4.6 GEOLOGY AND SOILS

4.6.1 Environmental Setting

Geology and Physiography

Physiography and Topography
The proposed project area is located in the Peninsular Ranges geomorphic province, which consists of a series of mountain ranges with summits that generally decrease in elevation to the west. The ranges are separated by northwest-trending valleys that are subparallel to faults branching from the San Andreas Fault. The San Diego County region generally is characterized by foothills ranging in elevation from 600 feet amsl to 2,000 feet amsl (County of San Diego 2011). The main topographic features are rolling uplands interspersed by narrow, winding valleys traversed by rivers and intermittent drainages extending to the west from the topographic highlands (Geosyntec 2012).

The project area is located within the coastal margin in the western portion of the province, about 11 miles east of the Pacific Ocean. The proposed substation site is relatively undisturbed and consists of gentle to moderately sloping hillsides that slope to the west, south, and east toward a natural drainage system downslope of the site. The transmission corridor is characterized by relatively flat to gently sloping terrain with steeper terrain and ridge tops more prevalent in the northern portion of the corridor, in the area around Mountain Miguel Road, just south of Miguel Substation. Elevations at the proposed substation site range from approximately 440 to 500 feet amsl, and elevations at Miguel Substation range from approximately 300 to 485 feet amsl. Elevations along the transmission corridor range from approximately 500 feet amsl to slightly above 600 feet amsl.

Drainage along most of the transmission corridor is to the west or southwest toward San Diego Bay. The southern portion of the corridor near the proposed substation site drains to the southeast toward Salt Creek and Lower Otay Lake.

Geologic Setting and Units
Low-lying coastal terraces in the project region are underlain by Quaternary (geologic age of 2.6 million years before present or less), Tertiary (65 to 2.6 million years before present), and late Cretaceous (145 to 65 million years before present) sedimentary rocks. The project area is underlain by Quaternary and Tertiary geologic units consisting of fill, topsoil, alluvium, colluvium, slopewash deposits, Tertiary Otay Formation, and Jurassic to Cretaceous Santiago Peak Volcanics at depth (Geosyntec 2012). The Tertiary Mission Valley Formation and Sweetwater Formation have been locally observed within the project area. Figures 4.6-1 and 4.6-2 show the geologic units in the project area. The main geologic units in the project area are described in Table 4.6-1, from surface deposits downward (Geosyntec 2012).

Figure 4.6-1 Geologic Units in the Project Area (1 of 2)

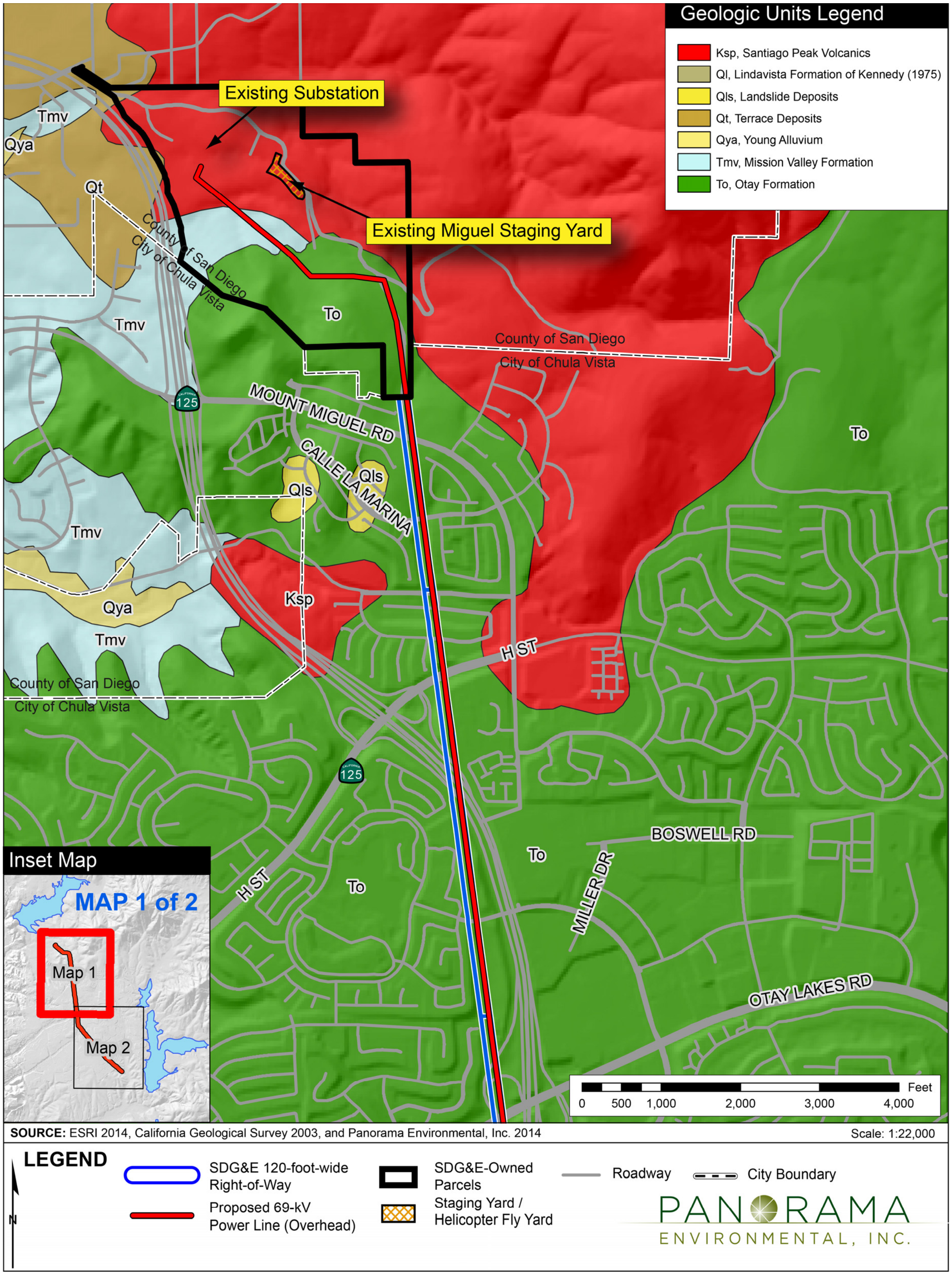


Figure 4.6-2 Geologic Units in the Project Area (2 of 2)

