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Description:	This document replaces in full TN # 257923. Revisions made address CEC data requests SOILS-1 through SOILS-3. This Section evaluates the direct, indirect and cumulative impacts the Project may have on geology and soil resources and identifies any required Applicant-Proposed Measures (APM) and any required Mitigation Measures.
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3.7 GEOLOGY AND SOILS

This section describes the existing geology, soil conditions, and seismicity in the vicinity of the project site in terms of local topography, geology, soil resources and regional seismicity. This section also identifies local geologic and seismic hazards that could affect structures associated with the project. The study area relevant to geology, soils, and geologic hazards comprises the project site: the physical footprint of project construction, operation, maintenance, and decommissioning activities. The study area relevant to faulting and seismic hazards comprises the broader eastern Mojave Desert region, reflecting that the project site could be affected by ground shaking and secondary seismic hazards associated with distant faults. The analysis is based on a review of existing resources, technical data, and applicable laws, regulations, plans, and policies, as well as the following technical reports prepared for the project:

- *Paleontological Resources Technical Report* prepared by SWCA Environmental Consultants (SWCA) (2024) (Appendix H)

3.7.1 Regulatory Setting

3.7.1.1 Federal

INTERNATIONAL BUILDING CODE

The 2006 International Building Code (IBC) is a model building code developed by the International Code Council that sets rules specifying the minimum acceptable level of safety for constructed objects such as buildings in the United States. As a model building code, the IBC has no legal status until it is adopted or adapted by government regulation. California has adopted the IBC. The IBC was developed to consolidate existing building codes into one uniform code that provides minimum standards to ensure the public safety, health, and welfare insofar as they are affected by building construction and to secure safety to life and property from all hazards incident to the occupancy of buildings, structures, and premises. With some exceptions, the California Building Code (CBC) discussed below is based on the IBC.

FEDERAL LAND POLICY AND MANAGEMENT ACT OF 1976 (AS AMENDED)

The Federal Land Policy and Management Act of 1976, as amended (FLPMA), establishes policy and goals to be followed in the administration of public lands by the Bureau of Land Management (BLM). The intent of FLPMA is to protect and administer public lands within the framework of a program of multiple use, sustained yield, and the maintenance of environmental quality. Particular emphasis is placed on the protection of the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resources, and archaeological values. FLPMA is also charged with the protection of life and ensuring safety from natural hazards.

DESERT RENEWABLE ENERGY CONSERVATION PLAN

In September 2016, the BLM adopted the Desert Renewable Energy Conservation Plan (DRECP) Land Use Plan Amendment (LUPA) to the California Desert Conservation Area (CDCA) Plan, Bishop Resource Management Plan, and Bakersfield Resource Management Plan. The DRECP LUPA addresses solar, wind, and geothermal energy generation and transmission projects on 10.8 million acres of BLM-administered lands in the desert regions of southern California (BLM 2016a).

The BLM DRECP LUPA establishes several land use classifications, including Development Focus Areas (DFAs), Variance Process Lands (VPLs), Recreation Management Areas, General Public Lands, and various conservation land use designations. In DFAs, renewable energy projects are incentivized and permitting is streamlined. Renewable energy projects may be implemented on VPLs, but they must first be evaluated under a variance process and then approved by the BLM to proceed through National Environmental Policy Act (NEPA) environmental review. BLM Conservation Areas include National Landscape Conservation System lands, Areas of Critical Environmental Concern (ACECs), and Wildlife Allocations. Recreation Management Areas are designated for recreation actions. This designation includes Extensive Recreation Management Areas, which entail management specifically to address recreation use and demand; and Special Recreation Management Areas, which are high-priority areas for recreation and have unique value and importance for recreation. General Public Lands are BLM-administered lands that do not have a specific land allocation or designation associated with energy development, conservation, or recreation. These lands are not needed to fulfill the DRECP biological conservation or renewable energy strategy. These areas are available to renewable energy applications but do not benefit from permit review streamlining or other incentives.

Most of the project site is on DRECP General Public Lands, and the generation-tie line (gen-tie line) route is within an ACEC.

FEDERAL EARTHQUAKE HAZARDS REDUCTION ACT

In 1977, the U.S. Congress passed the Earthquake Hazards Reduction Act, which established the National Earthquake Hazards Reduction Program to reduce the risks to life and property from future earthquakes. The agencies responsible for coordinating this program are the Federal Emergency Management Agency (FEMA), the National Institute of Standards and Technology, the National Science Foundation, and the U.S. Geological Survey (USGS). In 1990, the National Earthquake Hazards Reduction Program was amended by the National Earthquake Hazards Reduction Program Act, which refined the description of the agency responsibilities, program goals, and objectives. The four goals of this act are to 1) develop effective practices and policies for earthquake loss reduction and accelerate their implementation, 2) improve techniques to reduce seismic vulnerability of facilities and systems, 3) improve seismic hazards identification and risk-assessment methods and their use, and 4) improve the understanding of earthquakes and their effects.

CLEAN WATER ACT

Formerly the Federal Water Pollution Control Act of 1972, the Clean Water Act (CWA) was enacted with the intent of restoring and maintaining the chemical, physical, and biological integrity of the waters of the United States (WOTUS). The CWA, enforced by the U.S. Environmental Protection Agency (EPA), requires states to set standards to protect, maintain, and restore water quality through the regulation of point source and certain non-point source discharges to surface water.

The definition of WOTUS (33 Code of Federal Regulations [CFR] 328) was revised by the 2023 WOTUS rule and its final rule amendment which took effect September 8, 2023 (‘Conforming Rule’) (*Federal Register* 88: 61964 No. 173). In general, WOTUS are waterbodies such as lakes, rivers, streams, wetlands, and ponds.

WOUS include navigable waters, certain non-wetland waters, and adjacent wetlands with a continuous surface connection to a WOUS. Non-wetland WOUS, such as streams, are delineated by the ordinary high-water mark (OHWM) and must have a continuous surface connection to a WOUS that has a continuous surface connection a traditional navigable water (TNW). Non-wetland WOUS streams may be relatively permanent waters or non-relatively permanent waters as determined by the U.S. Army Corps of Engineers (USACE). The OHWM is defined as “that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas" (33 CFR 329.11). In situations where an alluvial fan braided stream system has channels located close to one another with small upland areas in between, likened to capillaries of tissue, both the aquatic and upland areas may all be combined within the full outer bounds of the WOUS extent (see *Save Our Sonoran Inc. v. Flowers*, U.S. Court of Appeals, Ninth Circuit, 2004).

Section 402 of the CWA requires that direct and indirect discharges and stormwater discharges into WOTUS be pursuant to a National Pollutant Discharge Elimination System (NPDES) permit for industrial or construction activities. NPDES permits contain industry-specific, technology-based limits and may include additional water quality–based limits and pollutant-monitoring requirements. An NPDES permit may include discharge limits based on federal or state water quality criteria or standards. NPDES permitting authority is delegated to, and administered by, the California State Water Resources Control Board (SWRCB) and its nine regional water quality control boards (RWQCBs).

Section 404 of the CWA authorizes the USACE to regulate the discharge of dredged or fill material to WOTUS and adjacent wetlands. Discharges to WOTUS must be avoided where possible and minimized and mitigated where avoidance is not possible. Permits are issued by the USACE.

Section 401 of the CWA requires that any activity that may result in a discharge into WOTUS be certified by the RWQCB. This certification ensures that the proposed activity follows state and/or federal water quality standards.

3.7.1.2 State

CALIFORNIA BUILDING CODE

The CBC, codified in 24 California Code of Regulations 2, was promulgated to safeguard the public health, safety, and general welfare by establishing minimum standards related to structural strength, egress facilities, and general building stability. The purpose of the CBC is to regulate and control the design, construction, quality of materials, use/occupancy, location, and maintenance of all buildings and structures within its jurisdiction.

The current CBC is the 2013 Triennial Edition, which is based on the 2012 IBC. In addition, the CBC contains necessary California amendments that are based on the American Society of Civil Engineers (ASCE) Minimum Design Standard 7-05. ASCE 7-05 provides requirements for general structural design and includes means for determining earthquake loads as well as other loads (flood, snow, wind, etc.) for inclusion in building codes. The provisions of the CBC apply to the construction, alteration, movement, replacement, and demolition of every building or structure, or any appurtenances connected or attached to such buildings or structures, throughout California.

The earthquake design requirements of the CBC consider the occupancy category of the structure, site class, soil classifications, and various seismic coefficients, all of which are used to determine a Seismic Design Category (SDC) for a project. The SDC is a classification system that combines the occupancy categories with the level of expected ground motions at the site and ranges from SDC A (very small seismic vulnerability) to SDC E/F (very high seismic vulnerability and near a major fault). Design specifications are then determined according to the SDC.

ALQUIST-PRIOLO EARTHQUAKE FAULT ZONING ACT

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. In accordance with this act, the State Geologist established regulatory zones, called earthquake fault zones, around the surface traces of active faults and has published maps showing these zones. Within these zones, buildings for human occupancy cannot be constructed across the surface trace of active faults. Each earthquake fault zone extends approximately 200 to 500 feet on either side of the mapped fault trace because many active faults are complex and consist of more than one branch that may experience ground surface rupture. This act does not apply to the project because no active faults cross the project site (California Department of Conservation [CDOC] 2022).

SEISMIC HAZARDS MAPPING ACT

The Seismic Hazards Mapping Act was developed to protect the public from the effects of strong ground shaking, liquefaction, landslides, or other ground failure and from other hazards caused by earthquakes. This act requires the State Geologist to delineate “zones of required investigation” (i.e., seismic hazard zones) where site investigations are required to determine the need for mitigation of potential liquefaction and/or earthquake-induced landslide ground displacements. The act requires cities, counties, and other local permitting agencies to regulate certain development projects by implementing the provisions of the act through various local building codes, permits, and ordinances. Before a development permit is granted for a site within a seismic hazard zone, a geotechnical investigation of the site must be conducted and appropriate mitigation measures incorporated into the project design, consistent with the California Geological Survey’s (CGS’s) Special Publication 117, *Guidelines for Evaluating and Mitigating Seismic Hazards in California* (2008).

