DRAFT

JVR ENERGY PARK
FIRE PROTECTION PLAN
PDS2018-GPA-18-010

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JANUARY 2020

Printed on 30% post-consumer recycled material.

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Acronyms and Abbreviations

AFFF	Aqueous Film-Forming Foam
ANSI	American National Standards Institute
BLM	Bureau of Land Management
CAL FIRE	California Department of Forestry and Fire Protection
CBC	County Building Code
CCFC	County Consolidated Fire Code
CFC	California Fire Code
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CPUC	California Public Utilities Commission
CSA	County Service Areas
CSD	Community Service District
FAHJ	Fire Authorities Having Jurisdiction
FMZ	Fuel Modification Zone
FPP	Fire Protection Plan
GO	General Order
GPM	Gallons per minute
I-8	Interstate 8
IEEE	Institute of Electrical and Electronics Engineers
IFC	International Fire Code
kV	Kilovolt
MW	Megawatt
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
O&M	Operations and Maintenance Facility
ROW	Right-of-Way
SDG&E	San Diego Gas & Electric
SanGIS	San Diego Geographic Information Source
SCADA	Supervisory Control and Data Acquisition System
SDFCA	San Diego County Fire Authority
SRA	State Responsibility Areas
WUI	Wildland Urban Interface

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Executive Summary

This Fire Protection Plan (FPP) is submitted pursuant to Section 4903 of the San Diego County Consolidated Fire Code to address the potential adverse environmental effects that the proposed solar energy facility may have on or from wildland fire. It provides analysis and documentation that the project does not expose people or structures to a significant risk of loss, injury or death involving wildland fires based on its conformance with applicable fire and building codes. For purposes of this FPP, the JVR Energy Park project will be referred to as the "JVR Energy Park" or the "Proposed Project."

This document provides analysis of the site's fire environment and its potential impact on the JVR Energy Park as well as the Proposed Project's potential impact on the existing fire protection service. This document is incorporated as a technical appendix of the Project's Environmental Impact Report (EIR). Requirements and recommendations herein are based on site-specific fire environment analysis and proposed project characteristics and incorporate input from the County, area fire planning documents, site risk analysis, and standard principles of fire protection planning.

The Proposed Project is a solar facility that would use approximately 300,000 photovoltaic (PV) single-axis solar trackers to produce a rated capacity of up to 90 megawatts (MW) of alternating current (AC) generating capacity. Additionally, the Proposed Project would include inverters, an on-site substation, a switchyard, and a battery energy system located throughout the solar facility. The development footprint of the proposed solar facility would total approximately 642 acres within a 1,356-acre Project site. The Project site is located in unincorporated southeastern San Diego County, California. The Proposed Project would be located immediately east of the community of Jacumba Hot Springs, south of Interstate-8 (I-8), and north of the U.S./Mexico international border.

The 1,356-acre Proposed Project site is located in Moderate to Very High Fire Hazard Severity Zones, as statutorily designated by the California Department of Forestry and Fire Protection (CAL FIRE) (FRAP 2014). The entire Project site is located in an area dominated by relatively sparse chaparral and scrub vegetation, which are vegetation communities that experience occasional wildfire and can burn in an extreme manner under windy, dry conditions. The general topography of the site is gently rolling with some steeper hillslopes along the western and eastern sides. The development footprint has been previously disturbed for agricultural purposes. The Project site, like all of inland San Diego County, is subject to seasonal weather conditions that can heighten the likelihood of fire ignition and spread. Based on the region's fuels, fire history, and expected fire behavior, a moderate-intensity fire can be expected to occur in the Project area. Given the gently rolling terrain with some steeper hillsides and sparse fuelbeds, fire behavior on the site is expected to be moderate, although spotting distances may be long during peak Santa Ana wind conditions. The applicable County fire codes and additional measures required by this FPP directly address the fire concerns associated with this Project's location.

Fire protection in the Project area is shared by several agencies, with the County and CAL FIRE providing significant resources. The closest fire station is the County's Jacumba Fire Station 43, which is staffed with CAL FIRE firefighters under a Cooperative Fire Protection Agreement. Additionally, County and CAL FIRE are co-located at the next closest fire station, Station 47, in Boulevard. Response to the JVR Energy Park Project from Stations 43 and 47 would be within the acceptable time frame as designated in the County 0 (County of San Diego 2011).

The Project will introduce a solar facility, electrical transmission line, and related activities into a rural setting that is directly adjacent to the community of Jacumba to the west and includes semi-disturbed and undisturbed wildland fuels. The Project may incrementally increase potential ignition sources in the area with the ongoing operation and maintenance program, but will reduce the available wildland fuels and will result in a higher level of fire monitoring and awareness due to Project monitoring and security measures. The Project vicinity is currently subject to ignition sources including an on-site collector substation, a 138 kV Switchyard adjacent to the on-site collector substation, an existing SDG&E 138 kv, 220-foot-long 65-foot-high slack span overhead transmission line, two 138 kV, 550-foot-long 80-foot-high overhead transmission lines, roadways, regular U.S. Border Patrol operations, two gas stations located adjacent to the northeastern property boundary, the Jacumba Airport located directly south and east of the southernmost portion of the Project site, amongst others. The Project will include compliance with the San Diego County Fire Code, as applicable, and will provide additional measures that enhance fire safety and protection.

Based on the Project's conformance with applicable fire and building codes along with the additional measures identified in this FPP, the Project would not result in a significant impact under California Environmental Quality Act (CEQA).

1 Introduction

This Fire Protection Plan (FPP) has been prepared for the JVR Energy Park Project ("JVR Energy Park" or "Proposed Project") near the community of Jacumba Hot Springs, in unincorporated San Diego County, California. The purpose of the FPP is to assess the potential impacts resulting from wildland fire hazards and identify the measures necessary to adequately mitigate those impacts. As part of the assessment, this FPP has considered the fire risk presented by the site including: property location and topography, combustible vegetation (fuel types), climatic conditions, fire history and the proposed land use and configuration. This plan addresses water supply, access (including emergency access where applicable), solar facility components, structural ignitability and ignition resistive features, fire protection systems and equipment, impacts to existing emergency services, defensible space, and vegetation management. The plan identifies and prioritizes areas for hazardous fuel reduction treatments and recommends the types and methods of treatment that will protect this project and its essential infrastructure. The plan recommends measures to reduce the probability of ignition of equipment or structures.

This FPP is consistent with the 2017 County Consolidated Fire Code (CCFC; County of San Diego 2017) and 2016 California Fire Code (CFC) Section 49 and with the California Code of Regulations, Title 14, Fire Safe Regulations. Further, the JVR Energy Park is consistent with the County Building and Electrical Codes and will employ all related California Public Utilities Commission (CPUC) regulations including the General Order 95: Rules for Overhead Electric Line Construction. Since the Project is within SRA, Title 14 is applicable, and allows provisions for providing same practical effect for any non-conforming project features. This FPP is also consistent with the County of San Diego Guidelines for Determining Significance and Report Format, Wildland Fire and Fire Protection (County of San Diego 2019).

The purpose of this FPP is to analyze the Project's various components and siting in a fire hazard area and to generate and memorialize the fire safety requirements of the Fire Authorities Having Jurisdiction (FAHJ); i.e., the San Diego County Fire Authority (SDCFA). Recommendations of this FPP incorporate analysis of the Project and of the cumulative impact on the area's emergency service resources from foreseeable projects in the area. Recommendations for effectively mitigating identified impacts are based on site-specific characteristics and incorporate input from the project applicant and the County. This FPP incorporates applicable fire safety regulations and requirements and documents a selection of these regulations that are most pertinent to the Project's unique facility and location.

1.1 Project Summary

1.1.1 Project Location

The Project site totals approximately 1,356 acres in southeastern San Diego County, within the County's Mountain Empire Subregional Plan area (see Figure 1, Project Location). The Proposed Project would be located to the south of Interstate (I) 8, immediately east of the community of Jacumba Hot Springs, and immediately north of the U.S./Mexico international border. The Project site is located entirely on private land and consists of 24 parcels, including the following Accessor's Parcel Numbers (APNs): 614-100-20, 614-100-21, 614-110-04, 660-020-05, 660-020-06, 660-150-04, 660-150-07, 660-150-08, 660-150-10, 660-150-14, 660-150-17, 660-150-18, 660-170-09, 661-010-02, 661-010-15, 661-010-26, 661-010-27, 661-010-30, 661-060-12, 661-060-22, 660-140-06, 660-140-08, 660-150-21, 660-150-16. The location of the parcels is shown in Figure 1, Project Location. The Project site includes right-of-way easements for Old Highway 80, SDG&E easements, and an easement for the San Diego and Arizona Eastern Railway. The proposed solar facility would cover approximately 642 acres within the 1,356-acre Project site (shown on Figure 2, Project Components). Primary access to the Project site would be provided via an improved access driveway from Old Highway 80, with additional access off of Carrizo Gorge Road. The Project site is situated within Sections 3, 4, 5, 8 and 9 of Township 18 South, Range 8 East, as well as in Sections 32 and 33 of Township 17 South, Range 8 East on the U.S. Geographical Survey (USGS), 7.5 minute, Jacumba, California quadrangle maps.

The majority of the proposed solar facility would be constructed in areas classified as a High Fire Hazard Severity Zone (FHSZ) by California Department of Forestry and Fire Protection (CAL FIRE). Fire hazard designations are based on topography, vegetation, and weather, amongst other factors with more hazardous sites including steep terrain, unmaintained fuels/vegetation, and wildland urban interface (WUI) locations. A small portion in the northwest corner and along the western boundary of the 1,356 Project site and the adjacent area to the west is classified as a Very High FHSZ by CAL FIRE. A small portion of the western boundary of the 1,356Project site is classified as a Moderate FHSZ by CAL FIRE. Additionally, the lands adjacent to the west of the 1,356-acre Project site are classified as very high FHSZ and the lands adjacent to the east are classified as moderate FHSZ and include Federal Responsibility Areas (FRA) (FRAP 2014).

1.1.2. Existing Land Use

The Notice of Preparation (NOP) for the Proposed Project was published on March 7, 2019 (See Appendix 1 in this EIR for the NOP and comment letters). The baseline for the Project is established by the physical condition that exists at the time the NOP was published. The environmental setting is summarized below and described in greater detail for each environmental issue at the beginning of each section in Chapter 2 and 3 of this EIR.

The Project site is located within the area known as Ketchum Ranch, which previously has been used for agricultural operations although it is not currently under cultivation. The Project site contains 11 vegetation communities and/or land covers, including 9 sensitive communities (County of San Diego 2010a). Vegetation within the Project site consists of scrub, grassland, riparian, and non-native vegetation, which provides habitat for common upland and riparian species, including migratory and resident birds, as well as habitat for other wildlife species.

Within the Project boundaries, the site varies from relatively level land in the central and southern portions of the Project site to moderately to steeply sloping hillsides along the western and eastern margins. Across the 1,356-acre site, elevations range from approximately 2,745 feet above mean sea level (amsl) in the lower, northern portion of the site to 3,365 feet amsl at the top of Round Mountain in the northwestern portion of the Project site.

The Project site is located within the Anza Borrego watershed. Control Board Colorado River Hydrologic Basin Region 7 Planning Area. The contributing watersheds to the Project site cover an area of approximately 70,868 acres (111 square miles), with 76% located in Baja California, Mexico. The majority of flow from Mexico north into the Jacumba Valley is derived from the Flat Creek subwatershed, which includes the Blue Angel Peak subwatershed and an unnamed subwatershed, as defined by the U.S. Geological Survey. The subwatersheds predominantly located in the United States are the Boundary Creek and Walker Canyon-Carrizo Creek subwatersheds. Precipitation that falls in the Jacumba Valley Hydrologic Sub-Area and the aforementioned subwatersheds either infiltrates into the subsurface or enters Carrizo Creek and drains north through a narrow constriction known as the Carrizo Gorge. During significant precipitation events, Carrizo Creek flows northeast towards the Salton Sea.

Regional access to the Project site is provided by I-8, located to the north, and by Old Highway 80 which traverses the southern portion of the Project site. Both I-8 and Old Highway 80 are designated as County Scenic Highways within this area. The Jacumba Airport is located immediately to the east of the southern portion of the Project site. The southern boundary of the Project site is located along the U.S/Mexico border.

Public land in the surrounding area includes Anza Borrego State Park, located just to the northwest of the Project site, and the federal Bureau of Land Management Jacumba Mountain Wilderness located approximately 4 miles to the east. The Anza-Borrego Foundation also owns land to the west of the Project site.

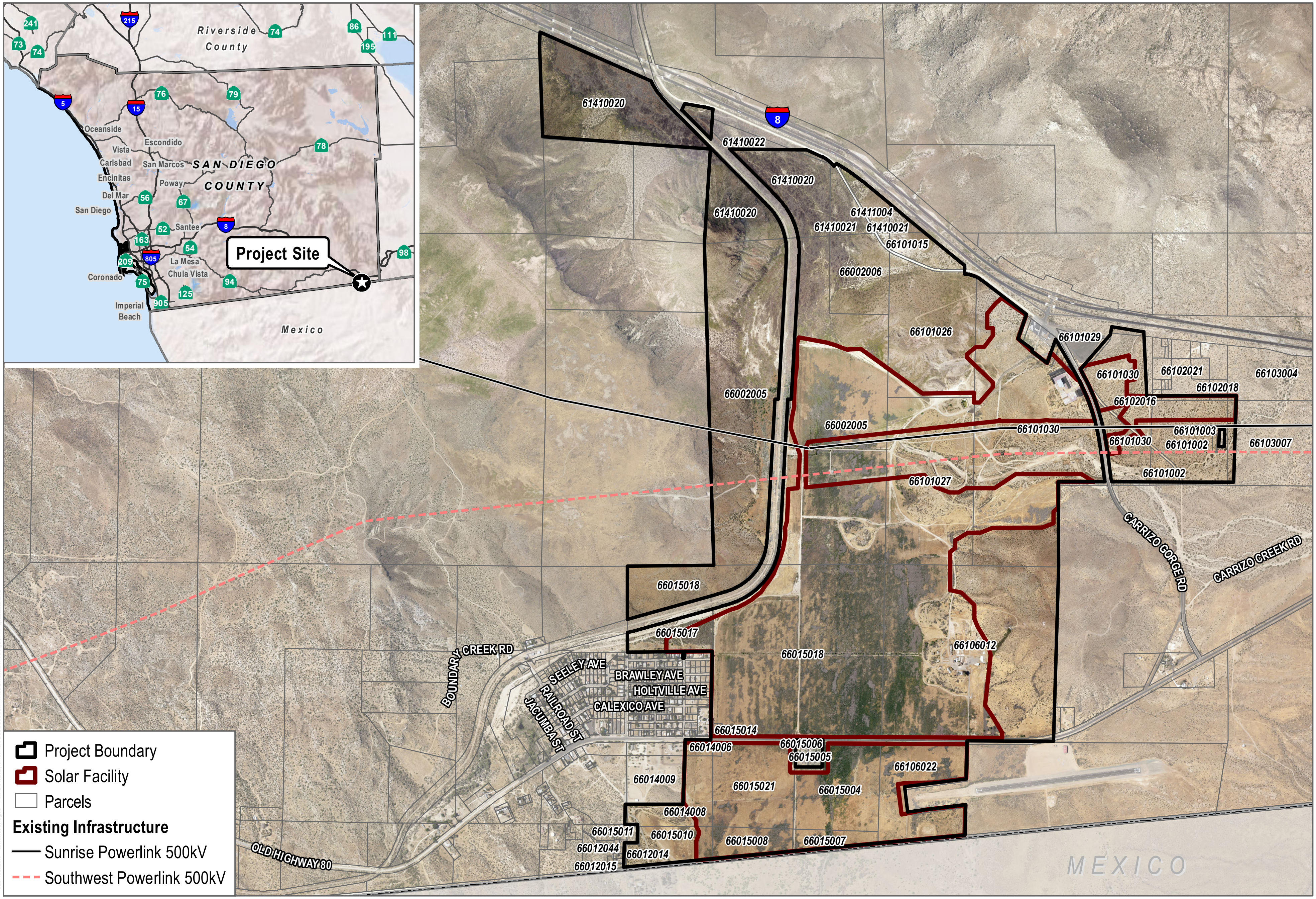
The unincorporated community of Jacumba Hot Springs is located adjacent to the proposed solar facility, to the west of the Project site. Jacumba Hot Springs is designated as a Rural Village by the County; the 2010 census population was 561. The community includes residential and commercial uses, including a hot springs resort. Jacumba Hot Springs and the surrounding area are totally dependent on groundwater for supply. The Jacumba Community Services District provides groundwater to the village area.

The Jacumba Airport is located to the east of the southern portion of the Project site. The Project site is also located within the Airport Influence Area of the Jacumba Airport, specifically within Zone 1 – Zone 6 of the Airport's Airport Land Use Compatibility Plan.

The site includes an easement for the San Diego and Arizona Eastern Railway, which is a short-line American railroad that provides a direct link for San Diego to the eastern United States. The railroad's 146.4-mile route originates in San Diego and terminates in El Centro. In June 2016, Baja California Railroad secured a 99-year lease with San Diego Metropolitan Transit System to rehabilitate and operate 70-miles of the railroad track between Tecate and Plaster City, California. Baja California Railroad calls this project the Desert Lines Project, and aims to reopen the old desert route to provide a new alternative for freight movement to the east. The Line, with 57 bridges and 17 tunnels, would be rehabilitated in three phases, with the first phase between Campo to Jacumba, and the third phase from Jacumba to Dos Cabezas. However, there is no projected timeline for commencing this rehabilitation. Further, the Project would not have any impact on the railroad because the railroad lies entirely outside of the MUP boundary.

The Sunrise Powerlink and Southwest Powerlink, each of which consists of a 500 kV electric transmission line supported by 150-foot-tall steel lattice structures, transect the Project site, as depicted in Figure 2. The East County 50023068 kV Substation is located approximately 3 miles to the east. This substation was constructed in 2009 to provide an interconnection hub for renewable generation and eliminate the need for multiple generator-owned or -operated switching stations along the existing SWPL 500 kV transmission line. The ECO Substation is looped into the existing 500 kV SWPL transmission line. An approximately 13.5-mile long 69 kV transmission line originates at the ECO Substation and runs to the existing Boulevard 69 kV Substation to the northwest.

The proposed project's switchyard would be looped into the 500 kV SWPL transmission line between the East County Substation and the Boulevard Substation.



SOURCE: Kimley-Horn 2019; SANGIS 2017, 2019

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0 1,000 2,000 Feet

FIGURE 1

Project Location

JVR Energy Park Fire Protection Plan

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1.1.3 Project Description

The Proposed Project is a solar energy generation and storage facility which would produce a rated capacity of up to 90 megawatts (MW) of alternating current (AC) generating capacity and would consist of 300,000 photovoltaic (PV) modules fitted on single-axis solar trackers on approximately 642 acres within the 1,356-acre Project site. In addition to the PV modules and direct current (DC) to alternating current (AC) conversion equipment, the proposed project would consist of the following primary components:

- Approximately 300,000 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 pads, 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 (152-foot by 180-foot)
- A 138 kV switchyard adjacent to the on-site collector substation to transfer power from the on-site collector substation to the existing San Diego Gas & Electric (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, 550-foot-long (1,100 feet total) 80-foot-high overhead transmission lines (gen-tie) would loop the switchyard into the existing SDG&E Boulevard – East County transmission line
- 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 Proposed Project's collector substation and the switchyard would be sized to accommodate the full 90 MW (AC) solar facility and a battery storage system with a capacity of up to 90 MW or 180 MWh. (ADD)

A map of the Project site plan, showing primary components, is included in Figure 2. Please refer to Chapter 1 in the EIR for a complete project description.

1.) Photovoltaic Modules

Photovoltaic (PV) modules generate electricity by safely converting the energy of the sun's photons into DC electrons. The Proposed Project would include approximately 300,000 PV modules, which would be installed in rows (arrays). Arrays grouped together are referred to as array fields.

The modules would be mounted on single-axis trackers oriented in the north–south direction. Single-axis tracking systems would employ a motor mechanism that allows the arrays to track the path of the sun (from east to west) throughout the day. The PV modules are uniformly dark in color, non-reflective, and designed to be highly absorptive of all the light that strikes their glass surfaces. The PV modules would cover the majority of the area of the proposed facility.

The PV modules deployed for use in the Proposed Project would comply with all industry standard quality testing. The PV modules would be electrically connected to the grounding system of the facility in accordance with local codes and regulations. The final PV module selection would be determined during the Proposed Project's detailed engineering phase. Most PV modules are guaranteed a useful life of 35 years in adverse weather conditions.

The PV modules and tracking systems would be inspected periodically. Electrical components would be tested routinely according to manufacturer's recommendations. In the event that remote monitoring indicates a problem, such as low performance in a section of the array field, a crew would investigate and correct the problem on an as-needed basis. It is anticipated that in-place PV panel washing would occur four times a year. Washing of the PV panels would be undertaken using wash trucks. Washing would occur during daylight hours, so no lighting would be required.

2.) PV Modules Support Structures

The solar PV modules would be mounted on support structures that allows them to be properly positioned for maximum capture of the sun's solar energy. Each row of PV modules (module arrays) would be a single-axis tracker system that would be oriented along a north-to-south axis. The support structures are typically mounted on metal pipe pile or I-beam foundations 6 to 10 inches in diameter. The beams would be driven into the soil using a pile/vibratory/rotary driving technique similar to that used to install freeway guardrails. Driven pier foundations are a "concrete-free"foundation solution that would result in minimal site disturbance and facilitate site reclamation at the end of the Proposed Project's lifecycle. Most pier foundations would be driven to approximate depths of 10 to 15 feet deep depending upon required embedment depth.

The PV modules, at their highest point, would be approximately 12 feet above the ground surface depending upon the 100-year flood elevations within the Project site. The PV module arrays' final elevations from the ground would be determined during the detailed Project design process; however, for the purpose of the analysis in this EIR, maximum height above the graded ground surface would be 12 feet. It is common practice to maintain as low of an elevation profile as possible to reduce potential wind loads on the PV module arrays.

3.) Electrical (DC) Underground Collection System

PV modules would be electrically connected to adjacent modules to form module "strings" using wiring attached to the support structures. PV module strings would be electrically connected to each other via underground wiring. Wire depths would be in accordance with local, state, and federal codes. String wiring terminates at PV module array combiner boxes, which are lockable electrical boxes mounted on or near an array's support structure. Output wires from combiner boxes would be routed along an underground trench system approximately 3-4 feet deep and 1-3 feet wide, including trench and disturbed area, to the inverter and transformers skids.

4.) Inverter/Transformer Pads

Inverters are a key component of solar PV power-generating facilities because they convert the DC generated by the PV module array into AC that is compatible for use with the transmission network, The medium-voltage transformers would step up the voltage to collection-level voltage (34.5 kV).

The inverters, medium-voltage transformers, and other electrical equipment would be installed at 25 locations on adjacent to the battery storage containers, throughout the solar facility. X inverters and X transformers would be installed on each metal skid. Each metal skid would be approximately 8 feet wide and 20 feet long. The skids would be mounted above the 100-year flood elevations on a set of piles driven into the ground and covered by an earth or gravel mount that is built up to the top of the skid to provide a working clearance to all access points on the skid per applicable electrical and labor codes. All electrical equipment would be either outdoor rated or mounted within enclosures designed specifically for outdoor installation.

5.) Electrical (AC) Collection System

The 35.4 AC power would be collected from the 25 skids and electrically transmitted through an underground AC collector system. This underground system would consist of approximately 5,000 feet of cables located in trenches approximately 4 feet deep and 1-3 feet wide. At the point of transfer, the AC power would be electrically transmitted through 50 feet of overhead AC feeders, approximately 30-feet-tall.

6.) Collector Substation

The Proposed Project includes a collector substation (152-foot by 180-foot (27,360 square feet)) that would be located near the center of the eastern side of the Project site. The purpose of the substation is to collect the power from the AC collector system and convert the voltage from 34.5 kV to 138 kV, as well as to be able to isolate equipment in the event of an electrical short-circuit, or for maintenance.

The major components of the proposed collector substation are as follows:

- One 34.5 kV to 138 kV transformer including secondary containment area per local and state regulations.

- One 138 kV circuit breaker used to protect equipment from an electrical short circuit on the gen-tie. Disconnect switches, wire, cables, and aluminum bus work used to connect and isolate the major pieces of equipment.
- The substation would also include a single 34.5 kV circuit breaker used to protect equipment from an electrical short circuit on the collection system, disconnects and bus work to connect and isolate the collector circuits, relays used to detect short circuits, equipment controls, telemetering equipment used to provide system control and data acquisition, voice communication, and the meters used to measure electrical power generated from the Proposed Project. Switching gear and other components would be a maximum of 40 feet in height.
- A 138 kV dead-end structure that would have a maximum height of 65 feet. This structure would have either an A-frame or H-frame design and would be constructed of steel. The dead-end structure is where the power output from each transformer is delivered to the gen-tie line.
- One Control Enclosure for the Supervisory Control and Data Acquisition (SCADA) system (approximately 34 feet long by 15.5 feet wide, and a height of 15 feet).

During operation of the collector substation, operation and maintenance staff would visit the substation periodically for switching and other operation activities. Maintenance trucks would be utilized to perform routine maintenance, including but not limited to equipment testing, monitoring, repair, routine procedures to ensure service continuity, and standard preventative maintenance.

7.) Switchyard

The Proposed Project would include a 138 kV switchyard located adjacent to the proposed collector substation. The size of the switchyard would be approximately 140,000 square feet. Within this area would be a __-foot high security fence (445 feet by 300 feet) surrounded by a 5-foot shoulder for grounding protection. Drainage facilities would be installed to control runoff and protect the switchyard from erosion. The 138 kV insulated electrical bus, steel support structures and foundations would be installed to support the following electrical equipment:

- 2 138 kV bays in a ring bus configuration
- 3 Gas Insulated Circuit Breakers with 4 Collection s each
- 12 Gang Operated Air Break (GOAB) switches
- 9 98kV surge arrestors
- 9 138kV Single Bushing Potential Transformers
- 2 138kV-240V/120V Station Service Transformers
- Control Enclosure
- Security and lighting

One single-story control enclosure would be used for relays, metering, SCADA information and security and communication equipment. A gas generator may also be installed for use as backup power to the station lights and station service power transformers. The maximum amount of oil required for the station service transformers at the switchyard would be approximately 175 gallons per pot, or 350 gallons total.

The tallest structures in the switchyard would be the 138 kV line and the dead-end structures. The maximum height in the yard would be the approximately 66-foot-high dead-end structure that spans wire to the collector substation.

After completion of construction of the switchyard, operation of the switchyard facility would be transferred to SDG&E. The switchyard would be unmanned during operation. Monitoring and control functions would be performed remotely from SDG&E's central operations facilities. Accordingly, no new personnel would be required for operation and maintenance. Routine operations would require a single pickup truck visiting the switchyard several times a week for switching, as well as several larger substation construction and maintenance trucks visiting the switchyard several times a year for equipment maintenance. Maintenance activities would include equipment testing, equipment monitoring and repair, and emergency and routine procedures for service continuity and preventive maintenance. Based on operations at similar facilities, routine maintenance is expected to necessitate approximately six trips per year by a two- to four-person crew. Routine operations would require one or two workers in a light utility truck to visit the switchyard on a weekly basis. Typically, a major maintenance inspection would take place annually, requiring approximately 20 personnel for approximately one week.

An approximately 1,500 foot-long asphalt paved access driveway will be constructed from Carrizo Gorge Road to the switchyard. The access driveway will be approximately 30-feet-wide, requiring approximately 1.2 acres of land in new right-of-way and 0.3 acres of land on existing SDG&E right-of-way. In addition, 30-foot-wide asphalt-paved interior access driveways may be constructed within the switchyard site to access the equipment.

8.) 138 kV Transmission Line Tie-in

The proposed switchyard would be connected into the existing 138 kV SDG&E Boulevard – East County transmission line. The proposed overhead transmission line tie-in would require two approximately 550-feet long spans of wire and up to four steel transmission poles. The tallest proposed transmission pole would be approximately 80 feet above the ground surface. Each Pole would have up to six cross arms and a pole top to accommodate a fiber optic ground wire for lightning protection and critical communication.

Temporary construction areas will be cleared and graded at each pole location for a safe working environment and pulling wire.

9.) Battery Energy Storage System

A battery energy storage system with a maximum capacity of up to 90 MW, 180 MWh is proposed to be located throughout the solar facility. This energy storage system would be comprised of battery storage containers located adjacent to the inverter/transformer pads (up to 3 containers per each pad for a total of 75 containers on site). The battery system would be DC coupled with the PV system, connecting electrically at the DC bus of the inverters. The same inverters, transformers, medium voltage equipment, and AC wiring all serves both the battery energy storage system and the PV system. The battery storage system would be inspected on a regular basis and would be monitored by the SCADA System.

The Project proposes the use of steel containers (customized Conex or similar depending on supplier) to hold Lithium-ion batteries. Each container would hold the battery packs on racks. The containers are typically made from

12 to 14 gauge steel, and measure approximately 55-feet-long, 19-feet-wide, and 10-feet-high. Currently available each container would be separated from neighboring containers by approximately 10 feet.

The specific battery type proposed for the Project is a Lithium-ion nanophosphate cell. Currently available data indicates that this particular type of Lithium-ion battery has proven to be less vulnerable to fire occurrences than typical Lithium-ion batteries. Lithum-ion nanophosphate batteries include a stable cathode chemistry that substantially reduces the possibility of thermal runaway and provides for reduced reaction from abuse (Sandia National Laboratories 2012).

The proposed battery storage system would include multiple levels of protections against overcharge. Each container would have underground wiring connecting it to a 600 kW DC:DC converter, which would bring the voltage from the batteries in the containers up to match the voltage of the PV energy entering into the inverter's DC bus. Each one of three containers would have three skid-mounted DC:DC converters.

The containers would be situated to enable emergency/fire response access. The containers would be sited with adequate set back from off-site areas as a buffer against potential wildfire ignitions. No additional transformer units or protective devices are required. The containers would not be walk-in containers, thus the battery storage containers would not be habitable structures per the fire code.

The proposed batteries and containers also include the following important monitoring and safety components:

- Modular battery racks designed for ease of maintenance
- Integrated heat and fire detection and suppression system
- Integrated air conditioning system
- Integrated battery management system

The heat and fire detection system would be linked to an automatic inert gas suppression system within each container. The containers would also have a basic interior containers sprinkler system with several sprinkler heads for coverage and an external dry standpipe for fire fighters to connect and pump water.

Critical information from the battery system, equipment data from the DC:DC converters and inverters would be monitored by the battery monitoring system inside the containers, at the LV (1500V) metering at the inverter cabinets and at the power plant controller measured along with the solar plant performance with the SCADA control system described in more detail below.

The battery management system would track the performance, voltage and current, and state of charge of the batteries. The system would proactively search for changes in performance that could indicate impending battery cell failure, and power down and isolate those battery strings in order to avoid potential failures.

The National Fire Protection Association (NFPA) has developed a new Standard for the Installation of Energy Storage Systems (NFPA 855). This standard addresses the design, construction, installation, commissioning, operation, maintenance and decommissioning of stationary energy storage systems. The Project would meet most of the standards, except where they are not applicable to the Proposed Project. The layout of the system would also meet the section 4.4.3 definition of remote locations, where energy storage system equipment is greater than 100-feet away from public ways or stored materials.

10.) Fiber-Optic Line

To provide for communication with the SCADA system, a fiber-optic cable would be placed underground to connect the substation to the switchyard. Utility interconnection regulations require the installation of a second separate, redundant fiber-optic cable. The redundant fiber-optic cable would also be installed within the Project development footprint and the proposed switchyard boundary.

11.) Control System

The Proposed Project's control system includes a SCADA system and an overall plant control system (PCS). Operation of the solar facility would be monitored through the SCADA system, as described below. The Proposed Project would also have a local overall PCS that provides monitoring of the solar field as well as control of the balance of facility systems.

The SCADA system is required for the purpose of providing plant system monitoring and control during steady state operation, safe operation during unperceived events and abnormal operating conditions, and equipment start-up/shutdown. In addition, the SCADA system is required for providing substation and inverter information to the Owner/Operator, as well as providing information about the PV Facility and interconnection Facility to transmission owner, independent system operator, and/or EPC Power contractor. The SCADA System is also required to accept data from the Utility/Transmission Provider and/or Independent System Operator (ISO) and record this data in a Historian and/or act upon the data appropriately. The SCADA system would be monitored remotely, and no on-site operations and maintenance facilities or personnel would be necessary.

The SCADA system would be located in two Control Enclosures. One enclosure would be located in the on-site collection substation area and the other enclosure would be located in the switchyard area. Each enclosure would be approximately 10 feet by 10 feet, and X feet in height. The SCADA system would be comprised of rack-mounted servers and software to allow for the continuous monitoring and control. Control algorithms would be designed to coordinate the PV system with substation equipment, utility and owner SCADA requirements. The SCADA system would allow inverters to have remote capability to adjust plant capacity, output voltage and reactive power output through communication between hardware and central SCADA server. It would have the ability to perform switching required to connect the plant to and to disconnect the plant from the local electrical grid. The SCADA System would include capabilities such as monitoring and control of PV inverters, solar trackers, PV weather monitoring system, and monitoring of MV skid transformers, substation equipment including protective relays, medium voltage circuit breakers, high voltage breakers, step-up transformer and revenue meters. In addition, the SCADA System would also monitor and control the battery storage system. SCADA consists of a few server racks installed with the control enclosure of the collector substation, and consists of LCD Display and Datalogger, Cellular Modem, Central Processing Unit, and meter for analog/digital measurements. The SCADA system would be used to provide critical operating information (e.g., power production, equipment status and alarms, and meteorological information) to the power purchaser, Project owners and investors, grid operator, and Project operations teams, and to facilitate production forecasting and other reporting requirements for Project stakeholders.

The microprocessor-based PCS would provide control, monitoring, alarm, and data storage functions for plant systems as well as communication with the Proposed Project's SCADA system. Redundant capability would be provided for critical PCS components so that no single component failure would cause a plant outage. All field instruments and controls would be hard-wired to local electrical panels. Local panels would be hard-wired to the PCS. Wireless technology would be considered as a potential alternative during final Project design.

12.) Meteorological Weather Stations

The Proposed Project includes five meteorological weather stations, which would be installed throughout the solar facility. The weather stations would be used to record weather to measure the performance of the solar facility. The parameters recorded would include air temperature, relative humidity, precipitation, air pressure, wind direction and speed, and solar irradiance. Measuring irradiance is important for determining how much power could potentially be harvested from the sun. A pyranometer would also be at each weather station to measure irradiance.

Four of the meteorological stations would be installed at a place closest to the inverter skids to minimize cable runs. The fifth station would be located adjacent to the collector substation. The locations would have no shading obstruction such that the irradiation received by the sensors ("pyranometer") in the station is the same as that received by all the modules in the Proposed Project. Each station would occupy an area of approximately 10 feet by 7 feet. The mounting equipment would be made up of steel to ultimately provide height to the actual sensor located at the end of an aluminum (approximately 2-inch diameter) arm about 3 feet long to isolate the equipment from parts that can potentially shade the sensor. The maximum height of the station would be 10 feet. The equipment would be installed on a 5 foot by 5 foot square pad. The setup would be connected to a datalogger and cellular modem with an approximately 10-meter cable to interface digitally with the SCADA system and the PCS.

13.) Site Access Driveways

The primary access driveways to the solar facility would provide access off of Old Highway 80 and would be approximately 24 feet wide. Three secondary driveways, 24 feet in width, would provide access off of Carrizo Gorge Road. Two driveways would provide arrays on the east side of Carrizo Gorge Road. The third secondary driveway would provide access to arrays on the west side of Carrizo Gorge Road.

In addition, an approximately 1,500 foot-long asphalt paved access driveway (30 feet in width) would be constructed from Carrizo Gorge Road to the switchyard. The access driveway would require approximately 1.2 acres of land in a new right-of-way and 0.3 acres of land within an existing SDG&E right-of-way. In addition, 30-foot-wide asphalt-paved interior access driveways may be constructed within the switchyard site to access the equipment.

Each site entrance would feature a manual swing gate, and a sign with a lighted directory map and contact information. All entrance gates would feature a 'Knox Box' for emergency access.

14.) Internal Access

The Proposed Project would include dual-purpose internal fire response access and service access. The perimeter internal access within the fenced solar facility would be constructed to a minimum improved width of 24 feet. The interior access would be constructed to a minimum improved width of 20 feet.

All internal access would be designed to provide a minimum inner turning radius of 28feet, would be graded and maintained to support the imposed loads of fire apparatus (not less than 75,000 pounds), and would be designed and maintained to provide all-weather driving capabilities. The internal access would allow for two-way access of fire apparatus throughout the solar facility in order to access all of the inverter/transformer pads.

All internal access surfaces would have a permeable nontoxic soil binding agent in order to reduce fugitive dust and erosion in accordance with County Code Section 87.428, Dust Control Measures, and with San Diego Air Pollution

Control District Rule 55, which regulates fugitive dust emissions from any commercial construction or demolition activity capable of generating fugitive dust emissions.

15.) Improvements within SDG&E Transmission Corridor

The SDG&E Transmission Corridor is approximately 600-feet wide and is comprised of three easements. The Proposed Project would include some civil improvements within the SDG&E Transmission Corridor as described below:

- Easement Crossing 1 would be located on the west end of the project site and would serve to connect two regions of the PV Array Field to each other across the SDG&E Transmission Corridor. This proposed easement crossing would be comprised of a 24-foot-wide aggregate base driveway and potentially an underground medium voltage collection line.

- Easement Crossing 2 would be located on the east end of the project site and serves to provide access from the east side of Carrizo Gorge Road to the easternmost end of the PV Array Field via the SDG&E Transmission Corridor. This proposed easement crossing would be comprised of a 24-foot wide aggregate base driveway and an earthen road-side diversion swale. This driveway would provide access to an existing SDG&E transmission tower in the southernmost 200-foot-wide easement and would replace an existing driveway. The existing driveway connection is proposed to be relinquished with the County. The diversion swale is proposed along the southwest side of the proposed driveway to protect the driveway and convey upstream runoff. The swale will cross the SDG&E connection to the main throat of the proposed driveway, and at this crossing, a low water crossing or culvert would be installed to manage stormwater runoff.

- Easement Encroachment 3 would be needed to interconnect the overhead power lines from the switchyard to the existing transmission lines.

16.) Security Fencing and Signage

The approximately 642-acre solar facility would be fenced along the entire facility boundary (see Figure 2) for security. The fencing would meet National Electrical Safety Code requirements for protective arrangements in electric supply stations. Fencing would be 7 feet in height total, with a 6-foot-high chain-link perimeter fence and 1 foot of three strands of barbed wire along the top. The fence would be constructed with anti-climbing material(s), such as small-ring chain-link fencing. The fence would also include tan slat inserts along certain segments to aid in the visual screening of the proposed PV panels. Signage in Spanish and English for electrical safety would be placed along the perimeter of the solar facility, warning the public of the high voltage and the need to keep out.

17.) Lighting

Lighting would be designed to provide security lighting and general nighttime lighting for operation and maintenance personnel, as may be required from time to time. Lighting would be provided at the entrances, the substation and switchyard, as described below. The PV arrays, the inverter/transformer pads, and the battery storage containers would not have lighting.

Lighting would be provided at the primary entrance off Old Highway 80 and would be on after 5:00 p.m. Motion censored lights would also be installed at the secondary entrances. Lighting would be shielded and directed downward to minimize any effects to the surrounding area,

Lighting would be installed within the substation to allow for safety inspections or maintenance that may be required during the evening hours. Lighting would also be provided next to the entrance door to the control enclosure. Lighting would also be installed at the entrance gates to the substation. Since maintenance activities are not anticipated to be completed during the evening hours, lights would only be turned on if needed.

Switchyard lighting would be placed near major electrical equipment in the switchyard. The switchyard lights would normally be turned off and would only be used during nighttime for security and safety reasons. Lighting would be installed at the entrance gate to the switchyard. The entry light would be left on during nighttime hours to allow the entry to be illuminated in the event that nighttime emergency repair or maintenance are needed.

All lighting for the solar facility would have bulbs that do not exceed 100 watts, and all lights would be shielded, directed downward, and would comply with the County of San Diego Light Pollution Code, also known as the Dark Sky Ordinance, Section 51.201 et seq. Additionally, lighting for the Proposed Project would be designed in accordance with the San Diego County Zoning Ordinance, Performance Standards Section 6320, 6322, and 6324, which guide performance standards for glare, and controls excessive or unnecessary outdoor light emissions.

18.) Water Tanks Fire Protection

ADD

19.) Fuel Modification Zones

ADD

Landscaping

Landscaping would be installed in the following locations to provide visual screening of the PV modules and other Project components:

- Along the proposed fenceline east of Carrizo Gorge Road facing
- Along Old Highway 80 on both sides of the highway and around internal lots that are to be avoided by the project.
- Around private lots located within the Project site
- Along the western boundary of the proposed solar facility adjacent to residential areas (along Seely Avenue, Laguna Street, and the entire western boundary south of Old Highway 80).