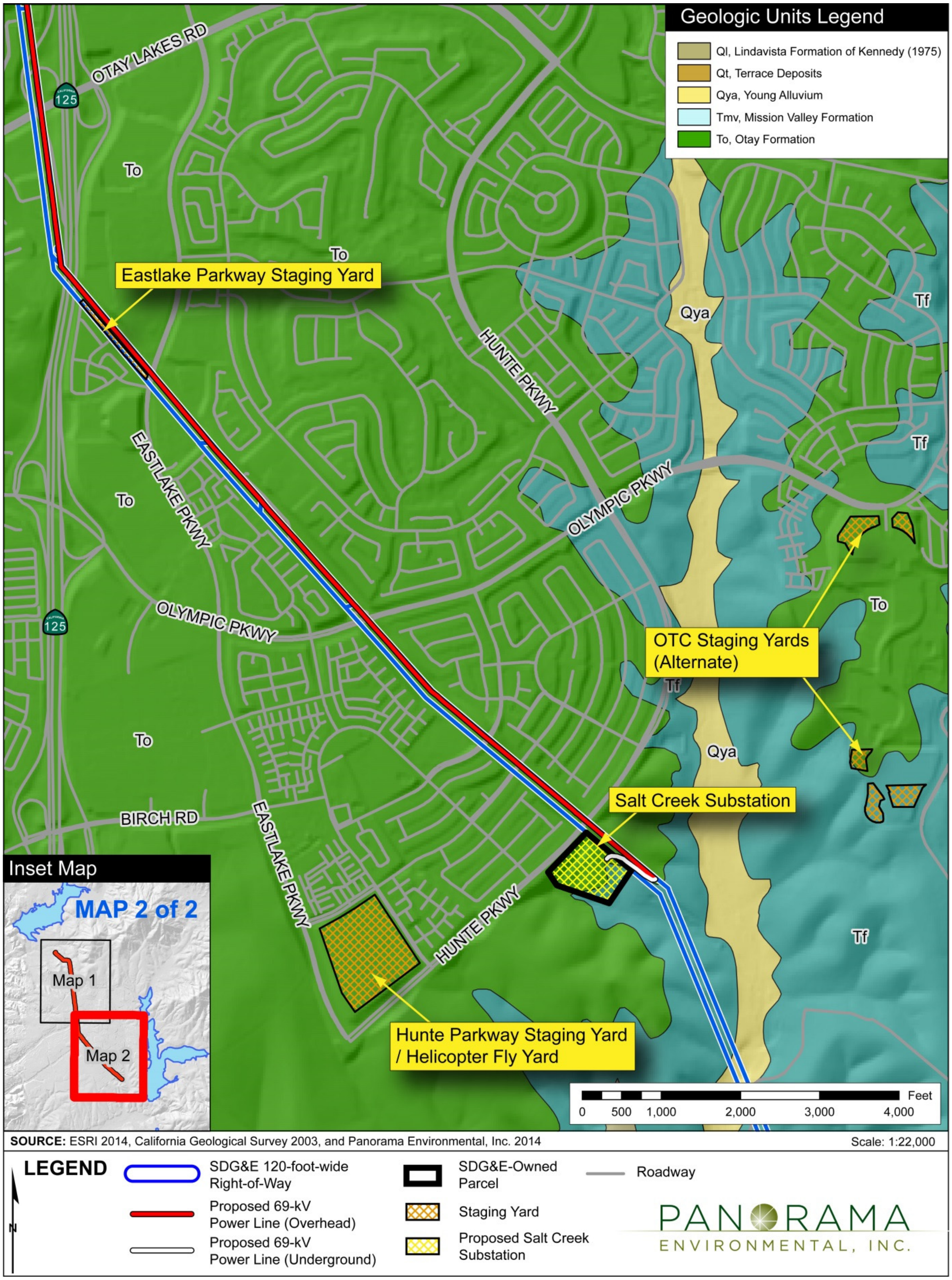


Table 4.6-1 Geologic Units in the Project Area

Age	Formation	Description
Quaternary	Surface Deposits	Surface deposits consist of undocumented fill, topsoil, alluvium, colluvium, and slopewash deposits. Sediments generally consist of coarse-grained materials (sands) with varying amounts of gravel and fine-grained materials (clays and silts). The deposits generally are dense and also include locally cemented zones and sandy to clayey siltstones. These deposits overlie portions of the Otay Formation in the vicinity of the Otay River basin.
Tertiary	Mission Valley Formation	This unit consists of interbedded claystone and siltstone, with various amounts of cementation. The unit was encountered near the northern extent of the transmission corridor.
Tertiary	Otay Formation	The Otay Formation consists of dense to very dense, silty, fine- to medium-grained sandstone with some siltstone, claystone, and conglomerate interbeds along the transmission corridor. The unit consists of dense, weakly cemented, highly weathered, coarse-grained clayey and silty sandstone with a minor gravel component at the proposed substation site. The Otay Formation underlays the majority of the transmission corridor and most of the proposed substation site.
Tertiary	Sweetwater Formation	The Sweetwater Formation was encountered during the 2005 URS investigation and the 1981 Woodward-Clyde Consultants investigation referenced in the Geosyntec (2012) report. It was described as a hard clay that contains variable amounts of cobbles and/or boulders.
Cretaceous-Jurassic	Santiago Peak Volcanics	This unit includes volcanic and low-grade metasedimentary rocks that are moderately strong to strong, intensely to slightly weathered, and moderately to slightly jointed. Santiago Peak Volcanics were not encountered during any geotechnical explorations performed for the proposed project.

Sources: Kleinfelder 2008 and Geosyntec 2012

Soil Types and Hazards

NRCS Soil Types

The U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) has mapped soils in the project area (NRCS 2013). The majority of the soils in the area consist of clays, cobbly loams, and rocky silty loams, with minor amounts of loams and clay loams. The majority of the transmission corridor and most of the Miguel Substation area is underlain by Diablo clay. The proposed substation area is dominated by Diablo-Olivenhain complex soils, and the northern portion of the transmission corridor, from just north of H Street, is underlain by rocky silt loams of the San Miguel-Exchequer series. A summary of the properties of the major soil types in the project corridor, as mapped by NRCS, is presented in Table 4.6-2. Maps of the major NRCS soil units in the project area are presented as Figures 4.6-3 and 4.6-4.

Table 4.6-2 Soils in the Project Area

Soil Series	Description	Acreage of Project Area[1]	Slopes (percent)	Runoff Rate	Shrink-swell Potential	Erosion Potential
Diablo clay	Forms in residuum weathered from shale, sandstone, and consolidated sediments with minor areas of tuffaceous material (derived from volcanic ash); found on complex undulating, rolling to steep uplands	37.8 126.6 50.7 1.3	2 to 9 9 to 15 15 to 30 15 to 30, eroded	Slow runoff when dry, medium to rapid when soils are moist	High due to smectitic[2] clay content	Slight to moderate
Diablo-Olivenhain complex	Diablo: see above Olivenhain: alluvium found on gently to strongly sloping terrain and on dissected marine terraces	24.7	9 to 30	Slow to medium	Moderate to high depending on Diablo content	Slight to severe
Huerhuero loam	Clay and clay loam derived from marine sediments; found on marine terraces	2.7	15 to 30, eroded	Slow to medium	High	Severe
Linne clay loam	Forms from soft shale and sandstone; found on mountainous uplands and foothills	6.0 1.5	9 to 30 30 to 50	Medium to very rapid	Moderate	Moderate to severe
Olivenhain cobbly loam	Alluvium found on gently to strongly sloping terrain and on dissected marine terraces	4.4 26.0	2 to 9 9 to 30	Slow to medium	Moderate	Severe
Salinas clay loam	Forms in alluvium weathered from sandstone and shale; found on alluvial plains, fans, and terraces	2.5	2 to 9	Slow to medium	Moderate	Moderate
San Miguel-Exchequer rocky silt loams	San Miguel: forms in residuum weathered from metavolcanic rocks; found in mountainous areas Exchequer: forms in residuum from hard andesitic breccia, schist, and metamorphosed volcanic rocks; found on undulating to steep uplands	44.1	9 to 70	Medium to very rapid	San Miguel: Moderate to high due to smectitic clay content Exchequer: low	Severe

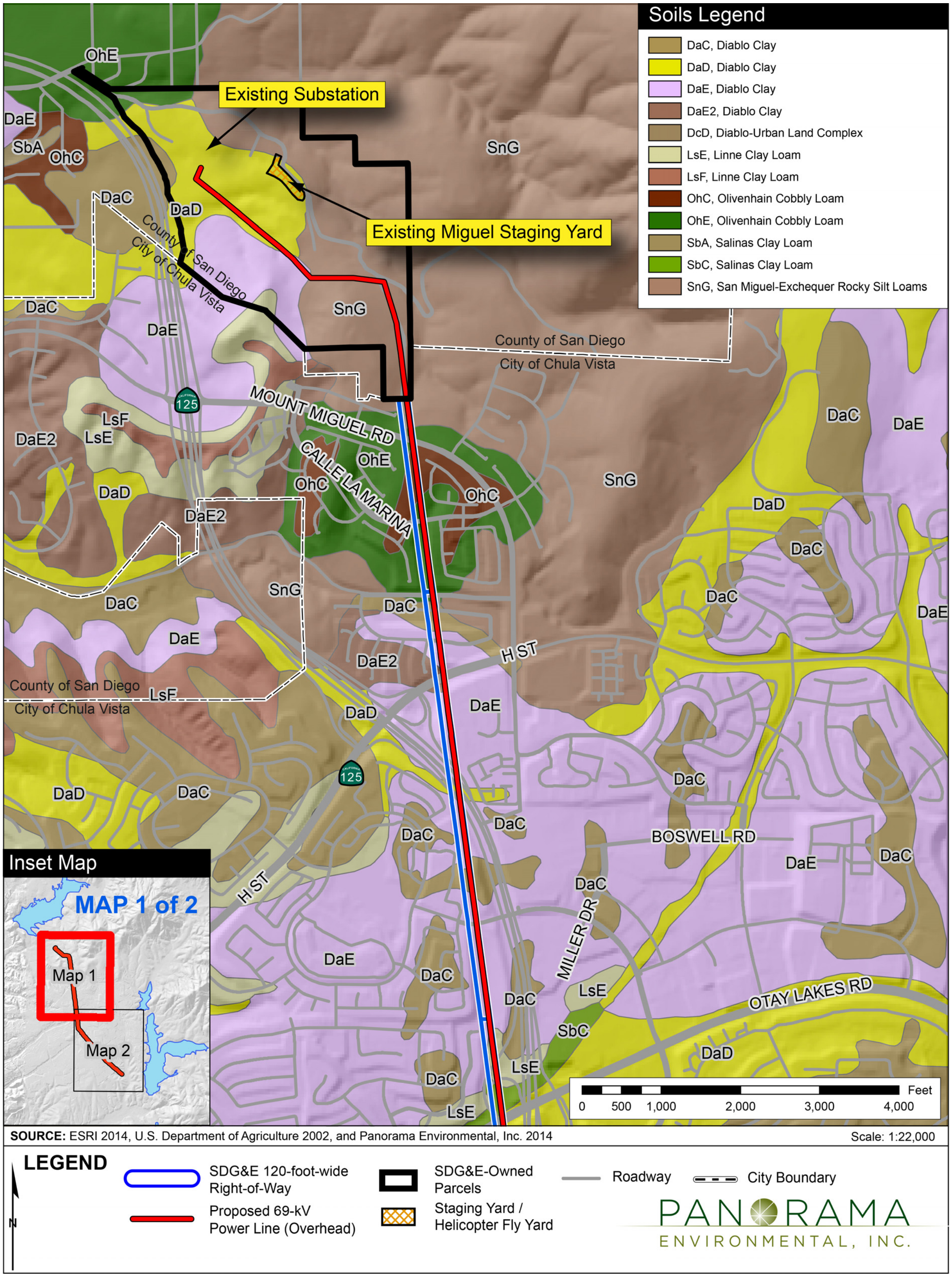
Notes:

1 For the purpose of the soils data, project area refers to the land occupied by project components, in addition to a 100-foot-wide buffer, with the exception of the transmission line alignment, which has a 150-foot-wide buffer on either side of the alignment.