At the time this Environmental Impact Report was written, Seismic Hazard Zone Maps had been prepared for portions of southern California and the San Francisco Bay area; however, no seismic hazard zones had been delineated for the project site. As a result, the provisions of the Seismic Hazards Mapping Act would not apply to the project (CDOC 2021).

CALIFORNIA OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION REGULATIONS

Occupational safety standards exist in federal and state laws to minimize worker safety risks from both physical and chemical hazards in the workplace. In California, the California Division of Occupational Safety and Health (Cal OSHA) and the federal Occupational Safety and Health Administration (OSHA) are the agencies responsible for ensuring worker safety in the workplace.

Excavation and trenching are among the most hazardous construction activities. The OSHA Excavation and Trenching standard, 29 CFR 1926.650, covers requirements for excavation and trenching operations. OSHA requires that all excavations in which employees are potentially exposed to cave-ins be protected by sloping or benching the sides of the excavation, supporting the sides of the excavation, or placing a shield between the side of the excavation and the work area. Cal OSHA would be the implementing agency for state and federal OSHA standards.

PORTER-COLOGNE WATER QUALITY CONTROL ACT

The Porter-Cologne Water Quality Control Act (Porter-Cologne Act) (Division 7 of the California Water Code) provides the basis for water quality regulation within California and defines water quality objectives as the limits or levels of water constituents that are established for reasonable protection of beneficial uses. The California State Water Resources Control Board administers water rights, water pollution control, and water quality functions throughout the state, while each of the nine RWQCBs conducts planning, permitting, and enforcement activities. The Porter-Cologne Act requires the RWQCB to establish a regional basin plan with water quality objectives, while acknowledging that water quality may be changed to some degree without unreasonably affecting beneficial uses. Beneficial uses, together with the corresponding water quality objectives, are defined as standards, per federal regulations. Therefore, the regional basin plans form the regulatory references for meeting state and federal requirements for water quality control. Changes in water quality are allowed if the change is consistent with the maximum beneficial use of the state, does not unreasonably affect the present or anticipated beneficial uses, and does not result in water quality less than that prescribed in the water quality control plans. The basin plan for this location is discussed below.

STATE WATER RESOURCES CONTROL BOARD STORMWATER PROGRAM CONSTRUCTION GENERAL PERMIT

The Construction General Permit, mandated under the federal CWA, is a statewide standing permit governing stormwater runoff from construction sites spanning 1 acre or more. To obtain coverage, qualifying construction activities must submit a Notice of Intent to the RWQCB and develop and adhere to a Stormwater Pollution Prevention Plan (SWPPP). This plan outlines the BMPs that will be utilized to safeguard stormwater runoff. The SWPPP must include a visual monitoring program, a chemical monitoring program for "non-visible" pollutants in case BMPs fail, and a sediment monitoring plan if the site discharges directly into a water body listed on the Section 303(d) list for sediment pollution.

Under the Construction General Permit, only stormwater and non-stormwater discharges authorized by the permit or another NPDES permit are permissible. Discharges containing hazardous substances exceeding reportable quantities established in 40 CFR 117.3 and 302.4 are prohibited unless a separate NPDES permit is issued to regulate such discharges. Additionally, the permit integrates discharge prohibitions outlined in basin plans. Discharges to Areas of Special Biological Significance are prohibited unless covered by an approved exception by the SWRCB.

The CWA provides definitions for BMPs, which may include various measures such as runoff control, soil stabilization, sediment control, proper stream crossing techniques, waste management, and spill prevention and control, tailored to specific site conditions.

LAHONTAN REGIONAL WATER QUALITY CONTROL BOARD

On the regional level, the project falls under the jurisdiction of the Lahontan RWQCB (LRWQCB), which is responsible for the implementation of state and federal water quality protection statutes, regulations, and guidelines. The LRWQCB adopted, and the SWRCB approved, the *Water Quality Control Plan for the Lahontan Region* (Basin Plan) (California Water Boards 2023) to define how the quality of surface water and groundwater in the region should be managed to provide the highest water quality as reasonably possible. The Basin Plan lists the various beneficial uses of water within the region; describes the water quality which must be maintained to allow those uses; describes the programs, projects, and other actions which are necessary to achieve the standards established in this plan; and summarizes plans and policies to protect water quality. Beneficial water uses are of two types: consumptive and non-consumptive. Consumptive uses are those normally associated with human activities, primarily municipal, industrial and irrigation uses that consume water and cause corresponding reduction and/or depletion of water supply. Non-consumptive uses include swimming, boating, waterskiing, fishing, hydropower generation, and other uses that do not significantly deplete water supplies. Beneficial uses associated with the Soda Lake Hydrologic Subarea in the vicinity of the project site are described for Soda Lake and for the Mojave River. These beneficial uses include municipal and domestic supply (MUN); agricultural supply (AGR); groundwater recharge (GWR); water contact recreation (REC-1); non-contact water recreation (REC-2); cold freshwater habitat (COLD); wildlife habitat (WILD); and water quality enhancement (WQE).

3.7.1.3 Local

SAN BERNARDINO COUNTY EMERGENCY RESPONSE PLAN

The goal of hazard mitigation is to minimize or prevent the loss of life and damage to property. According to FEMA, hazard mitigation is defined as "any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards." FEMA defines a hazard as "any event or condition with the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, environmental damage, business interruption, or other loss."

The objective of San Bernardino County's *Multi-Jurisdictional Hazard Mitigation Plan* (San Bernardino County 2022) is to illustrate the strategies for minimizing or preventing hazard risks in the unincorporated area of the county and the five special districts. The plan's approach incentivizes communities to establish objectives and develop projects aimed at diminishing risk and fostering more disaster resilient communities through the analysis of potential hazards.

SAN BERNARDINO COUNTYWIDE PLAN

The San Bernardino Countywide Plan (San Bernardino County 2024a), adopted by the Board of Supervisors in 2020, updates and expands the County's General Plan by addressing the physical, social, and economic issues facing the unincorporated portions of the county. The Countywide Plan consists of the Policy Plan, the Business Plan, and a communities plan. The Policy Plan, based on the former General Plan, consists of 11 elements: Land Use, Housing, Infrastructure and Utilities, Transportation and Mobility, Natural Resources, Renewable Energy and Conservation, Cultural Resources, Hazards, Personal and Property Protection, Economic Development, and Health and Wellness. The Business Plan consists of a policy-based governance element along with an implementation plan. The communities plan consists of 35 Community Action Guides that provide a framework for communities to create future character and independent identity through community actions.

The following policies identified in the Cultural Resources and Hazards elements of the San Bernardino Countywide Plan are relevant to this analysis (San Bernardino County 2024b).

> **Goal HZ-1 Natural Environmental Hazards.** Minimized risk of injury, loss of life, property damage, and economic and social disruption caused by natural environmental hazards and adaptation to potential changes in climate.

- **Policy HZ-1.1 New subdivisions in environmental hazard areas**. We require all lots and parcels created through new subdivisions to have sufficient buildable area outside of the following environmental hazard areas:

1. Flood: 100-year flood zone, dam/basin inundation area
2. Geologic: Alquist Priolo earthquake fault zone; County-identified fault zone; rockfall/debris-flow hazard area, existing and County-identified landslide area

- **Policy HZ-1.2 New development in environmental hazard areas**. We require all new development to be located outside of the environmental hazard areas listed below. For any lot or parcel that does not have sufficient buildable area outside of such hazard areas, we require adequate mitigation, including designs that allow occupants to shelter in place and to have sufficient time to evacuate during times of extreme weather and natural disasters.

1. Flood: 100-year flood zone, dam/basin inundation area
2. Geologic: Alquist Priolo earthquake fault zone; County-identified fault zone; rockfall/debris-flow hazard area, medium or high liquefaction area (low to high and localized), existing and County-identified landslide area, moderate to high landslide susceptibility area)
3. Fire: high or very high fire hazard severity zone

- **Policy HZ-1.8 Wind erosion hazards**. We require new development in medium-high or high wind erosion hazard areas to minimize the effects of wind-blown soil through building and site design features such as fencing, surface treatment or pavement, attenuation or wind barriers, architectural features, building materials, and drought resistant landscaping.
- **Policy HZ-1.9 Hazard areas maintained as open space**. We minimize risk associated with flood, geologic, and fire hazard zones or areas by encouraging such areas to be preserved and maintained as open space.

3.7.2 Environmental Setting

3.7.2.1 Regional Setting

The project site is in the southeastern portion of the Mojave Desert geomorphic province (CGS 2002). Mojave Desert geomorphology and topography are largely controlled by fault trends and are characterized by isolated mountain ranges separated by desert plains, many draining internally and having central playas (e.g., Soda Lake). To the north and west, the boundaries of the geomorphic province are marked by major mountain ranges (e.g., the Sierra Nevada and Transverse ranges) and regional faults (e.g., the Garlock Fault and the San Andreas Fault). To the east, the geomorphic province is bounded by the Nevada and Arizona borders.

Mountains surrounding the project site are primarily composed of granitic and volcanic rocks that formed less than 65 million years ago. The surrounding mountains also include nonmarine sedimentary rocks of a similar age, older volcanic rocks (approximately 145–200 million years old), and marine sedimentary rocks that formed over 300 million years ago (Jennings et al. 1962) (Figure 3.7-1). Paleozoic strata found in the Mojave Desert are typically representative of continental margin depositional environments (Walker et al. 2002). Mesozoic rocks include marine and nonmarine sedimentary rocks, volcanics, and plutonic igneous bodies that were emplaced during the Nevadan orogeny. Cenozoic strata in the Mojave Desert are widespread and typically include both volcanic and sedimentary rock types.