The proposed landscaping buffer would be approximately 15-feet wide and would be located outside of the perimeter fencing. The proposed landscaping would include native and/or drought tolerant trees (approximately 18-feet-tall after 10-years after planting) shrubs, and ground covers. The trees and taller species of shrubs would be placed closest to the fence. The lower species of shrubs and ground covers would be placed between the large shrubs and the buffer edge to effectively transition the plant material from highest at the fence to the lowest at the roadway. This design would help to maintain driver visibility.

All landscape improvements would be designed in accordance with the County of San Diego Landscape Standards, Jacumba Community Service District Design Guidelines and in accordance with Assembly Bill 1881, State Water Conservation Requirements. Native and Drought tolerant plants that minimize water use and maintenance would be utilized. All plant materials would be appropriate for the climate of Jacumba Valley. All planting required for screening would be established with vegetation typical of the particular habitat(s) in each area based on coordination with the Project biologist. All landscaping would be regularly irrigated with an automatic drip irrigation system supplied by an existing domestic water meter. All landscape would be maintained during the life of the permit, and all dead, dying or diseased plants would be replaced in kind. All existing trees and shrubs located in the area not under direct improvement, or within the landscape buffer, would be protected in place, and would be incorporated into the overall landscape. If area boulders are encountered and exposed during grading activities, they would be moved to the landscape buffer area to the extent practical.

1.1.4 Construction Fire Prevention Plan

A Construction Fire Prevention Plan (CFPP) has been prepared for the JVR Energy Park (Appendix A to this FPP). The CFPP provides standard protocols and approaches for reducing the potential of ignitions for typical construction site activities. When employed, the concepts discussed in the CFPP would help minimize and avoid ignitions as well as extinguish any ignitions while they are small and controllable.

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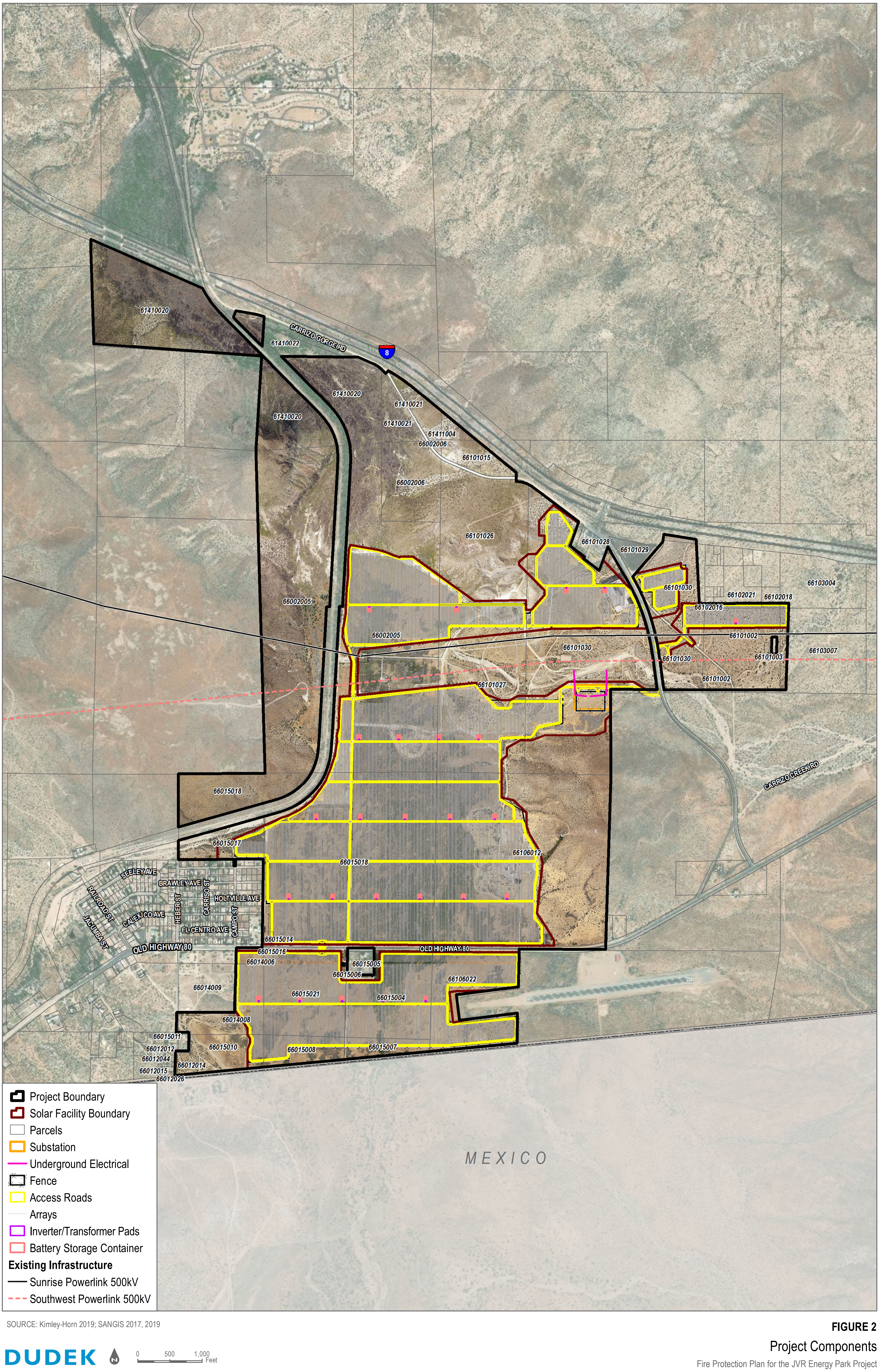

SOURCE: Kimley-Horn 2019; SANGIS 2017, 2019

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FIGURE 2

Project Components

Fire Protection Plan for the JVR Energy Park Project

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2 Project Site Risk Assessment

2.1 Field Assessment

A field assessment of the Project site was conducted on October 9, 2018 in order to acquire site information, document existing site conditions, and to determine potential actions for addressing the protection of the Proposed Project's components. While on site, Dudek's Fire Protection Planners assessed the area's topography, natural vegetation and fuel loading, surrounding land use and general susceptibility to wildfire. Among the field tasks that were completed are:

- Vegetation estimates and mapping refinements
- Fuel load analysis
- Topographic features documentation
- Photograph documentation
- Confirmation of hazard assumptions
- Ingress/egress documentation.
- Nearby Fire Station reconnaissance

Field observations were utilized to augment existing site data in generating the fire behavior models and formulating the recommendations detailed in this FPP. Appendix B provides representative photographs of the Project site in its current condition.

2.2 Site Characteristics and Fire Environment

2.2.1 Topography

Located in southeastern San Diego County, the Project site is situated in a valley at the northeast edge of an unnamed, mountain range that extends south into Mexico. The Project site lies between two major drainage divides: the Tecate Divide to the west and the In-Ko-Pah Mountains to the east. The Project site includes the eastern portion of Round Mountain which is located within the northwestern area of the Project site. Gray Mountain lies just north of I-8. Topography within the Project site includes primarily gently rolling slopes in the proposed development footprint. Round Mountain and steeper slopes are located within the western portion of the Project site. Site elevations range from approximately 3,365 feet above mean sea level (amsl) in the highest portions near Round Mountain to the northwest to 2,745 feet amsl in the lower northwestern corner of the Project site.

The Project site is located within the Anza Borrego watershed. Control Board Colorado River Hydrologic Basin Region 7 Planning Area. The contributing watersheds to the Project site cover an area of approximately 70,868 acres (111 square miles), with 76% located in Baja California, Mexico. The majority of flow from Mexico north into the Jacumba Valley is derived from the Flat Creek subwatershed, which includes the Blue Angel Peak subwatershed and an unnamed subwatershed, as defined by the U.S. Geological Survey. The subwatersheds predominantly located in the United States are the Boundary Creek and Walker Canyon-Carrizo Creek subwatersheds. Precipitation that falls in the

Jacumba Valley Hydrologic Sub-Area and the aforementioned subwatersheds either infiltrates into the subsurface or enters Carrizo Creek and drains north through a narrow constriction known as the Carrizo Gorge. During significant precipitation events, Carrizo Creek flows northeast towards the Salton Sea.

The Proposed Project would alter the topography within the approximately 642-acre development footprint such that land beneath and adjacent to the individual panel racks and other project components would be flat, though there would still be changes in elevation. The 642-acre development footprint would be a graded/cleared surface.

2.2.2 Climate

Eastern San Diego County, including the Project area, is influenced by the Pacific Ocean and are frequently under the influence of a seasonal, migratory subtropical high pressure cell known as the "Pacific High" (WRCC 2019a). Wet winters and dry summers with mild seasonal changes characterize the Southern California climate. This climate pattern is occasionally interrupted by extreme periods of hot weather, winter storms, or dry, easterly Santa Ana winds (WRCC 2019a). The average high temperature for the Project area is approximately 76.3°F, with average highs in the summer and early fall months (July–October) reaching 93.8°F. The average precipitation for the area is approximately 14.82 inches per year, with the majority of rainfall concentrated in the months of December (2.06 inches), January (3.04 inches), February (2.77 inches), and March (2.30 inches), while smaller amounts of rain are experienced during the other months of the year (WRCC 2019b).

The prevailing wind pattern is from the west (on-shore), but the presence of the Pacific Ocean causes a diurnal wind pattern known as the land/sea breeze system. During the day, winds are from the west–southwest (sea) and at night winds are from the northeast (land). During the summer season, the diurnal winds may average slightly higher than the winds during the winter season due to greater pressure gradient forces. Surface winds can also be influenced locally by topography and slope variations. The highest wind velocities are associated with downslope, canyon, and Santa Ana winds.

The Project area's climate has a large influence on the fire risk as drying vegetation during the summer months becomes fuel available to advancing flames should an ignition be realized. Typically the highest fire danger is produced by the high-pressure systems that occur in the Great Basin, which result in the Santa Ana winds of Southern California. Sustained wind speeds recorded during recent major fires in San Diego County exceeded 30 mph and may exceed 50 mph during extreme conditions. The Santa Ana wind conditions are a reversal of the prevailing southwesterly winds that usually occur on a region-wide basis during late summer and early fall. Santa Ana winds are warm and dry winds that flow from the higher desert elevations in the north through the mountain passes and canyons. As they converge through the canyons, their velocities increase. Consequently, peak velocities are highest at the mouths of canyons and dissipate as they spread across valley floors. Santa Ana winds generally coincide with the regional drought period and the period of highest fire danger. The Project site is affected by Santa Ana winds.

2.2.3 Vegetation

2.2.3.1 Fuels (Vegetation)

The Project site is generally an arid semi-desert environment that supports a limited range of habitats and biological communities. Based on Dudek's site visit conducted in October 2018 and the Biological Technical Report (Dudek 2019), there are nine vegetation communities and/or land cover types within the Project site. The vegetation communities include Sonoran Mixed Woody Scrub, Sonoran Mixed Woody and Succulent Scrub, Big Sagebrush Scrub, Desert Saltbush Scrub, Desert Sink Scrub, Mesquite Bosque, Disturbed Habitat, Urban/Developed, and Non-Vegetated Floodplain or Channel. The acreage of each of these vegetation communities and land covers are provided in Table 1 and their spatial distribution on the Project site is illustrated in Figure 3. As indicated, Sonoran Mixed Woody and Succulent Scrub, Sonoran Mixed Woody Scrub, Mesquite Bosque, and Disturbed Habitat are the most common vegetation communities and/or land cover types that currently exist on the Project site. These communities represent the fuels that would likely spread wildfire toward or away from the Project and would be required to be removed throughout the 680-acres solar facility development footprint.

Table 1. Project Site Vegetation Communities and Land Covers

Vegetation Community/Land Cover	Acres	Percentage Cover
Sensitive Vegetation Communities and Land Covers		
Big Sagebrush Scrub	0.26	0.02%
Desert Saltbush Scrub	71.13	5.2%
Desert Sink Scrub	12.43	0.9%
Mesquite Bosque	130.95	9.7%
Non-vegetated Floodplain or Channel	10.05	0.7
Sonoran Mixed Woody Scrub	139.34	10.3
Sonoran Mixed Woody and Succulent Scrub	390.67	28.8
Sensitive Communities and Land Covers Subtotal	754.83	-
Non-Sensitive Communities and Land Covers		
Disturbed Habitat	574.74	42.4%
Urban/Development	26.00	1.9%
Non-Sensitive Communities and Land Covers Subtotal	*600.74*	-
Total	**1,355.58**	**100.0%**

Descriptions of these vegetation types are as follows:

Disturbed Habitat

Disturbed habitat is characterized by predominantly non-native species introduced and established through human action (Oberbauer et al. 2008).

Urban/Developed

Urban/developed land refers to areas that have been constructed upon or disturbed so severely that native vegetation is no longer supported. Developed land includes areas with permanent or semi-permanent structures, pavement or hardscape, landscaped areas, and areas with a large amount of debris or other materials (Oberbauer et al. 2008).

Sonoran Mixed Woody Scrub

Sonoran mixed woody scrub is characterized as being predominantly woody shrubs, 1.6 to 9.8 feet tall, and includes a mixture of three or more woody species (Oberbauer et al. 2008). Characteristic species include creosote bush (*Larrea tridentata*), white bursage (*Ambrosia dumosa*), and brittle bush (*Encelia farinosa*). In San Diego County, this vegetation community commonly occurs on lower alluvial fans, above the desert floor, and below the coarse mountain substrates (Oberbauer et al. 2008).

Sonoran Mixed Woody and Succulent Scrub

Sonoran mixed woody and succulent scrub occurs in the Colorado Desert and is dominated by 1.6 to 9.8 feet shrubs and cacti and other stem succulents (Oberbauer et al. 2008). Common characteristic species include desert agave (*Agave deserti*), brittle bush, and Mojave yucca (*Yucca schidigera*). In San Diego County, this vegetation community is dominated by more than 50% cover of succulent species (Oberbauer et al. 2008).

Big Sagebrush Scrub

Big sagebrush scrub is characterized by mostly soft-woody shrubs approximately 1.6 to 6.5 feet tall. This vegetation community occurs on a variety of soils and terrain, including well-drained slopes to fine-textured valley soils. In San Diego County, big sagebrush scrub occurs in alluvial washes along dry margins of high desert and montane valleys (Oberbauer et al. 2008). Characteristic species include big sagebrush (*Artemisia tridentata*), fourwing saltbush (*Atriplex canescens*), black brush (*Coleogyne ramosissima*), and ashy ryegrass (*Elymus cinereus*).

Desert Saltbush Scrub

Desert saltbush scrub is characterized by spaced low, microphyllous 1 to 3.2 feet tall shrubs dominated by allscale (*Atriplex polycarpa*) and alkali goldenbush (*Isocoma acradenia*) (Oberbauer et al. 2008). This vegetation community commonly occurs on fine-textured, poorly drained soils with high alkalinity in drier areas. Characteristic species include silverscale saltbush (*Atriplex argentea*), fourwing saltbush (*Atriplex canescens*), and spiny hop sage (*Grayia spinosa*).

Desert Sink Scrub

Desert sink scrub is characterized by widely spaced low, microphyllous 1 to 3.2 feet tall shrubs (Oberbauer et al. 2008). Desert sink scrub is dominated by succulent chenopods and 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*).

Mesquite Bosque

Mesquite Bosque is characterized by an open to fairly dense, drought-deciduous streamside thorn forest with open annual and perennial grass understory (Oberbauer et al. 2008). This vegetation community is dominated by mesquite (*Prosopis glandulosa*) and additional characteristic species include carelessweed (*Amaranthus palmeri*), white bursage, fourwing saltbush, and allscale. Mesquite Bosque occurs on higher alluvial terraces and near washes, streambanks, alkali sinks, or outwash plains with substantial groundwater.

Non-Vegetated Floodplain or Channel

Non-vegetated floodplain or channel is characterized by sandy, gravelly, or rocky fringe of waterways or flood channels that is unvegetated on a relatively permanent basis (Oberbauer et al. 2008). Vegetation may be present but is usually less than 10% total cover and grows on the outer edge of the channel.

2.2.3.2 Vegetation Dynamics

The vegetation characteristics described above are used to model fire behavior modeling, discussed in detail in Section 4.0 of this FPP. Variations in vegetative cover type and species composition have a direct effect on fire behavior. Some plant communities and their associated plant species have increased flammability based on plant physiology (resin content), biological function (flowering, retention of dead plant material), physical structure (bark thickness, leaf size, branching patterns), and overall fuel loading. For example, grass dominated plant communities become seasonally prone to ignition and produce lower intensity, higher spread rate fires. In comparison, chaparral can produce higher heat intensity and higher flame lengths under strong, dry wind patterns, but does not typically ignite or spread as quickly as light, flashy grass fuels.

As described, vegetation plays a significant role in fire behavior, and is an important component to the fire behavior models discussed in this report. A critical factor to consider is the dynamic nature of vegetation communities. Fire presence and absence at varying cycles or regimes disrupts plant succession, setting plant communities to an earlier state where less fuel is present for a period of time as the plant community begins its succession again. In summary, high frequency fires tend to convert shrublands to grasslands or maintain grasslands, while fire exclusion tends to convert grasslands to shrublands, over time. In general, biomass and associated fuel loading will increase over time, assuming that disturbance (fire, farming, or grading) or fuel reduction efforts are not diligently implemented. It is possible to alter successional pathways for varying plant communities through manual alteration. This concept is a key component in the overall establishment and maintenance of the proposed fuel modification zones around the collector substation and battery energy storage containers.

The approximately 642-acre development footprint would be cleared and graded. The solar facility site would be subject to regular “disturbance” in the form of vegetation maintenance underneath and around PV panels and access roads and would not be allowed to accumulate excessive biomass over time, which results in reduced fire ignition, spread rates, and intensity within the solar facility.

2.2.4 Fire History

Fire history is an important component of an FPP. Fire history information can provide an understanding of fire frequency, fire type, most vulnerable project areas, and significant ignition sources, amongst others. Fire history represented in this FPP utilizes the Fire and Resource Assessment Program (FRAP) database. FRAP summarizes fire perimeter data dating to the late 1800’s, but which is incomplete due to the fact that it, typically, includes only fires over 10 acres in size and has incomplete perimeter data, especially for the first half of the 20th century (Syphard and Keeley 2016). However, the data does provide a summary of recorded fires and can be used to show whether large fires have occurred in the Project area, which indicates whether they may be possible in the future.

Figure 4 –Fire History Map, presents a graphical view of the Project area’s recorded fire history. As presented in the exhibit, there have been 16 fires recorded since 1911 by CAL FIRE in their Fire Resource and Assessment Program (FRAP) database[1] in the vicinity of the Project site. A total of three fires, ranging from 29 acres (2003 Range Fire) to 40 acres (2005 Railroad Fire) are noted to have burned within one mile of the site. Table 2 summarizes the fire history for the area within 3 miles of the Project site.

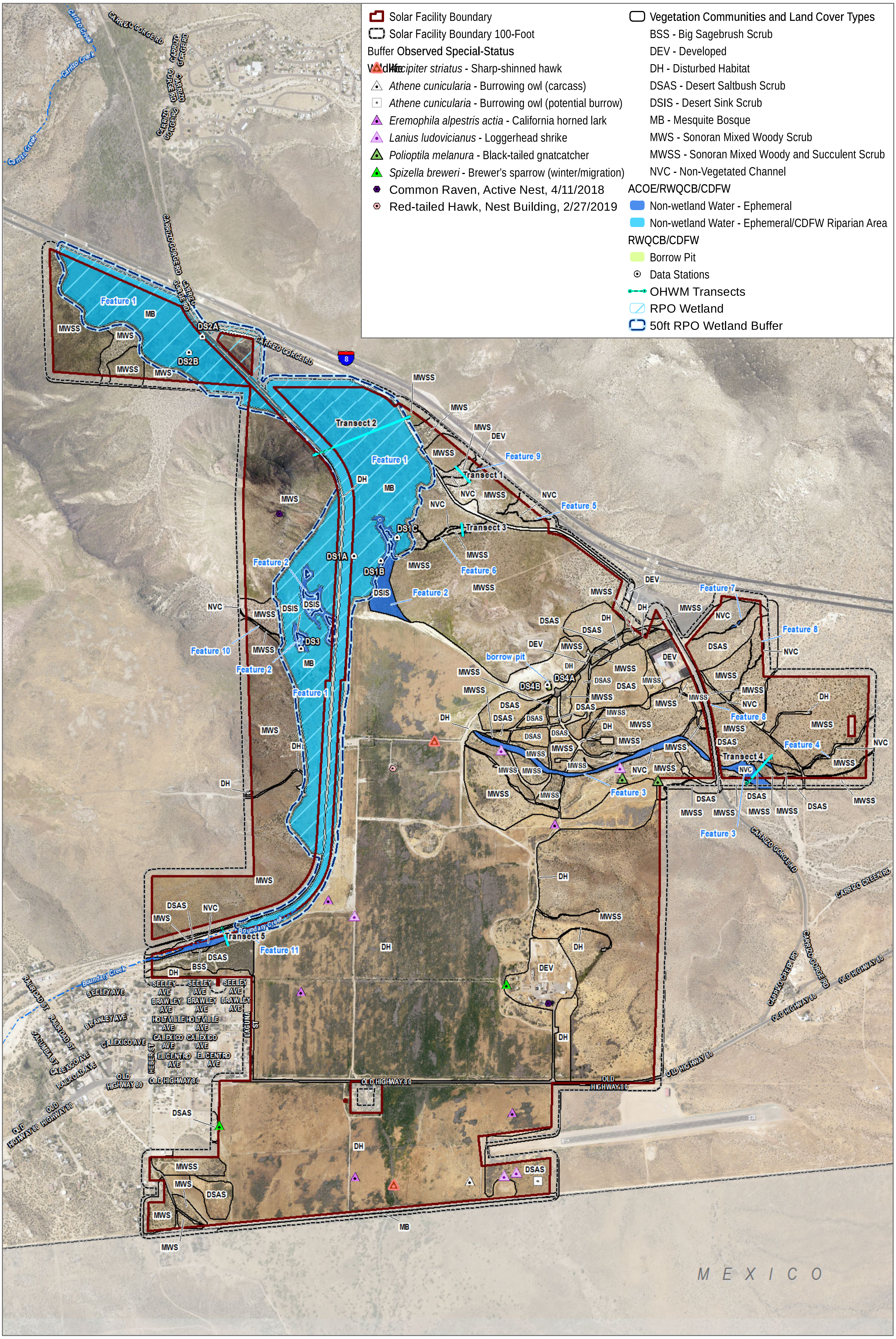
1 Based on polygon GIS data from CAL FIRE’s FRAP, which includes data from CAL FIRE, USDA Forest Service Region 5, BLM, NPS, Contract Counties and other agencies. The data set is a comprehensive fire perimeter GIS layer for public and private lands throughout the state and covers fires 10 acres and greater between 1911–2017.

Table 2. JVR Energy Park Fire History within 3 Miles

Fire Year	Fire Name	Total Area Burned (acres)
1941	Unnamed fire	94
1971	Unnamed fire	22
1972	Unnamed fire	676
1980	In-Ko-Pah Fire	25
1982	Tule Fire	4,645
1983	Carrizo Fire	665
2003	Range Fire	29
2003	Jewell Fire	42
2005	Railroad Fire	38
2006	Gunn 2 Fire	7
2008	Carrizo Fire	47
2008	Carrizo Fire	12
2012	Border 6 Fire	62
2012	Border 12 Fire	121
2013	Border Fire	62
2014	Jacumba Fire	27

Source: http://www.frap.fire.ca.gov/

Based on an analysis of the CAL FIRE FRAP fire history data set, specifically the years in which the fires burned, the average interval between wildfires in the area (includes areas up to roughly 3 miles from the Project site) was calculated to be six years with intervals ranging between 1 and 30 years. Based on this analysis, it is expected that wildfire that could impact the Proposed Project may occur, if weather conditions coincide, roughly every six years with the realistic possibility of shorter interval occurrences, as observed in the fire history records. Further, the large expanses of open space surrounding the proposed JVR Energy Park site and potential ignition sources along I-8, Old Highway 80, from existing transmission lines, and the San Diego and Arizona Eastern Railroad contribute to increased potential risk and wildfire hazard in the area.



SOURCE: SANGIS 2017

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0 500 1,000 Feet

FIGURE 3

Biological Resources

JVR Energy Park Fire Protection Plan

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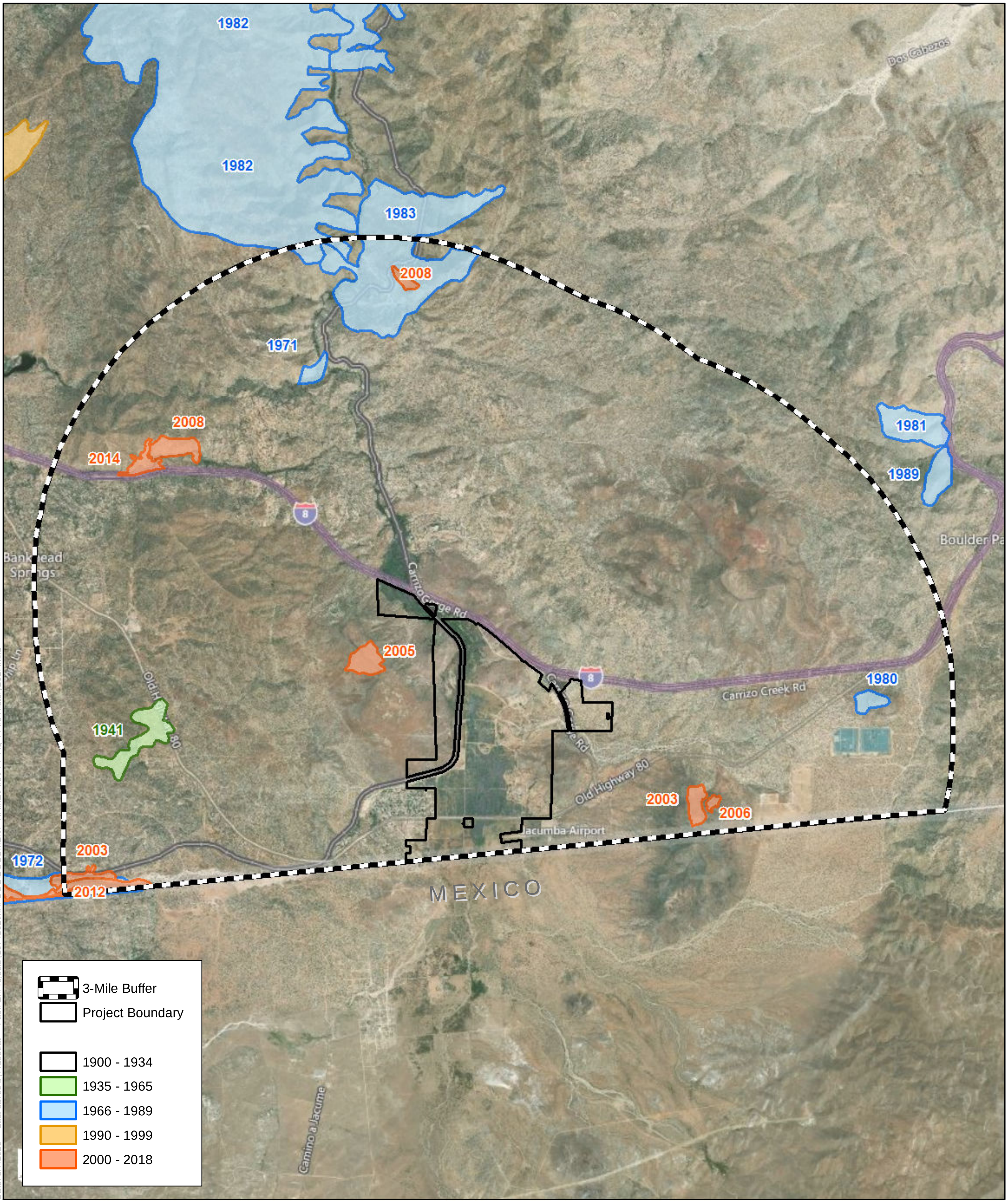

SOURCE: AERIAL- BING MAPPING SERVICE; FIRE DATA-CALFIRE 2017

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FIGURE 4

Fire History Map

JVR Energy Park Fire Protection Plan

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3 Determination of Project Effects

A FPP provides an evaluation of the adverse environmental effects a Project may have from wildland fire. The FPP must provide mitigation for identified significant impacts to ensure that development projects do not unnecessarily expose people or structures to a significant loss, injury or death involving wildland fires. Significance is determined by answering the following guidelines questions consistent with Appendix G of the CEQA Guidelines (CCR, Title 14, Division 6, Chapter 3).

Would the Project expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

The wildland fire risk in the vicinity of the Project site has been analyzed and it has been determined that wildfires are likely occurrences, but would not be significantly increased in frequency, duration, or size with the construction of the Proposed Project. The JVR Energy Park would include non-combustible solar array construction, on-site substation facility construction, a switchyard adjacent to the on-site collector substation, and related infrastructure, including 20-foot-wide interior access roads and a 35-foot wide primary access driveway.

The types of potential ignition sources that currently exist in the area include ignition sources along I-8, Old Highway 80, the San Diego and Arizona Eastern Railroad, existing electrical transmission line and machinery or vehicles associated with rural residential land uses. The proposed JVR Energy Park would introduce potential ignition sources (transformers, capacitors, electric transmission lines, collector substation, a switchyard adjacent to the on-site collector substation, energy storage facilities, vehicles, and gas or electric-powered small hand tools). While the inverters and solar panels represent potential ignition sources that are considered to have low likelihood of causing fires, all of this equipment represents a risk of sparking or igniting nearby fuels, particularly within close proximity to off-site flammable vegetation.

A number of fire protection measures, focusing on accessibility to and within the solar facility, as well as fuel modification providing defensible space, are provided. With the conversion of the Project site's fuels, the JVR Energy Park is expected to function as a firebreak that results in reduced fire spread, flame lengths and fire intensity based on the lower fuel volume that would be maintained throughout the solar facility. Fires from off-site would not have continuous fuels across the solar facility and would therefore be expected to burn around and/or over the facility via spotting. Burning vegetation embers may land on Project structures, but are not likely to result in ignition based on ember decay rates and the types of non-combustible and ignition resistant materials that will be used on site. Ignition resistant materials of glass, steel, aluminum and decomposed granite will provide resistance to ignitions from embers. Understory fuels will be maintained at roughly 6 inches, so ignitions in the ground cover from embers would produce a fast moving, but low intensity fire through the highly compartmentalized fuel modification areas beneath the PV modules.

The JVR Energy Park would comply with applicable fire codes and would include a layered fire protection system designed to current codes and inclusive of site-specific measures that will result in a Project that is less susceptible to wildfire than surrounding landscapes. Further, the facility will provide specific measures to reduce the likelihood of fire igniting on the site from necessary maintenance operations as well as measures to aid responding firefighters to the facility through direct site safety designs and training methods. Additionally, the Project's participation in a Fire Services Agreement would provide funds to be used to support fire agency capabilities and combined with other provided fire safety features at the site, results in effective mitigation of potential fire impacts.

Because there will be no full-time staff on site and there would be no occupied O&M structure, the Proposed Project would not expose people or structures to a significant risk of loss, injury or death involving wildland fires. It should be noted that there could be a potential for exposure to the people or structures in the immediately adjacent community of Jacumba Hot Springs from a fire originating within the solar facility, however, due to the fuel modification being implemented throughout the project site and around the JVR Energy Park facilities, the potential exposure would be less than significant.

Would the Project result in inadequate emergency access?

The Proposed Project includes emergency access and circulation throughout the solar facility. Interior access roads would be a minimum of 20 feet wide and supportive of fire apparatus. Fire access on the Project site would be improved from its current condition, which provides only limited access on dirt/gravel roads, through the grading and construction of new access roads. Therefore, emergency access is considered adequate for this type of facility.

Would the Project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance service ratios, response times or other performance objectives for fire protection?

The Proposed Project is estimated to result in fewer than 0.2 calls per year to the Jacumba Fire Station 43 and the co-located CAL FIRE and County Boulevard Fire Station 47. Both Fire Stations are compliant with the required County General Plan travel time requirements for the 1,356-acre Proposed Project site's four General Plan land use designations. The addition of 0.2 call per year to rural fire stations that currently respond to approximately one call per day is considered less than significant and will not require the construction of additional Fire Station facilities based on that increase alone.

However, the Proposed Project will be part of a cumulative impact from several renewable energy projects in the area that combined could cause service level decline. As such, the Proposed Project will participate in a Fire Service Agreement with the SDCFA for this portion of San Diego County, providing fair-share funding to be used to augment existing fire emergency response capabilities of the local Fire Response Resources and off-set cumulative impacts of the Project. The funding will provide a fair share amount toward constructing new fire stations, retrofitting existing fire stations, apparatus and equipment as well as staffing enhancements. The goal would be to maintain or enhance fire service ratios and response times to the existing condition.

Would the Project have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?

The Proposed Project would use water from on-site groundwater wells. A total of three 10,000 gallon water storage tanks would be constructed within the solar facility. This water supply system would provide enough water for estimated operational water demand as well as firefighting needs. Therefore, the Project would have sufficient water supplies to serve the Project and does not require expanded entitlements.

The measures described in the responses to these significance questions are provided more detail in the following sections.

4 Anticipated Fire

4.1 Fire Behavior Modeling

Following field data collection efforts and available data analysis, fire behavior modeling was conducted to document the type and intensity of fire that would be expected on this Project site and adjacent to the Project given characteristic site features such as topography, vegetation, and weather. The BehavePlus 5.0.5., fire behavior modeling software package was utilized to analyze fire behavior for the wildland fuels around the perimeter of the property. Results are provided below and a more detailed presentation of the BehavePlus analysis, including fuel moisture and weather input variables, is provided in Appendix C.

4.2 BehavePlus Fire Behavior Modeling Analysis

Fuel Models are simply tools to help fire experts realistically estimate fire behavior for a vegetation type. Fuel models are selected by their vegetation type; fuel stratum most likely to carry the fire; and depth and compactness of the fuels. Fire behavior modeling was conducted for vegetative types that are within or surround the Project site. The vegetation types are represented primarily by two fuel models as shown in Table 3. Other fuel models may exist, but not at quantities that significantly influence fire behavior in the Project area. Fuel models were selected from *Standard Fire Behavior Fuel Models: a Comprehensive Set for Use with Rothermel's Surface Fire Spread Model* (Scott and Burgan 2005).

Table 3. Fuel Model Assignments and Characteristics

Fuel Model	Vegetation Description	Location	Fuel Bed Depth (Feet)
Sh1	Sonoran Mixed Woody Scrub; Sonoran Mixed Woody and Succulent Scrub; Desert Sink Scrub; Desert Saltbush Scrub; Mesquite Bosque	Throughout the 1,356 Project site	<2.0 ft.
Sh5	Big Sagebush Scrub	Southeastern corner of 1,356 Project site.	4.0 ft.

4.3 Fire Behavior Modeling Results

Fire Behavior results derived from the BehavePlus modeling efforts are presented in Table 4 and in Figure 5, *JVR Energy Park Project BehavePlus Fire Behavior Modeling Analysis*. Two focused analyses (fire scenarios) were completed, each assuming worst-case fire weather conditions for a fire approaching the Project site from the west or east. The site and adjacent areas were modeled as a Fuel Model Sh1 (Low Load, Dry Climate Shrub fuelbed), and Fuel Model Sh5 (High Load, Dry Climate Shrub fuelbed). This detailed analysis compared fire behavior within and beyond the Project site boundary with outputs including surface fire flame length (feet), rate of spread (mph), fireline intensity (BTU/ft/s), and spotting distance (miles).

Table 4. BehavePlus Fire Behavior Modeling Results

Fire Scenario	Flame Length (feet)	Spread Rate (mph)	Fireline Intensity (Btu/ft/s)	Spot Fire[1] (miles)
Scenario 1: Peak Weather, Chaparral-scrub;2 and 5% slopes, 56 mph winds				
Sh1 – Low Load, Dry Climate Shrub	11.5	1.74	1,150	1.0
Sh5 – High Load, Dry Climate Shrub	63.6	14.3	47,187	3.4
Scenario 2: Summer Weather, Chaparral-scrub;3 and 10% slopes, 18 mph winds				
Sh1 – Low Load, Dry Climate Shrub	1.7	0.09	18	0.1
Sh5 – High Load, Dry Climate Shrub	26.0	2.38	6,739	0.8

Note:
1 Spotting distance from wind-driven surface fire.

Based on the fire behavior modeling results presented herein, the maximum flame lengths anticipated in untreated, scrub fuels would range from 11.5 to 63.6 feet in height with moderate (less than 2 mph) to rapid rates of spread (14.3 mph) under extreme weather conditions, represented by Santa Ana winds blowing at maximum winds of 56 mph. Embers could be generated from a surface fire resulting in ignition of receptive fuel beds 1.0 to 3.4 miles downwind.

Fires burning in from the southwest or west and pushed by ocean breezes exhibit less severe fire behavior. Under typical summer weather conditions, a chaparral fire could have flame lengths ranging from 1.7 to 26 feet in height and spread rates up to 2.4 mph. Spotting distances, where airborne embers can ignite new fires downwind of the initial fire, range from 0.1 to 0.8 mile.

It should be noted that the results presented in Table 4 depict values based on inputs to the BehavePlus software. The fuels models used in this analysis are dynamic models that were designed by the U.S. Forest Service to more accurately represent southern California fuel beds. Changes in slope, weather, or pockets of different fuel types are not accounted for in this analysis. Model results should be used as a basis for planning only, as actual fire behavior for a given location will be affected by many factors, including unique weather patterns, small-scale topographic variations, or changing vegetation patterns.

4.4 Project Area Fire Assessment

Wildland fires are a common natural hazard in most of southern California with a long and extensive history. Southern California landscapes include a diverse range of plant communities, including vast tracts of shrublands and riparian habitats. Wildfire in this Mediterranean-type ecosystem ultimately affects the structure and functions of vegetation communities (Keeley 1984) and will continue to have a substantial and recurring role (Keeley and Fotheringham 2003). Supporting this are the facts that 1) native landscapes, from forest to grasslands, become highly flammable each fall and 2) the climate of southern California has been characterized by fire climatologists as the worst fire climate in the United States (Keeley 2004) with high winds (Santa Ana) occurring during autumn after a six-month drought period each year. Based on this research and the regions fire history, it can be anticipated that periodic wildfires will occur in the open space areas of San Diego County, with the Tecate Divide corridor, being no exception.

As presented, wildfire behavior in the scrub fuel beds on the Project site is expected to be of moderate intensity during extreme, Santa Ana weather conditions with maximum sustained wind speeds of 56 mph and low fuel moistures. Sparse scrub fuels are predominant on site and in the area immediately surrounding the Project site, which would be the fuels affecting the constructed project. Based on the observed fuel beds surrounding the site, off-site fire behavior is expected to be similar to that modeled for the site. Wildfire in the project vicinity is expected to be relatively short in duration as vegetative fuels are consumed rapidly. As such, there would not be a sustained source of heat and or flame associated with site-adjacent wildland fuels.

Further, the fuels within the development footprint of the solar facility (approximately 642 acres) would be converted and reduced to ground cover. The post-project fuel modification areas would provide a significant reduction in the potential for fire ignition as well as the flame length, spread rate, and intensity of fires should ignition occur. The developed portion of the Project Site may be compared to a large fuel break once completed. Adjacent native and undisturbed fuels may readily carry fire, especially during portions of the year where vegetation moisture content falls and warm temperatures, low humidity and high winds become common. The developed portion of the site would be largely free of combustible vegetation with only a ground cover of maintained vegetation adjacent and beneath the solar panel racks. Flying embers from off-site fire may inundate the project site during wind-driven fire events. The modified fuel areas and construction type and materials for all project features will resist ignition from ember showers. Ignition of the ground cover could result in a fast moving, but lower intensity fire that burns in a patchy manner on the site due to the highly compartmentalized fuel modification areas beneath the panel racks.