2 Smectite is a swelling clay. Soils containing smectite have increased potential for shrinking and swelling. See discussion under Expansive and Collapsible Soils for additional details.

Source: NRCS 2013

Figure 4.6-3 Soil Units in the Project Area (1 of 2)

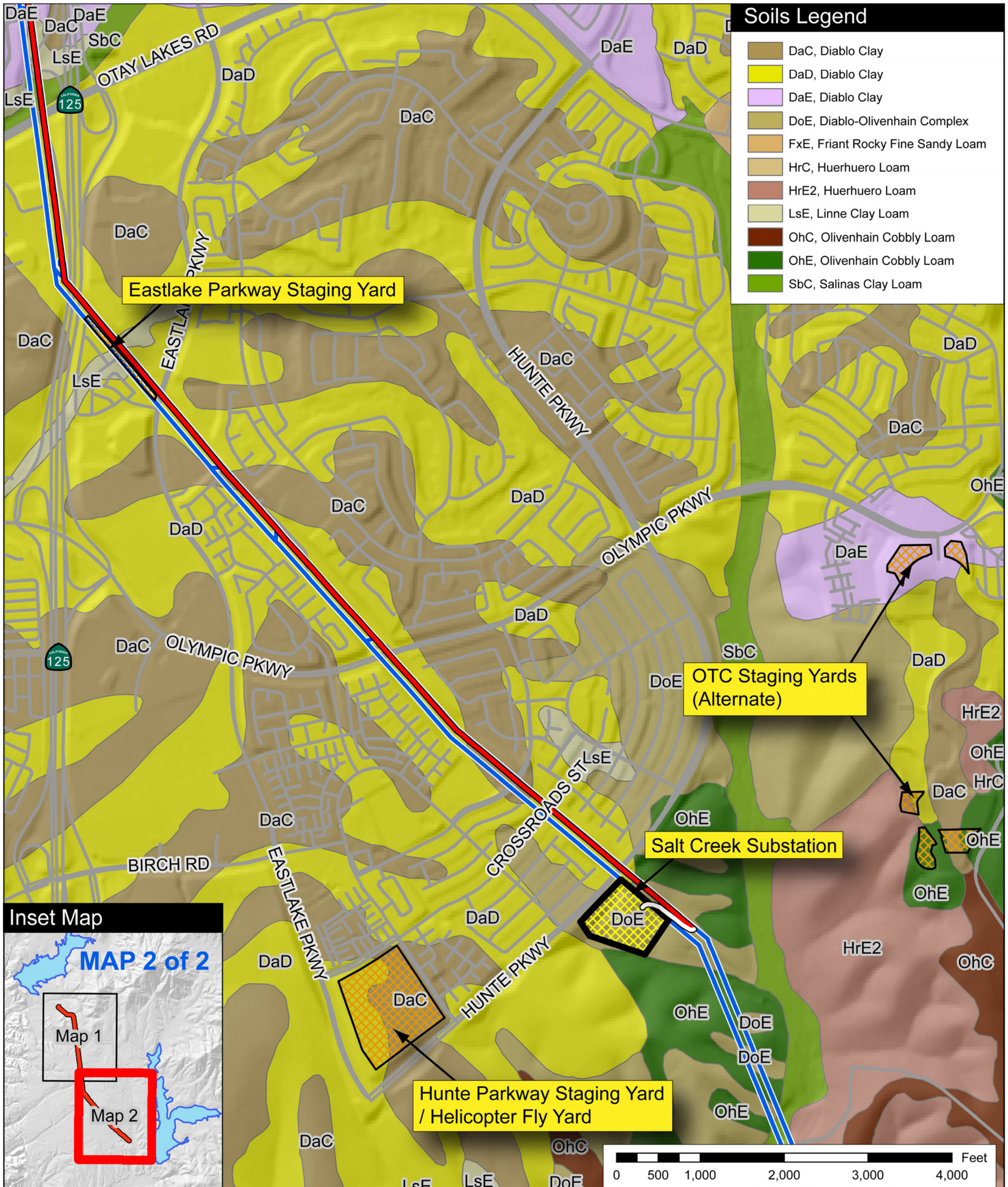


SOURCE: ESRI 2014, U.S. Department of Agriculture 2002, and Panorama Environmental, Inc. 2014

Scale: 1:22,000

PANORAMA ENVIRONMENTAL, INC.

Figure 4.6-4 Soil Units in the Project Area (2 of 2)



SOURCE: ESRI 2014, U.S. Department of Agriculture 2002, and Panorama Environmental, Inc. 2014

Scale: 1:22,000

On-site Soils

Soils classified as topsoil, alluvium, colluvium, slopewash, and residual soils[1] were observed in the shallow subsurface within natural drainages and mantling (covering) sloped areas along the transmission corridor (Geosyntec 2012). Composition and strength of these materials is variable depending on age, geologic parent material, and mode of deposition. Topsoil/colluvium was observed in all borings and test pits excavated at the proposed substation site, with the exception of a boring located within the existing access road (Kleinfelder 2008). Topsoil/colluvium was present from ground surface to depths of up to approximately 10 feet bgs, with deeper occurrences associated with areas located further downslope.

Fill was also observed in subsurface soils recovered during the geotechnical investigations performed at the proposed substation site and along the transmission corridor (Kleinfelder 2008; Geosyntec 2012). The fill is generally loose and consists of silty sand with cobbles and gravels. Fill materials present along portions of the access roads are clays primarily associated with construction of Hunte Parkway. Clay-rich fill was not observed at the proposed substation site.

Expansive and Collapsible Soils

Expansive soils contain large amounts of clays that expand when wetted and cause damage to foundations if moisture collects beneath structures (e.g., settlement, structure heave, or slab-on-grade foundation shifting). Wetting can occur as a result of precipitation, a rise in the water table, irrigation water application, water line leakage, and other factors. Damage from expansive soils also occurs when the soils dry out and contract.

The majority of the project area is underlain by soils of the Diablo clay series and the San Miguel-Exchequer series, both of which have a smectitic clay component (NRCS 2013). Smectitic clays are expansive. A topsoil sample collected during the geotechnical investigation of the proposed substation site was tested for expansion (Kleinfelder 2008). The expansion index (EI) was determined to be 46, which is classified in the medium expansion range (i.e., less than 50 EI), with the potential for high expansion in some areas. No EI testing was performed for soils along the transmission corridor. An approximation of soil swelling can be made by using the Atterberg limits determined by geotechnical testing. Based on these data presented in the Geosyntec (2012) report, the transmission corridor soil samples have a moderate potential for expansion. The Otay Formation, which underlies topsoil/colluvium over the majority of the proposed substation site, has low expansion potential due to its granular nature.

Soil collapse occurs when increased moisture weakens chemical or physical bonds between soil particles, which allows the soil structure to collapse and the ground surface to subside. Collapsible soils occur as relatively dry alluvial fan, colluvium, and wind-blown deposits. They

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[1] Residual soils are formed in place and are weathered from the bedrock immediately beneath.

typically consist of silt and sand, with minor amounts of clay. Collapsible soil deposits are not anticipated to be present in the project area (Geosyntec 2012).

Erosion

Erosion is the process by which rocks, soil, and other land materials are abraded or worn away from the Earth's surface over time by physical forces such as rainfall, flowing water, wind, or anthropogenic agents. The erosion rate depends on factors such as soil type, geologic parent material, slope, soil placement, vegetation, and human activity. Erosion potential generally is higher in areas with steep slopes and on granular soils. Erosion potential also increases when vegetation is removed and soils are compacted. The erosion potential in the project corridor is variable, with the majority of soils underlying the project area ranging from low to moderate erosion potential.

Subsidence

Subsidence is the deep-seated settlement of soils due to mining, dissolution of subsurface carbonate rocks, or fluid withdrawal (oil, natural gas, or groundwater). Subsidence also can be caused by consolidation, hydrocompaction, oxidation or dewatering of organic-rich soils, and, more rarely, tectonic down-warping during earthquakes. Soils in San Diego County are mostly granitic and, therefore, have a low potential for subsidence. Subsidence presents a minor threat to limited parts of San Diego County, and there is no historical record of subsidence in the region (County of San Diego 2010).