Alluvial fans vary from recent (decades to millennia) to very old (tens of thousands of years), with the older deposits forming the more elevated surfaces (BLM and San Bernardino County 2015). Recent (i.e., Holocene) stream deposits originating in the Soda Mountains form wedges of alluvial sand, gravel, cobbles, and boulders as the alluvium exits mountain canyons to the valley floor. The percentage of sand and smaller-diameter gravel generally increases with distance from the mountains, as cobbles and boulders generally drop out of the water column first as the force of water flow declines in more level valley terrain. Bedrock formations in the surrounding mountains are predominantly granitic and volcanic, although older and younger sedimentary formations are present at greater distance from the project site and to the north. These bedrock formations are generally very hard and moderately to very fractured, and they form the source materials that have been transported to build the alluvial fan deposits that fill the valley (BLM and San Bernardino County 2015).

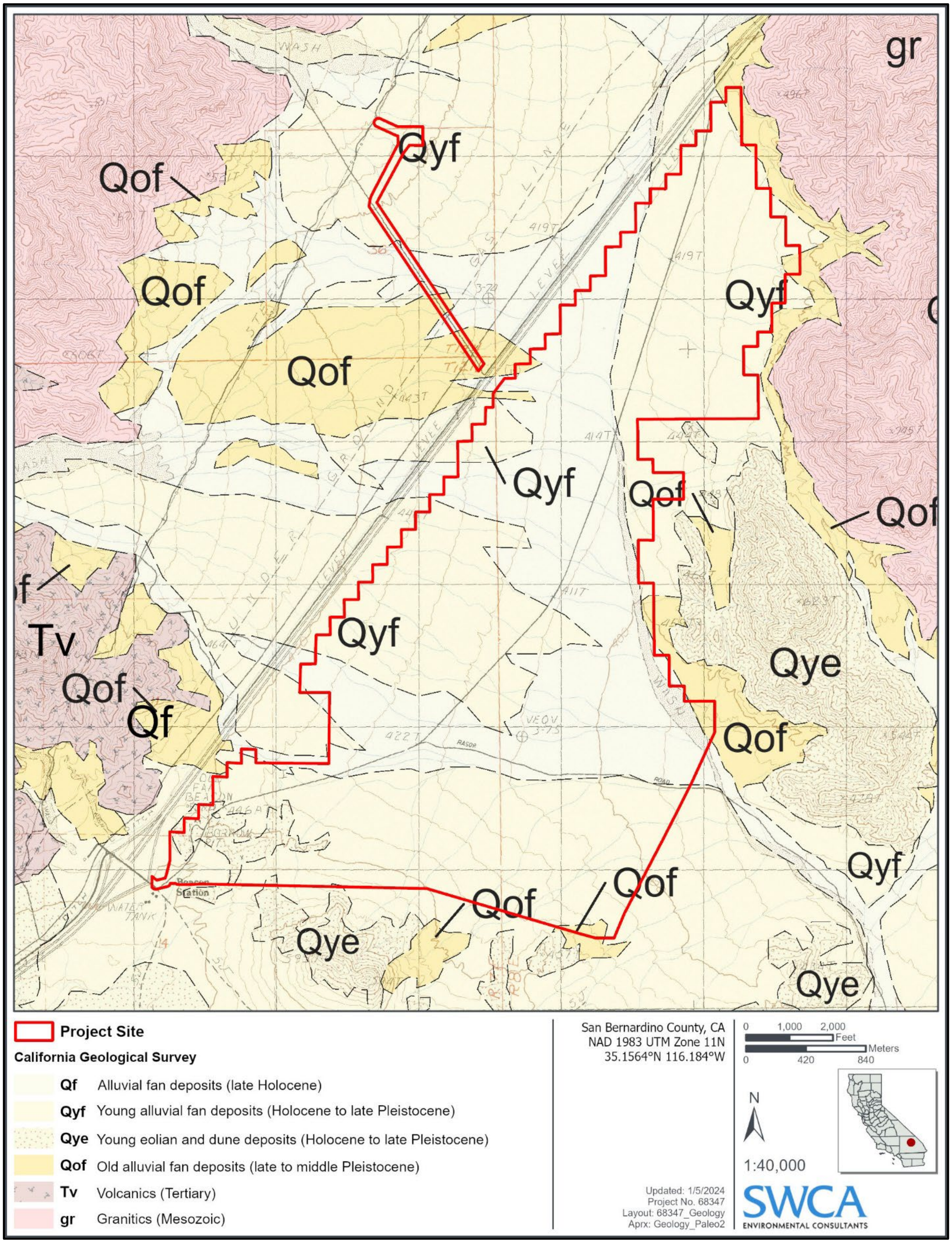

Figure 3.7-1. Geologic map of project site and vicinity.

3.7.2.2 Local Setting

TOPOGRAPHY

The project site lies within a small, intermontane desert valley occupied by alluvial fan deposits and surrounded by the Soda Mountains. The main mass of the Soda Mountains lies to the west of the project site and reaches an elevation of approximately 3,625 feet above mean sea level (amsl). Lower mountains to the south and east of the project site form a discontinuous border reaching elevations of 1,850 and 2,350 feet amsl, respectively (BLM and San Bernardino County 2015). The mountains farther to the north are within these same general elevational ranges. Elevations in the project site range from approximately 1,600 feet amsl in the southwest to 1,550 feet amsl on the north and 1,250 feet amsl on the southeast.

Terrain within the project site consists of predominantly south- to east-sloping (at 2% to 4%) alluvial deposits emanating from the Soda Mountains to the west, with minor north- and west-sloping terrain at the edges of the smaller mountains on the east. Channels and washes are deeper, and clast sizes increase up to small boulders closer to the base of the surrounding mountains. The southwestern portion of the project site, east of Interstate 15 (I-15), has an elevation of roughly 1,520 feet amsl. Surface morphology within the project site varies from older, smoothly undulating and relatively flat alluvial fan surfaces to young and active drainages incised into the alluvial fan surfaces (BLM and San Bernardino County 2015). Small shrubs and desert grasses cover approximately 35% of the site, and there is very little evidence of prior disturbance or any built environment; prior ground disturbance consists of slightly graded dirt roads and modern alluvial channels.

GEOLOGY

The geology of the Mojave Desert is complex, and rocks found in the Mojave Desert represent nearly all divisions of geologic time, from Precambrian basement rocks to modern alluvium. Geologic units within the project site consist primarily of alluvium (sedimentary deposits derived from weathering, erosion, and transport) on the flanks of the Soda Mountains and in the central valley and washes (see Figure 3.7-1). Small areas of bedrock are present in the southern and southwestern extremes of the site.

According to geologic mapping by Bedrossian et al. (2012), the surface of the project site contains late Holocene alluvial fan deposits (Qf), Holocene to late Pleistocene young alluvial fan deposits (Qyf), Holocene to late Pleistocene young eolian and dune deposits (Qye), and late to middle Pleistocene (11,700–774,000 years ago) old alluvial fan deposits (Qof) (Table 3.7-1; see Figure 3.7-1). In general, geologic units mapped at the surface near the project site (e.g., within a 0.5-mile buffer) can be a good indicator of the geologic units that may be present in the subsurface, provided that structural deformation has not altered or displaced the vertical or lateral continuity of the units and that the geologic units are in their original geochronological order (relatively young deposits overlying relatively old deposits based on the principles of stratigraphy). Neogene (Tertiary) formations of volcanic origin (Tv), and Mesozoic and older granitic and other intrusive crystalline rocks of all ages (gr) are also mapped along the uplifted hills east and west of the project site (Bedrossian et al. 2012) and may be present at substantial depth within the project site.

SOILS

Data from the Natural Resources Conservation Service (NRCS) State Soil Geographic (STATSGO) dataset was reviewed to identify soils on the subject property (NRCS 2023a). The STATSGO data were used because the map units are larger and define broader areas. These soil maps are compiled by generalizing more detailed soil survey mapping. They are normally used where more detailed soil survey maps are not available or not feasible for the scale of the project.

As shown in Figure 3.7-2, the project site is mapped as Rillito–Gunsight, Rositas–Carrizo, and rock outcrop soil complexes (NRCS 2023a). Soil type descriptions (NRCS 2023b) are provided in Table 3.7-1.

Table 3.7-1. Descriptions of Soil Types on the Project Site

Soil Name	Description
Carrizo	The Carrizo series consists of very deep, excessively drained soils formed in mixed igneous alluvium. It is gravelly sand and has negligible to low runoff and high hydraulic conductivity. Carrizo soils are on numerous landforms on floodplains, fan piedmonts, and bolson floors. Slopes range from 0 to 15 percent.
Rositas	The Rositas series consists of very deep, somewhat excessively drained soils formed in sandy eolian material. It is fine sand and has negligible to low runoff and rapid permeability. Rositas soils are on dunes and sand sheets. Slope ranges from 0 to 30 percent with hummocky or dune micro relief.
Gunsight	The Gunsight series consists of very deep, somewhat excessively drained, strongly calcareous soils that formed in alluvium from mixed sources. It is gravelly loam with very low to high runoff and moderate or moderately rapid permeability. Gunsight soils are on fan terraces or stream terraces and have slopes of 0 to 60 percent.
Rillito	The Rillito series consists of very deep, somewhat excessively drained soils that formed in mixed alluvium. It is gravelly sandy loam and has slow or medium runoff with moderate permeability. Rillito soils are on fan terraces or stream terraces. Slopes are predominantly 0 to 5 percent but range to 40 percent.
Rock outcrop	Miscellaneous soil unit.

Source: NRCS (2023b).

DESERT PAVEMENT

Desert pavement is a feature of desert surfaces and is generally composed of a closely fitted, single layer of rock fragments over fine sand or silt. The single layer of rock fragments traps dust particles over time, which settle and adhere to each other. Desert pavements could be formed via geological processes such as gradual removal of sand, dust, and other fine-grained material, or by the shrink/swell properties of the clay underneath the pavement; when clay absorbs precipitation it expands, and when it dries it cracks along weak planes. The project site consists of rocky alluvial slopes and desert pavement separated by washes.

