]
\[ s_y = 0.04672 \]
\[ \beta = 0.2076 \]
Diagnostic Statistics

Estimation complete! Parameter change criterion (ETOL) reached.

Aquifer Model: Unconfined
Solution Method: Neuman

Estimated Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Std. Error</th>
<th>Approx. C.I.</th>
<th>t-Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>2.641E+4</td>
<td>62.34</td>
<td>+/- 122.2</td>
<td>423.7</td>
</tr>
<tr>
<td>S</td>
<td>0.00826</td>
<td>6.918E-5</td>
<td>+/- 0.0001356</td>
<td>119.4</td>
</tr>
<tr>
<td>Sy</td>
<td>0.04672</td>
<td>0.0002334</td>
<td>+/- 0.0004574</td>
<td>200.2</td>
</tr>
<tr>
<td>β</td>
<td>0.2076</td>
<td>0.0002334</td>
<td>+/- 0.0004574</td>
<td>216.6</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>T</th>
<th>S</th>
<th>Sy</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>1.00</td>
<td>-0.31</td>
<td>-0.95</td>
<td>0.02</td>
</tr>
<tr>
<td>S</td>
<td>-0.31</td>
<td>1.00</td>
<td>0.11</td>
<td>-0.69</td>
</tr>
<tr>
<td>Sy</td>
<td>-0.95</td>
<td>0.11</td>
<td>1.00</td>
<td>0.11</td>
</tr>
<tr>
<td>β</td>
<td>0.02</td>
<td>-0.69</td>
<td>0.11</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Residual Statistics

for weighted residuals

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum of Squares</td>
<td>0.3775 ft²</td>
</tr>
<tr>
<td>Variance</td>
<td>6.558E-5 ft²</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>0.008098 ft</td>
</tr>
<tr>
<td>Mean</td>
<td>-0.0002177 ft</td>
</tr>
<tr>
<td>No. of Residuals</td>
<td>5760</td>
</tr>
<tr>
<td>No. of Estimates</td>
<td>4</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Pumping Wells</th>
<th>Observation Wells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well Name</td>
<td>X (ft)</td>
</tr>
<tr>
<td>Well 2</td>
<td>0</td>
</tr>
</tbody>
</table>

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

\[ T = 3.305E+4 \text{ ft}^2/\text{day} \]
\[ S = 0.000136 \]
\[ K_z/K_r = 1. \]
\[ b = 40. \text{ ft} \]
Diagnostic Statistics

Estimation complete! RSS criterion (RTOL) reached.

Aquifer Model: Unconfined
Solution Method: Theis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Std. Error</th>
<th>Approx. C.I.</th>
<th>t-Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>3.305E+4</td>
<td>107.4</td>
<td>+/- 210.6</td>
<td>307.6 ft²/day</td>
</tr>
<tr>
<td>S</td>
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<td>7.934E-6</td>
<td>+/- 1.555E-5</td>
<td>17.14 ft²/day</td>
</tr>
<tr>
<td>Kz/Kr</td>
<td>1.00</td>
<td>not estimated</td>
<td>+/- 1.555E-5</td>
<td>17.14 ft²/day</td>
</tr>
<tr>
<td>b</td>
<td>40.0</td>
<td>not estimated</td>
<td>+/- 1.555E-5</td>
<td>17.14 ft²/day</td>
</tr>
</tbody>
</table>

C.I. is approximate 95% confidence interval for parameter

\[ t\text{-ratio} = \frac{\text{estimate}}{\text{std. error}} \]

No estimation window

\[ K = \frac{T}{b} = 826.3 \text{ ft/day} (0.2915 \text{ cm/sec}) \]

\[ Ss = \frac{S}{b} = 3.399E-6 \text{ 1/ft} \]

Parameter Correlations

<table>
<thead>
<tr>
<th></th>
<th>T</th>
<th>S</th>
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<tbody>
<tr>
<td>T</td>
<td>1.00</td>
<td>-0.99</td>
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<tr>
<td>S</td>
<td>-0.99</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Residual Statistics

for weighted residuals

- Sum of Squares: 11.52 ft²
- Variance: 0.002314 ft²
- 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