Landslides

A landslide is the slipping down or flowing of a mass of land (rock, soil, and debris) from a mountain or hill. Landslide potential is high in steeply sloped areas underlain by alluvial soils, highly weathered material, thinly bedded shale, or bedrock where the bedding planes are oriented in an out-of-slope direction (i.e., bedding plane angles that are greater than horizontal, but less than the slope face) or with fracture planes. Landslides can be caused by human activities and natural events (e.g., earthquakes, rainfall, and erosion).

The project area is not located within a landslide hazard area, defined by the City of Chula Vista as "areas containing active landslide-prone terrain." The project area does not include any mapped landslides (City of Chula Vista 2005). The closest landslide hazard areas are located south of the project area, southwest of the Lower Otay Reservoir, along the Otay River. Earthquakes can, however, result in rockfalls and/or instability on sloping terrain. The slopes most susceptible to earthquake-induced failure are those composed of highly weathered and unconsolidated materials that are moderately steep to steep.

Several formations within the project region, including the Otay Formation, are particularly prone to landslides. Otay Formation deposits within the project area are landslide-prone, and portions of Miguel Substation previously were identified as being underlain by landslide deposits or possible landslides (Geosyntec 2012). Additionally, Location 24 is adjacent to a descending slope with an inclination of approximately 2:1 (horizontal to vertical). Landslides have been mapped west of the proposed alignment just south of Mountain Miguel Road (Qls units on Figure 4.6-1). Geosyntec (2012) did not identify any landslides or other landslide factors within the proposed project area, based on review of the geologic maps and aerial photographs. The risk of slope movement associated with landslides along the transmission corridor is considered low (Geosyntec 2012).

Faults and Seismicity

Faults

Faults are fractures or lines of weakness in the Earth's crust. Sudden movement along a fault generates an earthquake. The project area is located in a seismically active region that is traversed by several major faults.

The Alquist-Priolo Earthquake Fault Zoning Act (A-P Act) designates Earthquake Fault Zones based on the presence of an active fault. The California Geologic Survey (CGS) has developed criteria to classify fault activity for the A-P Act. By definition, an active fault is one "sufficiently active and well-defined," with evidence of surface displacement within Holocene time (about the last 11,000 years) (Hart and Bryant 2007). A potentially active fault displaces Quaternary deposits (last 1.6 million years). Potentially active faults also represent possible surface rupture hazards, although to a lesser degree. In contrast to active or potentially active faults, faults considered inactive have not moved in the last 1.6 million years. There are no A-P zoned faults in the project area (CGS 2014).

There are a number of active and potentially active major regional fault systems within and adjacent to San Diego County (Jennings 2010). Table 4.6-3 lists the approximate distance of the active fault systems nearest to the project area, as well as known maximum value of magnitude (Mw_{max}) and slip rate. Fault locations are illustrated on Figure 4.6-5. No active or potentially active faults underlie the project area.

Table 4.6-3 Major Active Faults in the Project Region

Fault Name	Distance and Direction from Site[1]	Maximum Moment Magnitude[2]	Slip Rate (millimeters/year)
Rose Canyon	9.3 miles northwest	7.2	1.5
Coronado Bank-Palos Verdes	17.4 miles west	7.3	3.0
San Diego Trough	35 miles west	Data not available	Data not available
Elsinore (Julian segment)	45.9 miles northeast	7.1	5.0
San Jacinto (Coyote Creek segment)	47.8 miles northeast	6.8	4.0
San Clemente	59 miles west	Data not available	Data not available

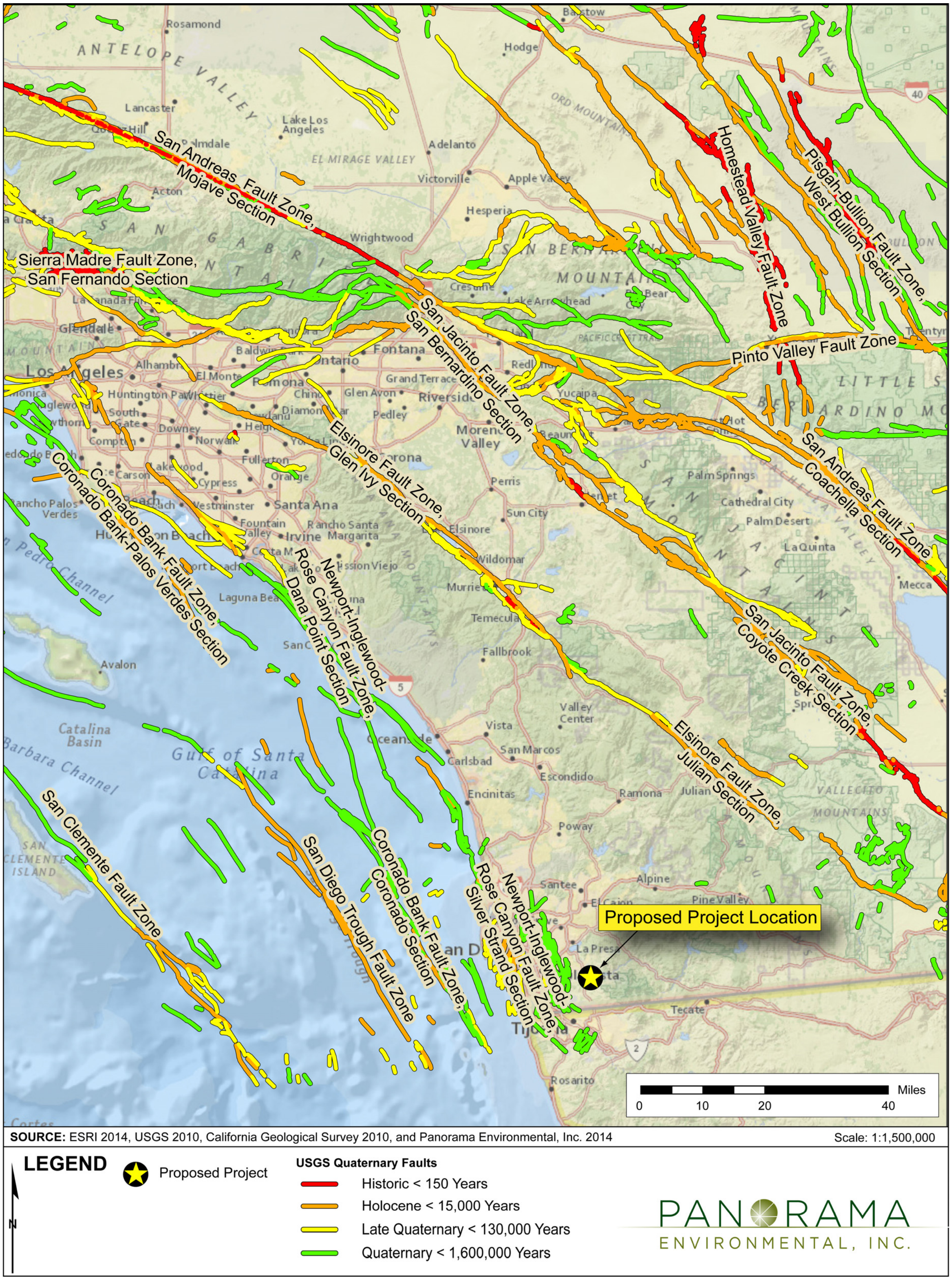
Notes:

1 Distances are closest distance to surface trace or inferred projection of fault as depicted by CGS.

2 Maximum moment magnitude values reported by CGS OFR 96-08 Appendix A, revised 2002.

Sources: 2007 WGCEP 2008; Cao, Bryant, Rowshandel, Branum, and Wills 2003; and Geosyntec 2012

Figure 4.6-5 Major Faults in the Project Region



The Rose Canyon fault is the active fault closest to the project area (CGS 2010), located approximately 9.3 miles to the northwest. It trends northwest, generally parallel to the transmission corridor (Figure 4.6-5). The potentially active La Nacion, San Ysidro, and Chula Vista fault zones are located within 10 miles of the project area.

Type A faults can produce large-magnitude (M) seismic events ($M \geq 7.0$) and have a high rate of seismic activity. Type C faults are not capable of producing large-magnitude events ($M \geq 7.0$) and have a relatively low rate of seismic activity. Type B faults are all other faults (not Type A or Type C). Segments of the San Jacinto and Elsinore fault zones are Type A. The majority of the other faults in the San Diego area are Type B including the Rose Canyon Fault zone.

The 2007 Working Group on California Earthquake Probabilities (2007 WGCEP 2008) has provided estimates of occurrence of a magnitude 6.7 earthquake by 2037 for the following Type A and B faults that occur in the project region:

- Type A faults:
  - Coyote Creek segment of San Jacinto fault zone: 31 percent probability
  - Julian segment of Elsinore fault zone: 11 percent probability
- Type B fault:
  - Palos Verdes fault: 5 percent probability

Fault Rupture

Surface fault rupture occurs when fault movement causes displacement of surface deposits. The displacement may result from a large-magnitude earthquake or from “creep” (measureable surface displacement in the absence of an earthquake) along a fault without an associated earthquake. Ground rupture is more likely along active faults.