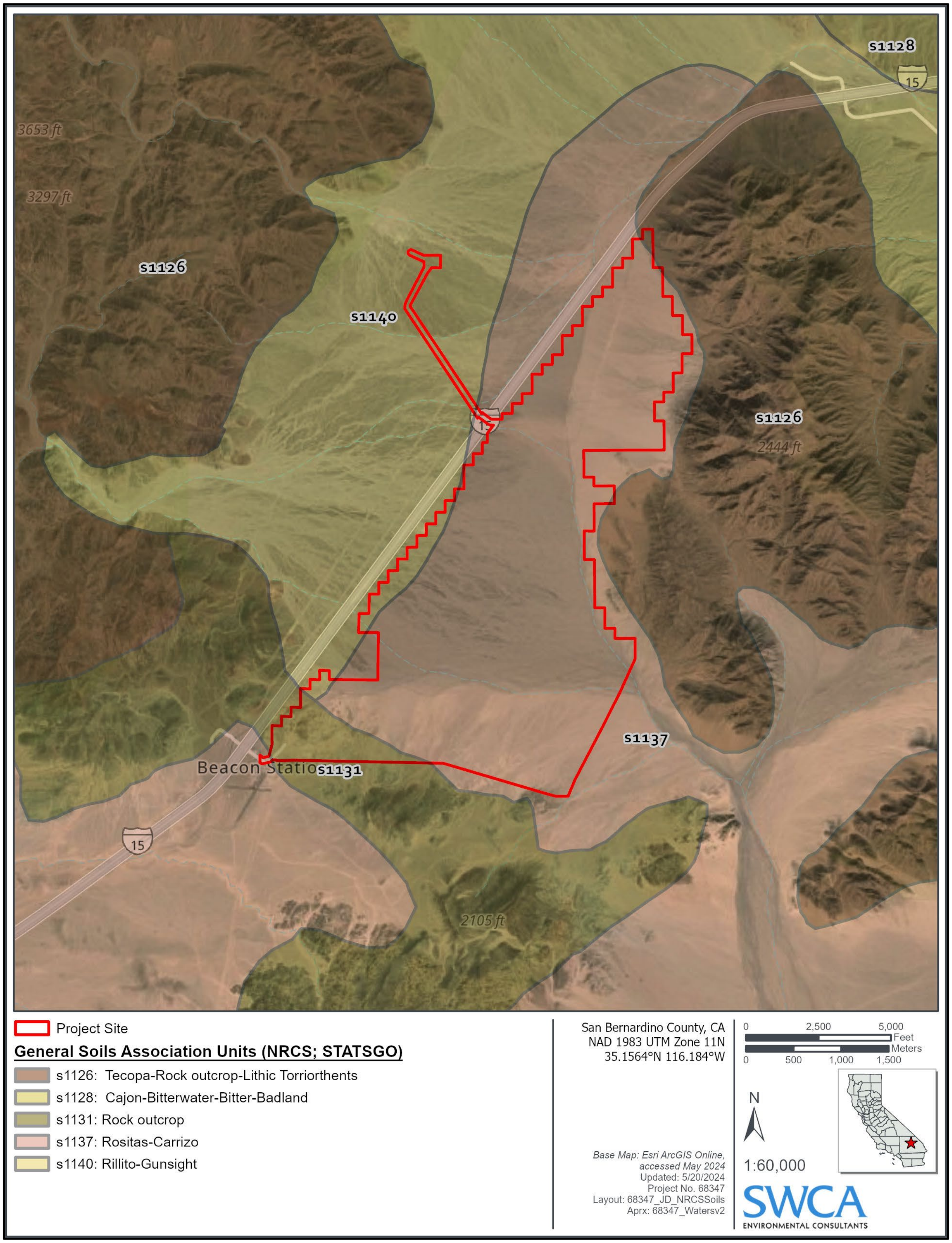

Figure 3.7-2. Soil types on the project site and vicinity.

3.7.2.3 Geologic Hazards

LANDSLIDES

Slope failures, commonly referred to as landslides, include many phenomena of downslope displacement and movement of material, triggered by either static (i.e., gravity) or dynamic (i.e., earthquake) forces. Slope stability depends on several interacting variables, including bedrock geology, geologic structure, the amount of groundwater present, climate, topography, slope geometry, and human activity. Contributing factors to slope movement may decrease the resistance in the slope materials or increase the stresses on the slope, or both. Landslides can occur on slopes of 15% or less, but the probability of slope failure is greater on steeper slopes that exhibit previous landslide features such as scarps, slanted vegetation, and transverse ridges. Landslides typically occur within slide-prone geologic units that contain excessive amounts of water or are located on steep slopes, or where planes of weakness are parallel to the slope angle. The predominantly flat, alluvial nature of the project site generally precludes risk of or susceptibility to landslides. No landslide hazards are identified for the project site or within 20 miles (CDOC 2023; San Bernardino County 2007).

SOILS

Problematic soil conditions such as erosion, corrosion, and expansion (linear extensibility or shrink-swell) are potential geologic hazards for engineering components of the project and are discussed in detail below.

Soil Erosion

Erosion of soil or rock can be driven by the shearing action of water and wind. Water erosion can occur by rill and gully development driven by overland flow or by lateral erosion of a stream channel. For example, active alluvial fans are typically very dynamic with respect to lateral changes in the main channels and are prone to relatively high rates of vertical and lateral scour. Active alluvial fans also typically are characterized by a continual sediment supply deposited over the fan surface. Soil erosion can eventually lead to damage of building foundations and roadways, loss of topsoil, or substantial changes in drainage patterns or water quality. At the project site, areas that are susceptible to increased erosion are generally those that would be disturbed and exposed during the construction phase.

The capacity of soils to resist erosion by rainfall and runoff is a function of soil infiltration capacity and resistance to detachment and transport by falling or flowing water. Soils with high infiltration rates and permeability reduce the amount of runoff (and therefore the erosion potential). Soils that contain high percentages of fine sands and silt and that are low in density are generally the most erodible by water and wind. The majority of the alluvial formations throughout the project site are sand- and gravel-rich and excessively drained to well-drained, thus reducing erosion potential (BLM and San Bernardino County 2015). Alluvial units with desert pavement are less prone to erosion if left undisturbed. Intermediate-age alluvial fans are covered with variously developed desert pavement. In general, the highly ephemeral nature of seasonal runoff leads to erosion generally being concentrated along active and, to a lesser degree, young alluvial fans and washes. Roughness of the desert soil surface, soil moisture content, mechanical stability of soil aggregates (clumps of soil), and stability of soil crusts also affect the potential for soil loss resulting from wind.

The potential for the project to result in an increase in soil erosion is further discussed in Section 3.3, Air Quality, and Section 3.19, Utilities and Service Systems.

Corrosive Soils

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens concrete or uncoated steel. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The steel in installations that span different soil types or cross soil layers is more susceptible to corrosion than the steel in installations that are entirely within one kind of soil or within one soil layer. The risk of corrosion is expressed as low, moderate, or high.

Project site soils were tested for pH, soluble sulfate content, soluble chloride content, and electrical resistivity (BLM and San Bernardino County 2015). Testing results showed that most of the project site soils have high corrosion potential for uncoated steel and low corrosion potential for concrete.

Expansive Soils

Expansive soils are characterized by their ability to undergo significant volume change (shrink and swell) due to variation in soil moisture content. Changes in soil moisture could result from several factors, including rainfall, landscape irrigation, utility leakage, and perched groundwater. Expansive soils are typically very fine-grained with a high to very high percentage of clay. Soils with moderate to high shrink-swell potential would be classified as expansive soils. Soils on the project site and surrounding area are relatively coarse-grained and lack a significant clay fraction or thick accumulations of organic material.

Expansive soils exhibit a shrink-swell behavior, also referred to as linear extensibility. Shrink-swell is the cyclic change in volume (expansion and contraction) that occurs in fine-grained clay sediments during the processes of wetting and drying. Changes to soil moisture could stem from several factors, including rainfall, irrigation, and/or shallow depth to groundwater. Structural damage may occur over a long period, usually as a result of inadequate soil and foundation engineering or the placement of structures directly on expansive soils. For the project site, no expansive soils were identified and based on the nature of alluvial deposition, no expansive soils are expected (BLM and San Bernardino County 2015).

Subsidence and Settlement

Subsidence of the land surface is a general process that can be attributed to natural phenomena such as tectonic deformation, consolidation, hydro-compaction, collapse of underground cavities, oxidation of organic-rich soils, or rapid sedimentation. Human activities, such as the withdrawal of groundwater, can also cause subsidence. Naturally occurring subsidence most frequently takes place in tectonically active areas such as volcanic regions and fault zones. Subsidence due to groundwater withdrawal is possible due to substantial groundwater pumping in the region. Records of subsidence, however, are not known from the vicinity of the project site, most likely because sandy and gravelly soils are less susceptible to subsidence (BLM and San Bernardino County 2015). Based on a geophysical investigation of the project site, groundwater is estimated to be 180 to 350 feet below ground surface (bgs). Therefore, even with groundwater withdrawal from the valley, it is very unlikely that subsidence would occur (BLM and San Bernardino County 2015).

REGIONAL FAULTING AND SEISMIC HAZARDS

Surface Fault Rupture

Seismically induced ground rupture is defined as the physical displacement of surface deposits in response to an earthquake's seismic waves. The magnitude, sense, and nature of fault rupture can vary for different faults or even along different strands of the same fault. A factor considered in the seismic design of project structures is the location of active faults that may cross a portion of the facility; ground movement and surface rupture offset can be several feet vertically and horizontally, which could cause damage that would severely disrupt operations.