<table>
<thead>
<tr>
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<th>Observation Wells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well Name</td>
<td>X (ft)</td>
</tr>
<tr>
<td>Well 2</td>
<td>0</td>
</tr>
</tbody>
</table>

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

\[ T = 2.831 \times 10^4 \text{ ft}^2/\text{day} \]
\[ S = 1.0 \times 10^{-10} \]
\[ S_y = 0.001 \]
\[ \beta = 1.0 \times 10^{-5} \]
Diagnostic Statistics

Estimation complete! Parameter change criterion (ETOL) reached.

Aquifer Model: Unconfined
Solution Method: Neuman

### Estimated Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Std. Error</th>
<th>Approx. C.I.</th>
<th>t-Ratio</th>
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<td>$T$</td>
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<tr>
<td>$S$</td>
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<td>0.0002303</td>
<td>+/- 0.0004513</td>
<td>4.343E-7</td>
</tr>
<tr>
<td>$S_y$</td>
<td>0.001</td>
<td>0.0002364</td>
<td>+/- 0.0004633</td>
<td>4.23</td>
</tr>
<tr>
<td>$\beta$</td>
<td>1.0E-5</td>
<td>3.438E-6</td>
<td>+/- 6.739E-6</td>
<td>2.908</td>
</tr>
</tbody>
</table>

C.I. is approximate 95% confidence interval for parameter

$t$-ratio = estimate/std. error

No estimation window

$K = \frac{T}{b} = 707.8$ ft/day (0.2497 cm/sec)

$S_s = \frac{S}{b} = 2.5E-12$ 1/ft

### Parameter Correlations

<table>
<thead>
<tr>
<th></th>
<th>T</th>
<th>S</th>
<th>$S_y$</th>
<th>$\beta$</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>1.00</td>
<td>-0.01</td>
<td>-0.21</td>
<td>0.05</td>
</tr>
<tr>
<td>S</td>
<td>-0.01</td>
<td>1.00</td>
<td>-0.98</td>
<td>-0.69</td>
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<tr>
<td>$S_y$</td>
<td>-0.21</td>
<td>-0.98</td>
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<tr>
<td>$\beta$</td>
<td>0.05</td>
<td>-0.69</td>
<td>0.67</td>
<td>1.00</td>
</tr>
</tbody>
</table>

### Residual Statistics

for weighted residuals

- Sum of Squares $= 14.1$ ft²
- Variance $= 0.002833$ ft²
- Std. Deviation $= 0.05322$ ft
- Mean $= 0.003024$ ft
- No. of Residuals $= 4980$
- No. of Estimates $= 4$
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
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

Veryl Wittig
California Professional Geologist No. 7115
California Certified Hydrogeologist No. 723

11/27/2012 Date

Project Number: SC0636
## TABLE OF CONTENTS

1. INTRODUCTION ................................................................................................................. 1  
   1.1 Terms of Reference ................................................................................................. 1  
   1.2 Background ............................................................................................................ 1  
   1.3 Site Location ......................................................................................................... 1  
   1.4 Objectives ............................................................................................................. 2  
2. GEOLOGIC AND HYDROGEOLOGIC CONDITIONS ......................................................... 3  
   2.1 General .................................................................................................................. 3  
   2.2 Groundwater Elevations and Flow Direction ....................................................... 3  
3. AQUIFER TESTING AND ANALYSIS .............................................................................. 4  
   3.1 Constant-Rate Discharge Test ............................................................................... 4  
      3.1.1 Ambient Phase ............................................................................................... 4  
      3.1.2 Pumping Phase .............................................................................................. 4  
      3.1.3 Recovery Phase .............................................................................................. 5  
   3.2 Analysis of Aquifer Test Data ............................................................................... 5  
      3.2.1 Observed and Projected Drawdown ............................................................... 5  
      3.2.2 Aquifer Properties ......................................................................................... 6  
   3.3 Aquifer Impact Analysis ......................................................................................... 6  
4. SUMMARY AND CONCLUSIONS ..................................................................................... 8  
   4.1 Aquifer Testing ...................................................................................................... 8  
   4.2 Aquifer Impact Analysis ......................................................................................... 8  
5. RECOMMENDATIONS ..................................................................................................... 9  
6. REFERENCES .................................................................................................................... 10  