The project area is not underlain by any known active faults (Kleinfelder 2008; Geosyntec 2012). The likelihood of surface rupture in the proposed project area is low.

Ground Motion

Ground shaking is the seismic effect that results in most structural damage. San Diego County is entirely located in Seismic Zone 4, as defined by the most recent Uniform Building Code. Seismic Zone 4 areas include those closest to active faults that are expected to experience ground motion during an earthquake of at least 0.40 g (g is the acceleration due to gravity). The faults and fault systems in San Diego County and the region have the potential to produce high-magnitude earthquakes throughout San Diego County, including within the proposed project area and vicinity. Earthquake magnitude, distance from the earthquake epicenter, and the geologic materials underlying and surrounding the area determine the intensity of ground motion (seismic shaking) during a seismic event. Structures built on bedrock experience less destructive shaking than those built on friable, granular soil deposits. Portions of the project corridor are located on alluvium and colluvium, which typically experience stronger ground shaking than areas located on hard rock.

Approximate ground motion parameters were estimated for the Miguel Substation and proposed substation site. The parameters presented in Table 4.6-4 are expressed as a fraction of g, which is acceleration due to gravity. Three ground motion parameters are shown: peak ground acceleration (PGA), short-period (0.2-second) spectral acceleration (Sa), and moderately long-period (1.0-second) Sa. PGA is a measure of earthquake acceleration experienced by a particle located on the ground and gives an indication of the intensity of ground shaking at a given location. Sa is an approximation of the earthquake acceleration experienced by a building or other structure. The parameters provide a measure of the seismic hazard in a given geographic area.[2] Each ground motion value is shown for three types of geologic material: firm rock, soft rock, and alluvium. The project area is primarily underlain by soft rock and firm rock at depth, with alluvium present at the surface in several areas.

Liquefaction

Liquefaction is a seismic phenomenon in which water-saturated, cohesionless sediments, such as sand and silt, temporarily lose strength and liquefy. Liquefaction occurs when saturated sediments are subjected to dynamic forces, such as intense and prolonged ground-shaking during an earthquake. Liquefaction is affected by soil type, soil density, and grain size;

Table 4.6-4 Estimated Ground Motion Parameters in the Project Area[1]

Ground Motion Parameter[1]	Geologic Material		
	Firm Rock (g)[2]	Soft Rock (g)[2]	Alluvium (g)[2]
Miguel Substation			
PGA	0.216	0.236	0.276
Sa (0.2-second)	0.509	0.555	0.662
Sa (1.0-second)	0.195	0.247	0.330
Proposed Substation			
PGA	0.213	0.232	0.274
Sa (0.2-second)	0.501	0.547	0.654
Sa (1.0-second)	0.191	0.242	0.324

Notes:

1 The ground motion parameters have a 10 percent probability of being exceeded during a 50-year period. They are for environmental review purposes and should not be used for engineering design.

2 g = acceleration due to gravity.

Sources: CGS 2013 as cited in SDG&E 2013

2 An acceleration of 0.02 g is associated with people losing their balance during a seismic event, whereas an acceleration of 0.50 g is associated with very strong ground shaking and potential damage to buildings and other structures if they have not been properly designed.

confining pressure; depth to groundwater; and intensity and duration of ground-shaking. Liquefaction can result in loss of bearing capacity below foundations, settlement, ground tilting, and instability on sloped areas (Geosyntec 2012).

The project area is not located within a liquefaction hazard area, defined by the City of Chula Vista as "areas with shallow groundwater tables and poorly consolidated granular sediments" (City of Chula Vista 2005). The closest liquefaction hazard areas are located south of the project area, southwest of the Lower Otay Reservoir, along the Otay River. The project is located in an area with generally low liquefaction potential (County of San Diego 2010). Liquefaction is most common in areas with shallow groundwater (i.e., less than 50 feet bgs) dominated by granular, unconsolidated materials. The potential for soil liquefaction in the project area is low, based on the anticipated level of earthquake-related ground shaking in the project area, the relative density of underlying soils, presence of weathered bedrock in the shallow subsurface, and the general absence of permanent shallow groundwater.

Lateral Spreading

Lateral spreading is a phenomenon that involves lateral displacement of large, intact blocks of soil down gentle slopes or toward a steep free face such as a stream bank. Lateral spreading occurs as a result of liquefaction of a shallow underlying deposit during an earthquake. It typically occurs on slopes of 0.3 to 5 percent underlain by loose sands and a shallow water table.

The project area contains soils with generally low liquefaction potential and, therefore, generally low lateral spreading potential.

4.6.2 Regulatory Setting

Federal

There are no federal laws or regulations pertaining to geology and soils that are applicable to the proposed project.

State

The Alquist-Priolo Earthquake Fault Zoning Act

The A-P Act was passed in 1972 to mitigate the hazard of surface faulting to structures intended for human occupancy. The main purpose of the A-P Act is to prevent the construction of buildings used for human occupancy on the surface traces of active faults. The A-P Act requires the State Geologist to delineate Earthquake Fault Zones along active faults within the state and to issue appropriate maps. Setbacks from active faults are required within the specified zones. For the purpose of the A-P Act, an active fault is one that has moved in the last 11,000 years. The A-P Act permits local jurisdictions to adopt more stringent requirements. San Diego County has incorporated the Earthquake Fault Zones into County Special Study Zones, which depict late-Quaternary faults (i.e., faults with movement within last 700,000 years). Traces of faults within Special Study Zones are treated by the County as active unless a fault investigation can prove otherwise. For projects located within those areas, the engineering geologists preparing fault rupture hazard investigations (as required and reviewed by the County Geologist) must follow the State's Guidelines for Evaluating the Hazard of Surface Fault Rupture (CGS Note 49).

Seismic Hazard Mapping Act

The Seismic Hazard Mapping (SHM) Act was passed in 1990 following the 1989 Loma-Prieta earthquake to reduce the potential impacts of earthquakes on public health and safety and to minimize property damage caused by earthquakes related to ground deformation. The SHM Act established a requirement for the identification and mapping of areas prone to the earthquake hazards of liquefaction, earthquake-induced landslides, and amplified ground-shaking. The State has not completed any seismic hazard maps for the County of San Diego.

California Building Code

The CBC is based on the 2012 International Building Code with the addition of more extensive structural seismic provisions. The CBC was adopted by the California Building Standards Commission on January 1, 2014, and became effective July 1, 2014. The CBC is included in the Title 24 of the CCR, California Building Standards Code, and is a compilation of three types of building standards from three different origins:

- Building standards that have been adopted by state agencies without change from building standards contained in national model codes
- Building standards that have been adopted and adapted from the national model code standards to meet California conditions
- Building standards authorized by the California legislature that constitute extensive additions not covered by the model codes that have been adopted to address particular California concerns

Seismic sources and the procedures used to calculate seismic forces on structures are defined in Section 1613 of the CBC. The code requires that all structures and permanently attached nonstructural components be designed and built to resist the effects of earthquakes. The code also includes grading and other geotechnical issues, building specifications, and non-building structures.

Local

County of San Diego General Plan

The County of San Diego General Plan (2011) establishes goals and objectives to provide guidance in the growth of the County. The following geology and soils resources policies were identified in the County of San Diego General Plan:

Policy S-7.1 Development Location. Locate development in areas where the risk to people or resources is minimized. In accordance with the California Department of Conservation Special Publication 42, require development be located a minimum of 50 feet from active or potentially active faults, unless an alternative setback distance is approved based on geologic analysis and feasible engineering design measures adequate to demonstrate that the fault rupture hazard would be avoided.

Policy -7.2	Engineering Measures to Reduce Risk. Require all development to include engineering measures to reduce risk in accordance with the California Building Code, Uniform Building Code, and other seismic and geologic hazard safety standards, including design and construction standards that regulate land use in areas known to have or potentially have significant seismic and/or other geologic hazards.
Policy S-7.3	Land Use Location. Prohibit high occupancy uses, essential public facilities, and uses that permit significant amounts of hazardous materials within Alquist-Priolo and County special studies zones.
Policy S-8.1	Landslide Risks. Direct development away from areas with high landslide, mudslide, or rock fall potential when engineering solutions have been determined by the County to be infeasible.
Policy S-8.2	Risk of Slope Instability. Prohibit development from causing or contributing to slope instability.