The project site is in a broad region of active and potentially active faults and fault zones that bound the Mojave Desert province. According to the California Geological Survey Seismic Hazards Program the project site is not located within an Alquist-Priolo earthquake fault zone (CDOC 2022). The closest active faults or fault zones to the project site are (in order of increasing distance) the Red Pass Lake Fault, the Eastern California Shear Zone, the Garlock Fault, and the San Andreas Fault Zone (USGS 2024). The Red Pass Lake Fault is 2.2 miles west of the project site on the southwestern flank of the Soda Mountains; the fault does not project toward the project site. Several Quaternary-age potentially active faults near the area (the nearest being the Baker Fault north and east of the project site) trend northwest-southeast, and others have a variety of trends. Although no mapped faults occur within or immediately adjacent to the project site, there is a short Quaternary fault west of and parallel to the main Baker Fault that projects toward the far eastern edge of the project site. Although it has not been mapped in this area, one or more faults may exist beneath the sediments filling the valley. However, there is no indication from the latest fault activity maps that this fault segment poses a surface rupture risk (BLM and San Bernardino County 2015; USGS 2024).

Seismic Ground Shaking

The USGS provides a uniform estimate of earthquake-induced ground motion intensity for the United States based on an up-to-date assessment of potential earthquake faults and other sources. One of the benchmarks used by the USGS is the peak ground acceleration (PGA) that has a 2% probability of being exceeded in 50 years. This probability level would allow structures to be designed for ground motions that have a 98% chance of not occurring in the next 50 years, making buildings safer than if they were simply designed for the most likely events. The approximate range of PGA with a 2% probability of occurrence during a 50-year period is 0.30 unit of gravity (g) to 0.40 g for the central and southern portions of the project site (including the proposed location of the operation and maintenance area buildings) and 0.20 g to 0.40 g for the northern edge of the project site. The maximum expected earthquake for the Red Pass Lake Fault could produce higher PGA levels, possibly near 0.50 g, for the entire project site and surrounding area due to its proximity and to the possibility it is a thrust fault that dips beneath the area (BLM and San Bernardino County 2015). Overall, this information suggests that strong ground shaking would be within the highest levels experienced in the Landers earthquake area in 1992 (0.45 g) and the Hector Mine earthquake in 1999 (0.42 g), both in the Mojave Desert region south-southwest of the project site (BLM and San Bernardino County 2015).

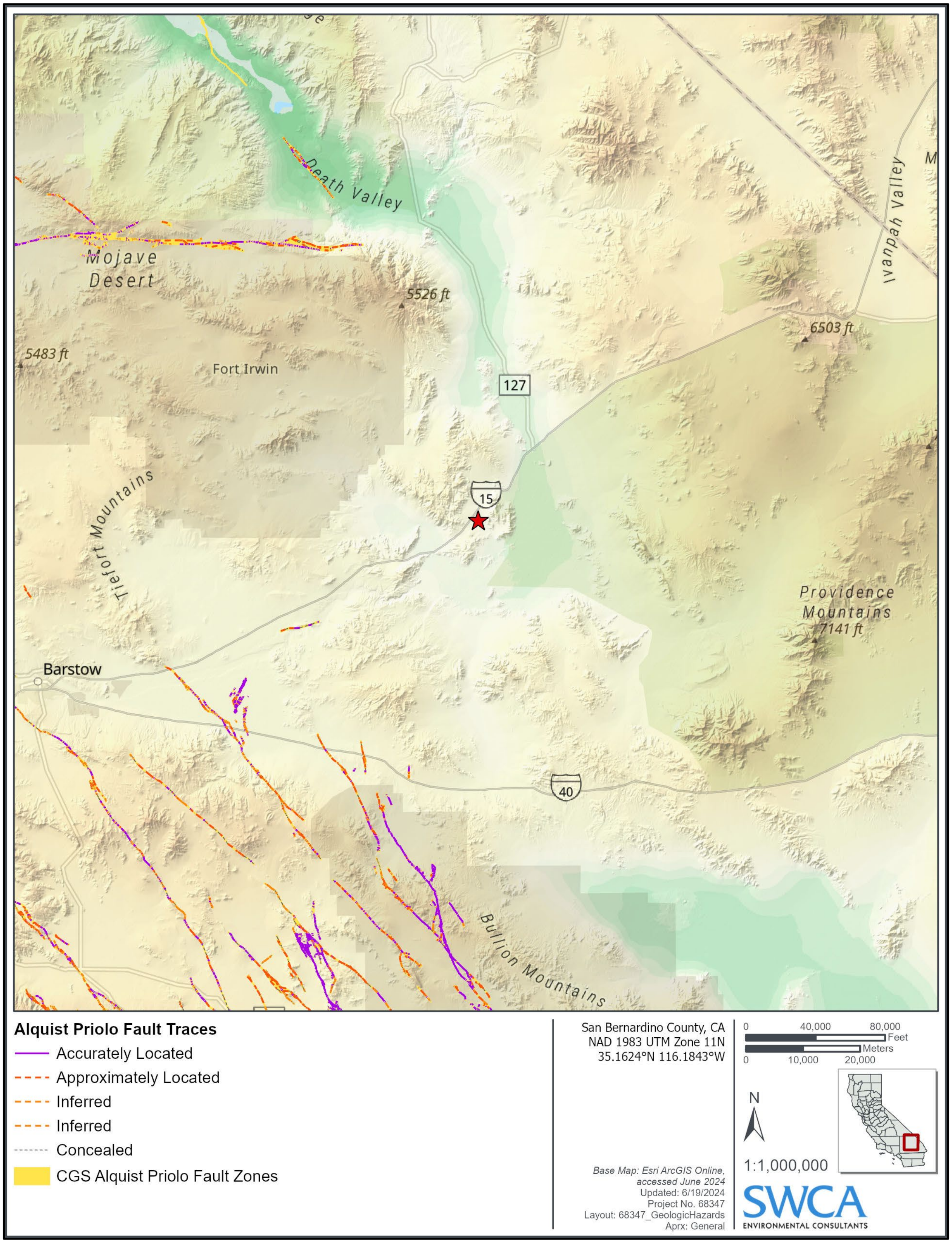

Figure 3.7-3. Alquist-Priolo earthquake fault traces.

Liquefaction

Saturated, unconsolidated silts, sands, and silty sands within 50 feet of the ground surface are most susceptible to liquefaction, which can include loss of bearing strength, lateral spreading, subsidence, and buoyancy effects caused when these sediments temporarily lose their shear strength during strong ground shaking. Susceptibility to liquefaction is a function of the sediment density, water content, depth, and the PGA. The potential for liquefaction within the project site is very low for the following reasons (BLM and San Bernardino County 2015):

1. Permanent groundwater depth is much greater than 50 feet (probably 180 to 350 feet deep).
2. Geologic material types are dense and contain a high percentage of gravel, cobbles, and boulders (intermediate and older alluvial fans).
3. Some geologic units have calcium carbonate cementation (some intermediate-age alluvial fans).

It is plausible that seasonal, perched groundwater may exist at depths less than 50 feet; however, the grain size and density of the alluvium should still preclude liquefaction (BLM and San Bernardino County 2015). In addition, the San Bernardino County Geologic Hazard Overlay Map – Baker CIDIC shows no liquefaction areas on or near the project site (San Bernardino County 2007).

Tsunami

The project site is situated in an inland desert area and is not susceptible to tsunami inundation (CDOC 2024). Furthermore, there are no water bodies (e.g., lake, reservoir, and canals) in the project vicinity that are capable of generating a seiche.

3.7.3 Impact Analysis

3.7.3.1 Thresholds of Significance

The determinations of significance of project impacts are based on applicable policies, regulations, goals, and guidelines defined by the California Environmental Quality Act. Specifically, the project would be considered to have a significant effect on geology and soils if the effects exceed the significance criteria described below:

1. Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:
    - i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault. Refer to Division of Mines and Geology Special Publication 42.
    - ii. Strong seismic ground shaking.
    - iii. Seismic-related ground failure, including liquefaction.
    - iv. Landslides.
2. Result in substantial soil erosion or the loss of topsoil.
3. Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.
4. Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property.

5. Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

Each of these thresholds is discussed under Section 3.7.3.3, Impact Assessment, below.

3.7.3.2 Applicant-Proposed Measures

The applicant has identified and committed to implement the following applicant-proposed measures (APMs) as part of the proposed project to avoid or substantially lessen potentially significant impacts to geology and soils, to the extent feasible. The APMs, where applicable, are discussed in Section 3.7.3.3, Impact Assessment, below.

APM AIR-4: The applicant shall stabilize graded site surfaces upon completion of grading when subsequent development is delayed or expected to be delayed more than 14 days, except when such a delay is due to precipitation that dampens the disturbed surface sufficiently to eliminate visible fugitive dust emissions.

APM GEO-1: After construction completion, the BLM shall monitor disturbed areas where clearing, grubbing, and cut-and-fill shall be compacted once construction is complete for greater resistance to wind erosion.

APM GEO-2: During construction, facilities will be built in accordance with San Bernardino County and California State Building Code requirements applicable to "Seismic Zone 3." No human-occupied structures will be placed across the trace of a documented active fault. No human-occupied structure will be placed within 50 feet of the trace of an active fault or within a seismic special studies zone without a fault evaluation report, satisfactory to the State Geologist, demonstrating that no undue hazard would be created by the construction or placement of the structure.

APM GEO-3: Roads shall be constructed at grade to maintain existing drainage patterns during storm events. Unpaved access roads shall be constructed of compacted native soils. Rock or gravel may be added to unpaved roads for stabilization to prevent rutting or erosion.

APM GEO-4: The project stormwater pollution prevention plan or best management practices (BMP) plan required by Lahontan Regional Water Quality Control Board (RWQCB) for compliance with its General Permit R6T-2003-0004 and prepared consistent with its Project Guidelines for Erosion Control (Board Order No R6T-2003-0-04 Attachment G; Lahontan RWQCB 2003) shall be prepared and submitted to the BLM and County for review by a watershed specialist, hydrologist, and/or engineer from each lead agency before implementation. Reports shall be submitted 30 days prior to ground-disturbing activities. Erosion control and drainage plans for new and existing roads to be utilized for the project shall be aimed at maintaining to the greatest extent feasible existing soil quality and integrity. In developing the plan, the applicant or its contractor shall consult with the BLM and the County to determine the appropriate soil quality objective(s) to be met following construction (for temporary construction disturbances) and following decommissioning (for total site restoration). As part of the erosion control and drainage plans, the applicant and/or its contractor shall implement an appropriate combination of BMPs in order to meet or exceed the applicable soil quality objective(s) (e.g., maintain or enhance soil quality and function).