### TABLES

1. Summary of Static Groundwater Depths and Well Details  
2. Summary of Observed and Projected Drawdown Data

### FIGURES

1. Site Vicinity and Location Map  
2. Groundwater Elevations and Flow Direction, 6 November 2012  
3. Observed and Projected Drawdowns  
4. Estimated Limit of 6-Month Drawdown
## APPENDICES

<table>
<thead>
<tr>
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<tr>
<td>A</td>
<td>Constant-Rate Aquifer Test Data</td>
</tr>
<tr>
<td>B</td>
<td>DPLU GP Update Report Excerpts</td>
</tr>
<tr>
<td>C</td>
<td>Aqtesolv™ Output Reports</td>
</tr>
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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 (ft²/day). Results of recovery data analysis in Well #3 using the Theis Approximation method estimated a transmissivity of 12,950 ft²/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.

TABLES
## Table 1
Summary of Static Groundwater Depths and Well Characteristics
Jacumba Valley Ranch Property
Jacumba, California

<table>
<thead>
<tr>
<th>Well</th>
<th>Gauging Date</th>
<th>Approximate Elevation (ft msl)</th>
<th>Height of Reference Point (ft above ground)</th>
<th>Depth to Water (ft toc)</th>
<th>Depth to Water (ft bgs)</th>
<th>Approximate Groundwater Elevation (ft msl)</th>
<th>Total Depth (ft bgs)</th>
<th>Pump Inlet Depth (ft bgs)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>2765</td>
<td>2.33(^1)</td>
<td>44.24</td>
<td>41.91</td>
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<td>100(^2)</td>
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<td>2.21</td>
<td>43.65</td>
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<td>60.24</td>
<td>2,739.76</td>
<td>112.77</td>
<td>NA</td>
</tr>
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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
## Table 2
Summary of Observed and Projected Drawdown Data
Jacumba Valley Ranch Property
Jacumba, California

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pumping Well</th>
<th>Observation Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Drawdown (ft) (72-Hours)</td>
<td>7.3</td>
<td>4.07</td>
</tr>
<tr>
<td>Projected Drawdown (ft) (6-Months)</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>Approx. Distance From Pumping Well</td>
<td>0</td>
<td>60 feet</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Well #3*</th>
<th>Daley Well</th>
<th>Mid-Valley Well</th>
<th>Well #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Drawdown (ft) (72-Hours)</td>
<td></td>
<td>4.07</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Projected Drawdown (ft) (6-Months)</td>
<td>12</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Approx. Distance From Pumping Well</td>
<td>0</td>
<td>60 feet</td>
<td>0.6 Miles</td>
<td>0.85 Miles</td>
</tr>
</tbody>
</table>
FIGURES
Groundwater Elevations and Flow Direction, 6 November 2012

Jacumba Valley Ranch Property
Jacumba, California

Legend

- Groundwater Monitor Well
  (Groundwater Elevation in Feet Above Mean Sea Level)

- Groundwater Elevation Contour
  (Contour Interval = 2 ft)

- Approximate Groundwater Flow Direction
  and Hydraulic Gradient (ft/ft)

- Approximate Property Boundary

San Diego
November 2012

Figure 2
Observed and Projected Drawdowns
Jacumba Valley Ranch Property
Jacumba, California

Projected Drawdown at 6 Months

-12 feet at Well #3

-9 feet at Daley Well

Well #3

Daley Well

Drawdown (feet)