City of Chula Vista General Plan

The City of Chula Vista General Plan (2005) establishes goals and objectives to provide guidance in the growth of the City. The following geology and soils resources policies were identified in the City of Chula Vista General Plan:

Policy E 14.1	To the maximum extent practicable, protect against injury, loss of life, and major property damage through engineering analyses of potential seismic hazards, appropriate engineering design, and the stringent enforcement of all applicable regulations and standards.
Policy E 14.2	Prohibit the subdivision, grading, or development of lands subject to potential geologic hazards in the absence of adequate evidence demonstrating that such development would not be adversely affected by such hazards and would not adversely affect surrounding properties.
Policy E 14.3	Require site-specific geotechnical investigations for proposals within areas subject to potential geologic hazards; and ensure implementation of all measures deemed necessary by the City Engineer and/or Building Official to avoid or adequately mitigate such hazards.

4.6.3 Applicant Proposed Measures

SDG&E has proposed to implement measures that would reduce environmental impacts. The following relevant APMs are considered part of the proposed project (Table 4.6-5). The significance of the impact, however, is first considered prior to application of the APM and a significance determination is made. The implementation of the APM is then considered as part of the project when determining whether impacts would be significant and thus would require mitigation. These APMs would be incorporated as part of any CPUC approval of the project, and SDG&E would be required to adhere to the APMs as well as any identified mitigation measures. The APMs would be included in the MMRP for the project (refer to Section 9: Mitigation Monitoring and Report Plan in this Draft EIR), and the implementation of the measures would be monitored and documented in the same manner as mitigation measures.

Table 4.6-5 Applicant Proposed Measures for Geology and Soils Impacts

APM Number	Requirements
APM GEO-1: Geotechnical Requirements	SDG&E will incorporate the design measures and findings of the geotechnical investigation reports in the final design of all project components.
APM GEO-2: Seismic Standards	SDG&E will comply with all applicable codes and seismic standards to minimize the potential for damage from a seismic event. The project will be designed to withstand strong seismic accelerations in accordance with SDG&E standard design and engineering practices to reduce the potential for damage to occur to the proposed facilities in the event of a major seismic event.

Significance Criteria

Appendix G of the CEQA Guidelines (14 CCR 15000 *et seq.*) provides guidance on assessing whether a project will have significant impacts on the environment. Consistent with Appendix G, the proposed project would have significant impacts on geology and soils if it would:

a. Expose people or structures to 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.
b. Result in substantial soil erosion or the loss of topsoil.
c. 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.
d. Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property.
e. 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.

4.6.4 Environmental Impacts and Mitigation Measures

This impact analysis considers the potential effects to geology and soils and from activities associated with the construction, operation, and maintenance of the proposed project.

Impact Assessment

Table 4.6-6 provides a summary of the significance of potential project impacts to geology and soils prior to application of APMs, after application of APMs and before implementation of mitigation measures, and after the implementation of mitigation measures.

Table 4.6-6 Summary of Potential Impacts to Geology and Soils

Significance Criteria	Project Phase	Significance Prior to APMS	Significance After APMs and Before Mitigation	Significance After Mitigation
Impact GeologySoils-1: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault or strong seismic ground-shaking	Construction	Less than significant	Less than significant	Less than significant
	Operation and Maintenance	Significant	Less than significant APM GEO-1, APM GEO-2	Less than significant
Impact GeologySoils-2: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground failure, including liquefaction	Construction	Significant	Less than significant APM GEO-1, APM GEO-2	Less than significant
	Operation and Maintenance	Less than significant	Less than significant	Less than significant
Impact GeologySoils-3: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving landslides	Construction	Significant	Less than significant APM GEO-1, APM GEO-2	Less than significant
	Operation and Maintenance	Less than significant	Less than significant	Less than significant
Impact GeologySoils-4: Potential for substantial soil erosion or the loss of topsoil	Construction	Significant	Significant APM GEO-1, APM HYDRO-1	Less than significant MM Aesthetics-1, MM Geology-1, MM Biology-11
	Operation and Maintenance	Less than significant	Less than significant	Less than significant
Impact GeologySoils-5: 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	Construction	Significant	Less than significant APM GEO-1	Less than significant
	Operation and Maintenance	Significant	Less than significant APM GEO-1	Less than significant

Significance Criteria	Project Phase	Significance Prior to APMS	Significance After APMs and Before Mitigation	Significance After Mitigation
Impact GeologySoils-6: Located on expansive soil, or collapsible soil, creating substantial risks to life or property	Construction	Significant	Less than significant APM GEO-1	Less than significant
	Operation and Maintenance	Significant	Less than significant APM GEO-1	Less than significant
Impact GeologySoils-7: 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	Construction	No impact	No impact	No impact
	Operation and Maintenance	No impact	No impact	No impact

Impact GeologySoils-1: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault or strong seismic ground-shaking (*Less than significant; no mitigation required*)

Construction

The proposed project is located in a region with several active and potentially active fault zones that have a history of strong earthquakes. The potential for fault rupture to occur is greatest in the immediate vicinity of a fault trace. The active fault closest to the project area is the Rose Canyon Fault, which is approximately 9.3 miles northwest of the project alignment. The potential for construction crews to experience impacts from fault rupture is minimal. Severe ground shaking has potential to cause harm to structures and human injury; however, due to the short duration of construction (18 to 24 months) and the low probability of a strong seismic event occurring during this time, the potential for project structures and construction personnel to be exposed to strong seismic ground shaking is minimal. Impacts during construction would be less than significant. No mitigation is required.

Operation and Maintenance

A significant seismic event is likely to occur over the lifetime of the project; however, the potential for fault rupture to occur is greatest in the immediate vicinity of a fault trace, and the active fault closest to the project area is almost 10 miles away from the project alignment. During the operational phase, the substation and transmission line would be unattended and operated remotely, which reduces the potential to expose people to hazards from ground shaking. Routine maintenance at the substation would occur during six trips per year, with a 1-week-long major maintenance inspection occurring once annually. Aerial and ground inspections of TL 6965 would be performed in conjunction with inspections of existing lines within the transmission corridor and, therefore, would not increase exposure of personnel to potential seismic risks.

Project components would be designed in accordance with CPUC GO 95 and the Institute of Electrical and Electronics Engineers, Inc., Standard 693 (IEEE 693) to withstand damage from ground rupture and seismic shaking. Geotechnical reports have been prepared to assess conditions at the substation (Kleinfelder 2008) and along the transmission corridor (Geosyntec 2012). There is a potential for damage to property if seismic shaking affected power line poles. Damage to property would be a significant impact. SDG&E has proposed APMs GEO-1 and GEO-2 to avoid significant effects. SDG&E will implement the recommendations included in the project geotechnical reports (Appendix H) in addition to recommendations provided by other geotechnical professionals (refer to APM GEO-1). The 2008 geotechnical report (Kleinfelder) includes a recommendation to use the 2007 CBC seismic design parameters for construction of the substation.[3] Implementation of CBC design parameters would minimize potential impacts associated with a significant seismic event (i.e., maximum magnitude 7.2 earthquake on Rose Canyon Fault). SDG&E would also adhere to all applicable codes and seismic standards (refer to APM GEO-2).

Implementation of the recommendations provided in the geotechnical reports and adherence to applicable codes and seismic standards would ensure that the project design addresses and minimizes effects to people and project components from fault rupture and strong seismic ground shaking. Impacts would be less than significant, and no mitigation is required.

Mitigation Measures: None required.

Impact GeologySoils-2: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground failure, including liquefaction (*Less than significant; no mitigation required*)

Construction

The project area is not located within a liquefaction hazard area and is classified as having a low liquefaction potential. Liquefaction is most common in areas with shallow groundwater (i.e., less than 50 feet bgs) dominated by granular, unconsolidated materials. The soils underlying the project components are relatively dense and groundwater was not observed in borings advanced in shallow soils throughout the majority of the project area; however, shallow perched groundwater was encountered at a depth of 11 feet one location along the transmission corridor, indicating that there may be perched groundwater or a localized zone of wet soil material (Geosyntec 2012). The potential for soil liquefaction in the project area is low because the depth to groundwater was more than 40 feet and is below the depth of excavation in the majority of the project area. The potential for construction crews and structures to be exposed to seismic-induced liquefaction or other types of ground failure is minimal due to the short

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3 The geotechnical report for the substation site (Kleinfelder 2008) was prepared in 2008 and references the 2007 CBC. The CBC has since been updated. The recommended seismic design parameters should be revised, as necessary, to reflect the most recent version of the CBC and any subsequent updates.

duration of construction (18 to 24 months) and the low probability of a seismic event occurring during this time. The project would involve ground disturbance related to site preparation, grading, temporary and permanent fill slope creation, retaining wall construction, drainage modification, and foundation construction. If the site soils are not handled properly and in accordance with appropriate engineering procedures, seismic-related impacts resulting in ground failure could occur in the event of seismic activity, which would be a significant impact. APMs GEO-1 and GEO-2 would reduce the impacts to less than significant levels. SDG&E has proposed to implement the recommendations included in the project geotechnical reports in addition to recommendations provided by other geotechnical professionals (refer to APM GEO-1 and Appendix H). Impacts related to seismic-related ground failure would be minimized through implementation of the recommendations included in the geotechnical reports, including, but not limited to, the following:

- Attendance at a preconstruction conference by the site owner, geotechnical engineer, and contractor to discuss grading, plans, and construction requirements
- Removal of unsuitable materials from site (e.g., abandoned utilities and improvements, vegetation, debris, and unsuitable topsoil and residual soils)
- Approval of suitable material for import, as needed (i.e., material with at least 40 percent of components less than ¼ inch in size; an EI less than 30; and no perishable, spongy, deleterious, impacted, or otherwise unsuitable material)
- Use of suitable on-site materials for fill, as needed (i.e., free of oversized rock, expansive clay, organic materials, and deleterious debris)
- Performing grading in accordance with appropriate codes, guidelines, and standards, as specified in the existing geotechnical reports
- Compaction of all fill and backfill to a minimum relative compaction of 90 percent as determined by ASTM D1557, placed in lifts no greater than 8 inches thick, and observed and tested by a representative of the geotechnical engineer
- Construction of fill slopes and benching as described in the geotechnical reports and under oversight of the geotechnical engineer
- Grading of areas around proposed poles and pads so that drainage does not pond and is directed away from foundations
- Designing foundations and retaining walls in accordance with the parameters provided in the existing geotechnical reports to minimize potential for erosion, soil instability, and collapse
- Excavating utility trenches in accordance OSHA regulations and backfilling trenches in accordance with compaction requirements outlined above
- Retention of the geotechnical engineer to observe site preparation, grading, and foundation excavation activities, as well as to test compacted fill

Impacts from seismic related ground failure or liquefaction would be less than significant and no mitigation is required.

Operation and Maintenance

The substation and transmission line would be unattended and operated remotely during the operational phase of the project. Routine maintenance at the substation would occur six times per year, with a 1-week-long major maintenance inspection occurring annually. Aerial and ground inspections of TL 6965 would be performed in conjunction with inspections of existing lines within the transmission corridor and, therefore, would not increase exposure of personnel to potential seismic risks. Impacts from exposure to seismically induced ground failure during the operation and maintenance phase would be similar to existing conditions and would be less than significant. No mitigation is required.

Mitigation Measures: None required.

Impact GeologySoils-3: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving landslides (*Less than significant; no mitigation required*)

Construction

The project area is not located within a landslide hazard area and does not include any mapped landslides; therefore, overall landslide potential in the project area is low. The Otay Formation, which underlies the majority of the project area, is susceptible to landslides; however, the geotechnical studies did not identify any evidence of landslides within the project footprint or areas immediately adjacent to the project area (Kleinfelder 2008; Geosyntec 2012).

Destabilization of natural or constructed slopes could result from project construction activities, such as grading and excavation, which could contribute to landslide hazards. Several project components would be constructed on slopes greater than 15 percent (Table 4.6-2). Earthwork at the substation site would involve approximately 61,500 CY of cut and approximately 83,100 CY of fill to create a flat pad for substation construction. Grading could alter existing slope profiles, making them unstable and causing a significant impact. SDG&E would implement APMs GEO-1 and GEO-2 to avoid significant effects. All earthwork would be conducted using appropriate engineering methods. The geotechnical reports describe the methods to avoid potential effects related to landslides that include:

- Compaction of all fill and backfill to a minimum relative compaction of 90 percent as determined by ASTM D1557, placed in lifts no greater than 8 inches thick, and observed and tested by a representative of the geotechnical engineer
- Construction of fill slopes and benching as described in the geotechnical reports and under oversight of the geotechnical engineer
- Designing foundations and retaining walls in accordance with the parameters provided in the existing geotechnical reports to minimize potential for erosion, soil instability, and collapse
- Retention of the geotechnical engineer to observe site preparation, grading, and foundation excavation activities, as well as to test compacted fill

Seismic-induced landslides also have the potential to occur during project construction. The potential for construction crews and project components to be exposed to seismic-induced landslides is low due to the short duration of construction (18 to 24 months) and the low probability of a seismic event occurring during this time. APM GEO-1 and APM GEO-2 will ensure the risks of slope stability are considered and risks avoided because the slopes will be adequately compacted, slope construction will be under the oversight of a geotechnical engineer, and retaining walls will be properly designed to withstand landslides (refer to Appendix H). Impacts would be less than significant. No mitigation is required.

Operation and Maintenance

No landslides or landslide-susceptible areas have been identified within the project area; therefore, landslides would not be expected to have a significant adverse impact over the lifetime of the project.

During the operational phase of the project, the substation and transmission line would be unattended and operated remotely. Routine maintenance at the substation would occur during six trips per year, with a 1-week major maintenance inspection occurring once annually. Aerial and ground inspections of TL 6965 would be performed in conjunction with inspections of existing lines within the transmission corridor and, therefore, would not increase exposure of personnel to potential landslide risks. Impacts from exposure to landslides during the operation and maintenance phase would be similar to the existing conditions and would be less than significant. No mitigation is required.

Mitigation Measures: None required.

Impact GeologySoils-4: Potential for substantial soil erosion or the loss of topsoil (*Less than significant with mitigation*)

Construction

Proposed Substation

Construction of the proposed substation requires substantial grading to construct a flat pad within a sloping parcel. The grading would involve cut of approximately 61,600 CY of material and fill of approximately 83,100 CY. There would be steep slopes to the south and east of the substation pad and along the expanded substation access road with no vegetation on these slopes immediately after completion of grading. SDG&E's preliminary grading plan (Appendix B) proposes construction of retaining walls along the expanded access road and the southeast corner of the substation hill slope. Topsoil would be salvaged during site preparation work to minimize the loss of topsoil during project construction; however, the steep slopes at the proposed substation site could be a source of substantial erosion and topsoil loss. Substantial erosion and loss of topsoil would be a significant impact. SDG&E has proposed APM GEO-1, which requires SDG&E to implement the design measures and findings in the geotechnical report including:

- Compaction of all fill and backfill to a minimum relative compaction of 90 percent as determined by ASTM D1557, placed in lifts no greater than 8 inches thick, and observed and tested by a representative of the geotechnical engineer
- Construction of fill slopes and benching as described in the geotechnical reports and under oversight of the geotechnical engineer
- Designing foundations and retaining walls in accordance with the parameters provided in the existing geotechnical reports to minimize potential for erosion, soil instability, and collapse
- Retention of the geotechnical engineer to observe site preparation, grading, and foundation excavation activities, as well as to test compacted fill

Soil erosion would also be reduced through the implementation APM HYDRO-1, which requires installation of erosion and sediment control BMPs as directed in the site-specific SWPPP. The steep landscaped slopes at the substation site may result in the potential for slope failure and substantial erosion if the landscape restoration plan is not successful. The slope failure and erosion would be a significant impact. The impact would be reduced through Mitigation Measure Aesthetics-1, which requires preparation of a Landscaping and Irrigation Plan that would be reviewed by a geotechnical engineer for consistency with the geotechnical approach. Mitigation Measure Aesthetics-1 also specifies success criteria and monitoring for slope revegetation. Impacts would be less than significant with mitigation.

TL 6965

Ground disturbance would occur while preparing new structure sites and augering holes for foundation and pole installation. Ground disturbance also would occur, to a limited extent, during use of existing unpaved access roads. These activities have the potential to result in soil erosion or loss of topsoil.

Erosion potential is generally higher in areas with steep slopes and on soils where vegetation has been removed. Vegetation would be cleared from all power pole work pads. The TL 6965 corridor generally is characterized by relatively flat to gently sloping terrain with steeper terrain and ridge tops more prevalent in the northern portion of the corridor. Ground disturbance on steep slopes where vegetation has been removed would increase the potential for erosion. Rain and wind can detach soil particles and transport them off site in areas of exposed soil. Areas of TL 6965 subject to temporary disturbance may be subject to soil erosion over the long-term if not reclaimed and stabilized. Construction of TL 6965 would result in a significant erosion impact if the work areas are not properly stabilized and substantial erosion occurs at one or more work areas.

SDG&E has proposed APM HYDRO-1 to reduce erosion through the implementation of BMPs contained in the site-specific SWPPP prepared prior to construction. The SWPPP will include measures such as silt fencing, straw waddles, geotextiles, and other BMPs to control sediment and erosion in compliance with SWRCB Order 2009-0009. The Board Order requires construction projects greater than 1 acre to implement visual and water quality monitoring to demonstrate that the BMPs have been effective and there is no impact to water quality.

Additional BMPs would be implemented if the water quality objectives are not met. BMPs would be inspected and maintained regularly as required by Order 2009-0009. While APM HYDRO-1 would reduce the potential for erosion and topsoil loss, a significant impact would occur if areas temporarily disturbed were not stabilized with permanent BMPs. Mitigation Measure Geology-1 requires permanent stabilization of temporarily disturbed surfaces. Mitigation Measure Biology-11 specifies additional success criteria for restoration and revegetation of temporarily disturbed areas. Impacts would be less than significant with mitigation.