All measures and facilities for controlling runoff and erosion shall be in place prior to ground-disturbing activities. Desert tortoise fencing shall be installed consistent with APM BIO-28**,** which requires approved design to ensure a minimum impact to existing washes and to limit any substantial increase of erosion or sediment transport. Any desert tortoise fencing that creates substantial excess soil shall have straw wattles or other measures installed to prevent soil transport.

All erosion control facilities shall be monitored immediately following a qualified storm event. A major rainfall event is defined as one for which flow is visibly detectable within the fenced drainage. All repairs shall be completed prior to the commencement of ground disturbing activity. Any erosion control facilities that are damaged by rainfall shall be repaired within 72 hours of any damage and shall be monitored after any precipitation. Clearance reports and inspection logs shall be submitted to the BLM and the County. Substantial damage to erosion control facilities shall be reported to the BLM and the County and per the above, no ground disturbing activity shall restart until the facilities are repaired.

APM GEO-5: Prior to construction of project facilities, a qualified California-licensed geotechnical engineer shall prepare and submit to BLM a final geotechnical investigation that provides design requirements for foundations, retaining walls/shoring, and excavation, compliant with the applicable seismic design standards in the CBC. The scope of the geotechnical report shall include the solar array fields, collection line routes, substation and switchyard site, and the operation and maintenance buildings sites. The geotechnical investigation shall expand upon the preliminary investigations as necessary and identify and evaluate the presence of expansive, compressible, liquefiable, or mechanically unstable soils and, if present, shall make recommendations for site preparation or design necessary to avoid or reduce adverse structural impacts. Structural foundations shall not be founded on engineered fill, nor on native soil, unless it is demonstrated that the soils would be adequate to support the foundation. A California-licensed geotechnical engineer shall be retained by the applicant to be present on the project site during excavation, grading, and general site preparation activities to monitor the implementation of the recommendations specified in the geotechnical investigation. When/if needed, the geotechnical engineer shall provide structure-specific geologic and geotechnical recommendations that shall be documented in a report approved by the permitting agency.

APM GEO-6: Grading and other methods of ground disturbance in areas covered by desert pavement shall be avoided or minimized. If avoidance of these areas is not possible, the desert pavement surface shall be protected from damage or disturbance from construction vehicles by use of temporary mats on the surface. A Desert Pavement Identification, Avoidance, and Protection Plan shall be prepared and submitted to the BLM for review and approval at least 60 days prior to start of construction which shall include, at a minimum:

1. A preconstruction survey using accepted methodology to identify areas covered by desert pavement;
2. Identification of areas covered by desert pavement that can feasibly be avoided and methods for avoidance, such as through placement of project structures during final design, flagging and/or fencing areas of desert pavement for avoidance, and/or other measures;
3. Identification of areas covered by desert pavement that cannot feasibly be avoided and methods for protection, including at a minimum the use of temporary mats on the surface. Other methods may include restrictions on vehicle weight in addition to the use of mats.

APM HWQ-1: Prior to site mobilization, the applicant shall submit a Drainage, Erosion, and Sedimentation Control Plan (DESCP) to the CDFW and the BLM for managing stormwater during project construction and operations. The DESCP must ensure proper protection of water quality and soil resources, address exposed soil treatments in the solar fields for both road and non-road surfaces, and identify all monitoring and maintenance activities. The plan must also cover all linear project features such as the proposed generation-tie line.

The DESCP shall contain, at a minimum, the elements presented below that outline site management activities and erosion and sediment-control BMPs to be implemented during site mobilization, excavation, construction, and postconstruction (operating) activities.

Elements of the DESCP:

- Vicinity Map: A map(s), at a minimum scale of 1 inch to 500 feet, shall be provided indicating the location of all project elements with depictions of all significant geographic features including swales, storm drains, drainage concentration points, and sensitive areas.
- Site Delineation: All areas subject to soil disturbance for the proposed project shall be delineated showing boundary lines of all construction areas and the location of all existing and proposed structures and drainage facilities.
- Clearing and Grading Plans: The DESCP shall provide a delineation of all areas to be cleared of vegetation and areas to be preserved. The plan shall provide elevations, slopes, locations, and extent of all proposed grading as shown by contours, cross sections, or other means. The locations of any disposal areas, fills, or other special features shall also be shown. Existing and proposed topography shall be illustrated by tying in proposed contours with existing topography.
- Clearing and Grading Narrative: The DESCP shall include a table with the estimated quantities of material excavated or filled for the site and all project elements, whether such excavation or fill is temporary or permanent, and the amount of such material to be imported or exported.
- Erosion Control: The plan shall address exposed soil treatments to be used during construction and operation, including specifically identifying all chemical-based dust palliatives, soil bonding, and weighting agents appropriate for use that would not cause adverse effects to vegetation. BMPs shall include measures designed to prevent wind and water erosion, including the application of chemical dust palliatives after rough grading to limit water use.
- Best Management Practices Plan: The DESCP shall identify on the topographic site map(s) the location of the site-specific BMPs to be employed during each phase of construction (initial grading, project element excavation and construction, and final grading/stabilization). BMPs shall include measures designed to control dust, stabilize construction access roads and entrances, and control stormwater runoff and sediment transport.
- Best Management Practices Narrative: The DESCP shall show the location, timing, and maintenance schedule of all erosion- and sediment-control BMPs to be used before initial grading, during excavations and construction, final grading/stabilization, and operation. Separate BMP implementation schedules shall be provided for each project element for each phase of construction. The maintenance schedule shall include postconstruction maintenance of structural-control BMPs, or a statement provided about when such information would be available.

The DESCP shall be prepared, stamped, and sealed by a professional engineer or erosion control specialist. The DESCP shall include copies of recommendations, conditions, and provisions from CDFW and/or the BLM.

3.7.3.3 Impact Assessment

Impact GEO-1: Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:

i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42. (Less than Significant)

Southern California as a region, including the project site, is subject to the effects of seismic activity due to active faults that traverse the region. Active faults are defined as those that have experienced surface displacement within Holocene time (approximately the last 11,000 years) or are in a State-designated

Alquist-Priolo earthquake fault zone, or both. The type and magnitude of seismic hazards affecting the site depend on the distance to causative faults and on the intensity and magnitude of the seismic event.

The California Geological Survey Seismic Hazards Program does not map any Alquist-Priolo earthquake fault zones, or other substantial known faults, that pass through the project site (CDOC 2022). Although there are no mapped faults in the project site, it is possible that one or more faults exist beneath the sediments filling the valley. On the eastern edge of the project site, there is a short Quaternary fault west of and parallel to the Baker Fault. However, there is no indication from the latest fault activity maps that this fault segment poses a surface rupture risk (BLM and San Bernardino County 2015; USGS 2024). Operational activities involve periodic maintenance and inspections, and the likelihood of a newly discovered fault rupturing at a facility site while people are present is low.

All solar facilities, the gen-tie line, and associated structures would not be placed on or near a known active or potentially active fault zone. Implementation of APM GEO-2 would ensure that the project would lessen exposure of people or structures to adverse fault rupture effects, and impacts would be **less than significant.**

ii. Strong seismic ground shaking. (Less than Significant)

As discussed above under Item i, the potential exists for large magnitude earthquakes to result in seismically induced ground shaking within the project site and surrounding area. The intensity of such an event would depend on the fault and the distance to the epicenter, the moment magnitude, the duration of shaking, and the nature of the geologic materials in or on which the project components would be constructed. Intense ground shaking and high ground accelerations could affect the proposed facilities (e.g., solar panel arrays and support structures, substation and switchyard facilities, operation and maintenance facilities, and water supply lines). The primary and secondary effects of ground shaking could damage structural foundations and cause failure of concrete. During construction, damage to these features could cause temporary short-term delays in construction. During operations, damage to these features could cause temporary service disruption.

Modern standard engineering and construction practices include design criteria to mitigate potential damage from an earthquake. Based on preliminary geologic and geotechnical investigations, the applicant has incorporated recommended design measures and criteria to minimize risks associated with geologic and seismic hazards. These investigations and subsequent design measures relate to earthwork, foundation design, resistance to lateral loads, utility trenches, pavement thickness, and soil corrosion potential, and further design-level geotechnical analysis and review will occur as part of final project design. In addition, the administration building and other occupied parts of the facility site would be designed to withstand strong ground motion (BLM and San Bernardino County 2015).

Compliance with applicable building codes and implementation of APM GEO-2 would ensure that soil and ground instabilities would not have substantial adverse impacts on facilities or on-site workers. This would include the effects of seismic ground shaking. Building codes include requirements to design structures according to their SDC, as determined by the CBC, which provides specific building standards based on the level and intensity of expected ground motions, and the occupancy category of the structure. Because building codes and geotechnical seismic design parameters are primarily intended to avoid building collapse or substantial structural damage, a strong earthquake could still cause short-term damage to or toppling of unsecured equipment, which could result in injuries to workers. This would include the effects of seismic ground shaking. However, potential worker injuries would be anticipated to be minor, and facility damage would not be expected to be severe and could be later inspected and repaired or corrected. Implementation of APM GEO-2 and other recommended design criteria, i.e., incorporation of preliminary design recommendations (BLM and San Bernardino County 2015), and compliance with applicable construction and design requirements in the CBC and County codes would result in the effects of seismic ground shaking on facilities and workers being minor. Therefore, impacts would be **less than significant.**

iii. Seismic-related ground failure, including liquefaction. (Less than Significant)

Liquefaction is a loss of strength in soil when a stress, such as that caused by an earthquake, is applied to susceptible soils, such as loose, saturated sands and silts. These susceptible soils were not encountered during the preliminary geotechnical analysis, as groundwater within the project site is generally deeper than 150 bgs. Further, no designated or identified liquefaction, lateral spreading, or other ground failure zones have been identified across, or near, the project site (BLM and San Bernardino County 2015). Due to the lack of shallow groundwater and liquefaction-prone sediments, seismic-related ground failures are not expected in the project site. In addition, the San Bernardino County Geologic Hazard Overlay Map - Baker CIDIC (San Bernardino County 2007) shows no liquefaction areas on or near the project site.