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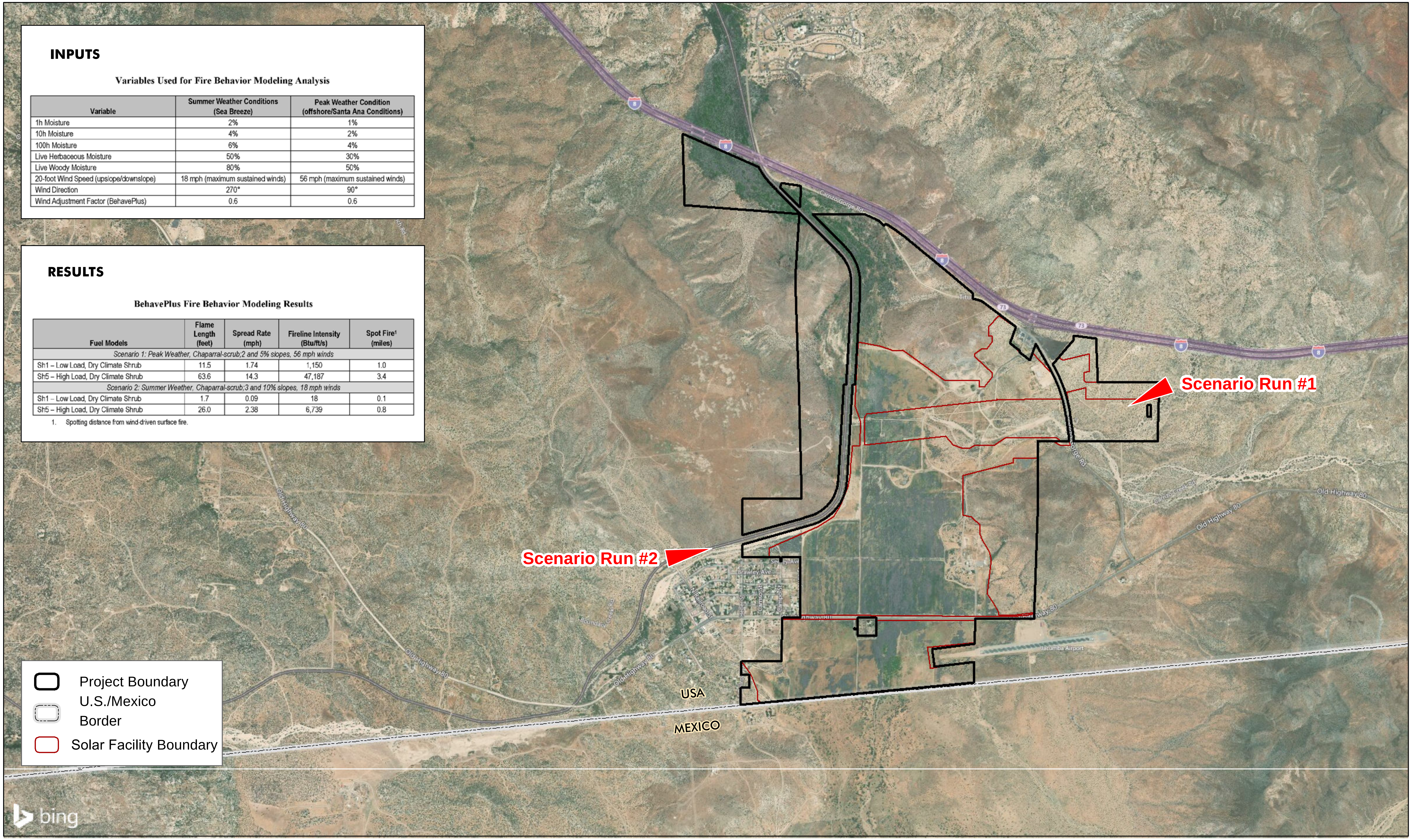

INPUTS

Variables Used for Fire Behavior Modeling Analysis

Variable	Summer Weather Conditions (Sea Breeze)	Peak Weather Condition (offshore/Santa Ana Conditions)
1h Moisture	2%	1%
10h Moisture	4%	2%
100h Moisture	6%	4%
Live Herbaceous Moisture	50%	30%
Live Woody Moisture	80%	50%
20-foot Wind Speed (upslope/downslope)	18 mph (maximum sustained winds)	56 mph (maximum sustained winds)
Wind Direction	270°	90°
Wind Adjustment Factor (BehavePlus)	0.6	0.6

RESULTS

BehavePlus Fire Behavior Modeling Results

Fuel Models	Flame Length (feet)	Spread Rate (mph)	Fireline Intensity (Btu/ft/s)	Spot Fire[1] (miles)
Scenario 1: Peak Weather, Chaparral-scrub;2 and 5% slopes, 56 mph winds				
Sh1 – Low Load, Dry Climate Shrub	11.5	1.74	1,150	1.0
Sh5 – High Load, Dry Climate Shrub	63.6	14.3	47,187	3.4
Scenario 2: Summer Weather, Chaparral-scrub;3 and 10% slopes, 18 mph winds				
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Sh5 – High Load, Dry Climate Shrub	26.0	2.38	6,739	0.8

1. Spotting distance from wind-driven surface fire.

SOURCE: AERIAL-BING MAPPING SERVICE 2017

DUDEK 0 1,000 2,000 Feet

FIGURE 5

BehavePlus Fire Behavior Modeling Analysis

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5 Analysis of Project Effects

5.1 Adequate Emergency Services

5.1.1 Emergency Response

The JVR Energy Park site is located within the County's responsibility area. Emergency response for the Project would be provided, initially, by the County and/or CAL FIRE from the County's Fire Station 43 in Jacumba Hot Springs. The Fire Station is located at 1255 Jacumba Street and is staffed with two CAL FIRE firefighters on a Type 1 fire engine under a Cooperative Fire Protection Agreement with the CAL FIRE (See below for details). Station 43 is approximately 3.6 miles from the most remote areas of the Proposed Project site with a calculated travel time of approximately 6.8 minutes[2].

In addition to this responding fire station, The County and/or CALFIRE co-located Station 47 is also nearby and would respond with additional resources. Fire Station 47 is located at 40080 Ribbonwood Road in the unincorporated community of Boulevard and is staffed with CAL FIRE and County volunteer firefighters. The Boulevard Station is approximately 10.6 miles to the most remote portion of the JVR Energy Park site with a calculated travel time of approximately 18.7 minutes. In addition to these responding fire stations, there are additional resources available through automatic or mutual aid agreements. The region's fire resources are discussed further in the following sections.

Within the unincorporated region's emergency services system, fire and emergency medical services are provided by Fire Protection Districts, County Service Areas (CSA), and CAL FIRE. Collectively, there are over 2,800 firefighters responsible for protecting the San Diego region from fire. Generally, each agency is responsible for structural fire protection and wildland fire protection within their area of responsibility. However, mutual and automatic aid agreements enable non-lead fire agencies to respond to fire emergencies outside their district boundaries. Interdependencies that exist among the region's fire protection agencies are primarily voluntary as no local governmental agency can exert authority over another.

Due to the remote location of the Project site, fire services generally consist of volunteer departments or County Fire stations that are staffed with CAL FIRE firefighters. As such, the unincorporated area of San Diego County has a Cooperative Fire Protection Agreement with CAL FIRE for the provision of fire and emergency services in the East County. CAL FIRE responds to wildland fires, structure fires, floods, hazardous material spills, swift water rescues, civil disturbances, earthquakes, and medical emergencies. CAL FIRE co-operates both the Boulevard and Jacumba Fire Stations. CAL FIRE staffs these stations with full-time 24/7 career firefighters through an Amador contract (staffing continues through the "off season" with the County under which, the County funds CAL FIRE presence during this period. The primary responsibility of the CAL FIRE is wildfire protection. CALFIRE, in association with the California Department of Corrections and Rehabilitation, also jointly manages McCain Valley Camp (male fire crews) and provides inmates with a limited level of training in fire safety and suppression techniques. Crew levels at the camp fluctuate and the response is typically for wildland fire, flood control, and community projects. McCain Valley Camp is located at 2550 McCain Valley Road, approximately 11 miles northwest of the Proposed Project site.

2 Travel distances were derived from Google Earth road data and driving on the access roads to fire stations from Proposed Project site while travel times were calculated applying the nationally recognized Insurance Services Office (ISO) Public Protection Classification Program's Response Time Standard formula (T=0.65 + 1.7 D, where T= time and D = distance). The ISO response travel time formula discounts speed for intersections, vehicle deceleration and acceleration, and does not include turnout time.

Response to the Proposed Project from Stations 43 and 47 will be within the acceptable time frame as designated in the County General Plan. The Project site is within the Mountain Empire Subrgional Plan of San Diego County's General Plan. The 1,356-acre Proposed Project site has four General Plan land use designations, including approximately 1, 214.98 acres designated as Specific Plan Area, approximately 90.22 acres designated as Public Agency Lands, approximately 37.88 acres designated as Rural Lands, approximately 1.79 acres designated as Rural Commercial, and approximately 0.06 acres designated as Village Residential..Based on these zoning categories, the County's emergency response travel time threshold would be 10 minutes. Response from Jacumba Fire Station 43 is calculated at less than 7 minutes. The Boulevard Fire Station's engine would be roughly 19 minutes. Therefore, the Proposed Project complies with the General Plan for response travel time. The intent of the 10 minute travel time is that very-low rural densities mitigates the risk associated with wildfires by reducing the number of people potentially exposed to wildfire hazard.

5.1.2 Emergency Service Level

The Proposed Project does not propose any full-time personnel on site, but may include up to five people on site during operations inspections, maintenance, and repair activities. This on-site population would vary, not be consistent, and therefore, does not fit into typical models to calculate projected call volume. As a conservative comparison, this analysis uses five people on-site during daylight hours. Therefore, the 24-hour equivalency would be half that number since staff would not be on site after dark/overnight (there will be some variation throughout the year with a higher number of persons during the construction phases). Using San Diego County fire agencies' estimate of 82 annual calls per 1,000 population, the project's estimated 2.5 daylight only on-site personnel, would generate up to 0.2 calls per year (1 call every 5 years). These estimates are likely overly conservative, because County statistics represent calls from dense urban areas where medical and fire related calls are much higher than would be anticipated from the Project site.

Service level requirements are not expected to be significantly impacted with the increase of less than 0.2 calls per year for the Jacumba Fire Station and the Boulevard Fire Station that both currently respond to approximately one call per day in their respective primary service areas[3]. For reference, a station that responds to 5 calls per day in an urban setting is considered average and 10 calls per day is considered busy. Therefore, the Proposed Project is not expected to cause a decline in the emergency response times. A Fire Service Facility Availability Form is included in Appendix D to this FPP.

5.1.3 Response Personnel Training

Studies (Grant 2010 and others) indicate that solar facility fire data is lacking, but it is clear that electrical fires (not associated with solar) occur relatively regularly and solar component fires can and do occur, although at much lower levels and typically related to roof-top solar arrays, at least to date. The same studies evaluated what measures provide the best results for improving response capabilities and firefighter safety. Among the types of measures that provide the most benefit are firefighter training, proper labeling, firefighter familiarizing, and extreme caution during fire response. To that end, this FPP requires the Proposed Project to implement the following measures:

- Conduct training sessions with local fire station personnel.
- Provide a technical report (refer to Appendix G of this FPP) identifying project specific firefighting issues.
- Provide a SDCFA-approved and CAL FIRE-approved training video that would be provided to local fire agencies for refresher training and training new firefighters who may rotate into potentially responding stations.

[3] County's Boulevard and Jacumba Fire Stations responded to 302 and 263 calls, respectively, during 2017 (Pine, pers. e-mail comm. August 29, 2018).

- Create consistent and clear labeling and placarding warnings on all electrical equipment; and
- Provide system technical contact information for reliably available key personnel who can assist responding firefighters with technical aspects of the Project.

5.2 Fire Access

5.2.1 Fire Access Roads/Driveways for Solar Facility

Primary access to the Project site would be provided off the existing Old Highway 80. This road intersects with Carrizo Gorge Road to the east of the Project entrance driveway. Carrizo Gorge Road eventually connects with I-8 to the north. Additional access points into the northern portion of the solar facility are provided off of Carrizo Gorge Road. Figure 6 shows the locations of access roads on- and off-site.

The perimeter on-site driveways would be constructed to a minimum improved width of approximately 24 feet. The interior on-site inverter access driveways would be constructed to a minimum improved width of 20 feet. All on-site driveways would be arranged to provide a minimum inner turning radius of 28-feet, would be graded and maintained to support the imposed loads of a fire apparatus (not less than 75,000 pounds), and would be designed and maintained to provide all-weather driving capabilities. Minimum vertical clearance of 13 feet 6 inches from the driving surface shall be maintained for the Project interior site’s fire access roads.

Road grades will not exceed 10%, complying with the Consolidated Fire Code for the proposed decomposed granite aggregate road surface. If during construction it is realized that any road surface may exceed 10%, appropriate mitigations will be provided including providing paved surface for those stretches over 10%.

Motion sensor lighting will be placed at all entrances; motion sensors will be monitored remotely. Gates at all driveway/road entrances shall be equipped with an approved knox box. All gates will be accessible for the fire department. The gates have a measured opening of 30 feet and would be installed in compliance with CCFC Sections 503.5 and 503.6.

5.2.2 Solar Facility Identification

Identification of roads and structures will comply with CCFC, Section 505.

5.2.3 De-Energizing (Project Shut-off)

The Project will provide a shut-off switch near all entrance gates and near the collector substation site, if needed, that will enable responding firefighters to de-energize/disconnect the components of the solar facility that can be de-energized (inverters, substation, switchyard, etc.). An illuminated sign will be installed at the entrance gates that clearly indicates inverter and electrical grid layout and entire site de-energizing disconnect switch identification and location.

5.3 Water

Once the Project is operational, typical water usage would be used for washing the solar modules and nominal amounts for other maintenance activities. It is anticipated that in-place PV panel washing would occur 4 times a year during evening or nighttime hours, between sunset and sunrise. Potable water will be provided by existing on-site wells.

The Project proposes six 10,000-gallon water tanks with fire department connections available; one tank will be provided at each entrance to a site section as defined by geographic isolation from other sections and one tank will be provided near the substation. Water would be stored in aboveground tanks complying with the SDCFA requirements and with NFPA 22, Private Fire Protection Water Tanks. A procedure for ongoing inspection, maintenance, and filling of tanks would be in place. The tank and fire engine connections shall be located on the side of the fire access road(s). The width of the road at the water tank location shall be at least 18 feet (travel width), plus an additional 10-foot width, for a distance of 50 feet, to allow for fire engines to park and connect to the tank while leaving the road open. The tank shall be labeled “Fire Water: 10,000 gallons” using reflective paint.

The capacity of the water tank at the facility would be based upon the demand for hand lines, plus a reasonable allocation for water supply for fire engines to generate firefighting foam for 15 minutes at an application density of 0.16 gallons per minute per square foot from a hose line using a 3% Aqueous Film-Forming Foam concentrate, for use on an oil fire in transformer containment. A conceptual estimate at this point, prior to detailed design, is 250 gallons per minute for 15 minutes (3,750 gallons of water) plus 112.5 gallons of foam concentrate for oil firefighting.

The County would approve the final location of the tank and total number of gallons based on a tank location drawings to be prepared by a Fire Protection Engineer and submitted by JVR Energy Park LLC. Drawings shall show tank locations, fire department connections, and roads, and shall include the tank standard drawing and notes.

5.4 Energy Storage System

A battery energy storage system with a maximum capacity of up to 90 MW, 180 MWh is proposed to be located throughout the Project site. The battery system is DC coupled with the PV system, connecting electrically at the DC bus of the inverters. The same inverters, transformers, medium voltage equipment, and AC wiring all serves both the battery energy storage system and the PV system. The project proposes the use of customized steel containers to store banks of Lithium-ion batteries which will enable storage of solar energy produced by the project. There are various types of Lithium-ion batteries available for use in this application. The specific battery type proposed for the Project is a Lithium-ion nanophosphate cell. Available data indicates that this particular type of Lithium-ion battery has proven to be less vulnerable to fire occurrences than typical Lithium-ion batteries, which as a category, include a very low occurrence of fires, but have experienced some especially high profile fires in recent years. Lithum-ion nanophosphate batteries include a stable cathode chemistry that substantially reduces the possibility of thermal runaway and provides for reduced reaction from abuse (Sandia National Laboratories 2012).

The proposed Project’s battery storage would include multiple levels of protections against overcharge. The Project would locate steel containers (customized Conex or similar, depending on supplier) that each hold Lithium-ion nanophosphate battery packs on racks throughout a large percentage of the container. The proposed project’s battery energy system can store up to 180 MWh, and would include up to 75 containers adjacent to the inverter skids distributed throughout the PV array. Each container would have underground wiring connecting it to a 600 kW skid mounted DC:DC converter, which would bring the voltage from the strings of batteries in the containers up to match the voltage of the PV energy entering into the inverter’s DC bus. Each one of the 25 inverter skids and transformer units situated throughout the site would have a set of three battery containers and three DC:DC converters, as discussed above. The enclosures and converters would be situated internally to the project site, with access from a primary fire apparatus roadway in a linear configuration. Figure 2, Project Components provides an example of how the containers can be situated for ease of ongoing maintenance and fire department access with adequate set back from off-site areas as a buffer against potential wildfire ignitions. The containers are typically made from the 12 to 14-gauge steel in shipping containers, and measure approximately 55-feet-long, 19-feet-wide, and 10-feet-high. Each container would be separated from neighboring containers by approximately 10 feet, and there would be no additional transformer units or protective devices required. The proposed batteries and containers also include the following important monitoring and safety components:

- Modular battery racks designed for ease of maintenance
- Integrated heat and fire detection and suppression system
- Integrated air conditioning system
- Integrated battery management system

The heat and fire detection system would be linked to an automatic inert gas suppression system within each container. The containers would also have a basic interior containers sprinkler system with several sprinkler heads for coverage and an external dry standpipe for fire fighters to connect and pump water.

Critical information from the battery system, equipment data from the DC:DC converters and inverters would be monitored by the battery monitoring system inside the containers, at the LV (1500V) metering at the inverter cabinets and at the power plant controller measured along with the solar plant performance with the SCADA control system described in more detail below.

The battery management system would track the performance, voltage and current, and state of charge of the batteries, proactively searching for changes in performance that could indicate impending battery cell failure, and power down and isolate those battery strings in order to avoid potential failures.

5.5 Defensible Space and Vegetation Management

The Project would provide defensible space by setting back all PV modules a minimum 30-feet from the solar facility's perimeter fence and modifying the fuels on-site by removing and grading them to a height of 6 inches, or, in the case of perimeter areas, drivable surfaces and vegetation free areas. The perimeter Fuel Modification Zone (FMZ) buffer will include at least 30 feet of modified fuels and will include the 30-foot wide perimeter fire access road, and cleared, contiguous modified fuel areas from the perimeter fence to the outermost panel racks. This area seamlessly meets the modified fuel areas that occur throughout the site where fuels are maintained at a 6 inch height. Defensible space around all electrical equipment would be provided by an FMZ buffer of 100 feet surrounding the project collector substation pad area and 100 feet surrounding the adjacent switchyard.

The entire solar facility site would include modified fuels with fire access roadways and service roads compartmentalizing the low-growing (less than 6-inch) maintained areas beneath all PV modules, surrounding the collector substation pad area, and surrounding the adjacent switchyard. No off-site clearing is required or authorized, as required fuel modification can be accommodated on the solar facility site. Site-wide fuel management zones will be maintained on at least an annual basis or more often, as needed, by Project applicant or current owner. Plant material to be used in the landscaped boundary areas will consist of drought-tolerant, fire resistive plant material from the County's Suggested Plant List for a Defensible Space[4]. Plant species and spacing will be reviewed and approved by the SDCFA Fire Marshal and included on submitted Landscape Plans. None of the plants on the Undesirable plant list (Appendix F to this FPP) shall be allowed on the site.

5.5.1 Fuel Modification

Project fuel modification will include one zone (opposed to multiple zones) that consists of non-irrigated, low growing ground cover. Because this site will utilize non-combustible construction, the proposed fuel modification areas will provide adequate setback for the potential short duration wildfire that may be realized in the adjacent wildland fuels.

A minimum 30 feet wide FMZ will be provided at the perimeter of the Project between the solar modules and the off-site wildland fuels. This area will include contiguous fuel modification from the perimeter fence inward and includes the perimeter fire access road. Additionally, a minimum 100 feet wide FMZ will surround the project collector substation and switchyard. Therefore, the PV modules, collector substation, and switchyard could be exposed to short-duration wildfire, but would not be expected to include consistent, focused heat exposure from the off-site vegetative fuels. Figure 6 provides a depiction of the perimeter fuel modification area along with other project components.

5.5.1.1 Fuel Modification Requirements

The following recommendations are provided for fuel modification areas, which are proposed to occur throughout the site from perimeter fence to interior preserve area boundaries, including beneath all solar arrays.

Site Wide Low-Flammability Zone

The site's fuel modification is applicable throughout the developed portions of the solar facility site. The area where the solar facility equipment is located will be free of vegetation. As such, the existing vegetation will be removed and in fuel modification areas, replanting with low-growing, desirable ground cover will occur. The following specifications apply to the fuel modification area:

- Non-combustible surface (gravel, dirt, etc.) is acceptable, or:
- Cleared of all existing native vegetation and replanted with drought tolerant native species. This area will be maintained to 6 inches or less;
- Ground cover less than 6 inches high;
- Removal of all dead, dying, and dried (low fuel moisture) vegetation;
- Refer to Appendix F for Undesirable Plants that will not be allowed on site. Trees are not recommended on the site or its perimeter; and
- If the area is planted with native annual and perennial grasses they shall be allowed to grow and produce seed during the winter and spring. As grasses begin to cure (dry out), they will be cut to 6 inches or less in height.

5.5.1.2 Other Vegetation Management

1. **Roadway-Adjacent Defensible Space**

4 https://www.sandiegocounty.gov/content/dam/sdc/pds/docs/DPLU199.pdf

An area of three feet from each side of fire apparatus access roads shall be maintained clear of vegetation. This area shall be maintained by the property owner. Vertical clearance of 13 feet 6-inches shall also be maintained along fire apparatus access roads.

2. **Electrical Transmission Line Vegetation Management**

In addition to the Project fuel modification requirements, all interconnection transmission lines, if applicable, would require standard vegetation clearance for the 300-foot-long overhead span and riser pole. Overhead transmission line and transmission pole vegetation management is regulated by various codes and ordinances including by the following regulations:

California Public Utilities Commission

GO 95: Rules for Overhead Electric Line Construction

GO 95 is the standard governing the design, construction, operation, and maintenance of overhead electric lines in California. It was adopted in 1941 and updated most recently in 2006.

GO 95 includes safety standards for overhead electric lines, including minimum distances for conductor spacing, minimum conductor ground clearance, standards for calculating maximum sag, and vegetation clearance requirements.

Vegetation clearance requirements of GO 95 are:

GO 95: Rule 35, Tree Trimming Criteria, defines minimum vegetation clearances around power lines.

Rule 35 guidelines specify, at the time of trimming require:

- 4 feet radial clearances are required for any conductor of a line operating at 2,400 volts or more, but less than 72,000 volts;
- 6 feet radial clearances are required for any conductor of a line operating at 72,000 volts or more, but less than 110,000 volts;
- 10 feet radial clearances are required for any conductor of a line operating at 110,000 volts or more, but less than 300,000 volts (this would apply to the project);
- 15 feet radial clearances are required for any conductor of a line operating at 300,000 volts or more.

CCR, Title 14 Section 1254

The firebreak clearances required by PRC § 4292 are applicable within an imaginary cylindrical space surrounding each pole or tower on which a switch, fuse, transformer or lightning arrester is attached and surrounding each dead-end or corner pole, unless such pole or tower is exempt from minimum clearance requirements by provisions of CCR, Title 14 Section 1255 or PRC § 4296.

The radius of the cylindroids is 10 feet measured horizontally from the outer circumference of the specified pole or tower with height equal to the distance from the intersection of the imaginary vertical exterior surface of the cylindroid with the ground to an intersection with a horizontal plane passing through the highest point at which a conductor is attached to such pole or tower. Flammable vegetation and materials located wholly or partially within the firebreak space shall be treated as follows:

- At ground level – remove flammable materials, including but not limited to, ground litter, duff and dead or desiccated vegetation that will propagate fire;
- From 0 to 8 feet above ground level – remove flammable trash, debris or other materials, grass, herbaceous and brush vegetation. All limbs and foliage of living trees shall be removed up to a height of 8 feet; and
- From 8 feet to horizontal plane of highest point of conductor attachment – remove dead, diseased or dying limbs and foliage from living sound trees and any dead, diseased or dying trees in their entirety.

1. **Pre-Construction Vegetation Management**
   - Fuel modification must be maintained on the perimeter throughout construction to achieve the 30 feet of modified fuels for perimeter PV modules, transformers, inverters, and battery storage.
   - Perimeter fuel modification zone must be implemented prior to commencement of construction utilizing combustible materials.

2. **Undesirable Plants**

   Certain plants are considered to be undesirable in the landscape due to characteristics that make them highly flammable. These characteristics can be physical or chemical. The plants included in the Undesirable Plant List (Appendix F) are unacceptable from a fire safety standpoint, and shall not be planted on the site. Trees and flammable plants shall be removed and any subsequent sprouting or volunteering of trees or undesirable plant materials will be removed on an annual basis.

5.5.1.3 Fuel Modification Area Vegetation Maintenance

All fuel modification area vegetation management shall be completed annually by May 15 of each year and more often as needed for fire safety, as determined by the County. Project applicant or current owner shall be responsible for all vegetation management throughout the facility and Project site, in compliance with the requirements detailed herein. The Project applicant or current owner shall be responsible for ensuring long-term funding and ongoing compliance with all provisions of this FPP, including vegetation planting, fuel modification, vegetation management, and maintenance requirements throughout the Project site.

Fuel modification maintenance work may be provided by mowing, trimming, masticating, managed goat grazing, or other methods that result in the desired low-fuel conditions detailed herein.

As a further means of ensuring the fuel modification area is maintained per this FPP, the Project applicant or current owner shall obtain an inspection and report from a County-authorized Wildland Fire Safety Inspector by June 1st of each year, certifying that vegetation management activities throughout the project site have been performed pursuant to this plan. This effort further ensures vegetation maintenance and compliance with no impact on the County.

6 Cumulative Impact Analysis

The Proposed Project and other projects may have a cumulative impact on the ability of local agencies to protect residents from wildfires. This project and other development in the area will increase the population and/or activities and ignition sources in the Jacumba area, which may increase the chances of a wildfire and increase the number of people and structures exposed to risk of loss, injury or death.

The potential cumulative impacts from multiple projects in a specific area can cause fire response service decline and must be analyzed for each project. The Project and its proposed solar facilities along with substantial other solar and/or wind projects in the greater Jacumba region represent an increase in potential service demand along with challenges regarding rescue or firefighting within or adjacent to electrical facilities.

Despite the generally low calculated increase in number of calls per year anticipated from the Proposed Project, the project contributes to the cumulative impact on fire services, when considered with other anticipated projects in the area. The cumulative impact results in a situation where response capabilities may erode and service levels may decline. In response, the Project will participate in the County's Fire Services Agreement, paying fair share funding toward fire services. Funding provided by the project results in capital that can be used toward firefighting and emergency response augments, improvements, and additions so that the County area firefighting agencies will be able to perform their mission into the future at levels consistent with the General Plan.

The requirements described in this FPP, including ignition-resistive construction, fire protection systems, pre-planning, education and training, and fuel modification/vegetation management, are designed to aid firefighting personnel such that the Project is defensible and on-site personnel are protected and potential cumulative impacts to the fire authority are mitigated.

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7 Fire Protection Measures and Design Considerations

As presented in this FPP, the Project provides customized measures that address the identified potential fire hazards on the site. The measures are independently established, but will work together to result in reduced fire threat and heightened fire protection. Figure 6 provides a Site Fire Safety Plan indicating the locations of important site safety features including roads, an on-site water storage tank, battery storage containers, inverters, fire access roadways, and fuel modification areas. The provided measures include both required and Project-volunteered items, as follows:

1. Fuel Modification throughout the solar facility site from boundaries inward, including beneath PV modules, around the collector substation and adjacent switchyard, with restrictions on plant species, heights, densities, and locations (Required measure).
2. Provide a technical report indicating special precautions for firefighting response (Appendix G) (Code-exceeding measure).
3. Minimum 20-foot interior on-site inverter fore access driveways and a minimum improved 24-foot wide perimeter on-site driveways would be constructed (Required measure).
4. Participation in a County Fire Service Agreement, for funding firefighting and emergency medical resources of which the details will be determined in the Project Fire Service Developer Agreement (Required measure).
5. Project funded annual fuel modification inspections to ensure compliance with this FPP (Code-exceeding requirement).
6. Motion sensor illuminated (and/or reflective) signage at main entrance with inverter and electrical grid disconnect and isolation information and identification (Required measure).
7. Ability of first responders to de-energize the project's electrical components from at least one location (Required measure).
8. Training program for local fire agencies including preparation of a technical training video with County input and customized for this facility that can be easily viewed by new firefighters who rotate through the local fire stations (Code-exceeding measure).
9. Preparation of a construction fire prevention plan (CFPP) for this project to be implemented by all contractors working on this project (Appendix X) (Code-exceeding measure).
10. Portable carbon dioxide (CO_2) fire extinguishers mounted at the inverters and medium voltage transformer units.
11. Six (6) 10,000-gallon water tanks dedicated for firefighting purposes; one tank will be provided at each entrance to a site section as defined by geographic isolation from other sections and one tank will be provided near the substation (Required measure).
12. System contact information with local fire agencies/stations to assist responding firefighters during an emergency (Required measure).
13. Committed on-going maintenance of all facility components for the life of the project (Required measure).
14. Maintenance logs to be kept and made available upon request to SDCFA/CAL FIRE (Required measure).
15. Consistent placarding and labeling of all components for fire safety/response (Required measure).

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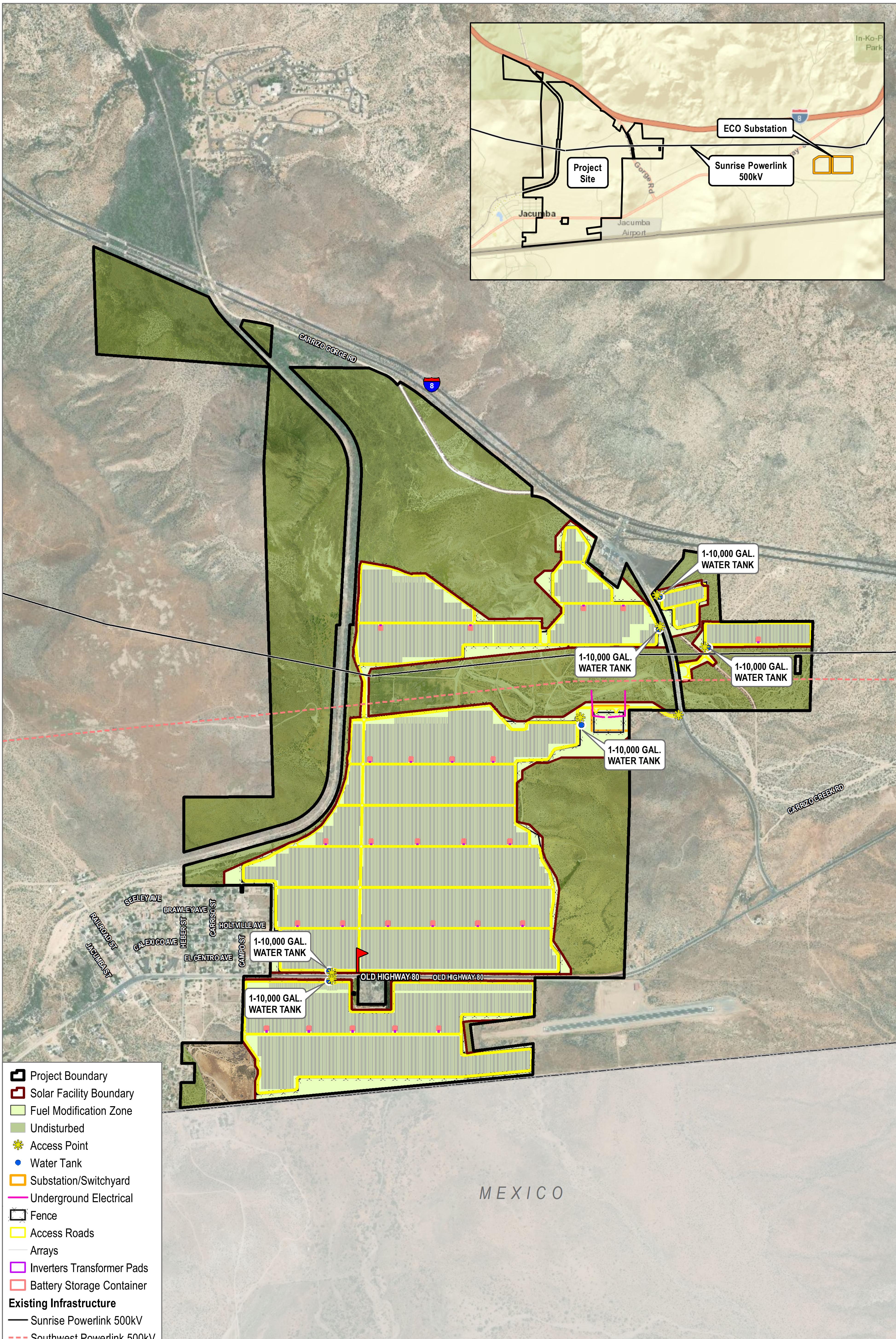
Being edited to reflect all components on previous figure on Page 50 below.



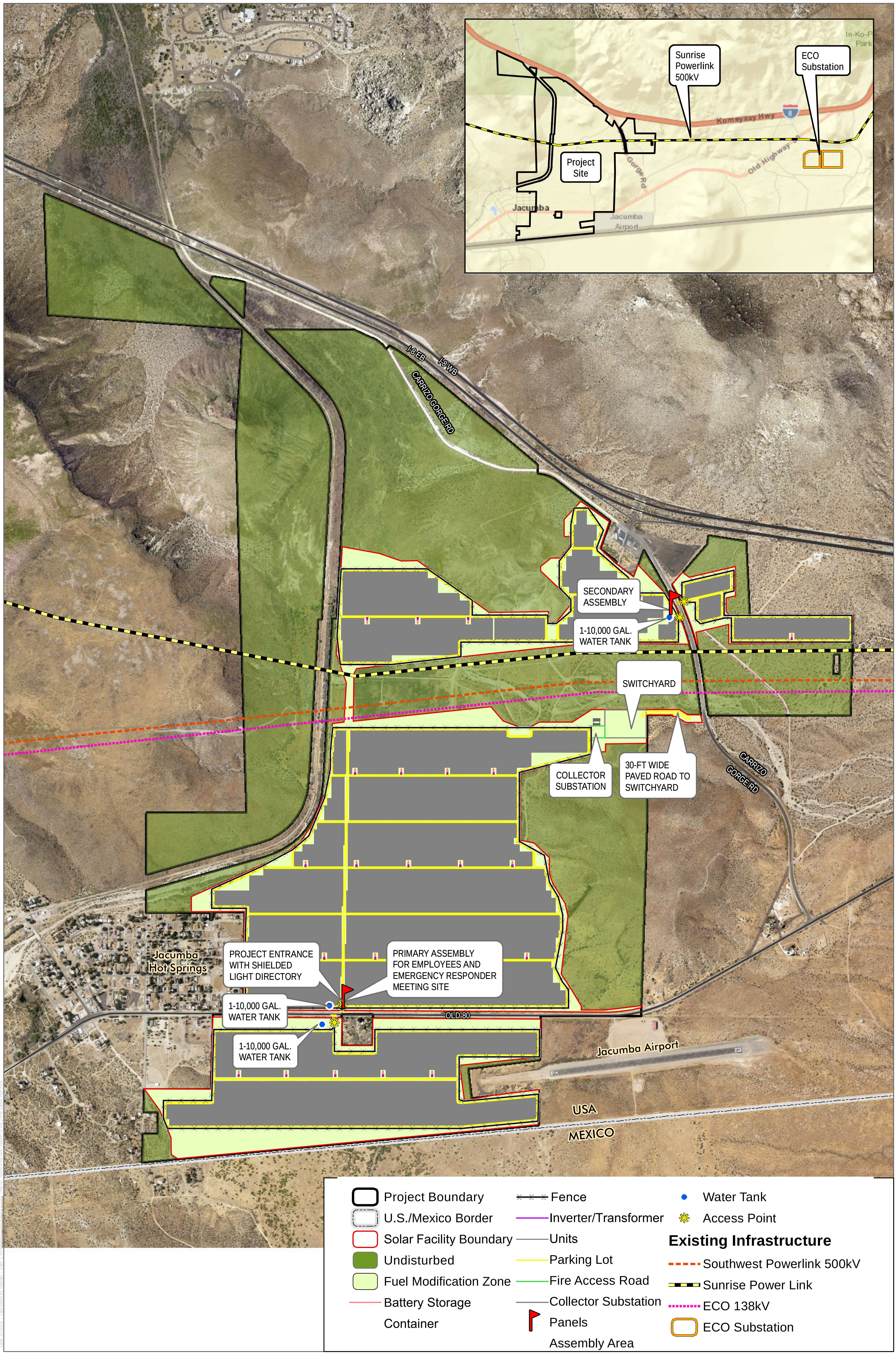
SOURCE: Kimley-Horn 2019; SANGIS 2017, 2019

FIGURE 6

Site Fire Safety Plan

JVR Energy Park Project Fire Protection Plan

DUDEK 0 500 1,000 Feet



SOURCE: AERIAL-BING MAPPING SERVICE; SITE PLAN-BAYWA 2018

DUDEK

0 750 1,500 Feet

FIGURE 6

Site Fire Safety Plan

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8 Conclusion

This FPP is submitted in support of an application for project entitlement of the JVR Energy Park. It is submitted as required in compliance with the County's conditions for FPP content. The requirements in this document meet the intent and purpose of the Code for fire safety, building design elements, fuel management/modification, and landscaping requirements of San Diego County. This FPP documents required fire safety features required by applicable codes and recommends additional measures that will enhance the site's fire safety and reduce potential impacts to insignificant without lessening health, life, or fire safety.

Fire and Building Codes and other local, county, and state regulations in effect at the time of each Project phase's building permit application supersede these recommendations unless the FPP recommendation is more restrictive.

The Project will provide fire access, on-site water, structures built to ignition resistant standards, fuel modification and vegetation management, and measures for fire protection during construction. The site fuel modification is based on fire behavior modeling representing the fire environment and the type of fire that would be anticipated at this site. The fuel modification areas will be maintained and inspected annually by a County-approved, Project-funded wildland fire inspector, removing all dead and dying materials and maintaining appropriate horizontal and vertical spacing. In addition, plants that establish or are introduced to the fuel modification area that are not on the approved plant list will be removed.

In addition, the Project will participate in a Fire Services Agreement with the County, which has provides resources in this portion of eastern San Diego County by requiring projects to provide funding toward fire department assets (stations, apparatus, equipment, personnel).

Ultimately, it is the intent of this FPP to guide, through code and mitigation requirements, the construction of a solar facility that is defensible from wildfire and, in turn, does not represent significant threat of ignition source for the adjacent community of Jacumba Hot Springs or the native habitat. It must be noted that during extreme fire conditions, there are no guarantees that a given structure will not burn. Precautions and mitigating actions identified in this report are designed to reduce the likelihood that fire would impinge upon the proposed structures. There are no guarantees that fire will not occur in the area or that fire will not damage property or cause harm to persons or their property. Implementation of the required enhanced construction features provided by the applicable codes and the mitigating fuel modification requirements provided in this FPP will accomplish the goal of this FPP to assist firefighters in their efforts to defend these structures and reduce the risk associated with this project's WUI location.

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9 References (Including References Cited in Appendices)

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10 List of Preparers

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APPENDIX A

Construction Fire Prevention Plan

DRAFT

JVR ENERGY PARK
CONSTRUCTION FIRE PREVENTION PLAN

Prepared for:

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17901 Von Karman Ave, Suite 1050
Irvine, California 92614

For submittal to:

County of San Diego
Planning and Development Services
5510 Overland Avenue, Suite 310
San Diego, California 92123

Prepared by:

DUDEK
605 Third Street
Encinitas, California 92024

JANUARY 2020

Table of Contents

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APPENDIX

FIGURES

TABLE

List of Acronyms and Abbreviations

AMSL	Above Mean Sea Level
CAL FIRE	California Department of Forestry and Fire Protection
CFC	California Fire Code (2016)
CFPP	Construction Fire Prevention Plan
CFR	Code of Federal Regulations
FAHJ	Fire Authority Having Jurisdiction
FHSZ	Fire Hazard Severity Zone
FPP	Fire Protection Plan
IC	Incident Commander
ICS	Incident Command System
JVR	Jacumba Valley Ranch
kV	Kilovolt
MW	Megawatts
NFPA	National Fire Protection Association
NWS	National Weather Service
OSHA	Occupational Safety and Health Administration
Project	Jacumba Valley Ranch Energy Park
RFW	Red Flag Warning
SCADA	Supervisory Control and Data Acquisition
SDCFA	San Diego County Fire Authority
SDG&E	San Diego Gas and Electric
SSO	Site Safety Officer
U.L.	Underwriter's Laboratory
WUI	Wildland Urban Interface

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Definitions

1. **Activity Risk**: Activity risks include those actions that present a risk of igniting a wildfire.
2. **Fire Patrol:** A JVR Energy Park individual will be assigned as "Fire Patrol" specifically to monitor work activities when an Activity Risk exists for fire compliance. The Fire Patrol personnel shall regularly patrol the area on foot and monitor the area for any signs of fire or unsafe practices. They shall have no other duties and shall not be sitting in a vehicle or using a cell phone or computer except for emergency-related calls or for checking for Red Flag Warning or other fire hazard or weather conditions. They will have the ability to stop work until an identified hazard has been mitigated.
3. **Fire Season:** Fire season is no longer officially designated by the wildland fire agencies. Southern California is considered to be in fire season on a yearlong basis. CAL FIRE adjusts their staffing patterns as fire conditions moderate or escalate and this can be used as an indicator of potential fire activity.
4. **Fire Tools**: Essential firefighting tools to be staged near work activities are a 46-inch round point shovel, Pulaski, McLeod, 5-gallon "Indian" Backpack hand pump water extinguisher, and minimum 10 pound, 4A:80BC Dry Chemical Fire extinguisher.
5. **Incident Commander (IC):** The incident commander is the person responsible for all aspects of an emergency response; including quickly developing incident objectives, managing all incident operations, application of resources as well as responsibility for all persons involved. The incident commander sets priorities and defines the organization of the incident response teams and the overall incident action plan.
6. **Incident Command System (ICS):** The Incident Command System (ICS) is "a systematic tool used for the command, control, and coordination of emergency response" according to the United States Federal Highway Administration. A more detailed definition of an ICS according to the United States Center for Excellence in Disaster Management & Humanitarian Assistance is "a set of personnel, policies, procedures, facilities, and equipment, integrated into a common organizational structure designed to improve emergency response operations of all types and complexities. Responding emergency service providers would establish the ICS and designate an IC.
7. **Red Flag Warning (RFW):** A Red Flag Warning is issued for a stated period of time by the National Weather Service using pre-determined criteria to identify particularly critical wildfire danger in a particular geographic area. All construction and maintenance activities shall temporarily cease during RFWs. The SSO will coordinate with personnel to determine which low fire hazard activities may occur. Should a local fire agency declare a Red Flag Warning affecting the JVR Energy Park site, the same work activity restrictions occurring during National Weather Service RFW periods would apply. RFW days typically occur in the fall, occasionally in the summer, and again during the spring. Typically, San Diego County will experience approximately 10 RFW days per year.
8. **Site Safety Officer (SSO):** The Site Safety Officer serves as a liaison to the emergency service agencies and all contractors or inspectors on the jobsite for the utilities on emergency incidents and construction-related activities. The SSO has the authority to stop any project work that appears to pose a particular fire risk or hazard.