Elapsed Time (minutes)
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

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Estimated GW Demand (AFY)</th>
<th>Estimated Average GW in Storage</th>
<th>Estimated Minimum GW in Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Conditions</td>
<td>165</td>
<td>100%</td>
<td>99%</td>
</tr>
<tr>
<td>Current General Plan Buildout</td>
<td>2295</td>
<td>54%</td>
<td>1%</td>
</tr>
<tr>
<td>Referral Map Buildout</td>
<td>1259</td>
<td>91%</td>
<td>74%</td>
</tr>
<tr>
<td>Draft Land Use Map Buildout</td>
<td>1258</td>
<td>91%</td>
<td>74%</td>
</tr>
<tr>
<td>Hybrid Map Buildout</td>
<td>1258</td>
<td>91%</td>
<td>74%</td>
</tr>
<tr>
<td>Environmentally Superior Buildout</td>
<td>1008</td>
<td>93%</td>
<td>81%</td>
</tr>
<tr>
<td>Cumulative Impacts Buildout</td>
<td>1258</td>
<td>91%</td>
<td>74%</td>
</tr>
</tbody>
</table>

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

JAC-01 (Active)
JAC-02 (Active)

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**

<table>
<thead>
<tr>
<th>Pumping Wells</th>
<th>Observation Wells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well Name</td>
<td>X (ft)</td>
</tr>
<tr>
<td>Well #3</td>
<td>0</td>
</tr>
<tr>
<td>Daley Well</td>
<td>60</td>
</tr>
</tbody>
</table>

**SOLUTION**

Aquifer Model: Unconfined  
T = 8778.5 ft²/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

WELL DATA

<table>
<thead>
<tr>
<th>Pumping Wells</th>
<th>Observation Wells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well Name</td>
<td>X (ft)</td>
</tr>
<tr>
<td>Well #3</td>
<td>0</td>
</tr>
</tbody>
</table>

SOLUTION
Aquifer Model: Confined    Solution Method: Theis (Recovery)
\[ T = 1.295E+4 \text{ ft}^2/\text{day} \]    \[ S/S' = 0.05601 \]
FIGURE C-3

Data Set: Q:\SC0636 JVR Aquifer Test\AQTESTOL\Daley Well.Drawdown.Figure C-3.aqt
Date: 11/21/12  Time: 10:30:35

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

<table>
<thead>
<tr>
<th>Pumping Wells</th>
<th>Observation Wells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well Name</td>
<td>X (ft)</td>
</tr>
<tr>
<td>Well #3</td>
<td>0</td>
</tr>
<tr>
<td>Daley Well</td>
<td>60</td>
</tr>
</tbody>
</table>

SOLUTION

Aquifer Model: Unconfined  Solution Method: Cooper-Jacob
T = 4923.3 ft²/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
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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

<table>
<thead>
<tr>
<th>Section</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>2  ESTABLISHMENT OF GROUNDWATER THRESHOLDS</td>
<td>3</td>
</tr>
<tr>
<td>2.1 Potential Off-Site Well Interference</td>
<td>3</td>
</tr>
<tr>
<td>2.2 Groundwater-Dependent Habitat</td>
<td>6</td>
</tr>
<tr>
<td>3  MONITORING PROCEDURES AND MITIGATION CRITERIA</td>
<td>7</td>
</tr>
<tr>
<td>3.1 Groundwater Production and Groundwater Level Monitoring</td>
<td>7</td>
</tr>
<tr>
<td>3.2 Groundwater-Dependent Habitat Monitoring</td>
<td>7</td>
</tr>
<tr>
<td>3.2.1 Monitoring</td>
<td>7</td>
</tr>
<tr>
<td>3.3 Groundwater Mitigation Criteria</td>
<td>9</td>
</tr>
<tr>
<td>4  REPORTING REQUIREMENTS</td>
<td>11</td>
</tr>
<tr>
<td>5  REFERENCES</td>
<td>13</td>
</tr>
<tr>
<td>6  LIST OF PREPARERS</td>
<td>15</td>
</tr>
</tbody>
</table>

## APPENDIX

A  Groundwater Level Hydrographs

## FIGURE

1  Well Interference and Potential Groundwater-Dependent Habitat ............17

## TABLES

1  Alluvial Aquifer Wells Within 0.5-Mile Radius of Extraction Wells ..........4
2  Baseline Conditions, Groundwater Level Threshold, and Current Groundwater Levels.................................................................5
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.
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. 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.
Groundwater Monitoring and Mitigation Plan for the JVR Energy Park