The solar facilities, gen-tie line, access roads, and associated structures would be designed in compliance with state and local regulations and standards and established engineering procedures. In addition, the project's construction, operation, and decommissioning would not directly or indirectly cause substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground failure, including liquefaction. As a result, impacts would be **less than significant**.

iv. Landslides? (Less than Significant)

Non-seismically induced landslides can be caused by water from rainfall, landscaping, or other origins that infiltrate slopes with unstable material. Boulder-strewn hillsides can pose a boulder-rolling hazard from blasting or a gradual loosening of their contact with the surface. The predominantly flat, alluvial nature of the project site generally precludes any risk of or susceptibility to landslides. Additionally, no landslide hazards are identified on or near the project site on the San Bernardino County Geologic Hazards Overlay Map - Baker CIDIC (San Bernardino County 2007). Therefore, impacts associated with landslides are considered **less than significant**.

Impact GEO-2: Would the project result in substantial soil erosion or the loss of topsoil? (Less than Significant)

The occurrence of severe erosion is a function of the strength and competence of the earth materials and the presence of water, wind, and/or slope (gravity) that can dislodge and transport these materials. Most alluvial earth materials within the project site are moved by water in and near the desert washes, resulting in well-defined drainages with steep side slopes (BLM and San Bernardino County 2015).

CONSTRUCTION

Construction activities that could affect soil resources include excavation, grading, and soil compaction to prepare the site for installation of project components such as the solar panels and support structures, operation and maintenance facilities, new roads, and surface runoff controls. Ground-disturbing activities would have the potential to result in erosion, transport, and deposition of soil and/or surface sediments, particularly where desert pavement (a protective layer of pebble- to cobble-size material) or biological soil crusts are present. Disturbance of these protective ground covers could increase wind erosion rates by exposing the underlying layer of finer-grained material. Without protective measures, disturbance of desert pavement or biological soil crusts, or both, could cause a noticeable and possibly substantial increase in wind erosion rates during construction.

Fluvial erosion (i.e., from water) is only likely during storm events, whereas wind erosion would not necessarily be dependent upon seasonality or storm occurrence. Further, soil compaction and vegetation clearing may increase soil erosion through decreased infiltration rates and dislodging soil particles and can result in the loss of the soil pore spaces and oxygen necessary to support native plant growth. Construction activities also would result in soil compaction within linear corridors associated with new and realigned roads.

Without measures to avoid or minimize damage to soil function (e.g., due to soil compaction and rilling) during construction and operation of the project, and without plans to properly decommission disturbed areas (i.e., restoration and revegetation), soils within the project site could experience long-term, adverse impacts in specific areas through degradation of soil function and increased susceptibility to erosion. The sandy and gravelly soils throughout the project site are generally highly permeable and thus have a low susceptibility to erosion, particularly for the coarser soil types. However, certain areas where the soils contain a relatively high proportion of fine sands and silts could be particularly vulnerable to either fluvial or eolian erosion.

To reduce the potentially significant impact to soil erosion during project construction, the applicant would incorporate APM AIR-4, APM GEO-1, APM GEO-3, APM GEO-4, and APM HWQ-1 to avoid or substantially reduce the project's adverse impacts on soil resources. To ensure that APMs are reviewed and approved by BLM personnel and that proper BLM standards and guidance are used when developing erosion control and drainage plans, the applicant shall implement and APM GEO-6 to ensure that disturbance of desert pavement is minimized. Implementation of the APMs would avoid or substantially reduce adverse impacts to soil resource and impacts would be **less than significant.**

OPERATION AND MAINTENANCE

Following facility construction and installation, operation and maintenance activities would have minimal additional soil impacts. Maintenance activities would include inspecting, repairing, and maintaining the arrays and tracking systems and the supervisory control and data acquisition (SCADA) system; washing panels; and troubleshooting the collector lines and repairing damaged cables, which may necessitate some trenching. Additional maintenance would be required to maintain the administrative buildings, fencing and signage, roadways, and other ancillary facilities at the site. All these activities would take place within previously disturbed areas and would not require additional disturbances outside of the construction footprint analyzed for the construction phase. Implementation of APM AIR-4, APM GEO-1, APM GEO-3, APM GEO-4, and APM HWQ-1 would ensure that adverse impacts to soil resources are avoided or substantially reduced. Impacts would be **less than significant.**

DECOMMISSIONING AND RECLAMATION

As part of the decommissioning phase, the applicant would prepare and implement a site restoration plan addressing removal of structures, including solar photovoltaic blocks, and roads in conformance with BLM requirements. As part of this plan, the surface of the site would be restored to conform to approximate pre-project land uses, and the vegetation would be allowed to return to its natural condition without intervention. The site restoration plan also would address stabilization and revegetation of disturbed areas in conformance with BLM requirements.

Decommissioning of the project would have short-term, localized adverse impacts on soil resources while facilities are decommissioned, prior to site restoration. These impacts would be similar to, though less intense than, the construction-related impacts discussed above. To reduce the potentially significant impact to soil erosion during decommissioning, the applicant would incorporate APM AIR-4, APM GEO-1, and APM GEO-3 to avoid or substantially reduce the project's adverse impacts on soil resources. To ensure that APMs are reviewed and approved by BLM personnel and that proper BLM standards and guidance are used when developing erosion control and drainage plans, the applicant shall implement APM GEO-4 and APM GEO-6 to ensure that disturbance of desert pavement is minimized. Areas disturbed by the project would be returned to preconstruction conditions through minor grading and revegetation. Adverse impacts to soil resources during project site decommissioning and reclamation would thus be avoided or substantially reduced. Impacts would be **less than significant.**

Impact GEO-3: Would the project be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse? (Less than Significant)

As previously discussed, the solar facility site and gen-tie line are in an area that has a low landslide hazard due to the predominantly flat, alluvial nature of the project site and a low liquefaction/lateral spreading potential due to groundwater depths in excess of 50 feet. The San Bernardino County Geologic Hazards Overlay Map – Baker CIDIC (San Bernardino County 2007) does not identify landslide hazards or liquefaction areas on or near the project site. Additionally, because the groundwater depths are estimated to be 180 to 350 feet bgs, it is very unlikely that any subsidence would occur due to groundwater withdrawal from the valley.

Given the geologic setting, the project site is unlikely to become unstable and collapse as a result of these geologic hazards. According to an initial examination of available geologic and soil information, the project site is unlikely to be underlain or otherwise affected by unstable soil conditions. However, adverse soil conditions, if present, would be a threat only to project facilities and not to the public at large. Therefore, impacts would be **less than significant**.

Impact GEO-4: Would the project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property? (Less than Significant)

Soils on the project site and surrounding area are relatively coarse-grained and lack a significant clay fraction or thick accumulations of organic material. No expansive soils were identified by the geotechnical investigation and based on the nature of alluvial deposition, no expansive soils are expected (BLM and San Bernardino County 2015). As a result, the project would not create substantial risks to life or property associated with expansive soils. During the building permit application process, the BLM will verify that the type of construction proposed is consistent with the soils present on the proposed project site and that the recommendations found in the geotechnical report have been incorporated into the site design as required by APM GEO-5. Based on on-site conditions and development requirements outlined in the CBC, as well as the recommendations in the geotechnical report, impacts associated with expansive soils are considered **less than significant**.

Impact GEO-5: Would the project have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater? (Less than Significant)

Construction of the proposed project would require an average of 200 temporary workers daily on-site with an anticipated 300 temporary employees during peak construction activities. Decommissioning will require a similar number of temporary employees. Aboveground portable sanitary waste facilities would be used for these activities. Waste liquids would be removed by qualified waste disposal contractors and disposed of in accordance with all applicable regulations and codes. No septic or alternative wastewater disposal systems are proposed for use during project operation. Therefore, impacts would be **less than significant**.

3.7.4 Mitigation Measures

No mitigation measures are required.

3.7.5 Cumulative Impacts

Impact C-GEO-1: Would the impacts of the proposed project, in combination with other past, present, and reasonably foreseeable future projects, contribute to a cumulative impact related to geology and soils? (Less than Significant)

Loss of soil through erosion, land subsidence due to groundwater withdrawals, and soil instability caused by construction and operation of a project are impacts that can cumulatively affect soil and geologic resources in combination with other past, present, and reasonably foreseeable future actions in a given area. These potential cumulative impacts would apply to the construction, operation, maintenance, and decommissioning phases of the proposed project. All other geology and soils issues (such as strong seismic ground shaking, seismically induced ground failure, collapsible soils, and expansive soils) relate to local, site-specific soil conditions, ground response to earthquakes, and the potential for adverse soil conditions to damage the project's structural components. The presence of other projects in the cumulative scenario would have no effect on either the severity or the probability of geotechnical challenges associated with seismicity and/or the character of underlying soils. Such issues are site-specific and unaffected by the presence of other projects in the cumulative scenario. Therefore, only potential soil erosion and land subsidence are analyzed in this discussion.