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1 Summary

This Construction Fire Prevention Plan (CFPP) provides basic direction for fire safety awareness on the JVR Energy Park site during construction. CFPPs do not anticipate every potential fire scenario that may occur during construction, but attempt to educate site personnel to the very real danger associated with fire ignitions. Fire ignitions can, if they involve off-site vegetation under certain weather conditions, develop into large scale wildfires that burn many acres and can threaten public and private assets. Therefore, this CFPP provides standard protocols and approaches for reducing the potential of ignitions for typical construction site activities. When employed, the concepts discussed herein will help minimize and avoid ignitions as well as extinguish any ignitions while they are small and controllable.

Note: The National Weather Service may issue Red Flag Warnings (RFW) at any time when humidity and wind conditions meet pre-determined thresholds that would promote fire ignition and spread. Because the majority of acreage burned in California occurs during RFW weather conditions, certain construction activities, such as hot work, would be limited to low fire hazard, non-hot work, until the RFW has been lifted. For more details, see Sections 7.5 and 8 of this CFPP.

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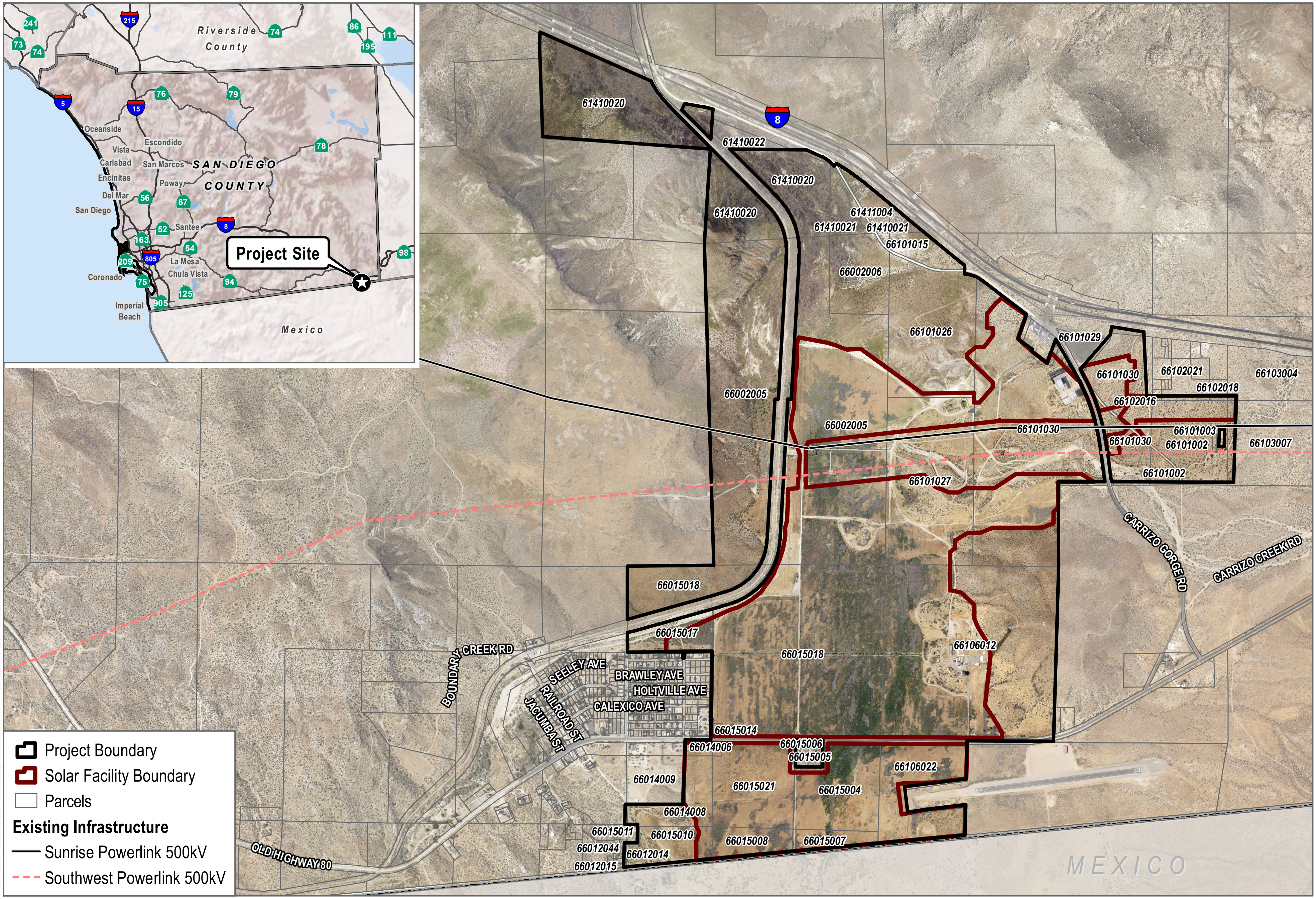
2 Introduction

The Project site totals approximately 1,356 acres in southeastern San Diego County, within the County's Mountain Empire Subregional Plan area (see Figure 1, Project Location). The Proposed Project would be located to the south of Interstate (I) 8, immediately east of the community of Jacumba Hot Springs, and immediately north of the U.S./Mexico international border. The Project site is located entirely on private land and consists of 24 parcels and includes the following Accessor's Parcel Numbers (APNs): 614-100-20, 614-100-21, 614-110-04, 660-020-05, 660-020-06, 660-150-04, 660-150-07, 660-150-08, 660-150-10, 660-150-14, 660-150-17, 660-150-18, 660-170-09, 661-010-02, 661-010-15, 661-010-26, 661-010-27, 661-010-30, 661-060-12, 661-060-22, 660-140-06, 660-140-08, 660-150-21, 660-150-16. The location of the parcels is shown in Figure 1, Project Location. The Project site includes right-of-way easements for Old Highway 80, SDG&E easements, and an easement for the San Diego and Arizona Eastern Railway. The proposed solar facility would cover approximately 642 acres within the 1,356-acre Project site. Primary access to the Project site would be provided via an improved access driveway from Old Highway 80, with additional access off of Carrizo Gorge Road. The Project site is situated within Sections 3, 4, 5, 8 and 9 of Township 18 South, Range 8 East, as well as in Sections 32 and 33 of Township 17 South, Range 8 East on the U.S. Geographical Survey (USGS), 7.5 minute, Jacumba, California quadrangle maps.

The majority of the proposed solar facility would be constructed in areas classified as a High Fire Hazard Severity Zone (FHSZ) by California Department of Forestry and Fire Protection (CAL FIRE). Fire hazard designations are based on topography, vegetation, and weather, amongst other factors with more hazardous sites including steep terrain, unmaintained fuels/vegetation, and wildland urban interface (WUI) locations. A small portion in the northwest corner and along the western boundary of the 1,356 Project site and the adjacent area to the west is classified as a Very High FHSZ by CAL FIRE. A small portion of the western boundary of the 1,356Project site is classified as a Moderate FHSZ by CAL FIRE. Additionally, the lands adjacent to the west of the 1,356 Project site are classified as very high FHSZ and the lands adjacent to the east are classified as moderate FHSZ and include Federal Responsibility Areas (FRA) (FRAP 2014).

The Proposed Project would produce up to 90 megawatts (MW) of alternating current (AC) generating capacity that can operate during on-peak power periods to indirectly reduce the need to emit greenhouse gases (GHGs) caused by the generation of similar quantities of electricity from either existing or future non-renewable sources to meet existing and future electricity demands. The renewable energy system would consist of approximately 300,000 photovoltaic (PV) modules mounted on single-axis trackers, a battery energy storage system of up to 90 MW, 180 MWh which would be comprised of battery storage containers located adjacent to the inverter skids previously described (up to 3 containers per each inverter skid for a total of 75 containers on site), an on-site collector substation, and a switchyard.

The majority of the proposed solar facility would be constructed in areas classified as a High Fire Hazard Severity Zone (FHSZ) by California Department of Forestry and Fire Protection (CAL FIRE). Fire hazard designations are based on topography, vegetation, and weather, amongst other factors with more hazardous sites including steep terrain, unmaintained fuels/vegetation, and wildland urban interface (WUI) locations. A small portion in the northwest corner and along the western boundary of the 1,356 Project site and the adjacent area to the west is classified as a Very High FHSZ by CAL FIRE. A small portion of the western boundary of the 1,356Project site is classified as a Moderate FHSZ by CAL FIRE. Additionally, the lands adjacent to the west of the 1,356 Project site are classified as very high FHSZ and the lands adjacent to the east are classified as moderate FHSZ and include Federal Responsibility Areas (FRA) (FRAP 2014).The entire Project site is located in an area dominated by relatively



SOURCE: Kimley-Horn 2019; SANGIS 2017, 2019

DUDEK

0 1,000 2,000 Feet

FIGURE 1

Project Location

JVR Energy Park Construction Fire Prevention Plan

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3 Emergency Notification Procedures

Any fire event at or near the Project site will trigger the emergency notification procedures identified in this section. Fire reporting is critical for tracking where, when, how, and why fire ignitions occur and will help the fire agencies develop protocols for reducing their occurrence.

3.1 First Call: 9-1-1

Reporting Fires and other emergencies: The first call should be to 9-1-1 so that appropriate apparatus can be dispatched.

The personnel in Table 1 are the primary site contacts to be notified during a fire emergency.

Table 1. Emergency Notification Primary Contacts

Name*	Position	Telephone Number*
	Site Safety Officer	
	Site Manager	
	Project Manager	
	Project Engineer	
	Construction Supervisor	

Note:

* Upon designation of each of the positions listed, the names and contact numbers and emails shall be inserted into this table. Position names may be changed, but responsibilities remain the same.

Technical Staff Contact: *Project contact information will be provided to local fire agencies/stations to assist responding firefighters during an emergency. A copy of this CFPP will be submitted to the responding fire agencies.*

The first call should be to 911 so that emergency responders can be dispatched. Travel times to the site require notification of 911 as early as possible after the fire or other emergency has been observed.

Emergency related contacts near the Project site include:

- Fire/Emergency Medical - CAL FIRE Dispatch Center, Monte Vista – 2249 Jamacha Road, El Cajon, California 92019 (Emergency: 9-1-1 and Business: 619.590.3100)
- Fire/Emergency Medical – San Diego County Sheriff's Dispatch Center, Boulevard – 39919 Highway 94, Boulevard, California 91905 (Emergency: 9-1-1 and Business: 858.565.5200)
- Jacumba Fire Station 43 – 1255 Jacumba Street, Jacumba Hot Springs, California 91934 (Emergency: 9-1-1 and Business: 619.766.4535)
- Boulevard Fire Station 47 – 40080 Ribbonwood Road, Boulevard, California 91905 (Emergency: 9-1-1 and Business: 619.390.2020)
- San Diego County Fire Authority (SDCFA) Administrative Office – 5510 Overland Avenue, Suite 250, San Diego, California 92123 (Business: 858.974.5999)
- San Diego County Sheriff, Boulevard/Jacumba Substation – 39919 Highway 94, Boulevard, California 91905 (Emergency: (9-1-1 and Business: 619.766.4585)

- California Highway Patrol, El Cajon Office – 1722 E. Main Street, El Cajon, California 92021 (Emergency: 9-1-1 and Business: 619.401.2000)
- Hospital - El Centro Regional Medical Center (ECRMC) – 1415 Ross Avenue, El Centro, California 92243 (ECRMC Emergency Department Business: 760.339.7100)

To facilitate the arrival of fire services during construction, an emergency response meeting point will be established with the County and CAL FIRE. The Site Safety Officer (SSO), or designee if other SSO tasks have not been completed, will meet the emergency response team at the meeting point (location to be determined, but likely to be at the Project's primary entrance driveway (refer to Figure 2, the Site Fire Safety Plan) to lead them into the site. The meeting point will be selected with fire agency input.

3.2 Evacuation Procedures

During significant emergency situations at or near the Project site, the site manager and/or SSO, in consultation with law or fire authorities, as possible, may issue an evacuation notice. When an evacuation has been called, all site employees will gather at the designated assembly area which would be the site's primary access driveway, but may be elsewhere, depending on the emergency and as designated by the SSO. The SSO will account for all personnel, as time allows. Once all employees are accounted for, or sooner if dictated by the emergency, the vehicles will safely convoy from the site to safe zones, which are generally areas off-site away from the threat, including greater San Diego urban areas. Should there still be persons within the site after the evacuation has been called, the SSO will send convened personnel off site to safe zones and the SSO and designated construction supervisors will perform a sweep of the facility, if it is safe to do so, to locate persons and reconvene at the assembly area. Once all personnel are accounted for, they will exit the site. The Primary Designated Assembly Area is located at the main entrance and as illustrated on Figure 2. Should a structure or wildland fire (or other emergency) occur that threatens the primary assembly area; other locations may be designated as secondary assembly areas (Figure 2) by the SSO or site supervisors, as dictated by the situation. The SSO and/or site supervisors should be prepared to be available to the IC throughout the incident to facilitate information exchange.

3.2.1 Evacuation Routes

Depending on the type and severity of the emergency, along with weather and/or localized site conditions, roadways designated on Figure 3 will be used for evacuating the area. The primary evacuation route is via Carrizo Gorge Road, which intersects with I-8 to the north and Old highway 80 to the south, which also intersects with I-8 to the east or west. I-8 is a major transportation corridor that offers travel options to the west or east.

The SSO and site supervisors are primarily responsible for evacuations. They will employ situation awareness procedures to determine the emergency, talk with all site personnel and fire officials, as possible, and declare the emergency status. Foreman level supervisors shall assist the SSO in accounting for personnel. The SSO or designee, shall be assigned to meet and guide firefighting resources to the scene.

sparse chaparral and scrub vegetation, which are vegetation communities that experience occasional wildfire and can burn in an extreme manner under windy, dry conditions. The general topography of the site is gently rolling with some steeper hillslopes along the western and eastern sides. Site elevations range from approximately 3,365 feet above mean sea level (amsl) in the highest portions near Round Mountain to 2,745 feet amsl in the northwest corner of the Project site.

The property is largely undeveloped with exception of several abandoned structures in the southern portion of the site that were associated with former agricultural uses. These structures would be removed as part of the Project to allow for installation of the solar facility. A number of existing gravel and dirt roadways traverse portions of the property. An existing easement for the Carrizo Gorge Railway enters the southwestern portion of the site at the western boundary, running generally east-west then turning northward and exiting the northwestern corner of the property near I-8. An existing San Diego Gas & Electric (SDG&E) easement also traverses the central portion of the site from east to west. Several large-scale SDG&E transmission towers are present within the easement.

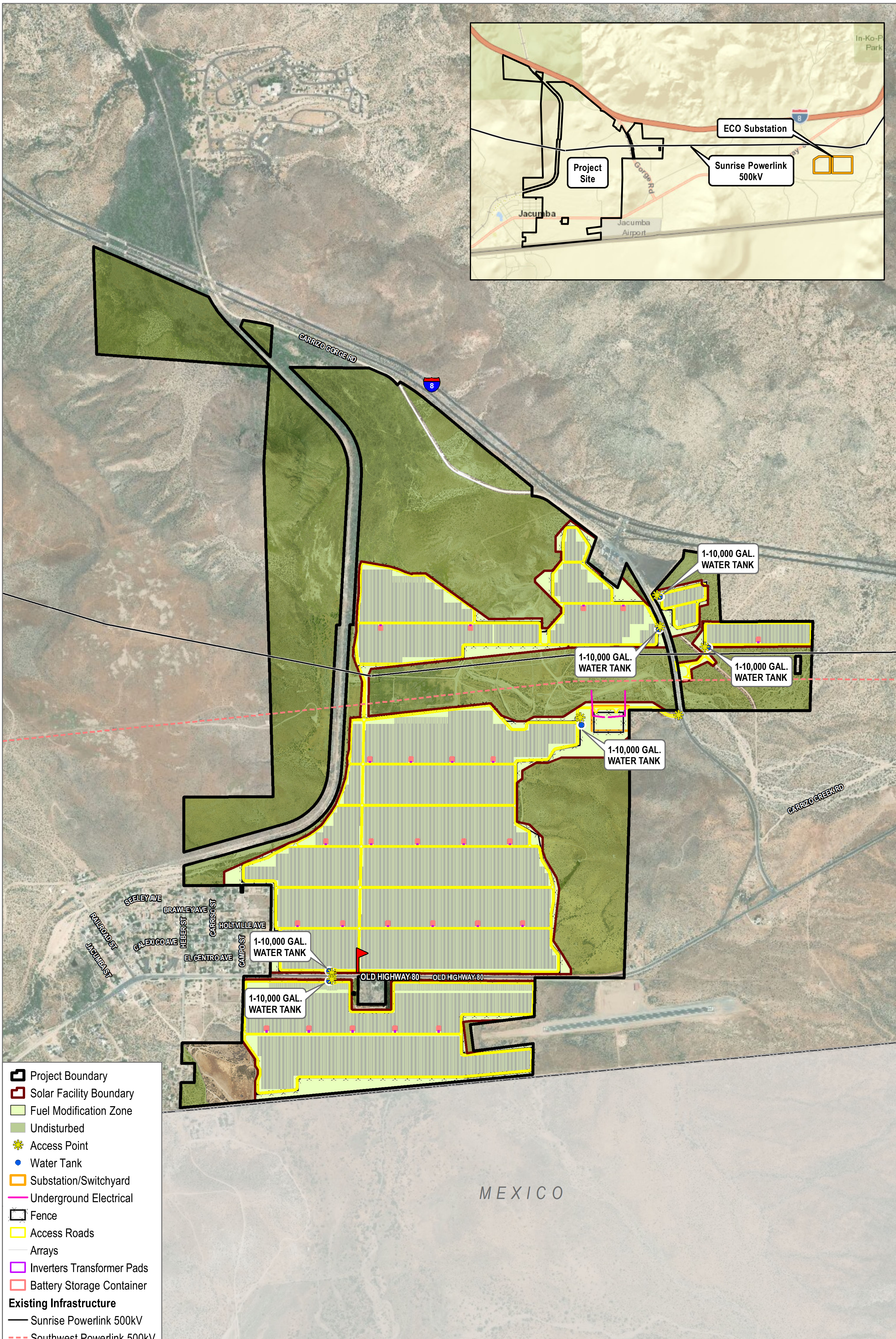
The majority of the lands surrounding the Project site are largely undeveloped. The town of Jacumba Hot Springs is located west and southwest of the site and development within Jacumba consists of rural residential uses and small-scale retail stores and services. Limited small-scale active and fallow agricultural uses are also present on a number of surrounding lands. Two gas stations are located along Carrizo Gorge Road, adjacent to the northeastern property boundary. The Project site includes the eastern portion of Round Mountain which is located within the northwestern area of the Project site. Gray Mountain lies just north of I-8The East County (ECO) Substation, operated by SDG&E, is located approximately 2.1 miles to the east of the site. There is a newly constructed 20 megawatt (MW) photovoltaic solar plant located adjacent to the ECO Substation.

The Jacumba Valley Airport is located just south of Old Highway 80, and directly south and east of the southernmost portion of the proposed development area. The Project site is located within the boundaries of the Airport Land Use Compatibility Plan (ALUCP) for the airport and is within the Airport Influence Areas, which is affected by issues such as noise, safety, airspace protection, and overflight protection. The Jacumba Valley Airport ALUCP is used by the San Diego County Airport Land Use Commission (ALUC), in fulfilling its purpose of promoting airport land use compatibility. Additionally, the U.S./Mexico international border lies just south of the Jacumba Valley Airport.

Because the Project is located within a remote area surrounded by native vegetation, and is located adjacent to the community of Jacumba Hot Springs, there is the potential for fire ignition and escape. This project-specific CFPP is intended to assist the project developers and their contractors and staff with identification of fire risk and implementation of important fire prevention measures. This CFPP is also intended to provide a training guide as well as a quick reference for all site staff for recognizing fire hazards, reporting them, and managing them during construction.

Fire protection in the project area is shared by two agencies, with the County and CALFIRE providing significant resources. Emergency response for the Project would be provided, initially, by the County/CALFIRE Jacumba Fire Station 43, which is staffed with two CAL FIRE firefighters on a Type 1 fire engine under a Cooperative Fire Protection Agreement with CAL FIRE and County. Both County and CAL FIRE are co-located at the next closet fire station, Station 47 in Boulevard, which is staffed with CALFIRE firefighters via Schedule A contract with the County.

Being edited to reflect all component on the Figure on page 0 below.



SOURCE: Kimley-Horn 2019; SANGIS 2017, 2019

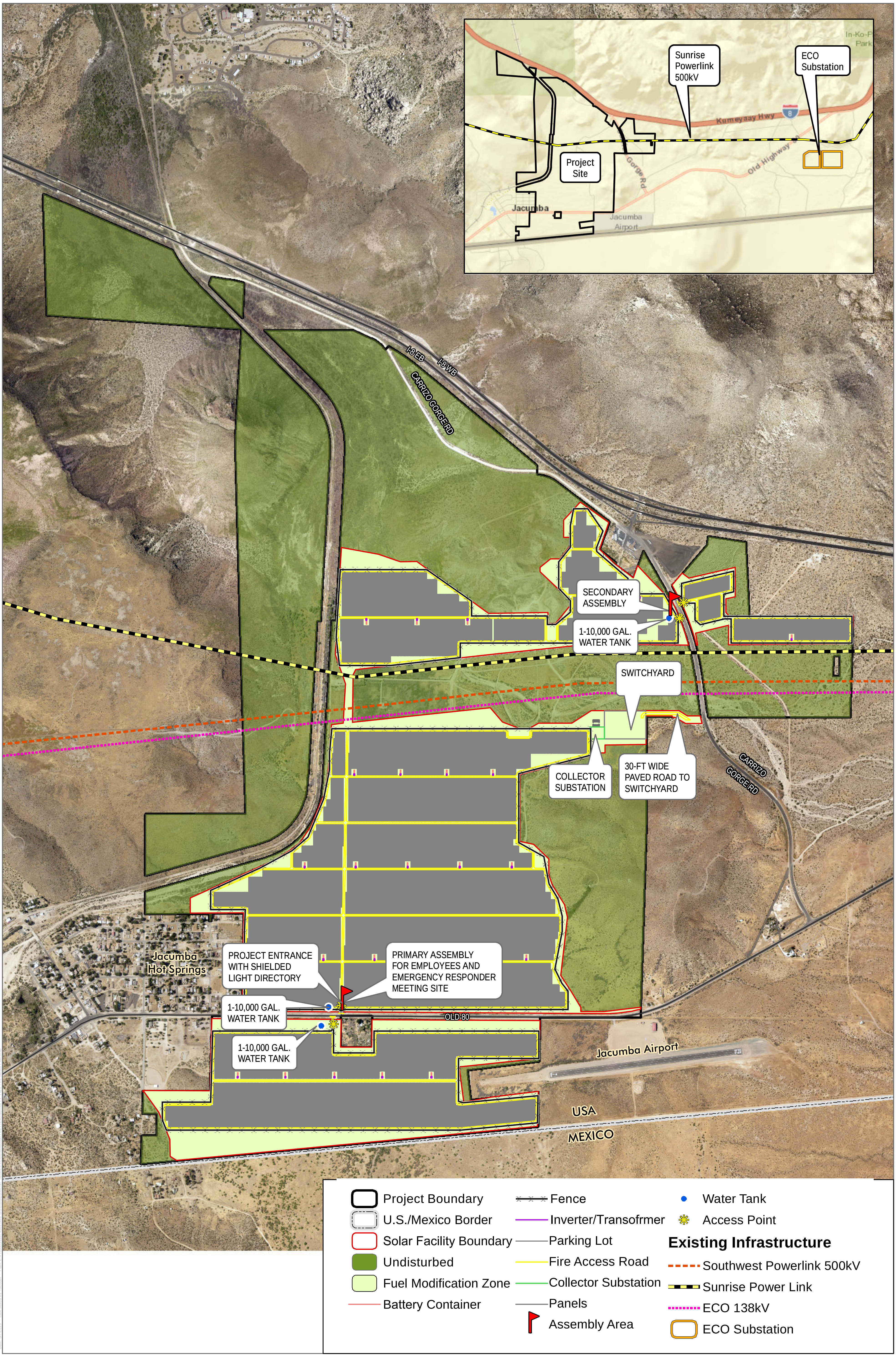
DUDEK

0 500 1,000 Feet

FIGURE 2

Site Fire Safety Plan

JVR Energy Park Project Construction Fire Protection Plan



SOURCE: AERIAL-BING MAPPING SERVICE; SITE PLAN-BAYWA 2018

DUDEK 0 750 1,500 Feet

FIGURE 2

Site Fire Safety Plan

JVR Energy Park Construction Fire Prevention Plan

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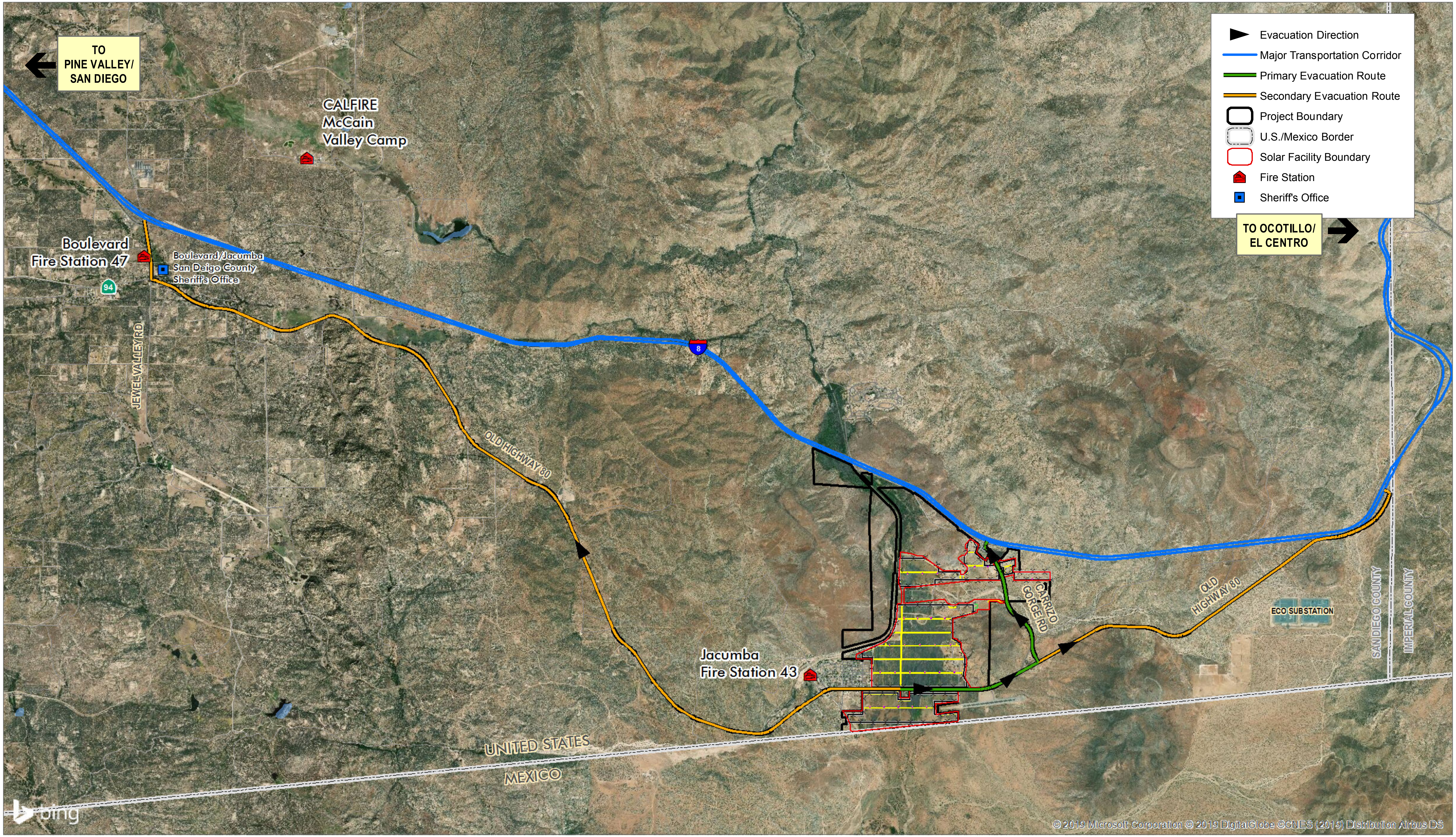

SOURCE: AERIAL-BING MAPPING SERVICE 2017

DUDEK

0 0.5 1 Miles

FIGURE 3

JVR Energy Park Fire Evacuation Map

JVR Energy Park Construction Fire Prevention Plan

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4 JVR Energy Park Roles and Responsibilities

All employees should know how to prevent and respond to fires, and are responsible for adhering to policies regarding fire emergencies. In particular, the following sections detail general responsibilities, by position.

4.1 Project Owner/Management

A site specific Fire Protection Plan (FPP) to determine overall fire risk was prepared for the Project (Dudek, November, 2019). The Project is required to implement necessary measures to reduce the risk of fire and comply with federal, state, and local fire safety/protection policies. Additionally, Project owner/manager is responsible for ensuring that all contractors on the site have the contractual obligations in place to abide by the FPP and CFPP.

4.2 Site Safety Officer (SSO)

The SSO in addition to previously identified duties will also manage the Project's FPP and this CFPP and shall maintain all records pertaining to the plan. Among the other responsibilities of the SSO are:

- Understanding the CFPP and its mandates for training, fire prevention, fire suppression, and evacuation.
- Understanding the fire risk associated with the site and with activities that will occur on site.
- Developing and administering the fire prevention and safety training program.
- Ensuring that fire control equipment and systems are properly maintained and in good working condition.
- Monitoring combustibles on the site and managing where they are stored.
- Conducting fire safety surveys and making recommendations.
- Posting fire rules on the project bulletin board at the contractor's field office and areas visible to employees.
- Stopping project work activities that pose a fire hazard or are not in compliance with this CFPP.
- Reporting all fires ignited on the site, whether structural, vegetation, electrical, or other, to SDCFA and CAL FIRE.

4.3 Supervisors

Supervisors are responsible for the following:

- Ensuring that all employees receive appropriate fire safety training
- Notifying the SSO when changes in operation increase the risk of fire
- Enforcing fire prevention and protection policies
- Accounting for all employees/contractors in the case of an evacuation
- Performing site sweeps to round up staff
- Facilitating fire agency access to the Project site

- Cooperating with the fire agencies/incident command during and following fires
- Identifying unsafe work practices that may lead to fire ignitions

4.4 Employees/Contractors

Employees and contractors would perform the following tasks:

- Complete all required training before working on site
- Conduct operations safely to limit the risk of fire
- Report potential fire hazards to their supervisors
- Follow fire emergency procedures
- Understand the emergency evacuation protocols

5 Construction Fire Prevention Plan Goals

The primary goals of this CFPP are to address the identified ignition sources and risks so that the personnel involved with constructing of the Project have clearly defined protocols and procedures for reducing fire risk and maintaining a fire safe worksite. Among the fire related goals developed for the JVR Energy Park site are:

- Prevent/minimize fires during construction activities
- Provide a safe work-site for all employees, contractors, visitors, and emergency personnel
- Prevent shock to emergency responders, workers, and unauthorized trespassers
- Prevent arcing or sparking, which could ignite vegetation on site
- Prevent or minimize dollar loss to the equipment
- Prevent or minimize potential for a fire starting on site to spread off site
- Provide water, appropriate fire extinguishers, and access for firefighters
- Provide adequate signage and shut off devices to stop power feed into power lines in the event of a line failure, or fire in right of way
- Provide water trucks equipped with fire extinguishers, hoses, shovels, Pulaski's and McLeods when work involves the use of chainsaws, chippers, vegetation masticators, grading/blading, grinders, drill rigs, tractors, torches, and/or explosives
- Provide the ability to report a fire or other emergency to emergency dispatch center without delay and to make contact with internet websites and personnel
- Report all fire ignitions, regardless of size, to the SDCFA and CAL FIRE

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6 Site and Project Description

6.1 Location

The Project site totals approximately 1,356 acres in southeastern San Diego County, within the County's Mountain Empire Subregional Plan area (see Figure 1, Project Location). The Proposed Project would be located to the south of Interstate (I) 8, immediately east of the community of Jacumba Hot Springs, and immediately north of the U.S./Mexico international border. The Project site is located entirely on private land and consists of 24 parcels and includes the following Accessor's Parcel Numbers (APNs): 614-100-20, 614-100-21, 614-110-04, 660-020-05, 660-020-06, 660-150-04, 660-150-07, 660-150-08, 660-150-10, 660-150-14, 660-150-17, 660-150-18, 660-170-09, 661-010-02, 661-010-15, 661-010-26, 661-010-27, 661-010-30, 661-060-12, 661-060-22, 660-140-06, 660-140-08, 660-150-21, 660-150-16. The location of the parcels is shown in Figure 1-1, Project Location. The Project site includes right-of-way easements for Old Highway 80, SDG&E easements, and an easement for the San Diego and Arizona Eastern Railway. The proposed solar facility would cover approximately 642 acres within the 1,356-acre Project site. Primary access to the Project site would be provided via an improved access driveway from Old Highway 80, with additional access off of Carrizo Gorge Road. The Project site is situated within Sections 3, 4, 5, 8 and 9 of Township 18 South, Range 8 East, as well as in Sections 32 and 33 of Township 17 South, Range 8 East on the U.S. Geographical Survey (USGS), 7.5 minute, Jacumba, California quadrangle maps.

The majority of the proposed solar facility would be constructed in areas classified as a High Fire Hazard Severity Zone (FHSZ) by California Department of Forestry and Fire Protection (CAL FIRE). Fire hazard designations are based on topography, vegetation, and weather, amongst other factors with more hazardous sites including steep terrain, unmaintained fuels/vegetation, and wildland urban interface (WUI) locations. A small portion in the northwest corner and along the western boundary of the 1,356 Project site and the adjacent area to the west is classified as a Very High FHSZ by CAL FIRE. A small portion of the western boundary of the 1,356Project site is classified as a Moderate FHSZ by CAL FIRE. Additionally, the lands adjacent to the west of the 1,356 Project site are classified as very high FHSZ and the lands adjacent to the east are classified as moderate FHSZ and include Federal Responsibility Areas (FRA) (FRAP 2014).

6.2 Vegetation

The Project site and surrounding areas are generally an arid semi-desert environment that supports a limited range of habitats and biological communities. The site is situated within a valley near the Jacumba Mountains that is dominated by semi-desert chaparral with large patches of scrub communities. There are nine vegetation communities and/or land cover types within the Project area, including Sonoran Mixed Woody Scrub, Sonoran Mixed Woody and Succulent Scrub, Big Sagebrush Scrub, Desert Saltbush Scrub, Desert Sink Scrub, Mesquite Bosque, Disturbed Habitat, Urban/Developed, and Non-Vegetated Floodplain or Channel (Dudek 2019). These fuel types are fire-adapted vegetation, which historically experience occasional wildfire and can burn in an extreme manner under the occasional severe fire weather (dry and windy) conditions that occur in the area.

6.3 Project Description

The Proposed Project is a solar energy generation and storage facility which would produce a rated capacity of up to 90 megawatts (MW) of alternating current (AC) generating capacity and would consist of 300,000 photovoltaic (PV) modules fitted on single-axis solar trackers on approximately 642 acres within the 1,356-acre Project site. In addition to the PV modules and direct current (DC) to alternating current (AC) conversion equipment, the proposed project would consist of the following primary components:

- Approximately 300,000 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 pads, 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 (152-foot by 180-foot)
- A 138 kV switchyard adjacent to the on-site collector substation to transfer power from the on-site collector substation to the existing San Diego Gas & Electric (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, 550-foot-long (1,100 feet total) 80-foot-high overhead transmission lines (gen-tie) would loop the switchyard into the existing SDG&E Boulevard – East County transmission line
- 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 Proposed Project's collector substation and the switchyard would be sized to accommodate the full 90 MW (AC) solar facility and a battery storage system with a capacity of up to 90 MW or 180 MWh. (ADD)

A map of the Project site plan, showing primary components, is included in Chapter 1 in the EIR.

1.) Photovoltaic Modules

Photovoltaic (PV) modules generate electricity by safely converting the energy of the sun's photons into DC electrons. The Proposed Project would include approximately 300,000 PV modules, which would be installed in rows (arrays). Arrays grouped together are referred to as array fields.

The modules would be mounted on single-axis trackers oriented in the north–south direction. Single-axis tracking systems would employ a motor mechanism that allows the arrays to track the path of the sun (from east to west) throughout the day. The PV modules are uniformly dark in color, non-reflective, and designed to be highly absorptive of all the light that strikes their glass surfaces. The PV modules would cover the majority of the area of the proposed facility.

The PV modules deployed for use in the Proposed Project would comply with all industry standard quality testing. The PV modules would be electrically connected to the grounding system of the facility in accordance with local codes and regulations. The final PV module selection would be determined during the Proposed Project's detailed engineering phase. Most PV modules are guaranteed a useful life of 35 years in adverse weather conditions.

The PV modules and tracking systems would be inspected periodically. Electrical components would be tested routinely according to manufacturer's recommendations. In the event that remote monitoring indicates a problem, such as low performance in a section of the array field, a crew would investigate and correct the problem on an as-needed basis. It is anticipated that in-place PV panel washing would occur four times a year. Washing of the PV panels would be undertaken using wash trucks. Washing would occur during daylight hours, so no lighting would be required.

2.) PV Modules Support Structures

The solar PV modules would be mounted on support structures that allows them to be properly positioned for maximum capture of the sun's solar energy. Each row of PV modules (module arrays) would be a single-axis tracker system that would be oriented along a north-to-south axis. The support structures are typically mounted on metal pipe pile or I-beam foundations 6 to 10 inches in diameter. The beams would be driven into the soil using a pile/vibratory/rotary driving technique similar to that used to install freeway guardrails. Driven pier foundations are a "concrete-free"foundation solution that would result in minimal site disturbance and facilitate site reclamation at the end of the Proposed Project's lifecycle. Most pier foundations would be driven to approximate depths of 10 to 15 feet deep depending upon required embedment depth.

The PV modules, at their highest point, would be approximately 12 feet above the ground surface depending upon the 100-year flood elevations within the Project site. The PV module arrays' final elevations from the ground would be determined during the detailed Project design process; however, for the purpose of the analysis in this EIR, maximum height above the graded ground surface would be 12 feet. It is common practice to maintain as low of an elevation profile as possible to reduce potential wind loads on the PV module arrays.

3.) Electrical (DC) Underground Collection System

PV modules would be electrically connected to adjacent modules to form module "strings" using wiring attached to the support structures. PV module strings would be electrically connected to each other via underground wiring. Wire depths would be in accordance with local, state, and federal codes. String wiring terminates at PV module array combiner boxes, which are lockable electrical boxes mounted on or near an array's support structure. Output wires from combiner boxes would be routed along an underground trench system approximately 3-4 feet deep and 1-3 feet wide, including trench and disturbed area, to the inverter and transformers skids.

4.) Inverter/Transformer Pads

Inverters are a key component of solar PV power-generating facilities because they convert the DC generated by the PV module array into AC that is compatible for use with the transmission network, The medium-voltage transformers would step up the voltage to collection-level voltage (34.5 kV).

The inverters, medium-voltage transformers, and other electrical equipment would be installed at 25 locations on adjacent to the battery storage containers, throughout the solar facility. X inverters and X transformers would be installed on each metal skid. Each metal skid would be approximately 8 feet wide and 20 feet long. The skids would be mounted above the 100-year flood elevations on a set of piles driven into the ground and covered by an earth or gravel mount that is built up to the top of the skid to provide a working clearance to all access points on the skid per applicable electrical and labor codes. All electrical equipment would be either outdoor rated or mounted within enclosures designed specifically for outdoor installation.