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

<table>
<thead>
<tr>
<th>Well Name</th>
<th>Owner/Status</th>
<th>Distance from Well #2 (feet)</th>
<th>Distance Well #3 (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well Km&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Small Water System/Active</td>
<td>2,453</td>
<td>3,548</td>
</tr>
<tr>
<td>Highland Center Well</td>
<td>JCSD/Active</td>
<td>1,817</td>
<td>4,835</td>
</tr>
<tr>
<td>Park Well</td>
<td>JCSD/Active</td>
<td>2,256</td>
<td>5,025</td>
</tr>
<tr>
<td>Border Patrol Well&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Federal/Inactive</td>
<td>1,892</td>
<td>6,235</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Well Name</th>
<th>Owner/Status</th>
<th>Distance from Well #2 (feet)</th>
<th>Distance Well #3 (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daley Well</td>
<td>JVR/NA</td>
<td>4,460</td>
<td>60</td>
</tr>
<tr>
<td>Central Irrigation Well</td>
<td>JVR/NA</td>
<td>2,692</td>
<td>2,713</td>
</tr>
</tbody>
</table>

<sup>a</sup> 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

<table>
<thead>
<tr>
<th>Well ID</th>
<th>Baseline Groundwater Level Measurement (Feet BTOC)</th>
<th>Threshold Condition (Drawdown, Feet)</th>
<th>Groundwater Level Threshold (Feet BTOC)</th>
<th>Current Groundwater Level Measurement (Feet BTOC / Date)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highland Center Well</td>
<td>55.05</td>
<td>N/A</td>
<td>N/A</td>
<td>56.75 / May 12, 2020</td>
</tr>
<tr>
<td>Park Monitoring Well</td>
<td>57.71</td>
<td>N/A</td>
<td>N/A</td>
<td>59.18 / May 12, 2020</td>
</tr>
<tr>
<td>Gas Station Well</td>
<td>64.25</td>
<td>N/A</td>
<td>N/A</td>
<td>65.67 / May 12, 2020</td>
</tr>
<tr>
<td>JVR Well 2</td>
<td>55.40</td>
<td>N/A</td>
<td>N/A</td>
<td>59.27 / May 12, 2020</td>
</tr>
<tr>
<td>Central Irrigation Well</td>
<td>48.09</td>
<td>52.89</td>
<td>4.80 feet below baseline condition</td>
<td>48.09 / May 12, 2020</td>
</tr>
</tbody>
</table>

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)

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. 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. 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 programmed 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.
Groundwater Monitoring and Mitigation Plan for the JVR Energy Park

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5 REFERENCES


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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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Well Interference and Potential Groundwater-Dependent Habitat

FIGURE 1

Groundwater-Monitoring Network
- Off-site Production Wells
- Project Groundwater Production Well
- Monitoring Wells
- Approximate Location of Well K1 and K3

Potential Groundwater-Dependent Habitat
- Desert Sink Scrub
- Mesquite Bosque
- Proposed Groundwater-Dependent Habitat Sampling Points

SOURCE: Dudek 2019
Groundwater Monitoring and Mitigation Plan for the JVR Energy Park

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APPENDIX A

Groundwater Level Hydrographs
Jacumba Valley Groundwater Basin
Highland Center Well

Depth to Groundwater (Feet Below Top of Casing)

- Manual Depth to Groundwater Level Measurement
- Transducer Depth to Groundwater Level Measurement

Static level
Pumping level
Groundwater Monitoring and Mitigation Plan for the JVR Energy Park

Gas Station Well Groundwater Level Data

- 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
Groundwater Monitoring and Mitigation Plan for the JVR Energy Park

Jacumba Community Services District Groundwater Level Monitoring:
JVR Well 2

Groundwater Level Threshold = 59.25 ft bglc

Static Groundwater Level Threshold

May 12th, 2020