Projects located in the same watershed as the proposed project could contribute to cumulative soil erosion or land subsidence impacts. The greatest potential for cumulative impacts with respect to soil erosion would occur if either the construction or decommissioning phases of the cumulative projects were to happen concurrently with the project. However, the operation and maintenance phase of the cumulative projects is included in this analysis because minor alterations in topography and the addition of impervious surfaces could combine to cause or contribute to cumulative impacts. For land subsidence, applicable potential cumulative projects include all projects that would draw groundwater from the same aquifer. The scope of impacts would include all phases of the project because some level of groundwater typically is needed for construction and decommissioning activities (e.g., dust suppression) and operation and maintenance needs (e.g., panel washing and water service for operation and maintenance buildings). In the Cumulative Impact Analysis, discussed in Chapter 3, Environmental Impacts Analysis, a 50-mile radius was evaluated (see Table 3-1 and Figure 3-1 for the list of existing and reasonably foreseeable projects in the region). The I-15 Mojave Wildlife Crossings Restoration project would be within 1 mile of the boundary of the project site and could therefore combine with the proposed project and result in a cumulative considerable impact. Several other utility-scale solar development projects are proposed within 50 miles of the proposed project. There are not any cumulative projects that would be constructed in the same watershed and add impervious surfaces that could combine to cause or contribute to cumulative impacts to geology and soils.

Land subsidence could occur either at the project site or a neighboring project site if the amount of groundwater use associated with these projects results in a lowering of the groundwater levels sufficient to result in ground subsidence. As discussed in Section 3.10, Hydrology and Water Quality, a groundwater model was completed to support the analysis for groundwater supply and drawdown. Water basins that could be affected by the proposed project or an action alternative were identified in this report. The only cumulative projects that cross these basins is the I-15 Mojave Wildlife Crossings Restoration Project, which does not propose to disturb geology and soils on the project site. The amount of groundwater drawdown therefore would be determined solely by the proposed project, which is not expected to cause subsidence during construction or operation. Therefore, the project's cumulative contribution to subsidence would be considered **less than significant.**

3.7.6 Laws, Ordinances, Regulations, and Standards

Federal, state, and local Laws, Ordinances, Regulations, and Standards (LORS) applicable to geology, soils, and paleontological resources are discussed and summarized in Table 3.7-2.

Table 3.7-2. Laws, Ordinances, Regulations, and Standards

LORS	Administering Agency	Applicability	Compliance
NRCS (1983), National Engineering Handbook, Sections 2 and 3	NRCS	Standards for soil conservation (estimating runoff volume/peak discharge and sedimentation)	Section 3.7.3.2, 3.7.3.3, 3.10.3.2, 3.10.3.3
Clean Water Act	Lahontan Regional Water Quality Control Board	Regulates stormwater and non-stormwater discharges from construction and industrial activities	Section 3.7.3.2, 3.7.3.3, 3.10.3.2, 3.10.3.3
Porter-Cologne Water Quality Control Act	Lahontan Regional Water Quality Control Board	Regulates discharges of waste to state waters and land	Section 3.7.3.2, 3.7.3.3, 3.10.3.2, 3.10.3.3
Table 18-1-B of the Uniform Building Code (International Code Council, 1994)	California Building Standards Commission	Sets standards for defining expansive soils	Section 3.7.3.2, 3.7.3.3
California Building Code, 2022	California Building Standards Commission, State of California	Acceptable design criteria for structures with respect to seismic design and load-bearing capacity	Section 3.7.3.2, 3.7.3.3
Alquist-Priolo Earthquake Fault Zone Act (Title 14, Division 2, Chapter 8, Subchapter 1, Article 3, CCR)	California Building Standards Commission, State of California	Identifies areas subject to surface rupture from surface faults.	Section 3.7.3.2, 3.7.3.3, 3.9.3.2, 3.9.3.3
The Seismic Hazards Mapping Act (Title 14, Division 2, Chapter 8, Subchapter 1, Article 10, CCR)	California Building Standards Commission, State of California	Identifies secondary seismic hazards (liquefaction and seismically induced landslides)	Section 3.7.3.2, 3.7.3.3, 3.9.3.2, 3.9.3.3
County of San Bernardino General Plan	County of San Bernardino Planning Division	Identifies geological hazards and resource areas in the County and provides related goals and policies for development	Section 3.7.3.2, 3.9.3.2
County of San Bernardino Municipal Code	County of San Bernardino Building Division	Standards for grading and water quality, including permit requirements	Section 3.7.3.2, 3.9.3.2

3.7.7 Agencies Contacted and Permits

A list of agencies that were contacted during preparation of this application is provided in Appendix V, Table 2-1. Permits Required for Soda Mountain Solar Project. Federal, state, and local permits applicable to geology and soils are also summarized in Appendix V, Table 2-1 and below in Table 3.7-3.

Table 3.7-3. Permits Required

Regulatory Agency	Permit Required	Agency Contact	Schedule
Lahontan Regional Water Quality Control Board	Construction General Permit Waste Discharge Requirements	Tiffany Steinert, Engineering Geologist 15095 Amargosa Road, Building 2, Suite 210, Victorville, CA 92394 760-241-7305 tiffany.steinert@waterboards.ca.gov	Concurrent with CEC Opt-In Application

Lahontan Regional Water Quality Control Board	Clean Water Act Section 401 Permit	Lisa Horowitz McCann, Environmental Program Manager 1515 Clay Street, Suite 1400, Oakland, CA 94612 916-323-0884 lisa.mccann@waterboards.ca.gov	Concurrent with CEC Opt-In Application

Pursuant to Assembly Bill 205 subsection 25545.1(b)(1), the CEC retains exclusive authority over permitting and supersedes any applicable local statute, ordinance, or regulation. However, the Applicant and CEC would collaborate with the County of San Bernardino on review of this Opt-in Application to ensure compliance with County rules and regulations.

3.7.8 References Cited

Bedrossian, T.L., S. McCrea, M.A. Myers, and S. Utley. 2012. Geologic compilation of Quaternary surficial deposits in Southern California Soda Mountains 30' × 60' Quadrangle. 2012 Revision. California Geological Survey Special Report 217 Plate 25. Available at: https://www.conservation.ca.gov/cgs/publications/sr217. Accessed April 2024.

Bureau of Land Management (BLM). 2016a. *Land Use Plan Amendment Desert Renewable Energy Conservation Plan*. Available at: https://eplanning.blm.gov/public_projects/lup/66459/133474/163144/DRECP_BLM_LUPA.pdf. Accessed January 2024.

BLM and San Bernardino County. 2015. *Soda Mountain Solar Project Proposed Plan Amendment/Final Environmental Impact Statement/Environmental Impact Report*. Available at: https://eplanning.blm.gov/public_projects/nepa/66043/80113/93126/Vol_1_SodaMtn_PA-FEIS-EIR_508.pdf. Accessed January 2024.

California Department of Conservation (CDOC). 2021. Earthquake zones of required investigation. Available at: https://maps.conservation.ca.gov/cgs/EQZApp/app/. Accessed January 2024.

———. 2022. CGS Seismic Hazards Program: Alquist-Priolo Fault Hazard Zones. Available at: https://gis.data.ca.gov/maps/ee92a5f9f4ee4ec5aa731d3245ed9f53/explore?location=35.037546%2C-116.245686%2C9.96. Accessed January 2024.

———. 2023. Landslides. Available at: https://www.conservation.ca.gov/cgs/landslides#landslidemaps. Accessed January 2024.

———. 2024. California Tsunami Maps. Available at: https://www.conservation.ca.gov/cgs/tsunami/maps. Accessed January 2024.

California Geological Survey (CGS). 2002. *California Geomorphic Provinces*, Note 36. Available at: https://www.conservation.ca.gov/cgs/Documents/Publications/CGS-Notes/CGS-Note-36.pdf. Accessed January 2024.

———. 2008. *Guidelines for Evaluating and Mitigating Seismic Hazards in California*, Special Publication 117A. Available at: https://www.conservation.ca.gov/cgs/Documents/Publications/Special-Publications/SP_117a.pdf. Accessed January 2024.

Diaz Yourman & Associates (DYA). 2010. Preliminary Geotechnical Investigation (Phase 1A) Caithness Soda Mountain Solar Facility Project, Baker, San Bernardino County, California. December 7, 2010.

Jennings, C.W., J.L. Burnett, and B.W. Troxel. 1962. Geologic map of California: Trona Sheet. California Division of Mines and Geology, scale 1:250,000. Available at: https://www.conservation.ca.gov/cgs/Documents/Publications/Geologic-Atlas-Maps/GAM_23-Trona-1962-Map.pdf. Accessed January 2024.

Lahontan Regional Water Quality Control Board (RWQCB). 2003. Lahontan Region Project Guidelines for Erosion Control. Available at: https://www.waterboards.ca.gov/lahontan/board_decisions/adopted_orders/2003/docs/r6t-2003-0004_small_const_wdr.pdf. Accessed June 2023.

Natural Resources Conservation Service (NRCS). 2023a. Web soil survey. Produced by the National Cooperative Soil Survey. Available at: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx. Accessed January 2024.

———. 2023b. Official soil series descriptions. Available at: http://soils.usda.gov/technical/classification/osd/. Accessed January 2024.

San Bernardino County. 2022. Multi-Jurisdictional Hazard Mitigation Plan. Available at: https://www.sbcounty.gov/uploads/SBCFire/documents/EmergencyServices/Hazard-Mitigation-Plan-202212.pdf. Accessed June 2024.

———. 2024a. Countywide Plan. Available at: https://lus.sbcounty.gov/planning-home/general-plan/. Accessed January 2024.

———. 2024b. About the Policy Plan. Available at: https://countywideplan.com/policy-plan/. Accessed June 2024.

———. 2007. San Bernardino County Land Use Plan General Plan Geologic Hazard Overlays - Baker CIDIC. Available at: https://www.sbcounty.gov/Uploads/lus/GeoHazMaps/CIDIC.pdf. Accessed June 2024.

SWCA Environmental Consultants (SWCA). 2024. *Paleontological Resources Technical Report.* SWCA Environmental Consultants. Pasadena, California.

U.S. Geological Survey (USGS). 2024. U.S. Quaternary faults. Available at: https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=5a6038b3a1684561a9b0aadf88412fcf. Accessed January 2024.

Walker, J.D., A.K. Berry, P.J. Davis, J.E. Andrew, and J.M. Mitsdarfer. 2002. Geologic map of northern Mojave Desert and southwestern Basin and Range, California: compilation and methods. *Geological Society of America Memoir* 195:295–296. Accessed January 2024.