5.) Electrical (AC) Collection System

The 35.4 AC power would be collected from the 25 skids and electrically transmitted through an underground AC collector system. This underground system would consist of approximately 5,000 feet of cables located in trenches approximately 4 feet deep and 1-3 feet wide. At the point of transfer, the AC power would be electrically transmitted through 50 feet of overhead AC feeders, approximately 30-feet-tall.

6.) Collector Substation

The Proposed Project includes a collector substation (152-foot by 180-foot (27,360 square feet)) that would be located near the center of the eastern side of the Project site. The purpose of the substation is to collect the power from the AC collector system and convert the voltage from 34.5 kV to 138 kV, as well as to be able to isolate equipment in the event of an electrical short-circuit, or for maintenance.

The major components of the proposed collector substation are as follows:

- One 34.5 kV to 138 kV transformer including secondary containment area per local and state regulations.
- One 138 kV circuit breaker used to protect equipment from an electrical short circuit on the gen-tie. Disconnect switches, wire, cables, and aluminum bus work used to connect and isolate the major pieces of equipment.
- The substation would also include a single 34.5 kV circuit breaker used to protect equipment from an electrical short circuit on the collection system, disconnects and bus work to connect and isolate the collector circuits, relays used to detect short circuits, equipment controls, telemetering equipment used to provide system control and data acquisition, voice communication, and the meters used to measure electrical power generated from the Proposed Project. Switching gear and other components would be a maximum of 40 feet in height.
- A 138 kV dead-end structure that would have a maximum height of 65 feet. This structure would have either an A-frame or H-frame design and would be constructed of steel. The dead-end structure is where the power output from each transformer is delivered to the gen-tie line.
- One Control Enclosure for the Supervisory Control and Data Acquisition (SCADA) system (approximately 34 feet long by 15.5 feet wide, and a height of 15 feet).

During operation of the collector substation, operation and maintenance staff would visit the substation periodically for switching and other operation activities. Maintenance trucks would be utilized to perform routine maintenance, including but not limited to equipment testing, monitoring, repair, routine procedures to ensure service continuity, and standard preventative maintenance.

7.) Switchyard

The Proposed Project would include a 138 kV switchyard located adjacent to the proposed collector substation. The size of the switchyard would be approximately 140,000 square feet. Within this area would be a __-foot high security fence (445 feet by 300 feet) surrounded by a 5-foot shoulder for grounding protection. Drainage facilities would be installed to control runoff and protect the switchyard from erosion. The 138 kV insulated electrical bus, steel support structures and foundations would be installed to support the following electrical equipment:

- 2 138 kV bays in a ring bus configuration
- 3 Gas Insulated Circuit Breakers with 4 Collection s each
- 12 Gang Operated Air Break (GOAB) switches
- 9 98kV surge arrestors
- 9 138kV Single Bushing Potential Transformers

- 2 138kV-240V/120V Station Service Transformers
- Control Enclosure
- Security and lighting

One single-story control enclosure would be used for relays, metering, SCADA information and security and communication equipment. A gas generator may also be installed for use as backup power to the station lights and station service power transformers. The maximum amount of oil required for the station service transformers at the switchyard would be approximately 175 gallons per pot, or 350 gallons total.

The tallest structures in the switchyard would be the 138 kV line and the dead-end structures. The maximum height in the yard would be the approximately 66-foot-high dead-end structure that spans wire to the collector substation.

After completion of construction of the switchyard, operation of the switchyard facility would be transferred to SDG&E. The switchyard would be unmanned during operation. Monitoring and control functions would be performed remotely from SDG&E's central operations facilities. Accordingly, no new personnel would be required for operation and maintenance. Routine operations would require a single pickup truck visiting the switchyard several times a week for switching, as well as several larger substation construction and maintenance trucks visiting the switchyard several times a year for equipment maintenance. Maintenance activities would include equipment testing, equipment monitoring and repair, and emergency and routine procedures for service continuity and preventive maintenance. Based on operations at similar facilities, routine maintenance is expected to necessitate approximately six trips per year by a two- to four-person crew. Routine operations would require one or two workers in a light utility truck to visit the switchyard on a weekly basis. Typically, a major maintenance inspection would take place annually, requiring approximately 20 personnel for approximately one week.

An approximately 1,500 foot-long asphalt paved access driveway will be constructed from Carrizo Gorge Road to the switchyard. The access driveway will be approximately 30-feet-wide, requiring approximately 1.2 acres of land in new right-of-way and 0.3 acres of land on existing SDG&E right-of-way. In addition, 30-foot-wide asphalt-paved interior access driveways may be constructed within the switchyard site to access the equipment.

8.) 138 kV Transmission Line Tie-in

The proposed switchyard would be connected into the existing 138 kV SDG&E Boulevard – East County transmission line. The proposed overhead transmission line tie-in would require two approximately 550-feet long spans of wire and up to four steel transmission poles. The tallest proposed transmission pole would be approximately 80 feet above the ground surface. Each Pole would have up to six cross arms and a pole top to accommodate a fiber optic ground wire for lightning protection and critical communication.

Temporary construction areas will be cleared and graded at each pole location for a safe working environment and pulling wire.

9.) Battery Energy Storage System

A battery energy storage system with a maximum capacity of up to 90 MW, 180 MWh is proposed to be located throughout the solar facility. This energy storage system would be comprised of battery storage containers located adjacent to the inverter/transformer pads (up to 3 containers per each pad for a total of 75 containers on site). The battery system would be DC coupled with the PV system, connecting electrically at the DC bus of the inverters. The same inverters, transformers, medium voltage equipment, and AC wiring all serves both the battery energy storage system and the PV system. The battery storage system would be inspected on a regular basis and would be monitored by the SCADA System.

The Project proposes the use of steel containers (customized Conex or similar depending on supplier) to hold Lithium-ion batteries. Each container would hold the battery packs on racks. The containers are typically made from 12 to 14 gauge steel, and measure approximately 55-feet-long, 19-feet-wide, and 10-feet-high. Currently available each container would be separated from neighboring containers by approximately 10 feet.

The specific battery type proposed for the Project is a Lithium-ion nanophosphate cell. Currently available data indicates that this particular type of Lithium-ion battery has proven to be less vulnerable to fire occurrences than typical Lithium-ion batteries. Lithum-ion nanophosphate batteries include a stable cathode chemistry that substantially reduces the possibility of thermal runaway and provides for reduced reaction from abuse (Sandia National Laboratories 2012).

The proposed battery storage system would include multiple levels of protections against overcharge. Each container would have underground wiring connecting it to a 600 kW DC:DC converter, which would bring the voltage from the batteries in the containers up to match the voltage of the PV energy entering into the inverter's DC bus. Each one of three containers would have three skid-mounted DC:DC converters.

The containers would be situated to enable emergency/fire response access. The containers would be sited with adequate set back from off-site areas as a buffer against potential wildfire ignitions. No additional transformer units or protective devices are required. The containers would not be walk-in containers, thus the battery storage containers would not be habitable structures per the fire code.

The proposed batteries and containers also include the following important monitoring and safety components:

- Modular battery racks designed for ease of maintenance
- Integrated heat and fire detection and suppression system
- Integrated air conditioning system
- Integrated battery management system

The heat and fire detection system would be linked to an automatic inert gas suppression system within each container. The containers would also have a basic interior containers sprinkler system with several sprinkler heads for coverage and an external dry standpipe for fire fighters to connect and pump water.

Critical information from the battery system, equipment data from the DC:DC converters and inverters would be monitored by the battery monitoring system inside the containers, at the LV (1500V) metering at the inverter cabinets and at the power plant controller measured along with the solar plant performance with the SCADA control system described in more detail below.

The battery management system would track the performance, voltage and current, and state of charge of the batteries. The system would proactively search for changes in performance that could indicate impending battery cell failure, and power down and isolate those battery strings in order to avoid potential failures.

The National Fire Protection Association (NFPA) has developed a new Standard for the Installation of Energy Storage Systems (NFPA 855). This standard addresses the design, construction, installation, commissioning, operation, maintenance and decommissioning of stationary energy storage systems. The Project would meet most of the standards, except where they are not applicable to the Proposed Project. The layout of the system would also meet the section 4.4.3 definition of remote locations, where energy storage system equipment is greater than 100-feet away from public ways or stored materials.

10.) Fiber-Optic Line

To provide for communication with the SCADA system, a fiber-optic cable would be placed underground to connect the substation to the switchyard. Utility interconnection regulations require the installation of a second separate, redundant fiber-optic cable. The redundant fiber-optic cable would also be installed within the Project development footprint and the proposed switchyard boundary.

11.) Control System

The Proposed Project's control system includes a SCADA system and an overall plant control system (PCS). Operation of the solar facility would be monitored through the SCADA system, as described below. The Proposed Project would also have a local overall PCS that provides monitoring of the solar field as well as control of the balance of facility systems.

The SCADA system is required for the purpose of providing plant system monitoring and control during steady state operation, safe operation during unperceived events and abnormal operating conditions, and equipment start-up/shutdown. In addition, the SCADA system is required for providing substation and inverter information to the Owner/Operator, as well as providing information about the PV Facility and interconnection Facility to transmission owner, independent system operator, and/or EPC Power contractor. The SCADA System is also required to accept data from the Utility/Transmission Provider and/or Independent System Operator (ISO) and record this data in a Historian and/or act upon the data appropriately. The SCADA system would be monitored remotely, and no on-site operations and maintenance facilities or personnel would be necessary.

The SCADA system would be located in two Control Enclosures. One enclosure would be located in the on-site collection substation area and the other enclosure would be located in the switchyard area. Each enclosure would be approximately 10 feet by 10 feet, and X feet in height. The SCADA system would be comprised of rack-mounted servers and software to allow for the continuous monitoring and control. Control algorithms would be designed to coordinate the PV system with substation equipment, utility and owner SCADA requirements. The SCADA system would allow inverters to have remote capability to adjust plant capacity, output voltage and reactive power output through communication between hardware and central SCADA server. It would have the ability to perform switching required to connect the plant to and to disconnect the plant from the local electrical grid. The SCADA System would include capabilities such as monitoring and control of PV inverters, solar trackers, PV weather monitoring system, and monitoring of MV skid transformers, substation equipment including protective relays, medium voltage circuit breakers, high voltage breakers, step-up transformer and revenue meters. In addition, the SCADA System would also monitor and control the battery storage system. SCADA consists of a few server racks installed with the control enclosure of the collector substation, and consists of LCD

Display and Datalogger, Cellular Modem, Central Processing Unit, and meter for analog/digital measurements. The SCADA system would be used to provide critical operating information (e.g., power production, equipment status and alarms, and meteorological information) to the power purchaser, Project owners and investors, grid operator, and Project operations teams, and to facilitate production forecasting and other reporting requirements for Project stakeholders.

The microprocessor-based PCS would provide control, monitoring, alarm, and data storage functions for plant systems as well as communication with the Proposed Project's SCADA system. Redundant capability would be provided for critical PCS components so that no single component failure would cause a plant outage. All field instruments and controls would be hard-wired to local electrical panels. Local panels would be hard-wired to the PCS. Wireless technology would be considered as a potential alternative during final Project design.

12.) Meteorological Weather Stations

The Proposed Project includes five meteorological weather stations, which would be installed throughout the solar facility. The weather stations would be used to record weather to measure the performance of the solar facility. The parameters recorded would include air temperature, relative humidity, precipitation, air pressure, wind direction and speed, and solar irradiance. Measuring irradiance is important for determining how much power could potentially be harvested from the sun. A pyranometer would also be at each weather station to measure irradiance.

Four of the meteorological stations would be installed at a place closest to the inverter skids to minimize cable runs. The fifth station would be located adjacent to the collector substation. The locations would have no shading obstruction such that the irradiation received by the sensors ("pyranometer") in the station is the same as that received by all the modules in the Proposed Project. Each station would occupy an area of approximately 10 feet by 7 feet. The mounting equipment would be made up of steel to ultimately provide height to the actual sensor located at the end of an aluminum (approximately 2-inch diameter) arm about 3 feet long to isolate the equipment from parts that can potentially shade the sensor. The maximum height of the station would be 10 feet. The equipment would be installed on a 5 foot by 5 foot square pad. The setup would be connected to a datalogger and cellular modem with an approximately 10-meter cable to interface digitally with the SCADA system and the PCS.

13.) Site Access Driveways

The primary access driveways to the solar facility would provide access off of Old Highway 80 and would be approximately 24 feet wide. Three secondary driveways, 24 feet in width, would provide access off of Carrizo Gorge Road. Two driveways would provide arrays on the east side of Carrizo Gorge Road. The third secondary driveway would provide access to arrays on the west side of Carrizo Gorge Road.

In addition, an approximately 1,500 foot-long asphalt paved access driveway (30 feet in width) would be constructed from Carrizo Gorge Road to the switchyard. The access driveway would require approximately 1.2 acres of land in a new right-of-way and 0.3 acres of land within an existing SDG&E right-of-way. In addition, 30-foot-wide asphalt-paved interior access driveways may be constructed within the switchyard site to access the equipment.

Each site entrance would feature a manual swing gate, and a sign with a lighted directory map and contact information. All entrance gates would feature a 'Knox Box' for emergency access.

14.) Internal Access

The Proposed Project would include dual-purpose internal fire response access and service access. The perimeter internal access within the fenced solar facility would be constructed to a minimum improved width of 24 feet. The interior access would be constructed to a minimum improved width of 20 feet.

All internal access would be designed to provide a minimum inner turning radius of 28feet, would be graded and maintained to support the imposed loads of fire apparatus (not less than 75,000 pounds), and would be designed and maintained to provide all-weather driving capabilities. The internal access would allow for two-way access of fire apparatus throughout the solar facility in order to access all of the inverter/transformer pads.

All internal access surfaces would have a permeable nontoxic soil binding agent in order to reduce fugitive dust and erosion in accordance with County Code Section 87.428, Dust Control Measures, and with San Diego Air Pollution Control District Rule 55, which regulates fugitive dust emissions from any commercial construction or demolition activity capable of generating fugitive dust emissions.

15.) Improvements within SDG&E Transmission Corridor

The SDG&E Transmission Corridor is approximately 600-feet wide and is comprised of three easements. The Proposed Project would include some civil improvements within the SDG&E Transmission Corridor as described below:

- Easement Crossing 1 would be located on the west end of the project site and would serve to connect two regions of the PV Array Field to each other across the SDG&E Transmission Corridor. This proposed easement crossing would be comprised of a 24-foot-wide aggregate base driveway and potentially an underground medium voltage collection line.

- Easement Crossing 2 would be located on the east end of the project site and serves to provide access from the east side of Carrizo Gorge Road to the easternmost end of the PV Array Field via the SDG&E Transmission Corridor. This proposed easement crossing would be comprised of a 24-foot wide aggregate base driveway and an earthen road-side diversion swale. This driveway would provide access to an existing SDG&E transmission tower in the southernmost 200-foot-wide easement and would replace an existing driveway. The existing driveway connection is proposed to be relinquished with the County. The diversion swale is proposed along the southwest side of the proposed driveway to protect the driveway and convey upstream runoff. The swale will cross the SDG&E connection to the main throat of the proposed driveway, and at this crossing, a low water crossing or culvert would be installed to manage stormwater runoff.

- Easement Encroachment 3 would be needed to interconnect the overhead power lines from the switchyard to the existing transmission lines.

16.) Security Fencing and Signage

The approximately 642-acre solar facility would be fenced along the entire facility boundary for security. The fencing would meet National Electrical Safety Code requirements for protective arrangements in electric supply stations. Fencing would be 7 feet in height total, with a 6-foot-high chain-link perimeter fence and 1 foot of three strands of barbed wire along the top. The fence would be constructed with anti-climbing material(s), such as small-ring chain-link fencing. The fence would also include tan slat inserts along certain segments to aid in the visual screening of the proposed PV panels. Signage in Spanish and English for electrical safety would be placed along the perimeter of the solar facility, warning the public of the high voltage and the need to keep out.

17.) Lighting

Lighting would be designed to provide security lighting and general nighttime lighting for operation and maintenance personnel, as may be required from time to time. Lighting would be provided at the entrances, the substation and switchyard, as described below. The PV arrays, the inverter/transformer pads, and the battery storage containers would not have lighting.

Lighting would be provided at the primary entrance off Old Highway 80 and would be on after 5:00 p.m. Motion censored lights would also be installed at the secondary entrances. Lighting would be shielded and directed downward to minimize any effects to the surrounding area,

Lighting would be installed within the substation to allow for safety inspections or maintenance that may be required during the evening hours. Lighting would also be provided next to the entrance door to the control enclosure. Lighting would also be installed at the entrance gates to the substation. Since maintenance activities are not anticipated to be completed during the evening hours, lights would only be turned on if needed.

Switchyard lighting would be placed near major electrical equipment in the switchyard. The switchyard lights would normally be turned off and would only be used during nighttime for security and safety reasons. Lighting would be installed at the entrance gate to the switchyard. The entry light would be left on during nighttime hours to allow the entry to be illuminated in the event that nighttime emergency repair or maintenance are needed.

All lighting for the solar facility would have bulbs that do not exceed 100 watts, and all lights would be shielded, directed downward, and would comply with the County of San Diego Light Pollution Code, also known as the Dark Sky Ordinance, Section 51.201 et seq. Additionally, lighting for the Proposed Project would be designed in accordance with the San Diego County Zoning Ordinance, Performance Standards Section 6320, 6322, and 6324, which guide performance standards for glare, and controls excessive or unnecessary outdoor light emissions.

18.) Water Tanks Fire Protection

ADD

19.) Fuel Modification Zones

ADD

Landscaping

Landscaping would be installed in the following locations to provide visual screening of the PV modules and other Project components:

- Along the proposed fenceline east of Carrizo Gorge Road facing
- Along Old Highway 80 on both sides of the highway and around internal lots that are to be avoided by the project.
- Around private lots located within the Project site
- Along the western boundary of the proposed solar facility adjacent to residential areas (along Seely Avenue, Laguna Street, and the entire western boundary south of Old Highway 80).

The proposed landscaping buffer would be approximately 15-feet wide and would be located outside of the perimeter fencing. The proposed landscaping would include native and/or drought tolerant trees (approximately 18-feet-tall after 10-years after planting) shrubs, and ground covers. The trees and taller species of shrubs would be placed closest to the fence. The lower species of shrubs and ground covers would be placed between the large shrubs and the buffer edge to effectively transition the plant material from highest at the fence to the lowest at the roadway. This design would help to maintain driver visibility.

All landscape improvements would be designed in accordance with the County of San Diego Landscape Standards, Jacumba Community Service District Design Guidelines and in accordance with Assembly Bill 1881, State Water Conservation Requirements. Native and Drought tolerant plants that minimize water use and maintenance would be utilized. All plant materials would be appropriate for the climate of Jacumba Valley. All planting required for screening would be established with vegetation typical of the particular habitat(s) in each area based on coordination with the Project biologist. All landscaping would be regularly irrigated with an automatic drip irrigation system supplied by an existing domestic water meter. All landscape would be maintained during the life of the permit, and all dead, dying or diseased plants would be replaced in kind. All existing trees and shrubs located in the area not under direct improvement, or within the landscape buffer, would be protected in place, and would be incorporated into the overall landscape. If area boulders are encountered and exposed during grading activities, they would be moved to the landscape buffer area to the extent practical.

7 Project Specific Risk Summary

7.1 Fire Risk

Fire risks are assessed based upon the potential frequency (probability of an incident occurring) and consequence (potential damage should an event occur). The evaluation of fire risks must take into account the frequency and severity of fires and other significant incidents.

The Project site includes common risk types as well as heightened sources of risk. Common risks that result in emergency calls include accidental injuries (residential, vehicle, other), medical related incidents including heart attacks, strokes and other serious conditions and illnesses, accidental vegetation fires, and occasional structure fires. The Project site also includes a major transportation corridor risk category that has a higher occurrence rate than commonly realized in other areas. Vehicle related incidents along the I-8 freeway or Old Highway 80, are likely to occur at higher levels in the Project area than in areas without a major freeway or highway. Roadside fires are also a significant risk with spread into the adjacent wildlands possible.

Among the listed potential causes of fire incidents involving Solar Panels, Solar Farms, and a battery storage system, as well as natural conditions that could result in risk of fire. These hazards include several operations and activities associated with the PV solar energy facility that could elevate the probability of ignition. These potential sources of fire that are relevant for this Project are:

- Explosion/Arcs, arc flashing, electrical shorts, sparking, motor or other machinery fire, wiring and harnessing fire, overheated junction boxes, rodents chewing on wires and causing arcing, etc.
- Collapse of supporting structures causing electrical shorts and fire
- Overgrown vegetative fuel under and around the array
- Equipment and supplies stored under arrays for shading
- Tables, trash cans, smoking areas and other combustible storage under arrays
- Fire in an inverter
- Short circuit and fire of components in or on a panel
- Potential for sun reflection from panels igniting vegetation
- Illegal target practice or other vandalism or arson in a rural area
- Switchgear and cable fire

The Project's fire risks are primarily associated with the following:

7.1.1 Construction Phase Risks

- **Earth-moving equipment** – create sparks, heat sources, fuel or hydraulic leaks, etc.
- **Chainsaws** – may result in vegetation ignition from overheating, spark, fuel leak, etc. Chainsaws should be fueled and maintained only in areas away from combustible fuels.
- **Vehicles** – heated exhausts/catalytic converters in contact with vegetation may result in ignition
- **Welders** – open heat source may result in metallic spark coming into contact with vegetation

- **Wood chippers** – include flammable fuels and hydraulic fluid that may overheat and spray onto vegetation with a hose failure
- **Compost piles** – large piles that are allowed to dry and are left on-site for extended periods may result in combustion and potential for embers landing in adjacent vegetation
- **Grinders** – sparks from grinding metal components may land on a receptive fuel bed
- **Torches** – heat source, open flame, and resulting heated metal shards may come in contact with vegetation
- **Dynamite/blasting** – if necessary, blasting may cause vegetation ignition from open flame, excessive heat or contact of heated material on dry vegetation. The blasting plan will address mitigation for blasting procedures to minimize fire ignition potential.
- **Other human-caused accidental ignitions** – ignitions related to discarded cigarettes, matches, temporary electrical connections, inappropriately placed generators, poor maintenance of equipment, and others.

Fire Prevention Measures for all Construction Activities:

- Minimize combustible and flammable materials storage on site.
- Store any combustible or flammable materials that need to be on site away from ignition sources.
- Clear parking areas and fuel or oil storage areas of all grass and brush by a distance of at least 30 feet.
- Keep evacuation routes free of obstructions.
- Label all containers as to their contents and store in the same location as flammable or combustible liquids.
- Perform hot work according to fire safety practices in a controlled environment and with fire suppression equipment at the job site. Dispose of combustible waste promptly and according to applicable laws and regulations.
- Report and repair fuel leaks without delay.
- Do not overload circuits or rely on extension cords where other upgrades would be safer.
- Turn off and unplug electrical equipment when not in use.
- Direct contractors on the site to restrict use of chainsaws, chippers, vegetation masticators, grinders, drill rigs, tractors, torches, and explosives to low-fire risk conditions, which would include higher humidity (15% and higher) and low winds (less than 10 mph). Dry windy days should be avoided for these types of activities. When the above tools are used, water trucks equipped fire extinguishers, hoses, shovels, Pulaskis, and McLeods shall easily be accessible to personnel.
- All construction-related vehicles shall be equipped with a 10 pound, 4A:80BC Dry Chemical Fire Extinguisher, a 5-gallon backpack pump fire extinguisher, a 46-inch round point hardwood shovel, and a first aid kit.
- During significant emergency situations, an evacuation notice may be issued by the site manager/supervisor or SSO. When an evacuation has been called, all site employees will gather at the designated assembly area and the SSO, or a designated supervisor, will account for all personnel. Once all employees are accounted for, the vehicles will safely convoy from the site to safe zones, which are generally areas off site away from the threat.

7.1.2 Contractor On-site Risk

Contractors should know how to prevent and respond to fires, and are responsible for adhering to the Proposed Project's policies regarding fire emergencies. These general fire prevention measures should help in the efforts to prevent a fire from occurring while on site.

Fire Prevention Measures for Contractors:

The following list includes fire prevention measures for contractors whom shall be trained on fire prevention measures:

- Vehicles shall be equipped with the following fire prevention equipment:
  - 10 pound, 4A:80BC Dry Chemical Fire Extinguisher
  - 46-inch round point hardwood shovel
  - 5-gallons water or water backpack
  - First-aid kit
- No driving or parking of vehicles (cars, trucks, ATVs or similar) over unmaintained and dry vegetation.
- Site activities shall be restricted during Red Flag Warning Weather periods; stay alert to fire and weather conditions and evacuate employees, if safe to do so.
- Contractors will conduct operations safely to limit the risk of fire
- Hot work shall adhere to the guidelines provided below in Section 7.5.
- During significant emergency situations, an evacuation notice may be issued by the site manager/supervisor or SSO. When an evacuation has been called, all consultant or contractor employees will gather at the designated assembly area and the SSO, or a designated supervisor, will account for all personnel. Once all employees are accounted for, the vehicles will safely convoy from the site to safe zones, which are generally areas off the site away from the threat.

7.2 JVR Energy Park Project Risk Rating

The estimated risk associated with the JVR Energy Park solar site is considered to be low to moderate during construction and low during operation, based on the successful application of FPP and CFPP fire risk reducing requirements. The risk of fires associated with solar and battery storage facilities are low. There have been very few solar facility fire ignitions in California. Newer technology solar panels and processes result in even lower risk of ignitions.

The active construction phase results in higher potential for fires. Hot work, vegetation clearing, and other activities that may result in flame or heat sources can ignite vegetation, especially if non-native grasses have established and cured. Although there will be a potential for structural/equipment fires and wildfires, the risk is considered manageable as indicated by the low historic fire occurrence in existing solar energy facilities.

7.3 Risk Reduction Measures

The following measures will be employed, as appropriate, during the construction phase of the project to reduce the risk of ignitions. These measures will be enforced through the SSO and ongoing worker safety training.

- Fire rules shall be posted on the Project bulletin board at the contractor's field office and areas visible to employees. This shall include all contractors and subcontractors if more than one.
- All internal combustion engines used at the Project site shall be equipped with spark arrestors that are in good working order.
- Once initial two-track roads have been cut and initial fencing completed, light trucks and cars shall be used only on roads where the roadway is cleared of vegetation. Mufflers on all cars and light trucks shall be maintained in good working order.
- The Project will be equipped with at least one and up to two water trucks each of 4,000- gallon capacity. Each truck will be equipped with 50 feet of 0.25-inch fast response hose with fog nozzles. Any hose size greater than 1.5 inches shall use National Hose (NH) couplings.
- During construction, the project site will have at a minimum two pick-up trucks outfitted with Type-6 Skid-Mounted Units, including fire pump, hose, and nozzle, that are staffed with personnel properly trained to use the equipment.
- A cache of shovels, McLeods, and Pulaskis shall be available at staging sites. The amount of equipment will be determined by consultation between SSO and SDCFA/CAL FIRE. Additionally, on-site pickup trucks will be equipped with first aid kits, fire extinguishers, and shovels. Contractor vehicles will be required to include the same basic equipment.
- Equipment parking areas and small stationary engine sites shall be cleared of all extraneous flammable materials and provided with a gravel surface.
- A fire watch (i.e., person responsible for monitoring for ignitions) shall be provided during hot work and shall occur for up to one hour following completion of the hot work activities.
- Smoking will not be permitted on the site.
- Each Project construction site, if construction occurs simultaneously at various locations on the site, shall be equipped with fire extinguishers and firefighting equipment sufficient to extinguish small fires.
- The on-site contractor or Project staff shall coordinate with SDCFA/CAL FIRE to create a training component for emergency first responders to prepare for specialized emergency incidents that may occur at the Project site.
- All on-site employees shall participate in fire prevention and response training exercises with the SDCFA/CAL FIRE.
- The Project shall implement ongoing fire patrols during the fire season as defined by local and state agencies. The SSO will be assigned as fire patrol to monitor work activities when an activity risk exists for fire compliance. The SSO shall verify proper tools and equipment are on site, assess any fire agency work restrictions, and serve as a lookout for fire starts, including staying behind (e.g., a fire watch) to make certain no residual fire exists. Fire watch may be performed by any site personnel. A SSO shall perform routine patrols of the Project site during the fire season equipped with a portable fire extinguisher and communications equipment. The Project staff shall notify SDCFA/CAL FIRE of the name and contact information of the current SSO in the event of any change.

- Fires ignited on site shall be immediately reported via SDCFA and CAL FIRE.
- The engineering, procurement, and construction contracts for the Project shall clearly state the fire safety requirements that are the responsibility of any person who enters the site, as described in this CFPP.

7.4 Daily Fire Prevention Measures

To limit the risk of fires, all site staff, employees, and contractors shall take the following precautions:

- Fire safety shall be a component of daily tailgate meetings. Foremen will remind employees of fire safety, prevention, and emergency protocols on a daily basis.
- Smoking will not be permitted in the project site. Combustible materials shall be stored in areas away from native vegetation. Whenever combustibles are being stored in the open air, the SSO shall be informed of the situation.
- Evacuation routes shall be maintained and free of obstructions. Unavoidable evacuation route blockages shall be coordinated such that a secondary route is identified and available.
- Disposal of combustible waste in accordance with all applicable laws and regulations shall be required.
- Use and storage of flammable materials in areas away from ignition sources shall be required.
- Proper storage of chemicals such that incompatible (i.e., chemically reactive) substances would be separated appropriately shall be required.
- Performance of hot work (i.e., welding or working with an open flame or other ignition sources) in controlled areas under the supervision of a fire watch shall be required. Fire watch may be any site personnel who would watch for accidental ignitions. Hot work permits are required and shall be reviewed and granted by the SSO for all hot work.
- Equipment shall be kept in good working order by inspecting electrical wiring and appliances regularly and maintaining motors and tools free of excessive dust and grease.
- Ensuring that heating units are safeguarded shall be required.
- Immediate reporting of fuel or petroleum leaks. The site mechanic shall ensure that leaks are repaired immediately upon notification.
- Immediate repair and cleanup of flammable liquid leaks shall be required.
- Construction work areas shall be kept free of combustible materials.
- Extension cords shall not be relied on if wiring improvements are needed, and overloading of circuits with multiple pieces of equipment shall be prohibited.
- Turning off and unplugging electrical equipment when not in use.

7.4.1 Fire Prevention/Protection System Maintenance

The site maintenance personnel will ensure that fire suppression and related equipment is maintained according to manufacturers' specifications. National Fire Protection Association (NFPA) guidelines shall be implemented for specific equipment.

The following equipment is subject to ongoing maintenance, inspection, and testing procedures:

- Portable fire extinguishers;
- Skid-mounted units on pick-up trucks during construction
- Fire alarm systems;
- Water trucks and associated equipment; and
- Emergency backup generators/systems and the equipment they support.

7.5 Hot Work

These requirements are primarily from California Fire Code (CFC) Chapter 26, Welding and other Hot Work, and NFPA 51B, "Fire Prevention During Welding, Cutting and other Hot Work". Hot Work is defined in the CFC as operations involving cutting, welding, thermite welding, brazing, soldering, grinding, thermal spraying, thawing pipe, or other similar operations. Hot work areas are defined as the areas exposed to sparks, hot slag, radiant heat, or convective heat because of the hot work.

A Hot Work Permit shall be obtained from the SSO, following guidelines from the fire agencies. The SSO would require all hot work to be done in compliance with the requirements of NFPA 51B and the Fire Code, Chapter 26.

Hot Work shall only be done in fire safe areas designated by the SSO and would comply with the following:

- All personnel involved in hot work shall be trained in safe operation of the equipment by the SSO. This will include providing training at "tailgate safety meetings." Personnel would also be made aware of the risks involved and emergency procedures, such as how to transmit an alarm and who is responsible to call 9-1-1.
- Signage required in areas where workers may enter indicating "Caution; Hot Work in progress; Stay Clear" would be posted on site.
- Hot work would not be done on any containers which contain or have contained flammable liquids, gases, or solids until containers have been thoroughly cleaned, purged, or inerted.
- A fire extinguisher with a minimum rating of 4A:80BC, a 5-gallon backpack pump fire extinguisher, and a 46-round point hardwood shovel, shall be readily accessible within 25 feet of hot work area.
- The SSO shall would the hot work area before issuing a permit and shall then make daily inspections.
- Welding and cutting would comply with 2016 CFC Chapter 35- Welding and Hot Work.
- Electric arc hot work would comply with 2016 CFC Chapter 35 – Weling and Hot Work.
- Piping manifolds and hose systems for fuel gases and oxygen would comply with 2016 CFC Section 3509.
- Cylinder use and storage would comply with 2016 CFC Chapter 53 - Compressed Gases.
- Equipment would be approved by a fire agency, including torches, manifolds, regulators, or pressure-reducing valves, and any acetylene generators.
- Personal protective clothing would be selected to minimize the potential for ignition, burning, trapping hot sparks, and electric shock.

- A fire watch will be in place for a minimum of 30 minutes, or longer as considered necessary by the SSO, following any hot work.
- Any ignitions will be immediately extinguished (as possible) by site personnel, and SDCFA and CAL FIRE would be notified of the incident.

The SSO shall have the responsibility to assure safe hot work operations and would have the authority to modify hot work activities associated with construction and/or maintenance and to exceed the requirements in NFPA 51B and the 2016 CFC to the degree necessary to prevent fire ignition. Workers must be trained on the hot work information and criteria in this CFPP.

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8 Red Flag Warning Protocol

Red Flag Warnings are issued by the National Weather Service and indicate that conditions are such (low humidity, high winds) that wildfire ignitions and spread may be facilitated. To ensure compliance with Red Flag Warnings restrictions, the National Weather Service website would be monitored at the site (http://www.srh.noaa.gov/ridge2/fire/briefing.php). During Red Flag Warnings, cconstruction activities would be limited and precautions may be taken on site during periods of a Red Flag Warning, when conditions such as low humidity and high winds are present. Upon announcement of a Red Flag Warning, red flags will be prominently displayed at the entrance gate and main office, indicating to employees and contractors that restrictions are in place. Additionally, any hot work, grading, or other work that could result in heat, flame, sparks, or may cause an ignition to vegetation would be limited to low fire hazard, non-hot work, unless within an ignition resistant structure until RFW has been lifted Areas may be evacuated where personnel may be exposed to higher risks. If vehicles are required to be used during Red Flag Warning conditions, vehicles shall remain only on designated access roads on the site.

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9 Fire Safety Briefings, Inspections, and Training

9.1 Briefings and Inspections

The SSO will conduct routine unannounced inspections a minimum of once weekly. The SSO will develop an inspection check list to document these inspections. Completed checklists will be retained electronically and hard copies stored on site in the SSO's office/trailer. Checklists will be reviewed by the SSO and where issue is found, will be shared with site supervisors for correction. If corrections are not provided within 36 hours, the SSO will stop work and report to Project Owner, who will be responsible for corrections.

Prior to Project initiation, all Project personnel will receive a ½ hour presentation on the contents of this CFPP along with additional fire safety and fire prevention information provided by an informed SSO (or his/her designee). As possible, firefighters from the local fire department will attend these meetings and provide input, which has a dual benefit of informing site personnel and providing project familiarity for the firefighters.

Supervisors/foremen will be responsible for sharing CFPP content with transient Project personnel throughout the duration of the Project. A review of the content of this CFPP will take place at a formal safety briefing; a minimum of once each month.

Each daily safety tailgate session should include an assessment of the day's fire related risks or hazards and the mitigation for each.

Compliance with this CFPP is mandatory. Monitoring compliance with this CFPP is everybody's responsibility. All levels of project management have the authority to shut down any operation that presents an inappropriate amount of fire risk or hazard until it can be properly mitigated.

Violations of any of the requirements of this CFPP will be addressed immediately. Appropriate consequences for repeated or serious negligence in respect to this Plan will be dealt with accordingly.

9.2 Training Requirements

9.2.1 Basic Fire Safety Training

The SSO and or Site Supervisors/Foremen shall present basic fire prevention training to all employees upon employment, and shall maintain documentation of the training, which includes:

- This CFPP, including how it can be accessed
- The project FPP
- Review of OSHA Fire Protection and Prevention: 29 CFR 1926.24, including how it can be accessed;
- Fire Management: Wildfire Prevention (43 C.F.R. 9212.0 et seq.);

- Proper response and notification in the event of a fire;
- Instruction on the use of portable fire extinguishers (as determined by company policy in the Emergency Action Plan); hand tools such as shovels, and recognition of potential fire hazards.

The SSO shall train all persons entering the site about the fire hazards associated with the specific materials and processes to which they are exposed, and will maintain documentation of the training. Employees will receive this training:

- Upon first entering the facility
- Annually during a pre-planned meeting
- When changes in work processes necessitate additional training

9.2.2 Supervisor/Foreman Fire Safety Training

Prior to Project initiation and each spring prior to the high fire season; all Project supervisors will receive a minimum of one hour training on Wildland Fire Prevention and Safety. This training, created by the SSO or its designee, using this CFPP as its source, will be provided by the SSO or their qualified designee, such as the site compliance monitor. This training will then be shared with all construction personnel either by the Project supervisors or the SSO.

Each supervisor/foreman shall be trained to understand:

- Fire reporting
- Extinguishing small fires in order to prevent them from growing into more serious threats.
- Fire prevention
- Initial Attack Firefighting
- Identifying work activities that may result in a fire hazard

9.2.3 Communication Plan

The ability to communicate with all personnel working on the site is mandatory. The SSO and construction crews will be required to have a cell phone, satellite phone, and/or radios that are operational within the area of work to report an emergency. Communication pathways and equipment will be tested and confirmed operational each day prior to initiating construction activities. All fires and medical emergencies will be immediately reported to the County/CAL FIRE and the CPUC.

Each on-site worker will carry at all times a laminated, CFPP card listing 24-hour contact information, including telephone numbers for reporting an emergency and immediate steps to take if an incident occurs. Information on the CFPP card will be updated as needed and redistributed to all workers before the initiation of any construction activities. The Project's compliance monitor, who is responsible for ensuring the project complies with all conditions and required measures, will provide the CFPP cards to the site's SSO prior to construction kick-off so that all site staff can be provided training and receive their cards.

10 Project Personnel Fire Fighting Limitations

Responding to fires at the Project Site, whether structural, wildland, or other, is the responsibility of County and CAL FIRE. Because their response to the site may require several minutes or more, JVR Energy Park employees or contractors should provide only initial firefighting efforts, and only if they have had appropriate training. **THE FOLLOWING FIRE SUPPRESSION GUIDELINES ARE RECOMMENDED:**

- No employee shall fight a fire beyond the incipient stage and the arrival of professional fire suppression personnel. Involvement in firefighting is voluntary and should only be attempted by trained, qualified individuals.
- During construction, there will be two Project pick-up trucks outfitted with Type-6 Skid-Mounted Units (including fire pump, hose, and approved nozzle) and personnel properly trained to utilize the equipment.

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11 Review and Approval

The signatory reviewing officials are acknowledging that JVR Energy Park LLC has established a CFPP when properly implemented, maintained, and enforced, results in fire hazard and risk reduction for the Project's construction phase. Reviewing agencies do not accept any responsibility for JVR Energy Park LLC's interpretation or implementation of this plan prior to, during or following the construction of the Project or for any resulting actions associated with these activities.

Reviewed by:

____________________________	________________________
SSO	Date
____________________________	________________________
SDCFA	Date
____________________________	________________________
CAL FIRE	Date

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12 References

California Fire Code. 2016. California Code of Regulations, Title 24, Part 9.

Dudek. 2019. Draft Fire Protection Plan for the JVR Energy Park. November 2019.

FRAP (Fire and Resource Assessment Program). 2018. CAL FIRE Fire Resource and Assessment Program. California Department of Forestry and Fire Protection. Accessed October 2018. http://frap.cdf.ca.gov/.

NFPA 51B. National Fire Protection Association. Standard for Fire Prevention During Welding, Cutting, and Other Hot Work.

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Appendix A

Common Fire Ignition Sources and Fire Prevention Measures

Electrical Fire Hazards

Electrical system failures and the misuse of electrical equipment are leading causes of workplace fires. Fires can result from loose ground connections, wiring with frayed insulation, or overloaded fuses, circuits, motors, or outlets.

To prevent electrical fires, employees shall:

1. Make sure that worn wires are replaced.
2. Use only appropriately rated fuses.
3. Never use extension cords as substitutes for wiring improvements.
4. Use only approved extension cords [i.e., those with the Underwriters Laboratory (UL) or Factory Mutual (FM) label].
5. Check cords and equipment in hazardous locations where the risk of fire is especially high.
6. Check electrical equipment to ensure that it is either properly grounded or double insulated.

Hot Works (Cutting, Welding, and Open Flame Work)

The Site Safety Officer (SSO) and supervising foremen shall ensure the following occurs when hot works will be performed:

1. A jobsite evaluation for fire hazards will be completed prior to work beginning.
2. A hot work permit will be obtained and all requirements of the permit will be observed.
3. Cutting and welding are done by authorized personnel in designated cutting and welding areas whenever possible.
4. Torches, regulators, pressure-reducing valves, and manifolds are UL listed or SDCFA Fire Marshal approved.
5. Oxygen-fuel gas systems are equipped with listed and/or approved backflow valves and pressure-relief devices.
6. Cutters, welders, and helpers are wearing eye protection and protective clothing as appropriate.
7. Cutting or welding is prohibited in areas where explosive atmospheres of gases, vapors, or dusts could develop from residues.
8. Small tanks, piping, or containers that cannot be entered are cleaned, purged, and tested before cutting or welding on them begins.
9. A fire watch, which shall remain 1-hour after completion of work if site is adjacent to natural vegetation, has been identified and situated at the hot work site.

Flammable and Combustible Materials

The SSO shall regularly evaluate the presence of combustible materials at all jobsite locations.

Certain types of substances can ignite at relatively low temperatures or pose a risk of explosion if ignited. Such substances obviously require special care and handling. The following summary provides general information about combustible types and how risk can be reduced.

Class A Combustibles

These include common combustible materials (wood, paper, cloth, rubber, vegetation and plastics).

Class A combustible safe handling procedures:

- Dispose of waste daily in proper, metal receptacles with tight fitting covers.
- Keep work areas clean and free of accumulated fuels that could lead to ignition and fire spread.
- Maintain a safe distance between combustibles and ignition sources, such as hot plates, soldering irons, or other heat- or spark-producing devices.
- Store paper supplies in metal cabinets.
- Store rags in metal bins with self-closing lids.
- Do not store excessive amounts of combustibles on site.
- Make frequent inspections to anticipate fires before they start.
- Maintain extinguishers in all buildings and at various locations throughout the project. Water, multi-purpose dry chemical (ABC), and halon 1211 are approved fire extinguishing agents for Class A combustibles.

Class B Combustibles

These include flammable and combustible liquids (oils, greases, tars, oil-based paints, and lacquers), flammable gases, and flammable aerosols.

Class B combustibles safe handling procedures:

- Use only approved pumps, taking suction from the top, to dispense liquids from tanks, drums, barrels, or similar containers (or use approved self-closing valves or faucets).
- Do not dispense Class B flammable liquids into containers unless the nozzle and container are electrically interconnected by contact or by a bonding wire. Either the tank or container must be grounded.
- Store, handle, and use Class B combustibles only in approved locations where vapors are prevented from reaching ignition sources such as heating or electric equipment, open flames, or mechanical or electric sparks.
- Do not use a flammable liquid as a cleaning agent inside a building or tool van (the only exception is in a closed machine approved for cleaning with flammable liquids).
- Do not use, handle, or store Class B combustibles near areas normally used as exits.
- Do not weld, cut, grind, or use unsafe electrical appliances or equipment near Class B combustibles. Do not generate heat, allow an open flame, or smoke near Class B combustibles.
- Do not use water to extinguish Class B fires caused by flammable liquids. Water can cause the burning liquid to spread, making the fire worse. To extinguish a fire caused by flammable liquids, exclude air around the burning liquid. The following fire-extinguishing agents are approved for Class B combustibles: carbon dioxide, multi-purpose dry chemical (ABC), Halon 1301, and Halon 1211.

Vegetated Area Risk Reduction

The JVR Energy Park site includes and is surrounded by expanses of chaparral brush and other naturally occurring vegetated areas. These natural fuels may be prone to ignition from activities occurring on the Project site and require strict application of measures to minimize the likelihood of ignition and fire spread.

- All site vehicles used during construction, operation and maintenance, and decommissioning shall be equipped with a first-aid kit, fire extinguisher, and shovel (employee vehicles are not required to include this equipment)
- All internal combustion engines used at the project site shall be equipped with spark arresters that function as intended by the manufacturer.
- All machinery with an internal combustion engine will be equipped with a fire extinguisher.
- All vehicles equipped with catalytic converters will not park or be operated in vegetated areas unless on a designated roadway.
- Mufflers and catalytic converters on all vehicles will be maintained in good working order.
- When it is necessary for overland travel in native fuel areas, the travel route or place of operation shall be wetted down with a water truck, and a fire watch will monitor the area during and for up to one hour following the overland travel.
- No hot work is to be performed within or immediately adjacent natural vegetated areas unless specifically approved by the SSO and all precautions have been taken, including a fire watch, fire extinguisher, water truck, shovels, etc. are in place.
- Equipment parking areas and small stationary engine sites (e.g., generators) shall be cleared of all extraneous flammable materials including a setback from vegetated areas of at least 30 feet.
- The JVR Energy Park facility staff and contractors shall make an effort to restrict use of chainsaws, chippers, vegetation masticators, grinders, drill rigs, tractors, torches, and explosives to outside of the official fire season. When the above tools are used, portable water trucks (e.g., water tenders) equipped with hoses, or multi-purpose fire extinguishers and fire shovels shall be easily accessible to personnel.

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Storage of Flammable and Combustible Liquids and Fueling

Storage, use, handling, and dispensing of flammable and combustible liquids shall comply with the applicable sections 3404, 3405, and 3406 of California Fire Code (CFC) Chapter 34. The Maximum Allowable Quantities (MAQ) of flammable and combustible materials shall not exceed those in CFC Chapter 34. Flammable and combustible liquids and the fueling of vehicles and equipment shall only be done in the approved fueling areas. Approved, UL-listed containers or tanks, which comply with CFC Chapter 34, will be provided for storage and dispensing. Tanks and containers shall be labeled as required in CFC Chapter 34. Dispensing shall be done in an approved manner per CFC Chapter 34 using approved devices and hoses with approved shut offs, such approvals are UL or FM Global, or fire agency equivalent. Approved Fire Extinguishers with a rating of not less than 10 lb. 4A:80BC shall be provided within 50 feet of the storage/refueling area. Approved grounding and bonding will be provided for dispensing of flammable liquids. The storage and dispensing area shall have spill control and secondary containment to contain the contents of the largest container. No combustibles shall be stored in the same location as flammable or combustible liquids. All containers shall be labeled as to contents. Safety instructions and No Smoking signs shall be posted. No open flames are allowed. Vehicle or equipment motors shall be shut off prior to fueling. Any fueling of vehicles using compressed natural gas (CNG) or other gases shall comply with the CFC. Gasoline shall not be stored, used, or dispensed, unless required for small equipment.

Mobile fuel or lube oil trucks shall comply with the following:

- Be in good repair and comply with the spark arrestor rules;
- Have appropriate warning signs and decals;
- Use proper bonding and grounding equipment;
- Shut off all internal combustion engines prior to refueling;
- Allow engines to cool down sufficiently as to not ignite spilled fuel;
- Be equipped with a fire extinguisher with a 4A:80BC rating (or equivalent);
- Have one 46" round point shovel;
- Contain a metal can with lid for storage of rags;
- Have a suitable spill kit on truck;
- Be equipped with contractor radio and have Cell Phone;
- Equipment operators should stay in immediate area but stay off vehicle during refueling;
- Be trained in procedure for reporting emergencies;
    - No dispensing (dispensing includes re fueling) within 25 feet of any open flame or ignition source;
    - No dispensing within 15 feet of buildings, property lines, or combustible storage, per CFC 3406.5.4.5;
- No smoking at all.

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APPENDIX B

Representative Site Photographs

APPENDIX B

Representative Site Photographs

Appendix B

Representative Photographs

Photograph 1

Photograph 2

Photographs #1 (facing to the west) and #2 (facing to the southwest) show the typical fuel types (desert saltbush and Sonoran mixed woody and succulent scrub habitats) within the northern portion of the project area. Both photographs illustrate the gently sloped terrain throughout the project site.

Photograph 3

Photograph 4

Photographs #3 (facing to the south) and #4 (facing to the southeast) show the typical fuel types and fuel loading (non-contiguous shrub canopy) in central and eastern portions of the project site.

Photograph 5

Photograph 6

Photographs #5 and #6 were taken in northern portion of project site looking south from Carrizo Gorge Road. Fuel bed is typical for Sonoran mixed woody and succulent scrub plant community. Note open bare ground with very little grasses or shrubs.

Photograph 7

Photograph 8

Photograph #7 is looking southwest along the western edge of the property. The base of Round Mountain is in the background of the photo. Photograph #8 depicts the dense tree/shrub canopy of the Mesquite Bosque habitat. Note the San Diego and Eastern Arizona Railway tracks in lower half of photo.

Photograph 9

Photograph 10

Photograph #9 and 10 are taken in the northwestern corner of the Project site, looking northwest. Photos show northern extension of Carrizo Gorge Road as it passes underneath Interstate 8 and Mesquite Bosque habitat that continues up the drainage.

Photograph 11

Photograph 12

Photograph #11 is looking north towards Grey mountain ridgeline. This photo is also displaying Sonoran mixed woody and succulent scrub plant community. Photograph #12 is looking north along the paved segment of Carrizo Gorge Road.

Photograph 13

Photograph 14

Photographs #13 and #14 are taken in southern portion of Jacumba Valley, just east of the community of Jacumba Hot Springs. Photo #13 shows the former farmland (on-site) and the U.S./Mexico border fence (yellow arrow), which is approximately 150 feet from the southern edge of the project. Looking north, Photo #14 shows several abandoned structures and Gray Mountain in the background.

Photograph 15

Photograph 16

Photograph #15 is looking northwest standing along Old Highway 80 along the western edge of the project site. Photograph #16 is looking west down Old Highway 80 towards the community of Jacumba Hot Springs.

APPENDIX C

BehavePlus Fire Behavior Modeling Analysis

BehavePlus Fire Behavior Modeling

Fire behavior modeling has been used by researchers for approximately 50+ years to predict how a fire will move through a given landscape (Linn 2003). The models have had varied complexities and applications throughout the years. One model has become the most widely used as the industry standard for predicting fire behavior on a given landscape. That model, known as "BEHAVE", was developed by the U. S. Government (USDA Forest Service, Rocky Mountain Research Station) and has been in use since 1984. Since that time, it has undergone continued research, improvements, and refinement. The current version of BehavePlus software, includes the latest updates incorporating years of research and testing. Numerous studies have been completed testing the validity of the fire behavior models' ability to predict fire behavior given site specific inputs. One of the most successful ways the model has been improved has been through post-wildfire modeling (Brown 1972, Lawson 1972, Sneeuwjagt and Frandsen 1977, Andrews 1980, Brown 1982, Rothermel and Rinehart 1983, Bushey 1985, McAlpine and Xanthopoulos 1989, Grabner, et. al. 1994, Marsden-Smedley and Catchpole 1995, Grabner 1996, Alexander 1998, Grabner et al. 2001). In this type of study, Behave is used to model fire behavior based on pre-fire conditions in an area that recently burned. Real-world fire behavior, documented during the wildfire, can then be compared to the prediction results of Behave and refinements to the fuel models incorporated, retested, and so on.

Fire behavior modeling includes a high level of analysis and information detail to arrive at reasonably accurate representations of how wildfire would move through available fuels on a given site. Fire behavior calculations are based on site-specific fuel characteristics supported by fire science research that analyzes heat transfer related to specific fire behavior. To objectively predict flame lengths, spread rates, fireline intensities, and spot fire distance the BehavePlus 5.0.5 fire behavior modeling system was applied using predominant fuel characteristics, slope percentages, and two representative fuel models observed on site.

Predicting wildland fire behavior is not an exact science. As such, the movement of a fire will likely never be fully predictable, especially considering the variations in weather and the limits of weather forecasting. Nevertheless, practiced and experienced judgment, coupled with a validated fire behavior modeling system, results in useful and accurate fire prevention planning information.

To be used effectively, the basic assumptions and limitations of BehavePlus must be understood.

- First, it must be realized that the fire model describes fire behavior only in the flaming front. The primary driving force in the predictive calculations is dead fuels less than one-quarter inch in diameter. These are the fine fuels that carry fire. Fuels greater than one inch have little effect while fuels greater than three inches have no effect on fire behavior.
- Second, the model bases calculations and descriptions on a wildfire spreading through surface fuels that are within six feet of the ground and contiguous to the ground. Surface fuels are often classified as grass, brush, litter, or slash.
- Third, the software assumes that weather and topography are uniform. However, because wildfires almost always burn under non-uniform conditions, length of projection period and choice of fuel model must be carefully considered to obtain useful predictions.
- Fourth, the BehavePlus fire behavior computer modeling system was not intended for determining sufficient fuel modification zone widths. However, it does provide the average length of the flames, which is a key element for determining "defensible space" distances for minimizing structure ignition.

Although BehavePlus has some limitations, it can still provide valuable fire behavior predictions which can be used as a tool in the decision-making process. In order to make reliable estimates of fire behavior, one must understand the relationship of fuels to the fire environment and be able to recognize the variations in these fuels. Natural fuels are made up of the various components of vegetation, both live and dead, that occur on a site. The type and quantity will depend upon the soil, climate, geographic features, and the fire history of the site. The major fuel groups of grass, shrub, trees, and slash are defined by their constituent types and quantities of litter and duff layers, dead woody material, grasses and forbs, shrubs, regeneration, and trees. Fire behavior can be predicted largely by analyzing the characteristics of these fuels. Fire behavior is affected by seven principal fuel characteristics: fuel loading, size and shape, compactness, horizontal continuity, vertical arrangement, moisture content, and chemical properties.

The seven fuel characteristics help define the 13 standard fire behavior fuel models (Anderson 1982) and the five custom fuel models developed for Southern California (Weise 1997). According to the model classifications, fuel models used in BehavePlus have been classified into four groups, based upon fuel loading (tons/acre), fuel height, and surface to volume ratio. Observation of the fuels in the field (on site) determines which fuel models should be applied in BehavePlus. The following describes the distribution of fuel models among general vegetation types for the standard 13 fuel models and the custom Southern California fuel models:

- Grasses — Fuel Models 1 through 3
- Brush — Fuel Models 4 through 7, SCAL 14 through 18
- Timber — Fuel Models 8 through 10
- Logging Slash — Fuel Models 11 through 13

In addition, the aforementioned fuel characteristics were utilized in the recent development of 40 new fire behavior fuel models (Scott and Burgan 2005) developed for use in BehavePlus modeling efforts. These new models attempt to improve the accuracy of the standard 13 fuel models outside of severe fire season conditions, and to allow for the simulation of fuel treatment prescriptions. The following describes the distribution of fuel models among general vegetation types for the new 40 fuel models:

- Non-Burnable — Models NB1, NB2, NB3, NB8, NB9
- Grass — Models GR1 through GR9
- Grass-shrub — Models GS1 through GS4
- Shrub — Models SH1 through SH9
- Timber-understory — Models TU1 through TU5
- Timber litter — Models TL1 through TL9
- Slash blowdown — Models SB1 through SB4

BehavePlus software was used in the development of the JVR Energy Park Project Fire Protection Plan (FPP) in order to evaluate potential fire behavior for the project site. Existing site conditions were evaluated, and local weather data was incorporated into the BehavePlus modeling runs.

BehavePlus Fuel Model Inputs

Dudek utilized BehavePlus version 5.0.5 software to evaluate fire behavior potential for the Project site. Two fire scenarios were evaluated, including one summer, onshore weather conditions and one more extreme fall, offshore weather conditions. BehavePlus software requires site-specific variables for surface fire spread analysis, including fuel type, fuel moisture, wind speed, and slope data. The output variables used in this analysis include flame length (feet), rate of spread (feet/minute), fireline intensity (BTU/feet/second), and spotting distance (miles). The following provides a description of the input variables used in processing the BehavePlus models for the JVR Energy Park Project site. In addition, data sources are cited and any assumptions made during the modeling process are described.

Vegetation/Fuel Models

To support the fire behavior modeling efforts conducted for this FPP, Dudek Fire Protection Planners analyzed nine vegetation types observed on and adjacent to the site. Vegetation types were derived from vegetation mapping surveys and data (SANGIS 2014, Dudek 2017) for the Project. Based on vegetation mapping data, the six of the nine vegetation types were classified into two aforementioned numeric fuel models. It is these fuels that would have the potential to affect the project's structures from a radiant and convective heat perspective as well as from direct flame impingement. Therefore, the fuel model assignments summarized in Table 1 were used in the fire behavior modeling effort presented herein.

Table 1. Fuel Model Assignments and Characteristics

Fuel Model	Vegetation Description	Location	Fuelbed Depth (Feet)
Sh1	Sonoran Mixed Woody Scrub; Sonoran Mixed Woody and Succulent Scrub; Desert Sink Scrub; Desert Saltbush Scrub; Mesquite Bosque	Throughout the property	<2.0 feet
Sh5	Big Sagebush Scrub	Throughout the Property	4.0 feet

Topography

Slope is a measure of angle in degrees from horizontal and can be presented in units of degrees or percent. Slope is important in fire behavior analysis as it affects the exposure of fuelbeds. Additionally, fire burning uphill spreads faster than those burning on flat terrain or downhill as uphill vegetation is pre-heated and dried in advance of the flaming front, resulting in faster ignition rates. Slope values ranging from 2% to 10% were measured for this site from U.S. Geological Survey (USGS) topographic maps.

Weather Analysis

The County of San Diego, Department of Planning and Land Use (County of San Diego 2010) developed guidelines to identify acceptable fire behavior modeling weather inputs for fire conditions during summer months and Santa Ana fire weather patterns. The County analyzed and processed fire weather from Remote Automated Weather Stations (RAWS) between April 15 to December 31 in order to represent the general limits of the fire season. Data provided by the County's analysis included temperature, relative humidity, and sustained wind speed and is categorized by weather zone, including Maritime, Coastal, Transitional, Interior, and Desert.

As identified in the County's guidelines, Dudek utilized the Fine Dead Fuel Moisture (FDFM) tool within BehavePlus (v. 5.0.5) fire behavior modeling software package to determine potential fuel moisture values to be input into the BehavePlus runs. The temperature, relative humidity, and wind speed data for the Interior (County of San Diego 2010) weather zone were utilized for this FPP based on the Project's location. Reference fuel moistures were calculated in the FDFM tool and were based on site-specific topographic data inputs. Table 2 summarizes the FDFM inputs and the resulting fine dead fuel moisture values.

Table 2. BehavePlus Fine Dead Fuel Moisture Calculations

Variable	Summer Weather	Extreme (Peak) Weather
Dry Bulb Temperature	90–109 deg. F	90–109 deg. F
Relative Humidity	5– 9 %	5– 9 %
Reference Fuel Moisture	1%	1 %
Month	Feb Mar Apr Aug Sept Oct	May June July
Time of Day	12:00– 13:59	12:00–13:59
Elevation Difference	Level (within 1,000 ft.)	Level (within 1,000 ft.)
Slope	0–30%	0–30%
Aspect	East	North
Fuel Shading	Exposed (<50% shading)	Exposed (< 50% shading)
Fuel Moisture Correction	1 %	0 %
Fine Dead Fuel Moisture	2 %	1 %

Fire Modeling Scenarios

Based on slope and fuel conditions, two different fire scenarios were evaluated for the Project site. A scenario from the east was selected based on the strong likelihood of fire approaching from that direction during a Santa Ana wind-driven fire event. A scenario on the west was selected to evaluate fire behavior potential during a summer fire occurring during typical on-shore wind flow patterns. The fire behavior modeling input variables for the Project site are presented in Table 3. The weather variables presented in Table 3 are based on the calculated FDFM (Table 2) and the wind speed values identified in the County of San Diego standards. Locations for each modeling run are presented graphically in Figure 5 of the FPP.

Table 3. Variables Used for Fire Behavior Modeling Efforts

Variable	Summer Weather Conditions (Sea Breeze)	Peak Weather Condition (offshore/Santa Ana Conditions)
1h Moisture	2%	1%
10h Moisture	4%	2%
100h Moisture	6%	4%
Live Herbaceous Moisture	50%	30%

Table 3. Variables Used for Fire Behavior Modeling Efforts

Variable	Summer Weather Conditions (Sea Breeze)	Peak Weather Condition (offshore/Santa Ana Conditions)
Live Woody Moisture	80%	50%
20-foot Wind Speed (upslope/downslope)	18 mph (maximum sustained winds)	56 mph (maximum sustained winds)
Wind Direction	270°	90°
Wind Adjustment Factor (BehavePlus)	0.6	0.6

Fire Behavior Modeling Results

Four fire behavior variables were selected as outputs from the BehavePlus analysis conducted for the Project site, and include flame length (feet), rate of spread (mph), fireline intensity (BTU/feet/second), and spot fire distance (miles). The aforementioned fire behavior variables are an important component in understanding fire risk and fire agency response capabilities. Flame length, the length of the flame of a spreading surface fire within the flaming front, is measured from midway in the active flaming combustion zone to the average tip of the flames (Andrews, Bevins, and Seli 2004). It is a somewhat subjective and non-scientific measure of fire behavior, but is extremely important to fireline personnel in evaluating fireline intensity and is worth considering as an important fire variable (Rothermel 1983). Fireline intensity is a measure of heat output from the flaming front, and also affects the potential for a surface fire to transition to a crown fire. Fire spread rate represents the speed at which the fire progresses through surface fuels and is another important variable in initial attack and fire suppression efforts. Spotting distance represents the maximum distance that one can expect potential spot fires based on firebrands from a spreading wind-driven surface fire. The information in Table 4 presents an interpretation of these fire behavior variables as related to fire suppression efforts for surface fires. The results of fire behavior modeling efforts are presented in Table 5.

Table 4. Fire Suppression Interpretation

Flame Length (ft)	Fireline Intensity (Btu/ft/s)	Interpretations
Under 4 feet	Under 100 BTU/ft/s	Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire.
4 to 8 feet	100-500 BTU/ft/s	Fires are too intense for direct attack on the head by persons using hand tools. Hand line cannot be relied on to hold the fire. Equipment such as dozers, pumpers, and retardant aircraft can be effective.
8 to 11 feet	500-1000 BTU/ft/s	Fires may present serious control problems -- torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective.
Over 11 feet	Over 1000 BTU/ft/s	Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective.

Source: BehavePlus 5.0.5 fire behavior modeling program (Andrews, Bevins, and Seli 2004)

Table 5
BehavePlus Fire Behavior Modeling Results

Fuel Models	Flame Length (feet)	Spread Rate (mph)	Fireline Intensity (Btu/ft/s)	Spot Fire[1] (miles)
Scenario 1: Peak Weather, Chaparral-scrub;2 and 5% slopes, 56 mph winds				
Sh1 – Low Load, Dry Climate Shrub	11.5	1.74	1,150	1.0
Sh5 – High Load, Dry Climate Shrub	63.6	14.3	47,187	3.4
Scenario 2: Summer Weather, Chaparral-scrub;3 and 10% slopes, 18 mph winds				
Sh1 – Low Load, Dry Climate Shrub	1.7	0.09	18	0.1
Sh5 – High Load, Dry Climate Shrub	26.0	2.38	6,739	0.8

Note:
1 Spotting distance from wind-driven surface fire.

Summary

Based on the fire behavior modeling results presented herein, the maximum flame lengths anticipated in untreated, chaparral fuels could reach 63.6 feet in height with rapid rates of spread (14.3 mph) under extreme weather conditions, represented by Santa Ana winds blowing at maximum winds of 56 mph. Embers could be generated from a surface fire resulting in ignition of receptive fuelbeds 3.4 miles downwind.

Fires burning in from the southwest or west and pushed by ocean breezes exhibit less severe fire behavior. Under typical summer weather conditions, a chaparral fire could have flame lengths ranging from 1.7 to 26 feet in height and spread rates up to 2.4 mph. Spotting distances, where airborne embers can ignite new fires downwind of the initial fire, range from 0.1 to 0.8 mile.

It should be noted that the results presented in Table 5 depict values based on inputs to the BehavePlus software. The fuels models used in this analysis are dynamic models that were designed by the U.S. Forest Service to more accurately represent southern California fuelbeds. Changes in slope, weather, or pockets of different fuel types are not accounted for in this analysis. Model results should be used as a basis for planning only, as actual fire behavior for a given location will be affected by many factors, including unique weather patterns, small-scale topographic variations, or changing vegetation patterns.

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APPENDIX D

Project Facility Availability Form – Fire

County of San Diego, Planning & Development Services

PROJECT FACILITY AVAILABILITY - FIRE

ZONING DIVISION

Please type or use pen

Jacumba Valley Ranch LLC — 408 338 6052
Owner's Name — Phone

2423 Camino Del Rio South #212
Owner's Mailing Address — Street

San Diego, CA 92108
City — State — Zip

ORG ______ ACCT ______ ACT ______ TASK ______ DATE ______ AMT $______

DISTRICT CASHIER'S USE ONLY

F

SECTION 1. PROJECT DESCRIPTION — TO BE COMPLETED BY APPLICANT

A
- [ ] Major Subdivision (TM)
- [ ] Minor Subdivision (TPM)
- [ ] Boundary Adjustment
- [x] Rezone (Reclassification) from Specific Plan to Major Impact Services and Utilities zone
- [x] Major Use Permit (MUP), purpose Solar Generation
- [ ] Time Extension Case No ______
- [ ] Expired Map Case No ______
- [ ] Other ______
- [ ] Specific Plan or Specific Plan Amendment
- [ ] Certificate of Compliance

B
- [ ] Residential — Total number of dwelling units ______
- [ ] Commercial — Gross floor area ______
- [ ] Industrial — Gross floor area ______
- [x] Other — Gross floor area Solar Generation, 691 acres

C Total Project acreage 1345 Total lots N/A Smallest proposed lot N/A

Assessor's Parcel Number(s)
(Add extra if necessary)

614-100-20 614-100-21 614-110-04 660-020-05	660-020-06 660-150-04 660-150-07 660-150-08
660-150-10 660-150-14 660-150-17 660-150-18	660-170-09 661-010-02 661-010-15 661-010-26
661-010-27 661-010-30 661-060-12 661-060-22	660-140-06 660-140-08 660-150-21
	660-150-16

Thomas Guide Page 1321 Grid G-J 2-6

Old Highway 80 and Carrizo Gorge
Project address — Street

Jacumba Community Planning Group 91934
Community Planning Area/Subregion — Zip

OWNER/APPLICANT AGREES TO COMPLETE ALL CONDITIONS REQUIRED BY THE DISTRICT.

Applicant's Signature [signature] patrick browne — Date 11/06/2018

Address 17901 Von Karman Ave, Suite 1050 Irvine, CA 92614 — Phone 832 303 2477

(On completion of above, present to the district that provides fire protection to complete Section 2 and 3 below.)

SECTION 2: FACILITY AVAILABILITY — TO BE COMPLETED BY DISTRICT

SDC PDS RCVD 11-16-18

GPA18-010, REZ18-007, MUP18-022

District Name: San Diego County Fire Authority

Indicate the location and distance of the primary fire station that will serve the proposed project FS 43, 1255 Jacumba St., 3.0 miles

A.
- [x] Project is in the District and eligible for service
- [ ] Project is not in the District but is within its Sphere of Influence boundary, owner must apply for annexation.
- [ ] Project is not in the District and not within its Sphere of Influence boundary.
- [ ] Project is not located entirely within the District and a potential boundary issue exists with the ______ District.

B.* [x] Based on the capacity and capability of the District's existing and planned facilities, fire protection facilities are currently adequate or will be adequate to serve the proposed project. The expected emergency travel time to the proposed project is 5.75 minutes. *With the execution of a fire/emergency services agreement.
- [ ] Fire protection facilities are not expected to be adequate to serve the proposed development within the next five years.

C.
- [ ] District conditions are attached. Number of sheets attached: ______
- [x] District will submit conditions at a later date.

SECTION 3. FUELBREAK REQUIREMENTS

Note: The fuelbreak requirements prescribed by the fire district for the proposed project do not authorize any clearing prior to project approval by Planning & Development Services.

- [x] Within the proposed project 100 feet of clearing will be required around all structures.
- [ ] The proposed project is located in a hazardous wildland fire area, and additional fuelbreak requirements may apply. Environmental mitigation requirements should be coordinated with the fire district to ensure that these requirements will not pose fire hazards.

This Project Facility Availability Form is valid until final discretionary action is taken pursuant to the application for the proposed project or until it is withdrawn, unless a shorter expiration date is otherwise noted.

[signature] — HERMAN REDDICK, DIRECTOR — 858-974-5813 — 1/23/2019
Authorized Signature — *Print Name and Title* — *Phone* — *Date*

On completion of Section 2 and 3 by the District, applicant is to submit this form with application to:
Planning & Development Services – Zoning Counter, 5510 Overland Ave, Suite 110, San Diego, CA 92123

PDS-399F (Rev. 09/21/2012)

APPENDIX E

Lithium-Ion Battery Storage

Analysis Summary

The following analysis of battery storage at the JVR Energy Park (Project) site was conducted in support of preparation of the Project's Fire Protection Plan. The result of the analysis is that the battery storage component of the project can be incorporated in a fire safe manner with the inclusion of fire safety measures that are available and already being used with this technology.

The analysis indicates that (1) there is a minimal potential for battery failure that could lead to thermal runaway or fire due to the type of lithium ion (Lithium-ion) phosphate batteries that would be employed, advanced monitoring systems for the battery system, and climate control within the containers the batteries would be rack-mounted within; and (2) there is minimal potential for a fire in an energy storage container to escape that container and cause a fire based on the fire resistant materials that would be used for the energy storage system (including a 2 to 4 hour rated steel container), automated fire suppression systems within each energy storage container, fuel modification, fire buffer areas around the project, and the accessibility of the energy storage containers to firefighter response.

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1 Introduction

1.1 Applicable Regulations

This analysis focused on existing codes or guidelines that may be applicable to the proposed energy storage system.

1.1.1 California Fire Code

The California Fire Code (CFC) Section 608 addresses "Stationary Storage Battery Systems" and sets forth general fire protection for stationary storage battery systems, including Lithium-ion batteries. For Lithium-ion battery systems, the CFC requires a smoke detection system, signage indicating the presence of an energized battery system, and seismic bracing.

1.1.2 California Public Utilities Commission

Electric Rule 21. Interconnection Standard for Non-Utility Owned Generation. Electric Rule 21 is a tariff that describes the interconnection, operating and metering requirements for generation facilities to be connected to a utility's distribution system, including storage of energy, over which the California Public Utilities Commission has jurisdiction. Rule 21 addresses safety issues of such facilities including fire safety by minimizing risk of component failure.

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2 Project Description

The Project applicant, JVR Energy Park LLC, proposes to include a 90 MW (or 180 Mwh) battery energy storage system that is located throughout the solar facility. This Project component consists of energy storage in the form of lithium-ion batteries. It would consist of battery storage containers located adjacent to the interverter/ transformer pads (up to 3 continers at each location for a total of 75 containers on site. Each battery enclosure would be next to the inverter and transformer units situated throughout the site The enclosures are made using shipping containers and are approximately 37 feet long by approximately 8.5 feet in height, and approximately 6 feet wide. There would be no additional transformer units or protective devices required. Critical information from the system would be monitored (if required) by a LV (1500V) metering at the inverter cabinets and at the power plant controller measured along with the solar plant performance with the SCADA control system.

The Lithium-ion batteries would be arranged into modules, which in turn would be stored in battery racks. The racks would be entirely contained within the container. The container would have an access door at each end and overhead lighting on the interior roof. Each container would have an integrated heating, ventilation, and air conditioning (HVAC) unit located on the roof of the container. An inverter with a battery management system and container control system would be installed externally on a concrete pad next to each container. A step-up transformer would be associated with a set of two containers and would be installed alongside the container on a separate concrete pad.

The proposed battery storage containers also include the following important monitoring and safety components:

- Modular battery racks designed for ease of maintenance. Every rack's battery monitoring system continually monitors for unsafe voltage, current, and temperature, and has control of an automated switch (contactor) to disconnect the rack from the system if necessary.
- Integrated heat and fire detection and self-extinguishing suppression system.
- Explosive gas monitoring
- Exhast/ventilation systems
- Integrated air conditioning system
- Integrated battery management system

There are various types of Lithium-ion batteries available for use in this application. The specific battery type proposed for the solar facilities' energy storage system has not been determined at the time of this report's preparation. It is projected that a recent type, such as the Nanophosphate Lithium-ion battery will be selected based on its overall fire safe design. Available data indicates that this particular type of Lithium-ion battery has proven to be less vulnerable to fire occurrences than typical Lithium-ion batteries, which as a category, include a very low occurrence of fires, but have experienced some especially high profile fires in recent years. Nanophosphate Lithium-ion batteries include a stable cathode chemistry that substantially reduces the possibility of thermal runaway and provides for reduced reaction from abuse (Sandia National Laboratories 2012) and A123 Systems (no date).

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3 Lithium-ion battery technology

3.1 Lithium-ion Batteries

The term Lithium-ion battery refers to a battery where the negative electrode (anode) and positive electrode (cathode) materials serve as a host for the Lithium-ion (Li+) (Mikolacjzak et al. 2011). Lithium-ions move from the anode to the cathode during discharge and are inserted into voids in the crystallographic structure of the cathode. The ions reverse direction during charging. An important fact about Lithium-ion batteries is that based on their materials content and how they operate, there is no free lithium metal within a Lithium-ion cell. Therefore, if a cell ignition occurs, metal fire suppression techniques are not appropriate for controlling the fire.

The four primary functional components of a practical Lithium-ion cell are:

- Anode
- Cathode
- Separator
- Electrolyte

Additional components of Lithium-ion cells, such as the current collectors, case or pouch, internal insulators, headers, and vent ports also affect cell reliability, safety, and behavior in a fire. The chemistry and design of these components varies across multiple parameters, so it is difficult to make blanket statements about fire behavior, prevention and suppression strategies, and other fire safety measures. For example, cell components, chemistry, electrode materials, particle sizes, particle size distributions, coatings on individual particles, binder materials, cell construction styles, amongst others, generally will be selected by a cell designer to optimize a family of cell properties and performance criteria. However, there are fundamental commonalities with regard to fire that are applicable to most of the Lithium-ion battery types. In addition, since Lithium-ion cell chemistry is an area of active research, it is anticipated that cell manufacturers will continue to advance cell designs including more fire safety driven updates.

Mikolacjzak, et. al. (2011) indicate that:

> "An individual Lithium-ion cell has a safe voltage range over which it can be cycled that will be determined by the specific cell chemistry. A safe voltage range will be a range in which the cell electrodes will not rapidly degrade due to lithium plating, copper dissolution, or other undesirable reactions. For most cells, charging significantly above 100% state of charge can lead to rapid, exothermic degradation of the electrodes. Charging above the manufacturer's high voltage specification is referred to as overcharge. Since overcharging can lead to violent thermal runaway reactions, a number of overcharge protection devices are either designed into the cells or included in the electronics protection packages for Lithium-ion battery packs".

There are two methods to measure Lithium-ion battery life: (1) calendar life and (2) cycle life. Calendar life indicates how many years a battery is expected to last. The calendar life does not depend on amount times the battery has been charge or discharged, but rather how much charge is stored and its operating temperature (Saft 2014). Cycle life is based upon the number of charge and discharge cycles as well as to what level the battery is discharged to, or, its "depth of discharge" (Saft 2014). Lithium-ion batteries do not suddenly stop functioning in the same way a lead-acid battery would, rather a Lithium-ion battery exhibits a gradual decrease in performance (Saft 2014).

3.2 Fire Hazards

The primary hazard associated with Lithium-ion batteries is fire. Lithium-ion batteries may burn according to two primary factors. The first is being exposed to an adjacent fire or heat source that is hot enough to raise the internal temperature to combustion levels or provides actual flame impingement on the battery and leads to combustion or uncontrolled increased internal temperature. This leads to the second ignition factor, which is known as thermal runaway, where the battery's internal temperature rises and can lead to increased internal pressure, combustion of chemicals, venting or rupture and release of hydrogen or other flammable gases. Thermal runaway may be caused by a number of issues, but manufacturing defects or physical damage during transport or set up may lead to malfunctions. In most cases, mechanical damage would probably rank as the highest risk factor for initiating a thermal runaway (fire/explosion) event (Butler 2013). Improper handling can result in crush or puncture damage, possibly leading to the release of flammable electrolyte material through venting or leakage, or short-circuiting. These actions could result in thermal runaway and a resulting fire and/or explosion.

When a Lithium-ion battery has a thermal runaway, the battery physically expands and electrical shorts within the battery can start, or continue if that was the initial cause of the thermal runaway. The stored energy is released and may include an explosion. This process can cause adjacent battery cells to increase internal temperature, catch fire or thermally runaway (VAN 2014), leading to a chain reaction where successive batteries fail. In other words, once one battery cell goes into thermal runaway, it produces enough heat to potentially cause adjacent battery cells to also go into thermal runaway. This produces a fire that repeatedly flares up as each battery cell in turn ruptures and releases its contents. Lithium-ion batteries do not contain lithium metal, but do contain lithium ions in electrolyte (Butler 2013). Fires occurring in Lithium-ion batteries are not like a typical fire and therefore, they require a holistic pre-planning approach to reduce the potential for battery failure including battery design, shipping techniques, storage rack design and configuration, monitoring protocols, pre-planning, suppression systems, firefighter training, and extinguishing approaches.

Research (Butler 2013, Ditch & De Vries 2013, Mikolajczak et al. 2011, and others) indicates that the severity of a cell thermal runaway event will depend upon a number of factors, with the level of charge (how much electrical energy is stored in the form of chemical potential energy), the ambient environmental temperature, the electrochemical design of the cell (cell chemistry), and the mechanical design of the cell (cell size, electrolyte volume, etc.) having the greatest influence. For any given cell, the most severe thermal runaway reaction will be achieved when that cell is at 100% (or greater, if overcharged) of its charge capability, because the cell will contain maximum electrical energy. If a typical fully charged (or overcharged) Lithium-ion cell undergoes a thermal runaway reaction, a number of things occur, including:

- Cell internal temperature increases;
- Cell internal pressure increases;
- Cell undergoes venting;
- Cell vent gases may ignite;
- Cell contents may be ejected; and
- Cell thermal runaway may propagate to adjacent cells.

There is a lack of available data regarding large storage format of Nanophosphate Lithium-ion batteries. Testing by one battery manufacturer indicates that the thermal runaway potential is reduced due to the reduced oxygen release during a failure (A123 System 2012)) However, it is anticipated that all Lithium-ion batteries may follow a somewhat predictable path when thermal ruaway occurs, and that some variation is likely for Nanophosphate Lithium-ion batteries. Butler (2013) predicts that when a single Lithium-ion battery goes into thermal runaway, the propagation creates identifiable markers, i.e., the battery behaves in a certain way. He concludes that the fire may be a progressive burn-off or one that is explosive in nature.

Lithium-ion batteries are non-aqueous and therefore lack the capability of dissipating overcharge energy. As such, positive metal-oxide cells will continue to absorb and store overcharge energy to the point where the material becomes unstable causing release of substantial heat and ignition. While overcharge can lead to the most serious of Lithium-ion failures, it is considered the least probable for stationary batteries due to well controlled charging systems, alarms, and battery isolation switches (McDowall 2014).

3.3 Fire Behavior

Research conducted by Mikolajczak et al. (2011) indicates that the severity of a Lithium-ion cell failure is strongly affected by the total energy stored in that cell. Stored energy is a combination of chemical energy and electrical energy. Thus, the severity of a potential thermal runaway event can be mitigated by reducing stored chemical energy (i.e., by reducing the volume of electrolyte within a cell), or by changing the electrolyte to a noncombustible material (i.e., the cell chemistry). These are active research areas within the Lithium-ion field, but there are not currently commercial-ready products available. It is possible that future versions of Lithium-ion batteries will include lower potential for fire due to the ongoing research in this direction.

It is commonly thought that the most flammable component of a Lithium-ion cell is the hydrocarbon-based electrolyte. The hydrocarbon-based electrolyte in Lithium-ion cells results in a drastically different fire behavior than the typical household lead acid, nickel-metal hydride (NIMH) or nickel-cadmium (NICAD) cell batteries, which contain water-based electrolytes.

The importance of understanding the fire behavior of typical Lithium-ion cells is that if they are punctured or otherwise damaged to the point that leakage or venting occurs, it will release flammable vapors. Newer cell technology and Nanophosphate Lithum-ion cells have been tested and shown to include reduced venting and less flammable vapors, resulting in reduced intensity of thermal events (A123 2012). Similarly, fire impingement on Lithium-ion cells will cause release of flammable electrolyte, increasing the total heat release of the fire, assuming there are well-ventilated conditions. Other combustible components in a Lithium-ion cell include a polymeric separator, various binders used in the electrodes, and the graphite of the anode (Mikolajczak et al. 2011).

When a cell vents, the released gases mix with the surrounding atmosphere. Depending upon a number of factors, including fuel concentration, oxygen concentration, and temperature, the resulting mixture may or may not be flammable (Ditch & De Vries 2013). Ventilation and cooling capabilities of the storage container will have a strong influence on the ability of these gases to reach flammable levels. The combination of the Nanophosphate Lithium-ion batteries and the well-ventilated, cooled, customized storage containers should result in a lower likelihood that flammable gas levels would be experienced.

On fire scenes where large quantities of Lithium-ion cells would be in close proximity, decisions regarding overhaul procedures must be made with an understanding that as cells are uncovered, moved, or damaged, they may undergo thermal runaway reactions and vent, they may ignite, and they may generate (or may themselves become) hot projectiles. Similarly, the potential for rekindles will be high at such fire scenes, and these scenes will require extended monitoring by trained firefighters.

3.4 Fire Suppression

The observations from various testing previously described in this analysis would appear to have meaningful implications on fire protection/prevention as well as firefighting procedures. As indicated in these tests, battery heating and thermal runaway controls are important to preventing fires. Specifically, if a fire occurs within an energy storage container, the battery cells and battery packs must be protected from overheating, or they may begin to vent and ignite, spreading the fire more rapidly than would be expected for normal combustibles. Therefore, the design of the energy storage racks, spacing, internal container fire walls/separators, HVAC system, venting, fire suppression system and firefighter capabilities must all be pre-planned for best prevention, protection, and suppression success.

Butler (2013) indicates that at minimum, an effective strategy for storing lithium batteries is to develop fire containment and suppression systems that would deal with the battery fire event. Systems like this would contain the fire event and encourage Suppression through Cooling, Isolation, and Containment (SCIC). Research indicates that suppressing a Lithium-ion battery fire is best accomplished by extinguishing the flame with a gas-based suppression system and cooling the burning material with water. However, since the risk of fire spread beyond a container is minimal, and water and plumbing systems are cost-prohibitive and logistically challenging, it is anticipated that cooling of the batteries and container, if necessary, can be provided from firefighters.

In most instances, Lithium-ion battery fires would not be treated like common structure fires by responding firefighters. The burn characteristics and potentially toxic by-product release components do not align with a structure fire where wood and household flammables are burning. Among the precautions that would be considered by responding firefighters are:

- The energy storage containers include electric hazard
- The energy storage containers are adjacent to energized solar panels
- There is extra energy that may be released from polymeric materials burning (binder, separator, etc.)
- Burning batteries would present smoke toxicity and environmental issues
- There is no known way to eliminate "ignition sources," e.g. fire initiated from an internal short, subsequent to a manufacturing defect
- There may be re-ignitions and post-fire monitoring will be required

Training regarding fire hazards, behavior, and suppression can be provided to all contractors installing the energy storage systems, operating and maintaining them, and local firefighters who may respond to an emergency in order to preserve both life and property. Training materials should address issues including battery awareness and care, cautions, warning signs, battery fire behavior, emergency response procedures, and fire extinguisher use (Lithium-ion battery focus).

Firefighter Response

- Every fire emergency is unique and requires a customized approach, but a typical battery incident may include the following response:
- A firefighter would arrive on scene and size up the situation.
- Calls for additional units would be made as necessary.

- Assuming that the fire in the container was not chain reacting (the type of cell being proposed is not likely to chain react), they would confirm that the suppression gas system is performing as intended.
- If so, the fire would likely be out by the time firefighters arrived. If the system malfunctioned, then there could be a situation where fire is burning flammable materials within the container.
- The container would need to be cooled so firefighters would begin blanketing the container and nearby containers with water streams and as possible and necessary, streaming a water fog into the container.
- The fire would continue to burn inside until the flammables were consumed. There would be no need to enter the building unless someone was maintaining the batteries and was incapacitated inside. In that case, a rescue operation would be attempted if conditions allowed.

3.5 Fire Safety

McDowall 2014 states that Lithium-ion battery safety requires four (4) elements: (1) materials and process control, (2) choice of chemistry, (3) cell design, and (4) system design. In general, materials and process control is the responsibility of the cell manufacturer as opposed to the battery system operator. The first decision to be made by the battery operator to ensure system safety is appropriate cell chemistry for the intended use (e.g. solar power storage and delivery). Cells are designed to vent as a form of safety; therefore a safe Lithium-ion battery system must accommodate for large quantities of released gas.

As discussed above, thermal runaway has potential to cause a chain reaction of heat causing extreme failure in adjacent cells. Measures, such as electronic monitoring systems, alarms, circuit breakers and other layer safety features, should be incorporated to lower the possibility of a thermal runaway chain reaction. These electronic safety systems would monitor the individual cell voltages during charge and discharge, internal batter temperature, and cell balance; these systems would also provide communication with a form of management unit or dashboard (Saft 2014). For example, Saft's manufactured battery systems contain a Battery Management Module with two components: (1) battery management unit (manages battery functions) and (2) electrical disconnect unit (enables a safe disconnect of a portion of the system). (Saft 2014). This Battery Management Module is responsible for many of the previously listed system safety functions including: operations supervision, charge and discharge management, thermal management, warnings and alarms, State of Charge, State of Health, first level safety, watchdog, blackbox, and maintenance and diagnostics (Saft 2014). Each of these Battery Management Modules can be connected to a Master Battery Management Module for an additional layer of redundancy and safety (Saft 2014).

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4 Design Considerations

As presented in the Project's FPP, the Project provides customized measures that address the identified potential fire hazards on the site. The measures are independently established, but will work together to result in reduced fire threat and heightened fire protection. These include fuel modification zones, improved access throughout the site, participation in a community facilities district (CFD), fuel modification inspections, illuminated signage, de-energizing capability, training for firefighters, Construction Fire Prevention Plan, fire extinguishers, water tank, and others.

This analysis assumes the implementation of the following additional design features and training/operational protocols, which would ensure the fire impact associated with the energy storage units remain at a level below significance, including compliance with the County's Determination of Significance standards.

The energy storage system shall include the following components, or their equivalent:

- Available Battery Management Modules (BMMs) continuously monitor the state of charge, battery health, temperature, and other important information. Also available are Mastery Battery Management Modules (MBMMs) to ensure charge uniformity throughout each string of Lithium-ion batteries.
- Custom grate or fiberglass T-bar flooring available to cover corrosion resistant secondary containment.
- EPA Compliant Spill Containment and Access
- IEEE 1547 compliance (to preclude unplanned power backfeeding or islanding)
- Electrical fault protection compatible with downstream protection coordination
- Fault current/voltage limited inverters with full electrical protection and isolation switches
- AEROS energy control system monitors and ensures operation within safe limits and can disconnect power if needed
- Ground fault detection, integrated onboard fire suppression system with smoke and heat detection
- Every rack's battery management system continually monitors for unsafe voltage, current, and temperature and has control of an automated switch to disconnect the rack from the system if necessary
- High voltage fusing for the entire rack supplements the battery management control system
- Module electronics will monitor every cell voltage and select cell temperatures, and has its own dedicated overvoltage monitoring chip
- Two additional levels of fuse safety – individual cell fuses and integral module-level fuse
- Integrated pressure vent on all cylindrical cells
- Cells certified to stringent UL1642 Lithium cell safety standards
- Effective battery standard operating procedures (SOP's) shall be developed and shall include processes that guide every aspect of battery safety, from shipping and receiving, handling, daily use, storage, and other functions involving the batteries.
- An interior inert gas fire suppression system such as the FM-200 or similar shall be installed.
- Firefighters shall have access to the containers to provide water for cooling any battery fire, as possible with a back-up plan to avoid entering a container to cool the exterior of the container through water application (multiple water streams encompassing the involved container) which would positively impact interior temperatures as the batteries burned within.
- Regularly scheduled, on-site training and familiarity with local firefighters shall be conducted and battery system and container specifics provided to the fire agencies for integration in their operation pre-planning efforts.

- The HVAC and venting system shall be engineered to remove the expected toxic, thick smoke from burning plastics and the toxic fumes from electrolyte should a fire occur. The HVAC system shall be designed so that burning embers and smoke from nearby fires, such as a wildland fire, do not penetrate into the containers and ignite combustibles inside. The HVAC system shall also be on emergency standby power and monitored.
- Seismic engineering and restraint shall be incorporated in the containers and the battery racks. The proposed system comes with a seismic rating.
- Containers shall be separated an acceptable distance from one another to prevent fire/heat spread which will help control the rare occurrence of thermal runaway domino effect.
- Spill control and secondary containment shall be provided for transformers containing any appreciable amount of oil.
- An emergency shutdown device shall be provided to stop electrical flow for battery isolation and Firefighter safety. This type of device/control is proposed as part of the energy storage project.
- The required heat/smoke detection system, per Fire Code, shall comply with NFPA 72 and shall be remotely supervised. The proposed energy storage for the project includes a heat and fire detection system linked to an automatic fire suppression system.
- Safety signs and warning signs shall be installed on all building for firefighter and worker safety.
- Suitable portable fire extinguishers shall be provided.
- Approved fire engine access shall be provided to ensure access within 300 feet of all containers.

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APPENDIX F

Undesirable Plant List

Botanical Name	Common Name
Trees	
Abies species	Fir
Acacia species (numerous)	Acacia
Agonis juniperina	Juniper Myrtle
Araucaria species *(A. heterophylla, A. araucana, A. bidwillii)*	Araucaria (Norfolk Island Pine, Monkey Puzzle Tree, Bunya Bunya)
Callistemon species *(C. citrinus, C. rosea, C. viminalis)*	Bottlebrush (Lemon, Rose, Weeiping)
Calocedrus decurrens	Incense Cedar
Casuarina cunninghamiana	River She-Oak
Cedrus species *(C. atlantica, C. deodara)*	Cedar (Atlas, Deodar)
Chamaecyparis species (numerous)	False Cypress
Cinnamomum camphora	Camphor
Cryptomeria japonica	Japanese Cryptomeria
Cupressocyparis leylandii	Leyland Cypress
Cupressus species *(C. fobesii, C. glabra, C. sempervirens,)*	Cypress (Tecate, Arizona, Italian, others)
Eucalyptus species (numerous)	Eucalyptus
Juniperus species (numerous)	Juniper
Larix species *(L. decidua, L. occidentalis, L. kaempferi)*	Larch (European, Japanese, Western)
Leptospermum species *(L. laevigatum, L. petersonii)*	Tea Tree (Austrailian, Tea)
Lithocarpus densiflorus	Tan Oak
Melaleuca species *(M. linariifolia, M. nesophylla, M. quinqenervia)*	Melaleuca (Flaxleaf, Pink, Cajeput Tree)
Olea europea	Olive
Picea (numerous)	Spruce
Palm species (numerous)	Palm
Pinus species *(P. brutia, P. canariensis, P. eldarica, P. halopensis, P. pinea, P. radiate, numerous others)*	Pine (Calabrian, Canary Island, Mondell, Aleppo, Italian Stone, Monterey)
Platycladus orientalis	Oriental arborvitae
Podocarpus species *(P. gracilior, P. macrophyllus, P. latifolius)*	Fern Pine (Fern, Yew, Podocarpus)
Pseudotsuga menziesii	Douglas Fir
Schinus species (S. molle, S. terebenthifolius)	Pepper (California and Brazilian)
Tamarix species *(T. Africana, T. apylla, T. chinensis, T. parviflora)*	Tamarix (Tamarisk, Athel Tree, Salt Cedar, Tamarisk)
Taxodium species *(T. ascendens, T. distichum, T. mucronatum)*	Cypress (Pond, Bald, Monarch, Montezuma)
Taxus species *(T. baccata, T. brevifolia, T. cuspidata)*	Yew (English, Western, Japanese)
Thuja species (*T. occidentalis, T. plicata)*	Arborvitae/Red Cedar
Tsuga species *(T. heterophylla, T. mertensiana)*	Hemlock (Western, Mountain)
Groundcovers, Shrubs and Vines	
Acacia species	Acacia
Adenostoma fasciculatum	Chamise
Adenostoma sparsifolium	Red Shanks
Agropyron repens	Quackgrass
Anthemis cotula	Mayweed

Botanical Name	Common Name
Arbutus menziesii	Madrone
Arctostaphylos species	Manzanita
Arundo donax	Giant Reed
Artemesia species *(A. abrotanium, A. absinthium, A. californica, A. caucasia, A. dracunulus, A. tridentate, A. pynocephala)*	Sagebrush (Southernwood, Wormwood, California, Silver, True tarrangon, Big, Sandhill)
Atriplex species (numerous)	Saltbush
Auena fatua	Wild Oat
Baccharis pilularis	Coyote Bush[6]
Bambusa species	Bamboo
Bougainvillea species	Bougainvillea
Brassica species *(B. campestris, B. nigra, B. rapa)*	Mustard (Field, Black, Yellow)
Bromus rubens	Foxtail, Red brome
Cardera draba	Noary Cress
Carpobrotus species	Ice Plant, Hottentot Fig
Castanopsis chrysophylla	Giant Chinkapin
Cirsium vulgare	Wild Artichoke
Conyza bonariensis	Horseweed
Coprosma pumila	Prostrate Coprosma
Cortaderia selloana	Pampas Grass
Cytisus scoparius	Scotch Broom
Dodonea viscose	Hopseed Bush
Eriodyctyon californicum	Yerba Santa
Eriogonum species *(E. fasciculatum)*	Buckwheat (California)
Fremontodendron species	Flannel Bush
Hedera species *(H. canariensis, H. helix)*	Ivy (Algerian, English)
Heterotheca grandiflora	Telegraph Plant
Hordeum leporinum	Wild barley
Juniperus species	Juniper
Lactuca serriola	Prickly Lettuce
Larix species (numerous)	Larch
Larrea tridentata	Creosote bush
Lolium multiflorum	Ryegrass
Lonicera japonica	Japanese Honeysuckle
Mahonia species	Mahonia
Mimulus aurantiacus	Sticky Monkeyflower
Miscanthus species	Eulalie Grass
Muehlenbergia species	Deer Grass
Nicotania species *(N. bigelevil, N. glauca)*	Tobacco (Indian, Tree)
Pennisetum setaceum	Fountain Grass
Perronskia Atriplicifloria	Russian Sage
Phoradendrom species	Mistletoe
Pickeringia montana	Chaparral Pea

Botanical Name	Common Name
Rhus species *(R. diversiloba, R. laurina, R. lentii)*	Sumac (Poison oak, Laurel, Pink Flowering)
Ricinus communis	Castor Bean
Rosmarinus species	Rosemary
Salvia species (numerous)	Sage
Sacsola austails	Russian Thistle
Solanium Xantii	Purple Nightshade (toxic)
Sylibum marianum	Milk Thistle
Thuja species	Arborvitae
Urtica urens	Burning Nettle
Vinca major	Periwnkle
Rhus lentii	Pink Flowering Sumac

Notes:

1 For the purpose of using this list as a guide in selecting plant material, it is stipulated that all plant material will burn under various conditions.

2 The absence of a particular plant, shrub, groundcover, or tree, from this list does not necessarily mean it is fire resistive.

3 All vegetation used in fuel modification zones and elsewhere in this development shall be subject to approval of the San Diego County Fire Authority Fire Marshal.

4 Additional plants that are considered undesirable due to their invasiveness nature are detailed on the California Invasive Plant Council's Web site at *www.cal-ipc.org/ip/inventory/index.php*.

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APPENDIX G

JVR Energy Park Technical Report

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JVR Energy Park
Technical Report for Fire Personnel

Prepared for:

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For submittal to:

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JANUARY 2020

Printed on 30% post-consumer recycled material.

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1 Introduction

The safety of fire fighters and other emergency first responder personnel depends on understanding and properly handling potential hazards associated with Photovoltaic (PV) Solar facilities through adequate training and preparation. This Technical Report provides basic facility information for responding firefighters. It is important that firefighters who may respond to this or any solar facility understand the potential risks associated with their electricity producing components and what strategies, tools and equipment, and precautions are required for safely responding to emergencies. This Technical Report summarizes project features and readers should refer to the Project's Fire Protection Plan (FPP) prepared by Dudek (2019) for additional information.

The JVR Energy Park (Project) proposes to construct and operate up to 90 megawatts (MW) alternating current (AC) solar facility. The Project would consist of approximately 300,000 PV modules mounted on single-axis solar trackers (SAT), an energy storage battery system, an on-site collector substation, and switchyard. The Project would provide renewable power to the local grid in compliance with California's renewable portfolio standard requirements.

The Proposed Project would be located on approximately 642 acres within the 1,356-acre Project site in unincorporated southeastern San Diego County, California. The Project site is located adjacent to the unincorporated community of Jacumba Hot Springs.

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2 Background

2.1 Project Location

The Project site totals approximately 1,356 acres in southeastern San Diego County, within the County's Mountain Empire Subregional Plan area (see Figure 1-1, Project Location). The Proposed Project would be located to the south of Interstate (I) 8, immediately east of the community of Jacumba Hot Springs, and immediately north of the U.S./Mexico international border. The Project site is located entirely on private land and consists of 24 parcels and includes the following Accessor's Parcel Numbers (APNs): 614-100-20, 614-100-21, 614-110-04, 660-020-05, 660-020-06, 660-150-04, 660-150-07, 660-150-08, 660-150-10, 660-150-14, 660-150-17, 660-150-18, 660-170-09, 661-010-02, 661-010-15, 661-010-26, 661-010-27, 661-010-30, 661-060-12, 661-060-22, 660-140-06, 660-140-08, 660-150-21, 660-150-16. The location of the parcels is shown in Figure 1-1, *Project Location* of the Fire Protection Plan (FPP). The Project site includes right-of-way easements for Old Highway 80, SDG&E easements, and an easement for the San Diego and Arizona Eastern Railway. The proposed solar facility would cover approximately 642 acres within the 1,356-acre Project site (shown on Figure 2, Project Components of the FPP). Primary access to the Project site would be provided via an improved access driveway from Old Highway 80, with additional access off of Carrizo Gorge Road. The Project site is situated within Sections 3, 4, 5, 8 and 9 of Township 18 South, Range 8 East, as well as in Sections 32 and 33 of Township 17 South, Range 8 East on the U.S. Geographical Survey (USGS), 7.5 minute, Jacumba, California quadrangle maps.

The majority of the proposed solar facility would be constructed in areas classified as a High Fire Hazard Severity Zone (FHSZ) by California Department of Forestry and Fire Protection (CAL FIRE). Fire hazard designations are based on topography, vegetation, and weather, amongst other factors with more hazardous sites including steep terrain, unmaintained fuels/vegetation, and wildland urban interface (WUI) locations. A small portion in the northwest corner and along the western boundary of the 1,356 Project site and the adjacent area to the west is classified as a Very High FHSZ by CAL FIRE. A small portion of the western boundary of the 1,356Project site is classified as a Moderate FHSZ by CAL FIRE. Additionally, the lands adjacent to the west of the 1,356 Project site are classified as very high FHSZ and the lands adjacent to the east are classified as moderate FHSZ and include Federal Responsibility Areas (FRA) (FRAP 2014).

2.2 Proposed Project

The Proposed Project is a solar energy facility which would produce a rated capacity of up to 90 megawatts (MW) of alternating current (AC) generating capacity and would consist of 300,000 photovoltaic (PV) modules fitted on single-axis solar trackers on approximately 642 acres within the 1,356-acre Project site. In addition to the PV modules and direct current (DC) to alternating current (AC) conversion equipment, the proposed project would consist of the following primary components:

- Approximately 300,000 PV modules mounted on 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 skids used 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 on an approximately 27,360-square-foot (152-foot by 180-foot) crushed rock atop gravel overlay
- A 138 kV switchyard adjacent to the on-site collector substation would be utilized to transfer power from the on-site collector substation to the existing SDG&E 138 kV transmission line that traverses the Proposed Project
- A 138 kV, 220-foot-long 65-foot-high overhead slack span transmission line would connect the Proposed Project's substation to the switchyard
- Two 138 kV, 550-foot-long (1,100 feet total) 80-foot-high overhead transmission lines (gen-tie) would loop the switchyard into the existing transmission line
- A battery energy storage system of up to 90 MW, 180 MWh which would be comprised of battery storage containers located adjacent to the inverter skids previously described (up to 3 containers per each inverter skid for a total of 75 containers on site)
- Connector line, fiber optic line, and point of interconnection
- Control system
- Approximately 5 meteorological weather stations
- Access driveways
- Chain link fencing with tan slat inserts and strategic landscape buffers.
- The Proposed Project's collector substation and the switchyard would be sized to accommodate the full 90 MW (AC) solar facility and a battery storage system with a capacity of up to 90 MW or 180 MWh.

A map of the Project's Site Plan and primary components are presented in Figure 2 of the Fire Protection Plan (FPP). As indicated in Figure 2, primary access to the Project site would be provided via an improved road from Old Highway 80, with additional access off Carrizo Gorge Road.

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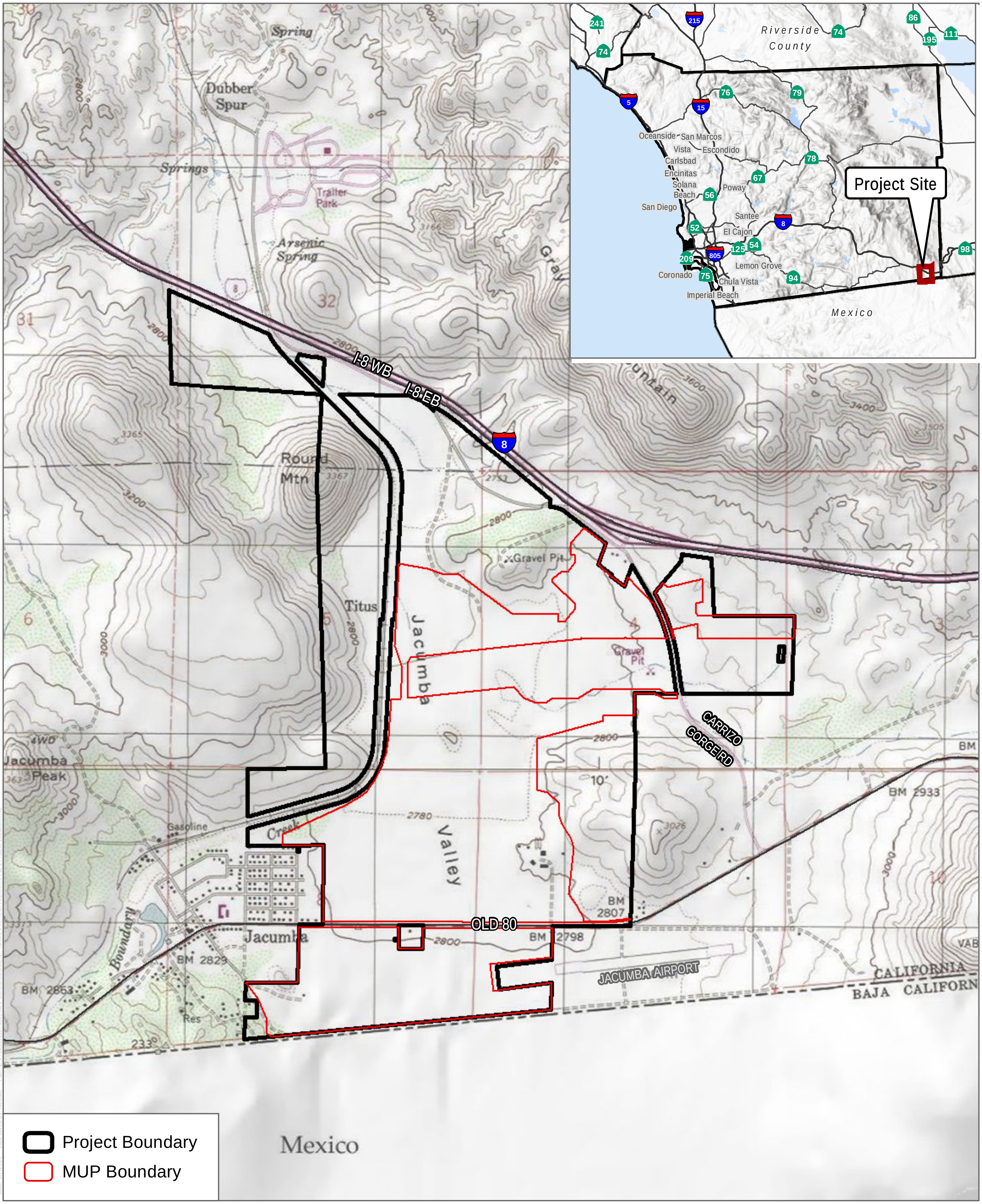

SOURCE: USGS, 7.5 MINUTE SERIES, JACUMBA AND JACUMBA OE S QUADRANGLES

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0 1,000 2,000 Feet

FIGURE 1

Project Location

JVR Energy Park Technical Report

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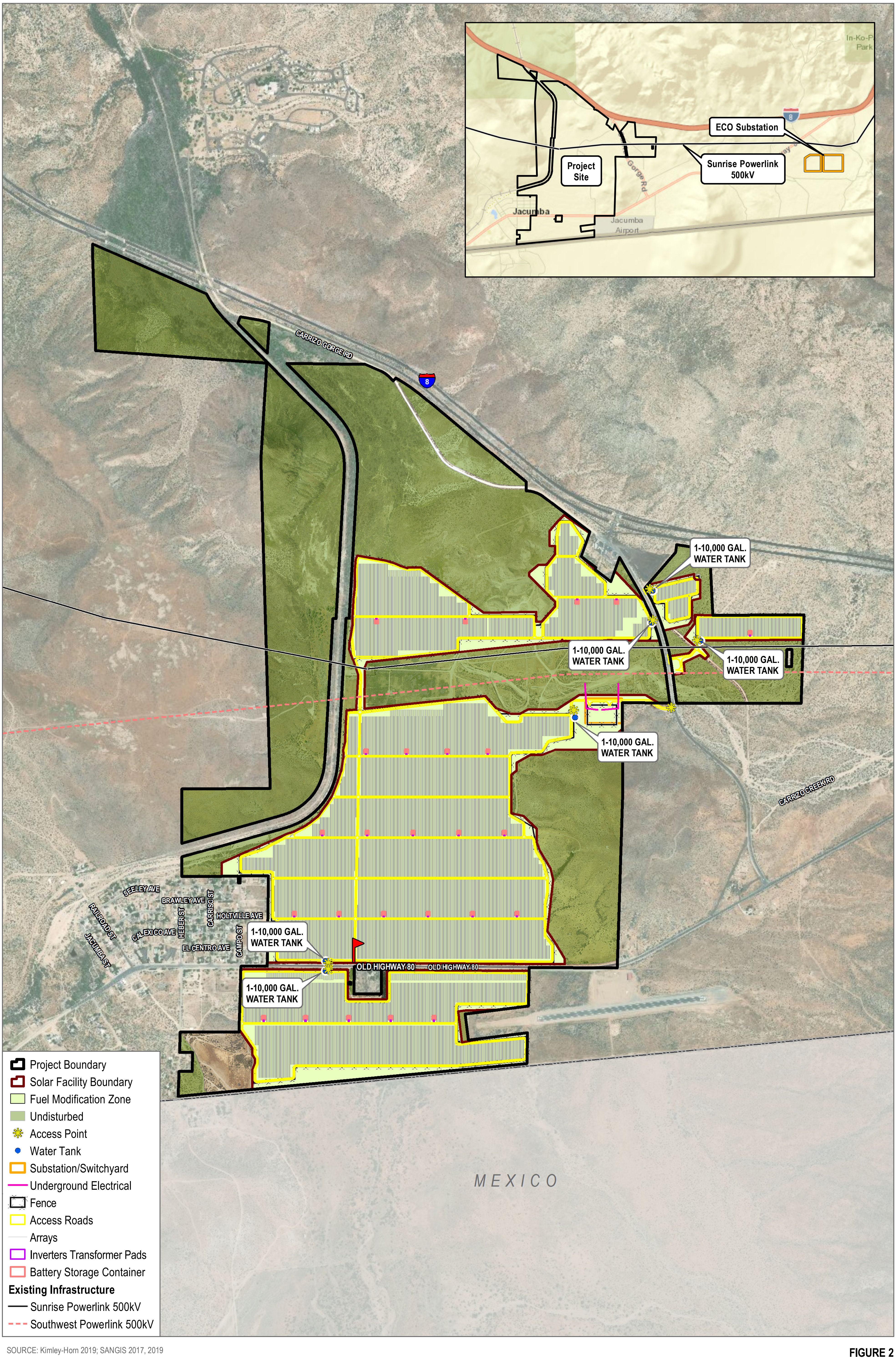

SOURCE: Kimley-Horn 2019; SANGIS 2017, 2019

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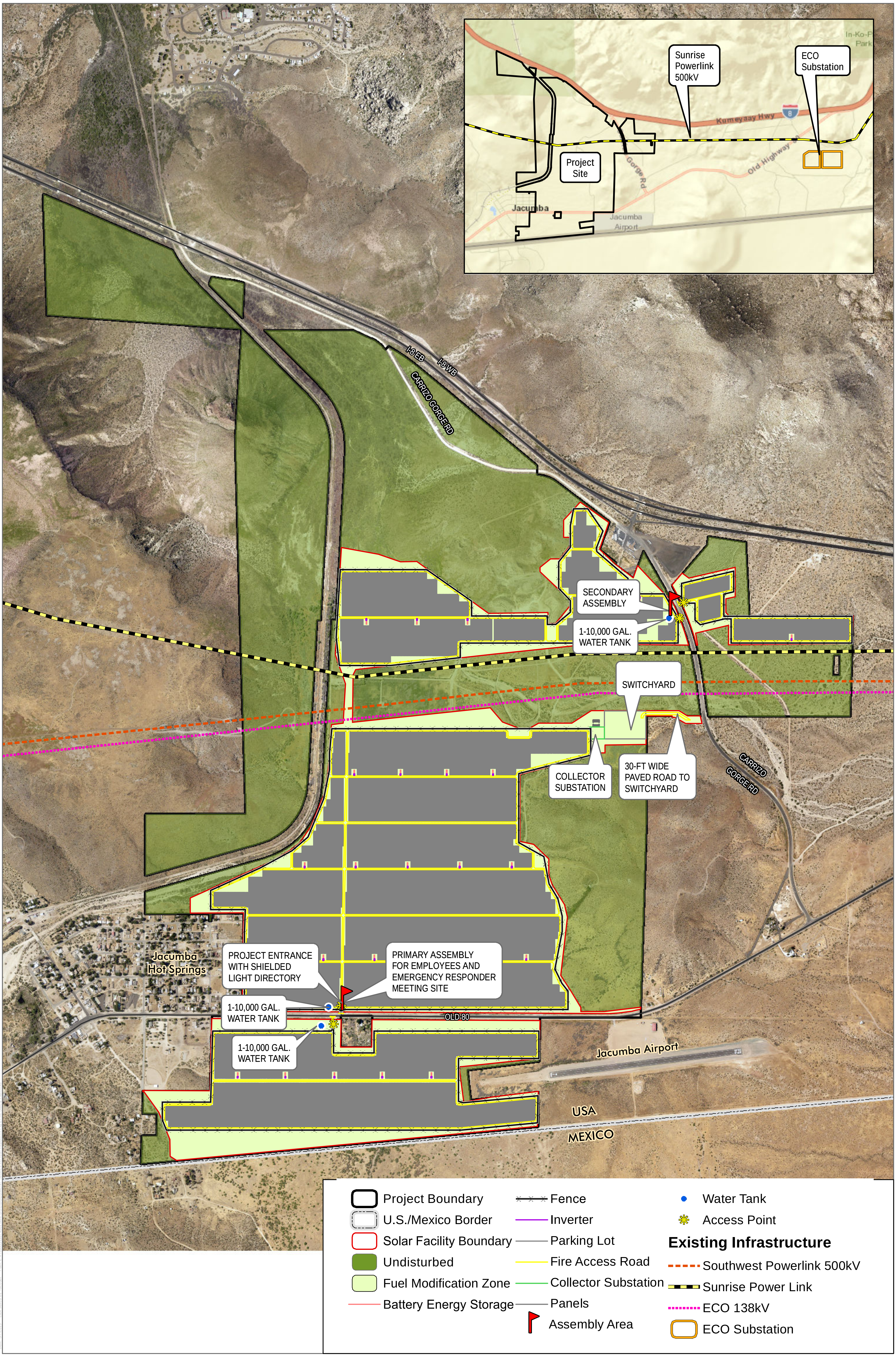
FIGURE 2

Site Fire Safety Plan



SOURCE: AERIAL-BING MAPPING SERVICE; SITE PLAN-BAYWA 2018

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0 750 1,500 Feet

FIGURE 2

Site Fire Safety Plan

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3 Solar Power Support Technology

3.1 Solar Facility

3.1 Solar Facility

The solar facility would use photovoltaic (PV) single-axis tracker electric generation system technology to produce solar energy at the utility scale, including inverters, an on-site substation, and up to a 25 MW battery storage facility. The Project would consist of approximately 300,000 PV modules fitted on single axis SATs. The proposed solar facility and access driveways would cover approximately 642 acres within the 1,356-acre Project site.

The Project does not propose any full-time personnel on site and will be unmanned once construction has completed, but may include up to five people on site during operations, inspections, and maintenance activities. The number of workers expected on the site during construction would vary over the construction period with a maximum of 500 workers during the most intense phase of construction. Workers will generate about 519 daily round trips, with a maximum of 1,158 trips a day during the most intense phase of construction (i.e., the racks and panels installation).

Deliveries of equipment and supplies to the site would also vary over the construction period but are expected to average about 40 to 70 daily trips. The following sections provide more detail regarding project components.

3.1.1 PV Modules

PV modules generate electricity by safely converting the energy of the sun's photons into DC electrons. The Proposed Project would include approximately 300,000 PV modules, which would be installed in rows (arrays). Arrays grouped together are referred to as array fields.

The modules would be mounted on single-axis trackers oriented in the north–south direction. Single-axis tracking systems would employ a motor mechanism that allows the arrays to track the path of the sun (from east to west) throughout the day. The PV modules are uniformly dark in color, non-reflective, and designed to be highly absorptive of all light that strikes their glass surfaces. The PV modules would cover the majority of the area of the proposed facility The PV modules deployed for use in the Proposed Project would comply with all industry standard quality testing.

The PV modules would be electrically connected to the grounding system of the facility in accordance with local codes and regulations. The final PV module selection would be determined during the Proposed Project's detailed engineering phase. Most PV modules are guaranteed a useful life of 35 years in adverse weather conditions.

The PV modules and tracking systems would be inspected periodically. Electrical components would be tested routinely according to manufacturer's recommendations. In the event that remote monitoring indicates a problem, such as low performance in a section of the array field, a crew would investigate and correct the problem on an as needed basis. It is anticipated that in-place PV panel washing would occur four times a year. Washing of the PV panels would be undertaken using wash trucks. Washing would occur during daylight hours, so no lighting would be required.

3.1.2 PV Modules Support Structures

The solar PV modules would be mounted on support structures that allows them to be properly positioned for maximum capture of the sun's solar energy. Each row of PV modules (module arrays) would be a single-axis tracker system that would be oriented along a north-to-south axis. The support structures are typically mounted on metal pipe pile or I-beam foundations 6 to 10 inches in diameter. The beams would be driven into the soil using a pile/vibratory/rotary driving technique similar to that used to install freeway guardrails. Driven pier foundations are

a "concrete-free" foundation solution that would result in minimal site disturbance and facilitate site reclamation at the end of the Proposed Project's lifecycle. Most pier foundations would be driven to approximate depths of 10 to 15 feet deep depending upon required embedment depth.

The PV modules, at their highest point, would be approximately 12 feet above the ground surface depending upon the100-year flood elevations within the Project site. The PV module arrays' final elevations from the ground would be determined during the detailed Project design process; however, for the purpose of the analysis in this EIR, maximum height above the graded ground surface would be 12 feet. It is common practice to maintain as low of an elevation profile as possible to reduce potential wind loads on the PV module arrays.

3.1.3 Electrical (DC) Underground Collection System

PV modules would be electrically connected to adjacent modules to form module "strings" using wiring attached to the support structures. PV module strings would be electrically connected to each other via underground wiring. Wire depths would be in accordance with local, state, and federal codes. String wiring terminates at PV module array combiner boxes, which are lockable electrical boxes mounted on or near an array's support structure. Output wires from combiner boxes would be routed along an underground trench system approximately 3-4 feet deep and 1-3 feet wide, including trench and disturbed area, to the inverters and transformer pads.

3.1.4 Inverter/Transformer Pads

Inverters are a key component of solar PV power-generating facilities because they convert the DC generated by the PV module array into AC that is compatible for use with the transmission network. The medium-voltage transformers step up the voltage to collection-level voltage (34.5 kV). The inverters, medium-voltage transformers, and other electrical equipment would be installed at 25 locations, adjacent to the battery storage containers throughout the solar facility. X inverters and X transformers would be installed on each metal skid. Each metal skid would be approximately 8 feet wide and 20 feet long. The skids would be mounted above the 100-year flood elevations on a set of piles driven into the ground and covered by an earth or gravel mount that is built up to the top of the skid to provide a working clearance to all access points on the skid per applicable electrical and labor codes. All electrical equipment would be either outdoor rated or mounted within enclosures designed specifically for outdoor installation.

3.1.5 Electrical (AC) Collection System

The 35.4 kV AC power would be collected from the 25 skids and electrically transmitted through an underground AC collector system. This underground system would consist of approximately 5,000 feet of cables located in trenches approximately 4 feet deep and 1-3 feet wide. At the point of transfer, the AC power would be electrically transmitted through 50 feet of overhead AC feeders, approximately 30-feet-tall.

3.1.6 Collector Substation

The Proposed Project includes a collector substation (152-foot by 180-foot (27,360 square feet)) that would be located near the center of the eastern side of the Project site. The purpose of the substation is to collect the power from the AC collector system and convert the voltage from 34.5 kV to 138 kV, as well as to be able to isolate equipment in the event of an electrical short-circuit or for maintenance.

The major components of the proposed collector substation are as follows:

- One 34.5 kV to 138 kV transformer including a secondary containment area per local and state regulations
- One 138 kV circuit breaker used to protect equipment from an electrical short circuit on the gen-tie.
- Disconnect switches, wire, cables, and aluminum bus work used to connect and isolate the major pieces of equipment.
- The substation would also include a single 34.5 kV circuit breaker used to protect equipment from an electrical short circuit on the collection system, disconnects and bus work to connect and isolate the collector circuits, relays used to detect short circuits, equipment controls, telemetering equipment used to provide system control and data acquisition, voice communication, and the meters used to measure electrical power generated from the Proposed Project. Switching gear and other components would be a maximum of 40 feet in height.
- A 138 kV dead-end structure that would have a maximum height of 65 feet. This structure would have either an A-frame or H-frame design and would be constructed of steel. The dead-end structure is where the power output from each transformer is delivered to the gen-tie line.
- One Control Enclosure for the Supervisory Control and Data Acquisition (SCADA) system (approximately 34 feet long by 15.5 feet wide, and a height of 15 feet).

During operation of the collector substation, operation and maintenance staff would visit the substation periodically for switching and other operation activities. Maintenance trucks would be utilized to perform routine maintenance, including but not limited to equipment testing, monitoring, repair, routine procedures to ensure service continuity, and standard preventative maintenance.

3.1.7 Switchyard

The Proposed Project would include a 138 kV switchyard located adjacent to the proposed collector substation. The size of the switchyard would be approximately 140,000 square feet. Within this area would be X-foot high security fence (445 feet by 300 feet) surrounded by a 5-foot shoulder for grounding protection. Drainage facilities would be installed to control runoff and protect the switchyard from erosion. The 138 kV insulated electrical bus, steel support structures and foundations would be installed to support the following electrical equipment:

- 2 138 kV bays in a ring bus configuration
- 3 Gas Insulated Circuit Breakers with 4 current transformers each
- 12 Gang Operated Air Break (GOAB) switches

- 9 98kV surge arrestors
- 9 138kV Single Bushing Potential Transformers
- 2 138kV-240V/120V Station Service Transformers
- Control Enclosure
- Security and lighting

One single-story control enclosure would be used for relays, metering, SCADA information and security and communication equipment. A gas generator may also be installed for use as backup power to the station lights and station service power transformers. The maximum amount of oil required for the station service transformers at the switchyard would be approximately 175 gallons per pot, or 350 gallons total.

The tallest structures in the switchyard would be the 138 kV line and the dead-end structures. The maximum height in the yard would be the approximately 66-foot-high dead-end structure that spans wire to the collector substation. After completion of construction of the switchyard, operation of the switchyard facility would be transferred to SDG&E. The switchyard would be unmanned during operation. Monitoring and control functions would be performed remotely from SDG&E's central operations facilities. Accordingly, no new personnel would be required for operation and maintenance. Routine operations would require a single pickup truck visiting the switchyard several times a week for switching, as well as several larger substation construction and maintenance trucks visiting the switchyard several times a year for equipment maintenance. Maintenance activities would include equipment testing, equipment monitoring and repair, and emergency and routine procedures for service continuity and preventive maintenance. Based on operations at similar facilities, routine maintenance is expected to necessitate approximately six trips per year by a two- to four-person crew. Routine operations would require one or two workers in a light utility truck to visit the switchyard on a weekly basis. Typically, a major maintenance inspection would take place annually, requiring approximately 20 personnel for approximately one week.

3.1.8 138 kV Transmission Line Tie-in

The proposed switchyard would be connected into the existing 138 kV SDG&E Boulevard – East County transmission line. The proposed overhead transmission line tie-in would require two approximately 550-feet long spans of wire and up to four steel transmission poles. The tallest proposed transmission pole would be approximately 80 feet above the ground surface. Each pole would have up to six cross arms and a pole top to accommodate a fiber optic ground wire for lightning protection and critical communication. Temporary construction areas will be cleared and graded at each pole location for a safe working environment and pulling wire.

3.1.9 Battery Energy Storage System

A battery energy storage system with a maximum capacity of up to 90 MW(180 MWh) is proposed to be located throughout the solar facility. This energy storage system would be comprised of battery storage containers located adjacent to the inverter/transformer pads (up to 3 containers per each pad for a total of 75 containers on site). The battery system would be DC coupled with the PV system, connecting electrically at the DC bus of the inverters.

The same inverters, transformers, medium voltage equipment, and AC wiring will serve both the battery energy storage system and the PV system. The battery storage systems would be inspected on a regular basis and would be monitored by the SCADA System.

The Project proposes to use steel containers (customized Conex or similar, depending on supplier) to hold Lithium-ion batteries. Each container would hold the battery packs on racks. The containers are typically made from 12 to 14-gauge steel and measure approximately 55-feet-long, 19-feet-wide, and 10-feet-high. Each container would be separated from neighboring containers by approximately 10 feet.

The specific battery type proposed for the Project is a Lithium-ion nanophosphate cell. Currently available data indicates that this particular type of Lithium-ion battery has proven to be less vulnerable to fire occurrences than typical Lithium-ion batteries. Lithum-ion nanophosphate batteries include a stable cathode chemistry that substantially reduces the possibility of thermal runaway and provides for reduced reaction from abuse (Sandia National Laboratories 2012).

The proposed battery storage system would include multiple levels of protections against overcharge. Each container would have underground wiring connecting it to a 600 kW DC:DC converter, which would bring the voltage from the batteries in the container up to match the voltage of the PV energy entering into the inverter's DC bus.

Each set of three battery containers would have three skid-mounted DC:DC converters. The containers would be situated to enable emergency/fire response access. The containers would be sited with adequate set back from off-site areas as a buffer against potential wildfire ignitions. No additional transformer units or protective devices are required. The containers would not be walk in containers, thus the battery storage containers would not be non-habitable structures per the fire code.

The proposed batteries and containers also include the following important monitoring and safety components:

- Modular battery racks designed for ease of maintenance
- Integrated heat and fire detection and suppression system
- Explosive gas monitoring
- Exhaust/ventilation systems
- Integrated air conditioning system
- Integrated battery management system

The heat and fire detection system would be linked to an automatic inert gas suppression system within each container. The containers would also have a basic interior containers sprinkler system with several sprinkler heads for coverage and an external dry standpipe for fire fighters to connect and pump water.

Critical information from the battery system, equipment data from the DC:DC converters and inverters would be monitored by the battery monitoring system inside the containers, at the LV (1500V) metering at the inverter cabinets and at the power plant controller measured along with the solar plant performance with the SCADA control system described in more detail below.

The battery management system would track the performance, voltage and current, and state of charge of the batteries. The system would proactively search for changes in performance that could indicate impending battery cell failure, and power down and isolate those battery strings in order to avoid potential failures.

The National Fire Protection Association (NFPA) has developed a new Standard for the Installation of Energy Storage Systems (NFPA 855). This standard addresses the design, construction, installation, commissioning, operation, maintenance and decommissioning of stationary energy storage systems. The Project would meet most of the standards, except where they are not applicable to the Proposed Project. The layout of the system would also meet the section 4.4.3 definition of remote locations, where energy storage system equipment is greater than 100-feet away from public ways or stored materials.

3.1.10 Fiber-Optic Line

To provide for communication with the SCADA system, a fiber-optic cable would be placed underground to connect the substation to the switchyard. Utility interconnection regulations require the installation of a second separate, redundant fiber-optic cable. The redundant fiber-optic cable would also be installed within the Project development footprint and the proposed switchyard boundary.

3.1.11 Control System

The Proposed Project's control system includes a SCADA system and an overall plant control system (PCS). Operation of the solar facility would be monitored through the SCADA system, as described below. The Proposed Project would also have a local overall PCS that provides monitoring of the solar field as well as control of the balance of facility systems.

The SCADA system is required for the purpose of providing plant system monitoring and control during steady state operation, safe operation during unperceived events and abnormal operating conditions, and equipment startup/ shutdown. In addition, the SCADA system is required for providing substation and inverter information to the Owner/Operator, as well as providing information about the PV Facility and interconnection Facility to transmission owner, independent system operator, and/or EPC Power contractor. The SCADA System is also required to accept data from the Utility/Transmission Provider and/or Independent System Operator (ISO) and record this data in a Historian and/or act upon the data appropriately. The SCADA system would be monitored remotely, and no on-site operations and maintenance facilities or personnel would be necessary.

The SCADA system would be located in two Control Enclosures. One enclosure would be located in the on-site collection substation area and the other enclosure would be located within the switchyard area. Each enclosure would be approximately 10 feet by 10 feet, and X feet in height. The SCADA system would be comprised of rackmounted servers and software to allow for the continuous monitoring and control. Control algorithms would be designed to coordinate the PV system with substation equipment, utility and owner SCADA requirements. The SCADA system would allow inverters to have remote capability to adjust plant capacity, output voltage and reactive power output through communication between hardware and central SCADA server. It would have the ability to perform switching required to connect the plant to and to disconnect the plant from the local electrical grid. The SCADA System would include capabilities such as monitoring and control of PV inverters, solar trackers, PV weather monitoring system, and monitoring of MV skid transformers, substation equipment including protective relays, medium voltage circuit breakers, high voltage breakers, step-up transformer and revenue meters. In addition, the SCADA System would also monitor and control the battery storage system. SCADA consists of a few server racks installed with the control enclosure of the collector substation, and consists of LCD Display and Datalogger, Cellular Modem, Central Processing Unit, and meter for analog/digital measurements. The SCADA system would be used to provide critical operating information (e.g., power production, equipment status and alarms, and meteorological information) to the power purchaser, Project owners and investors, grid operator, and Project operations teams, and to facilitate production forecasting and other reporting requirements for Project stakeholders.

The microprocessor-based PCS would provide control, monitoring, alarm, and data storage functions for plant systems as well as communication with the Proposed Project's SCADA system. Redundant capability would be provided for critical PCS components so that no single component failure would cause a plant outage. All field instruments and controls would be hard-wired to local electrical panels. Local panels would be hard-wired to the PCS. Wireless technology would be considered as a potential alternative during final Project design.

3.1.12 Meteorological Weather Stations

The Proposed Project includes five meteorological weather stations, which would be installed throughout the solar facility. The weather stations would be used to record weather to measure the performance of the solar facility. The parameters recorded would include air temperature, relative humidity, precipitation, air pressure, wind direction and speed, and solar irradiance. Measuring irradiance is important for determining how much power could potentially be harvested from the sun. A pyranometer would be installed at each weather station to measure irradiance.

Four of the meteorological stations would be installed at a place closest to the inverter skids to minimize cable runs. The fifth station would be located adjacent to the collector substation. The locations would have no shading obstruction such that the irradiation received by the sensors ("pyranometer") in the station is the same as that received by all the modules in the Proposed Project. Each station would occupy an area of approximately 10 feet by 7 feet. The mounting equipment would be made up of steel to ultimately provide height to the actual sensor located at the end of an aluminum (approximately 2-inch diameter) arm about 3 feet long to isolate the equipment from parts that can potentially shade the sensor. The maximum height of the station would be 10 feet. The equipment would be installed on a 5 foot by 5 foot square pad. The setup would be connected to a datalogger and cellular modem with an approximately 10-meter cable to interface digitally with the SCADA system and the PCS.

3.1.13 Site Access Driveways

The primary access driveway to the solar facility would provide access off of Old Highway 80 and would be approximately 24 feet wide. Three secondary access driveways, 24 feet in width, would provide access off of Carrizo Gorge Road. Two driveways would provide access to arrays on the east side of Carrizo Gorge Road. The third secondary driveway would provide access to arrays on the west side of Carrizo Gorge Road.

In addition, an approximately 1,500 foot-long asphalt paved access driveway (30 feet in width) would be constructed from Carrizo Gorge Road to the switchyard and substation. The access driveway would require approximately 1.2 acres of land in a new right-of-way and 0.3 acres of land within an existing SDG&E right-of-way. In addition, 30-foot-wide asphalt-paved interior access driveways would be constructed within the switchyard site to access the equipment.

Each site entrance would feature a manual swing gate, and a sign with a lighted directory map and contact information. All entrance gates would feature a 'Knox Box' for emergency access.

3.1.14 Internal Access

The Proposed Project would include dual-purpose internal fire response access and service access. The perimeter internal access within the fenced solar facility would be constructed to a minimum improved width of 24 feet. The interior access would be constructed to a minimum improved width of 20 feet. All internal access would be designed to provide a minimum inner turning radius of 28feet, would be graded and maintained to support the imposed loads of fire apparatus (not less than 75,000 pounds), and would be designed and maintained to provide all-weather driving capabilities. The internal access would allow for two-way access of fire apparatus throughout the solar facility in order to access all of the inverter/transformer pads.

All internal access surfaces would have a permeable nontoxic soil binding agent in order to reduce fugitive dust and erosion in accordance with County Code Section 87.428, Dust Control Measures, and with San Diego Air Pollution Control District Rule 55, which regulates fugitive dust emissions from any commercial construction or demolition activity capable of generating fugitive dust emissions.

3.1.15 Improvements within SDG&E Transmission Corridor

The SDG&E Transmission Corridor is approximately 600-feet wide and is comprised of three easements. The Proposed Project would include improvements within the SDG&E Transmission Corridor as described below:

- Easement Crossing 1 would be located on the west end of solar facility and would serve to connect two regions of the PV Array Field to each other across the SDG&E Transmission Corridor. This proposed easement crossing would be comprised of a 24-foot-wide aggregate base driveway. An underground medium voltage collection line may also be installed within this easement crossing.

- Easement Crossing 2 would be located on the east end of the solar facility and would provide access from the east side of Carrizo Gorge Road to the easternmost end of the PV array field. This proposed easement crossing would be comprised of a 24-foot wide aggregate base driveway and an earthen road-side diversion swale. This new crossing would provide access to an existing SDG&E transmission tower in the southernmost 200-foot-wide easement; it would replace the existing access. The existing access to the tower is proposed to be relinquished. The diversion swale is proposed along the southwest side of the new access to protect the access and convey upstream runoff. A low water crossing or culvert would be installed to manage stormwater runoff.

- Easement Encroachment 3 would be needed to interconnect the overhead power lines from the switchyard to the existing SDG&E transmission line.

3.1.16 Security Fencing and Signage

The approximately 642-acre solar facility would be fenced along the entire facility boundary for security. The fencing would meet National Electrical Safety Code requirements for protective arrangements in electric supply stations. Fencing would be 7 feet in height total, with a 6-foot-high chain-link perimeter fence and 1 foot of three strands of barbed wire along the top. The fence would be constructed with anti-climbing material(s), such as small-ring chainlink fencing. The fence would also include tan slat inserts along certain segments to aid in the visual screening of the proposed PV panels. Signage in Spanish and English for electrical safety would be placed along the perimeter of the solar facility on the fence, warning the public of the high voltage and the need to keep out.

3.1.17 Lighting

Lighting would be designed to provide security lighting and general nighttime lighting for operation and maintenance personnel, as may be required from time to time. Lighting would be provided at the entrances, the substation and switchyard, as described below. The PV arrays, the inverter/transformer pads, and the battery storage containers would not have lighting..

Lighting would be provided at the primary entrance off Old Highway 80 and would be on all year round after 5:00 p.m. Motion censored lights would be installed at the main entrance and secondary entrances. Lighting would be shielded and directed downward to minimize any effects to the surrounding areas. Lighting would be installed within the substation to allow for safety inspections or maintenance that may be required during the evening hours. Lighting would also be provided next to the entrance door to the control enclosure. Lighting would also be installed at the entrance gates to the substation. Since maintenance activities are not anticipated to be completed during the evening hours, lights would only be turned on if needed.

Switchyard lighting would be placed near major electrical equipment in the switchyard. The switchyard lights would normally be turned off and would only be used during nighttime for security and safety reasons. Lighting would also be installed at the entrance gate to the switchyard. The entrance light would be left on during nighttime hours to allow the entry to be illuminated in the event that nighttime emergency repair or maintenance are needed.

All lighting for the solar facility would have bulbs that do not exceed 100 watts, and all lights would be shielded, directed downward, and would comply with the County of San Diego Light Pollution Code, also known as the Dark Sky Ordinance, Section 51.201 et seq. Additionally, lighting for the Proposed Project would be designed in accordance with the San Diego County Zoning Ordinance, Performance Standards Section 6320, 6322, and 6324, which guide performance standards for glare, and controls excessive or unnecessary outdoor light emissions.

3.1.18 Water Tanks (Fire Protection)

The Project would have six 10,000-gallon water tanks with fire department connections available as shown on Figure 2. One tank would be provided at each entrance to a site section as defined by geographic isolation from other sections, and one tank would be provided near the substation. Water would be stored in aboveground tanks complying with the San Diego California Fire Agency requirements and with National Fire Protection Act 22, Private Fire Protection Water Tanks. A procedure for ongoing inspection, maintenance, and filling of tanks would be in place. The tank and fire engine connections would be located on the side of the fire access driveways. The width of the driveway at the water tank location would be at least 18 feet (travel width), plus an additional 10-foot width, for a distance of 50 feet, to allow for fire engines to park and connect to the tank while leaving the road open. The tanks would be labeled “Fire Water: 10,000 gallons” using reflective paint.

3.1.19 Fuel Modification Zones

A Project fuel modification zone would include one zone that consists of non-irrigated, low growing ground cover. Because this site would utilize non-combustible construction, the proposed fuel modification areas would provide adequate setback for the potential short duration wildfire that may be realized in the adjacent wildland fuels.

A minimum 30 feet wide FMZ would be provided at the perimeter of the Project between the PV modules and the off-site wildland fuels. This area would include contiguous fuel modification from the perimeter fence inward and would include the perimeter fire access road. Additionally, a minimum 100-foot-wide FMZ would surround the project collector substation and switchyard. Therefore, the PV modules, collector substation, and switchyard could be exposed to short-duration wildfire, but would not be expected to include consistent, focused heat exposure from the off-site vegetative fuels. A 20-foot-wide zone would be maintained around the perimeter of the switchyard to reduce fuel loads.

3.1.20 Landscaping

Landscaping would be installed in the following locations to provide visual screening of the PV modules and other Project components):

- Along the proposed fenceline east of Carrizo Gorge Road
- Along Old Highway 80 on both sides of the highway
- Around private lots located within the Project site
- Along the western boundary of the proposed solar facility adjacent to residential areas (along Seely Avenue, Laguna Street, and the entire western boundary south of Old Highway 80)

The proposed landscaping buffer would be approximately 15feet wide and would be located outside of the perimeter fencing. The proposed landscaping would include native and/or drought tolerant trees (approximately 18-feet-tall 10-years after planting) shrubs, and ground covers. . The trees and taller species of shrubs would be placed closest to the fence. The lower species of shrubs and ground covers would be placed between the large shrubs and the buffer edge to effectively transition the plant material from highest at the fence to the lowest at the roadway. This design would help to maintain driver visibility.

All landscape improvements would be designed in accordance with the County of San Diego Landscape Standards, Jacumba Community Service District Design Guidelines and in accordance with Assembly Bill 1881, State Water Conservation Requirements. Native and Drought tolerant plants that minimize water use and maintenance would be utilized. All plant materials would be appropriate for the climate of Jacumba Valley. All planting required for screening would be established with vegetation typical of the particular habitat(s) in each area based on coordination with the Project biologist. All landscaping would be regularly irrigated with an automatic drip irrigation system supplied by an existing domestic water meter. All landscape would be maintained during the life of the permit, and all dead, dying or diseased plants would be replaced in kind.

All existing trees and shrubs located in the area not under direct improvement, or within the landscape buffer, would be protected in place, and would be incorporated into the overall landscape. If area boulders are encountered and exposed during grading activities, they would be moved to the landscape buffer area to the extent practical.

4 Potential Fire Risk Analysis

This Technical Report supplements the Project's FPP, which evaluates and recommends actions for the Project to ensure it does not unnecessarily expose people or structures to fire risks and hazards. The FPP identifies and prioritizes the measures necessary to adequately mitigate those impacts. It considers the property location, topography, geology, combustible vegetation (fuel types), climatic conditions and fire history. It considers water supply, access, structure ignitability and fire resistive building materials, fire protection solar facilities and equipment, impacts to existing emergency services, defensible space and vegetation management.

The primary purpose of this Technical Report is to identify preventative actions that would reduce risk directly associated with the solar facility, actions that would protect and enhance the safety of fire suppression resources, and actions that could protect the solar facility from ignition caused by other sources.

Today's emergency responders face unexpected challenges as new uses of alternative energy increase. These renewable power sources save on the use of conventional fuels such as petroleum and other fossil fuels, but they also introduce new or non-typical hazards that require varying firefighting strategies, procedures, and training.

The safety of firefighters and other emergency first responder personnel depends on understanding and properly handling these hazards through adequate training and preparation. San Diego County and California Department of Forestry and Fire Protection (CAL FIRE) firefighters receive the necessary training required to respond to the various types of emergency incidents they may face. Electrical firefighting and solar facility firefighting and emergency response are not new to responding firefighters. There are existing solar facilities as well as other planned facilities that have led to firefighter training in best response strategies. This project will be similar to existing solar facilities near the Project site and is not anticipated to result in unfamiliar technology requiring special training to local First Responders.

The goal of this report is to assemble core principle and best practice information for fire fighters, fire ground incident commanders, and other emergency first responders to assist in their decision-making process for any emergencies at this site.

4.1 Solar Facilities' Effect on Fire Risk

The primary objective of this report is to identify the potential hazards resulting from the operation and maintenance of the solar facility or aboveground/underground transmission line as well as from natural conditions that could result in fire risk. Ignition risks are anticipated to drop considerably following the project's construction phase. Operation and maintenance activities occur within a defined project footprint where the adjacent fuels have been removed or converted to fuel modification-consistent vegetation. Operation activities include conversion of electricity to a useable form and transmission of electricity to the grid. Maintenance activities will include repair, maintaining, and replacing equipment. Equipment failures may occur over time in different components of the JVR Energy Park Project. Among the type of equipment that may present ignition sources:

1. **Transformers and inverters** – are subject to occasional failure, sending sparks, hot materials out in any direction; fire in a transformer may result in ignition of the oil therein
2. **Capacitors** – may overheat, fail, and cause a spark, which may result in combustion of flammable materials, such as vegetation, if nearby

3. **Electrical transmission lines** – energized lines may arch from adjacent vegetation (trees) or if tower/pole fails, may arch on the ground, causing ignition of vegetation
4. **Vehicles** – heated exhausts in contact with vegetation may result in ignition
5. **Hot Works Equipment** – all small hand tools either gas or electric powered that may result in sparks, flames, or excessive heat may result in vegetation ignition.

Among the potential hazards to responding firefighters are:

1. Firefighting crews should consider that all electrical components must always be considered energized. Crews should consider that all PV modules cannot be isolated during daylight hours and must always be considered energized. Firefighters should attack the fire as they would any other electrical fire and use a water spray for ordinary combustibles or vegetation located outside the solar facility or dry chemical extinguishers (or other suppression technology for energized equipment) on any electrical wiring and any solar facility component.
2. Depending on the level of damage to the solar facility during a fire incident, the electrical connection to ground may have been lost and create an extremely hazardous situation, especially if pooling of water occurs.
3. The use of electrical conductive tools is hazardous, since the PV modules, including both the light absorbing components and frames, may be energized. If a ground connection has been compromised, the rack may also be hazardous.
4. The inverters and DC combiner boxes could be located in the middle or in between rows of the arrays. There could be a delay in locating the inverter or identifying other controls. Firefighters should not step on or lean on modules and should be aware of the trip, slip and fall potential around PV arrays.
5. Care must be taken to avoid unnecessary contact with potentially energized solar facility components until they can be isolated and confirmed de-energized. Individual modules and complete arrays must be considered energized during daylight hours. A de-energized PV array could be energized at dusk or become energized at sunrise.
6. Burning transformers and wire insulation may produce toxic vapors. Outdoor oil-insulated transformers will be installed on concrete foundations and separated from each other by firewalls for the purpose of limiting damage and potential spread of fire from a transformer failure. Firefighters should wear full personal protection equipment (PPE) and Self Contained Breathing Apparatus (SCBA) due to the potential for toxic or hazardous inhalation that may be produced by these burning components. Crews should work upwind of the smoke plume, whenever possible.
7. Firefighters should never cut the wiring in a solar facility or transmission line. Specialized tools may be required for disconnecting the wiring. Electrical components should not be disassembled, damaged or removed by firefighters until all of the solar facility's components are isolated or de-energized by a qualified, high voltage technician. Firefighters should limit their activities to containment of the fire until it can be confirmed that all Project electrical components are isolated or de-energized.
8. At any incident where electrical components are present, the Incident Commander (IC) must designate a "Utilities Group" early to aid in locating and disabling all of the solar facility components. This can greatly decrease the electric shock hazard to all crews operating on the fire ground. Firefighters must remember that all electrical components must be considered HOT.
9. At the conclusion of an incident, demobilization and termination efforts should be directed at leaving the property in the safest condition possible. An overall focused size-up and risk-benefit analysis should be conducted.

10. Along with a structural stability assessment, hazard identification and the marking of any potentially energized areas should be a priority. A qualified high voltage technician should be called to the incident to de-energize any solar facility that has been compromised or creates a hazard. Transferring scene safety and security to an appropriate local, municipal authority may be an option if the fire department is unable to quickly secure the assistance of a high voltage technician or electrician. All hazards should be appropriately marked or barricaded. The contact information for a high voltage technician who will serve as the emergency contact will be provided to the local fire agencies prior to the Project being brought on-line.
11. Battery storage facilities have unique hazards associated with each type of battery chemistry. Batteries may experience overcharge or over discharge or short circuit conditions that lead to increased temperature and pressure resulting in risks of explosion. Flammable gas may be present in the energy storage area. Explosion and fire can result in highly flammable gas being released from the battery containment area. Most battery chemistries will react negatively with water and an appropriate dry extinguishing agent should be used within the energy storage area of the facility.
12. Firefighters operating in or around the battery storage area should only use flashlights and other equipment approved for CLASS I atmospheres. Firefighters should never cut into batteries for any reason. Even if the PV array system is disconnected from the battery bank, the batteries themselves will have the potential for electric shock. If a battery is punctured by a conductive object, assume that the object may be charged.

4.2 Fuels Modification to Protect Facilities from Other Sources

The majority of the proposed solar facility would be constructed in areas classified as a High Fire Hazard Severity Zone (FHSZ) by California Department of Forestry and Fire Protection (CAL FIRE). Fire hazard designations are based on topography, vegetation, and weather, amongst other factors with more hazardous sites including steep terrain, unmaintained fuels/vegetation, and wildland urban interface (WUI) locations. A small portion in the northwest corner and along the western boundary of the 1,356 Project site and the adjacent area to the west is classified as a Very High FHSZ by CAL FIRE. A small portion of the western boundary of the 1,356Project site is classified as a Moderate FHSZ by CAL FIRE. Additionally, the lands adjacent to the west of the 1,356 Project site are classified as very high FHSZ and the lands adjacent to the east are classified as moderate FHSZ and include Federal Responsibility Areas (FRA) (FRAP 2014).

The FPP for this Project documents recommendations to protect the JVR solar facility from fire from other sources and to minimize the likelihood that fire originating at the facility spreads off the site. Any wind or topography driven wildfire and especially those burning under a northeast (*Santa Ana*) wind pattern creates a wildland fire hazard scenario, especially for wildland fires starting northeast of the Project site. In addition, a typical fire day with a southwest wind will create a high wildland wildfire hazard. However, the proposed vegetative fuel modification treatments and the use of building standards compatible with solar facility's operations will lower the risk for potential loss of Project components to less than significant levels. The Project would provide defensible space by setting back all PV modules a minimum 30-feet from the solar facility's perimeter fence and modifying the fuels on-site by removing and grading them to a height of 6 inches, or, in the case of perimeter areas, drivable surfaces and vegetation free areas. The perimeter Fuel Modification Zone (FMZ) buffer will include at least 30 feet of modified fuels and will include the 30-foot wide perimeter fire access road, and cleared, contiguous modified fuel areas from the perimeter fence to the outermost panel racks. This area seamlessly meets the modified fuel areas that occur throughout the site where fuels are maintained at a 6 inch height. Defensible space around all electrical equipment would be provided by an FMZ buffer of 100 feet surrounding the project collector substation pad area and 100 feet surrounding the adjacent switchyard.

The entire solar facility site would include modified fuels with fire access roadways and service roads compartmentalizing the low-growing (less than 6-inch) maintained areas beneath all PV modules, surrounding the collector substation pad area, and surrounding the adjacent switchyard. No off-site clearing is required or authorized, as required fuel modification can be accommodated on the solar facility site. Site-wide fuel management zones will be maintained on at least an annual basis or more often, as needed, by Project applicant or current owner. Plant material to be used in the landscaped boundary areas will consist of drought-tolerant, fire resistive plant material from the County's Suggested Plant List for a Defensible Space[1]. Plant species and spacing will be reviewed and approved by the SDCFA Fire Marshal and included on submitted Landscape Plans. None of the plants on the Undesirable plant list (Appendix F to this FPP) shall be allowed on the site.

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1 https://www.sandiegocounty.gov/content/dam/sdc/pds/docs/DPLU199.pdf

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5 Safety Hazards of solar facilities

5.1 Fires and Burns

A fire could start in a number of locations on a PV solar and battery storage facility, including on the ground around the PV solar arrays or in the electrical compartments. According to OSHA, solar fires are considered a “Green Job Hazard” due to the fire hazards associated with electrical parts and combustible parts. Workers should be trained to know exactly what to do and how to escape in a fire emergency. (OSHA, 2007)

5.2 Electrical

According to OSHA, workers in solar facilities are potentially exposed to a variety of serious electrical hazards including arc flashes, electrical burns, and electric shock. Workers need to pay attention the overhead lines. Those working within the solar facility are covered by the *Electric power generation, transmission, and distribution* standards and, therefore, are required to implement the safe work practices and worker training requirements of OSHA’s Electric Power Generation, Transmission, and Distribution standard 29 Code of Federal Regulations (CFR) 1910.269 (OSHA, 2007).

5.3 Lockout-Tagout

According to OSHA standard 29 CFR 1910.147, lockout-tagout refers to the specific “practices and procedures to safeguard employees from the unexpected energization or startup of machinery and equipment, or the release of hazardous energy during service or maintenance activities” (OSHA, 2007). Before an employee services a piece of electrical equipment, the power supply should be turned off and the employee should place a padlock on the power supply. The padlock serves to prevent someone else from accidently re-energizing the equipment being serviced. The lock should have a tag on it identifying the individual who locked out the equipment. Once a piece of equipment has been locked out, the only individual with the authority to unlock that piece of equipment is the person who initially locked it out.

Employees should follow this practice every time they service any electrical or electrically powered equipment. OSHA estimates that compliance with lockout/tagout procedures prevents an estimated 120 fatalities and 50,000 injuries each year in the United States (OSHA 2007).

5.4 Confined Space Areas

“Confined space” is defined by OSHA as “having a limited or restricted means of entry or exit; large enough to bodily enter and perform tasks; and lastly, not designed for continuous occupancy.” Confined spaces are widely recognized as a common hazard. Confined spaces include, but are not limited to, tanks, pits, silos, underground vaults, storage bins, and manholes. When entering a confined space area, it is important to have an additional person observing outside the confined area. There should be a continuous supply of fresh, ventilated air due to the presence of biogas. Biogas includes constituents of carbon dioxide, methane, and hydrogen sulfide, all which present the potential for both asphyxiation (possibility of passing out) and fire or explosion in confined spaces. A confined space area should never be entered if there is an unconscious person and all precautions have not been taken into account. These precautions include wearing a SCBA.

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6 Effects of Electricity on the Human Body

6.1 Physiological Effects

Electricity flowing through the human body can shock, involuntary muscle reaction, paralyze muscles, burn tissues and organs, or kill. The typical effects of various electric currents flowing through the body on the average **150-lb male** and **115-lb female** body are given in Table H-1.

Burns. Although a current may not pass through vital organs or nerve centers, internal electrical burns can still occur. These burns, which are a result of heat generated by current flowing in tissues, can be either at the skin surface and/or in deeper layers (muscles, bones, etc.). Typically, tissues damaged from this type of electrical burn heal slowly.

Burns caused by electric arcs are similar to burns from high-temperature sources. The temperature of an electric arc, which is in the range of 4,000–35,000°F, can melt all known materials, vaporize metal in close proximity, and burn flesh and ignite clothing at distances up to 10 feet from the arc.

Table H-1. Effects of Electric Current on the Human Body

	Direct current		Alternating current (mA)				
	(mA)		*60 Hz*		*10,000 Hz*		
Effect/feeling	*150 lb*	*115 lb*	*150 lb*	*115 lb*	*150 lb*	*115 lb*	Incident severity
Slight sensation	1	0.6	0.4	0.3	7	5	None
Perception threshold	5.2	3.5	1.1	0.7	12	8	None
Shock not painful	9	6	1.8	1.2	17	11	None
Shock painful	62	41	9	6	55	37	Spasm, indirect injury
Muscle clamps source	76	51	16	10.5	75	50	Possibly fatal
Respiratory arrest	170	109	30	19	180	95	Frequently fatal
≥ 0.03-s vent. fibril.	1300	870	1000	670	1100	740	Probably fatal
≥ 3-s vent. fibril.	500	370	100	67	500	340	Probably fatal
≥ 5-s vent. fibril.	375	250	75	50	375	250	Probably fatal
Cardiac arrest	—	—	4000	4000	—	—	Possibly fatal
Organs burn	—	—	5000	5000	—	—	Fatal if it is a vital organ

Delayed Effects. Damage to internal tissues may not be apparent immediately after contact with the current. Internal tissue swelling and edema are also possible.

Critical Path. The critical path of electricity through the body is through the chest cavity. At levels noted in Table H-1, current flowing from one hand to the other, from a hand to the opposite foot, or from the head to either foot will pass through the chest cavity paralyzing the respiratory or heart muscles, initiating ventricular fibrillation and/or burning vital organs.

6.2 Biological Effects of Electrical Hazards on Humans

Influential Variables. The effects of electric current on the human body can vary depending on the following:

1. Source characteristics (current, frequency, and voltage of all electric energy sources).
2. Body impedance and the current's pathway through the body.
3. How environmental conditions affect the body's contact resistance.
4. Duration of the contact.

Source Characteristics. An AC with a voltage potential greater than 550 V can puncture the skin and result in immediate contact with the inner body resistance. A 110-V shock may or may not result in a dangerous current, depending on the circuit path which may include the skin resistance. A shock greater than 600 V will always result in very dangerous current levels. The most severe result of an electrical shock is death.

Conditions for a serious (potentially lethal) shock across a critical path, such as the heart, are:

1. More than 30 V root mean square (rms), 42.4-V peak, or 60 V DC at a total impedance of less than 5000
2. 10 to 75 mA
3. More than 10 J

Conditions for a potentially lethal shock across the heart are:

1. More than 375 V at a total body impedance of less than 5000
2. More than 75 mA
3. More than 50 J

Frequency: The worst possible frequency for humans is 60 Hz, which is commonly used in utility power systems. Humans are about five times more sensitive to 60 Hz AC than to DC. At 60 Hz, humans are more than six times as sensitive to AC than at 5000 Hz—and the sensitivity appears to decrease still further as the frequency increases. Above 100–200 kHz, sensations change from tingling to warmth, although serious burns can occur from higher radio-frequency energy. At much higher frequencies (e.g., above 1 MHz), the body again becomes sensitive to the effects of an alternating electric current, and contact with a conductor is no longer necessary; energy is transferred to the body by means of electromagnetic radiation (EMR).

Body Impedance: Three components constitute body impedance: internal body resistance and the two skin resistances at the contact points with two surfaces of different voltage potential. One-hand (or single-point) body contact with electrical circuits or equipment will prevent a person from completing a circuit between two surfaces of different voltage potential. Table H-2 provides a listing of skin-contact resistances encountered under various conditions. It also shows the work area surfaces and wearing apparel effects on the total resistance from the electrical power source to ground. This table can be used to determine how electrical hazards could affect a worker in varying situations.

Table H-2. Human resistance for Various Skin-contact conditions.

Body contact condition	Dry (Ω)	Wet (Ω)
Finger touch	40,000–1,000,000	4,000–15,000
Hand holding wire	15,000–50,000	3000–5000
Finger-thumb grasp	10,000–30,000	2000–5000
Hand holding a pliers	5,000–10,000	1000–3000
Palm touch	3000–8000	1000–2000
Hand around 1.5-inch pipe or drill handle	1000–3000	500–1500
Two hands around 1.5-inch pipe	500–1500	250–750
Hand immersed	—	200–500
Foot immersed	—	100–300

Life-Threatening Effects. Charles F. Dalziel, Ralph H. Lee, and others have established the following criteria for the lethal effects of electric shock:

1. Currents in excess of a human's "let-go" current (≥16 mA at 60 Hz) passing through the chest can produce collapse, unconsciousness, asphyxia, and even death (see also Table H-1).
2. Currents (≥30 mA at 60 Hz) flowing through the nerve centers that control breathing can produce respiratory inhibition, which could last long after interruption of the current.
3. Cardiac arrest can be caused by a current greater than or equal to 1 A at 60 Hz flowing in the region of the heart.
4. Relatively high currents (0.25–1 A) can produce fatal damage to the central nervous system.
5. Currents greater than 5 A can produce deep body and organ burns, substantially raise body temperature, and cause immediate death.
6. Delayed reactions and even death can be caused by serious burns or other complications.

Source: Lawrence Livermore National Laboratory.

The complete document can be found at http://www.llnl.gov/es_and_h/hsm/doc_16.01/doc16-01.html.

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7 Detailed Response Recommendations

Every emergency incident to which a fire department responds is unique. Despite the differences, however, there are common characteristics that allow first responders to better understand the tasks that need to be performed and to prepare for their duties. This section provides a review of the common elements of most interest to fire fighters when handling emergencies involving electrical power systems.

Solar Facility Highest Concerns

1. Tripping/Slipping
2. Structural Collapse
3. Flame Spread
4. Inhalation Exposure
5. Electrical Shock
6. Battery Hazards

7.1 Energized System Firefighting

If a PV solar array becomes engulfed in fire, appropriate care should be exercised in firefighting response, and it should be attacked similarly to any piece of electrically energized equipment. Normally this would involve shutting down the power and applying water in a fog pattern on combustible materials or utilizing a dry chemical or foam on the PV solar array, but it is critical to be aware that a solar panel exposed to sunlight is always on and energized. Further, the electrical energy produced by multiple series connected panels or large solar systems are normally very dangerous.

One additional secondary concern that should always be considered when approaching solar power systems is that the module frame and junction boxes may provide nesting locations for a variety of birds, insects and other animals. This could introduce an additional layer of difficulty for on scene firefighters, enhancing other hazard concerns such as fire in nesting material or bites along with tripping or slipping.

A PV solar system generates electricity when the sun is shining, and when it is receiving sunlight it is operational and generating electricity. This creates additional challenges for the fire ground task of shutting off the utilities and the electrical power in the structure that could be a dangerous source of electric shock. **Even with known shutdown steps taken to isolate electrical current, firefighters should always treat all wiring and solar power components as if they are electrically energized.**

Care should be taken throughout fire ground operations never to cut or damage any conduit or any electrical equipment, and they should be treated as energized at all times.

7.2 Energy Storage System

An additional electrical concern exists for systems that have an optional battery storage arrangement as part of the PV system. The batteries can maintain electrical current at nighttime and when the rest of the system has been isolated, thus presenting an additional electric shock hazard. Further, they can present leakage and hazardous materials concerns, and special attention is required for any battery storage systems that have been damaged in a fire.

Design requirements for batteries are established and can be extrapolated to the battery systems used in a photovoltaic system, such as the requirements for stationary storage battery systems addressed by Chapter 52 of NFPA 1, Fire Code, and Section 608 of the International Fire Code.130.131 Technology commonly used for stationary storage batteries include: flooded lead-acid, flooded nickel cadmium (Ni-Cd); valve-regulated lead-acid; lithium ion; and lithium metal polymer. The battery system for the JVR Energy Park Project will include a state-of-the-art system that reduces the potential for thermal runaway.

Batteries generally burn with difficulty, although plastic battery casings provide a limited contribution to the combustion process. However, batteries that do burn or are damaged in a fire generate fumes and gases that are extremely corrosive. Spilled electrolyte can react with other metals and produce toxic fumes, as well as potentially flammable or explosive gases. The risk of additional batteries becoming involved is high during a thermal runaway event, although these events are extremely rare. Full protective clothing and respiratory protection is imperative in such incidents, and special care and maintenance may be required during cleanup. Dry chemical, CO_2, and foam are the preferred methods for extinguishing a fire involving batteries, and water is normally not the extinguishing agent of choice, but may be used as a water fog for cooling purposes.

7.3 Respiratory Protection

Proper respiratory protection should be used during all fire ground operations that involve a potentially hazardous atmosphere. Similarly, these protective measures apply during post-fire activities such as overhaul or fire investigations. Care should be taken during all fire ground operations to protect against respiratory exposure from products of combustion involving electrical or transformer systems. Under normal conditions the materials used for solar cells and modules are relatively inert and safe, but they can become dangerous when exposed to fire. If solar power components are involved in a fire, care should be taken to avoid exposure to the products of combustion due to the somewhat unusual materials involved. In addition to inhalation concerns, dermal exposure from solar power system materials damaged by fire should also be handled with caution regardless of the type of power system.

Emergency responders are required to wear full respiratory protection (e.g., SCBA) for any atmosphere that is possibly IDLH (immediately dangerous to life or health), and this should be the case when handling damaged solar modules involved in fire unless proven otherwise.

7.4 Firefighting Strategic Mode

Following an assessment of a fire related situation, the choice of a strategic mode should be made by the Incident Commander (IC) following local jurisdiction Emergency Operation Manuals, SOPs and guides that would normally be used for electrical hazards. Tactics, like strategy, should also be based upon normal standard operating procedures for responding to an emergency incident for a PV solar facility. Before going any further:

- **Find the Directory for the Site located at/near the primary facility entrance off Carrizo Gorge Road, as it illustrates the location of key components and emergency contact information.**
- **Locate the Service Disconnects.**

1. **Strategy** - When a fire incident occurs in the vicinity of a PV solar facility, the following items must be considered when developing a strategy:

a. Document fire conditions found on arrival – confirm fire location, type of fire, extents, potential threats
b. Confirm whether a component of the PV solar facility itself is burning or whether fire is confined to the surrounding vegetation
c. Confirm whether anyone on site is threatened by the fire
d. Confirm whether aerial firefighting resources are being used or should be ordered for wildfire and know potential limitations of its use on/near solar facilities
e. Document any threatened exposures, including wild land areas;
f. Locate water and additional resources available (site includes three 10,000 gallon water tanks with firefighting water (Figures 2).

Once the IC has completed a size-up, the IC should determine the strategy and assign tasks to the fire suppression resources assigned to the incident. Due to the potential hazards associated with the site, the IC must adjust the strategy and potentially rearrange the order of the tactics to deal specifically with the PV solar facility technology. If the IC chooses an offensive strategy it needs to be supported as it would under other fire operations with an emphasis on disabling all power sources to and from the site or remaining at a safe distance and limiting spread if energy is not confirmed disabled.

2. **Tactics** – Tactics will be based on the chosen strategy and Department SOPs:
   a. Components are always hot! The single most critical message of emergency response personnel is to always consider site facilities and all their components as electrically energized. The inability to power-down photovoltaic panels exposed to sunlight make this an obvious hazard during the daytime, but it is also a potential concern at nighttime for a solar facility that may be equipped with battery storage.
   b. Isolation of the inverters and disconnection of the solar facility from the main electrical panel will be an important task. Assistance from a local PV technician is key for disabling the solar facility and confirming that all of the hazards have been mitigated. An emergency response plan identifying all tasks and the parties responsible for providing the electrical isolation for emergency responders is required.
   c. The battery storage system may include steel containers that house racks of batteries. These containers are required to include remote monitoring by the site's SCADA or similar systems and automatic, inert gas fire suppression systems that are very effective at extinguishing ignition, should that occur. The steel containers and fire suppression systems are expected to a contain fire, but if the very unlikely thermal runaway event is experienced, then external firefighting may be required.
   d. Another priority will be preventing fire spread and isolating it to its area of origin. This task may be difficult during a vegetation fire adjacent the site, especially if aerial resources are being used. Ground resources should be removed from the site until the air attack has concluded.
   e. Dry chemical extinguishers should be used to contain or extinguish electrical fires. Water should be used to extinguish any ordinary combustibles under or near the PV solar facility, or if the volume of fire requires its use. If water is used, a 30° fog pattern from at least a 30 foot distance, at 100 psi is recommended.
   f. Full PPE must be used due to the potential toxic inhalation hazard if panels are burning. Fire crews should position themselves upwind and out of any toxic atmosphere.
   g. Gates at all driveway/road entrances shall be equipped with an approved emergency key-operated switch overriding all function commands and opening the gates or a fire accessible padlock. The gates have a measured opening of 30 feet wide.

h. During the overall fire suppression and mop-up phases of an on-site fire, firefighters should avoid all potential electrical hazards until there is confirmation that the solar facility no longer poses an electric shock hazard. Firefighters must avoid inadvertently damaging PV components with their tools.

i. The IC will need the assistance from local PV technician to confirm that all of the hazards have been mitigated before the incident is terminated and the scene is turned over to the owner or responsible party. The contact information for a local PV technician will be provided to the fire authority prior to Project operation.

j. The tactical approach to a fire incident with electrical equipment must be stressed to all fire suppression personnel (i.e., stay clear).

8 References

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