Staging Yards

Vegetation would be cleared within the generally level Hunte Parkway and Eastlake Parkway staging yards. The staging yard areas would not be subject to substantial erosion or loss of topsoil due to their flat topography, and impacts would be less than significant. While less than significant, the impact would be further reduced through implementation of BMPs as required by APM HYDRO-1. No mitigation is required.

Preparation of the OTC and Miguel Substation staging yards would not involve grading or vegetation removal. Use of the OTC and Miguel Substation staging yards would have no impact related to increased erosion.

Operation and Maintenance

Minor ground-disturbing activities may be required periodically to perform maintenance and repair activities. If grading is required for maintenance, SDG&E would implement the measures provided in the SDG&E BMP Manual (Appendix H), which includes standard erosion and sedimentation control measures. Maintenance vehicles would use access roads and would not disturb undeveloped lands. No large areas of exposed soils would be subject to increased erosion. Impacts would be less than significant. No mitigation is required.

Mitigation Measures: Geology-1, Aesthetics-1, and Biology-11

> **Mitigation Measure Geology-1:** Once temporary surface disturbances are complete, areas that will not be subject to additional disturbance shall be stabilized within 7 days using permanent stabilization BMPs to control soil erosion. BMPs may include hydroseeding, planting, and minor regrading. An SDG&E Reclamation Specialist shall inspect and monitor BMPs following installation in areas where revegetation has been performed until the minimum vegetative cover specified in the Revegetation Plan (see Mitigation Measure Biology-11) is established.

Significance after Measures: Less than significant.

Impact GeologySoils-5: 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; no mitigation required*)

Construction

Destabilization of natural or constructed slopes within the project area could occur as a result of construction activities. Grading associated with substation construction, access roads, stringing sites, staging yards, and other work zones could alter existing slope profiles, making them unstable as a result of over-excavating slope material, steepening slopes, or increasing loads. The effect of siting project facilities on unstable geologic units or soils would be a significant impact.

The existing and proposed site slopes have been evaluated and are considered to be stable due to their proposed slope incline (e.g., 3:1), strength of subsurface materials, and lack of adverse bedding (Kleinfelder 2008; Geosyntec 2012). The potential for liquefaction and associated lateral spreading within the project area is low, and no impacts related to these factors are anticipated to occur during project construction.

The risk of slope movement associated with landslides at the proposed substation site (Kleinfelder 2008) and pole locations (Geosyntec 2012) is low. A retaining wall would be constructed adjacent to the existing sewer access road to reduce the risk of slope failure on the access road south of Hunte Parkway to the proposed substation site.

The potential for subsidence in the project area is low; no impacts from subsidence are anticipated to occur. Soil collapse risk in the project area is also anticipated to be low; however, standard engineering procedures would be followed during project construction to minimize effects from collapsible soils, if they are encountered.

The recommendations included in the geotechnical reports would be implemented during final project design, in accordance with APM GEO-1, which would include measures to minimize effects to people and structures from the presence of unstable geologic units and soils and would reduce potential impacts (see also discussion under Impact GeologySoils-2). Impacts would be less than significant and no mitigation is required.

Operation and Maintenance

Minor ground-disturbing activities may be required periodically to perform maintenance and repair activities. Appropriate engineering standards would be applied to ensure the integrity of the project components over the life of the project. However, due to the presence of steep slopes, there is potential for a landslide to occur if the project were not properly constructed, resulting in a significant impact. SDG&E would comply with APM GEO-1, which requires implementation of the recommendations and findings included in the geotechnical reports prepared for the project in final project design. Adherence to these standards and measures would reduce impacts from the presence of unstable geologic units during the operation and maintenance period. Impacts would be less than significant, and no mitigation is required.

Mitigation Measures: None required.

Impact GeologySoils-6: Located on expansive soil, or collapsible soil, creating substantial risks to life or property (*Less than significant; no mitigation required*)

Construction

Expansive soils shrink and swell and can damage foundations if moisture collects beneath structures. The majority of the project area is underlain by soils with a smectitic (expansive) clay component. Limited testing has been performed on project area soils to determine expansive properties; however, much of the soil underlying the project components has been evaluated. The Otay Formation, which underlies topsoil/colluvium over the majority of the project area, has low expansion potential. No collapsible soils have been mapped in the project area. The potential to encounter collapsible soils is low; however, the proposed project could create substantial risks to life or property if construction were to take place on expansive or collapsible soils. This would be a significant impact.

The geotechnical reports prepared for the project include recommendations that soils with an EI greater than 50 be blended with other granular soils and used as embankment fill. These soils also may be used as deeper compacted fill in non-structural areas, but may not be used in the outer portions of fill slopes (i.e., within 15 feet of slope face or height of slope, whichever is less). The recommendations in the report specify that potentially compressible soils within the limits of site grading be removed (excavated) to native soils prior to the placement of engineered fill materials. As prescribed by APM GEO-1, these recommendations for project design and construction practices would be followed to avoid or minimize impacts from expansive and collapsible soils. Impacts would be less than significant. No mitigation is required.

Operation and Maintenance

Minor ground-disturbing activities may be required periodically to perform maintenance and repair activities. The proposed project could result in a significant impact on life and property if construction were to take place on expansive or collapsible soils. If earthwork is required for maintenance, the soil to be disturbed would have been disturbed during project construction. These soils would be mitigated for the presence of expansive or collapsible soils, per APM GEO-1 during construction of the project. Impacts would be less than significant. No mitigation is required.

Mitigation Measures: None required.

Impact GeologySoils-7: 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 (*No impact*)

No septic tanks or alternative wastewater disposal systems (e.g., leach fields) would be constructed as part of the project. No impacts would occur.

Mitigation Measures: None required.

4.6.5 Project Alternatives

Table 4.6-7 provides a summary of the potential impacts to geology and soils from the project alternatives.

Table 4.6-7 Summary of Impacts from Alternatives by Significance Criteria

Significance Criteria	No Project Alternative	Alternative 1	Alternative 2	Alternative 3
Impact GeologySoils-1: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault or strong seismic ground-shaking	Less than significant	Less than significant APM GEO-1, APM GEO-2	Less than significant APM GEO-1, APM GEO-2	Less than significant APM GEO-1, APM GEO-2
Impact GeologySoils-2: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground failure, including liquefaction	Less than significant	Less than significant APM GEO-1, APM GEO-2	Less than significant APM GEO-1, APM GEO-2	Less than significant APM GEO-1, APM GEO-2
Impact GeologySoils-3: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving landslides	No impact	Less than significant APM GEO-1, APM GEO-2	Less than significant APM GEO-1, APM GEO-2	Less than significant APM GEO-1, APM GEO-2
Impact GeologySoils-4: Potential for substantial soil erosion or the loss of topsoil	Less than significant	Less than significant with mitigation APM GEO-1, APM HYDRO-1 MM Aesthetics-1	Less than significant with mitigation APM GEO-1, APM HYDRO-1 MM Aesthetics-1	Less than significant with mitigation APM GEO-1, APM HYDRO-1 MM Aesthetics-1
Impact GeologySoils-5: 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	Less than significant APM GEO-1	Less than significant APM GEO-1	Less than significant with mitigation APM GEO-1 MM Geology-Alt 3-1
Impact GeologySoils-6: Located on expansive soil, or collapsible soil, creating substantial risks to life or property	Less than significant	Less than significant APM GEO-1	Less than significant APM GEO-1	Less than significant with mitigation APM GEO-1 MM Geology-Alt 3-1

Significance Criteria	No Project Alternative	Alternative 1	Alternative 2	Alternative 3
Impact GeologySoils-7: 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	No impact	No impact	No impact	No impact

Alternative 1: 230/12-kV Substation and 230-kV Loop-In

Environmental Setting

Alternative 1 would involve construction of a 230/12-kV substation within the SDG&E fee-owned parcel south of Hunte Parkway (the same site as the proposed substation). The geologic and soil conditions for the proposed substation and Hunte Parkway and OTC staging yards, described in Section 4.6.1, would apply to this alternative. The geotechnical analysis and testing that was conducted to characterize subsurface conditions at the substation site would apply to Alternative 1.

TL 6965 would not be constructed and the transmission corridor is not within the Alternative 1 project area.

Impacts and Mitigation Measures

Alternative 1 would have similar impacts to geology and soils as construction of the proposed project substation; however, Alternative 1 would require larger retaining walls, steeper slopes on the retaining walls, and larger quantities of cut and fill. All APMs and mitigation measures for slope stabilization of the proposed project would apply to Alternative 1. Impacts related to construction and operation of TL 6965 would be avoided.

Construction

Substation Grading. The 230/12-kV substation would require more earthwork and larger retaining walls than the proposed substation. Under Alternative 1, a 230/12-kV substation would be constructed, in the same location as the proposed substation, south of Hunte Parkway, in an area with slopes greater than 15 percent. Construction of the substation pad would require substantial grading to create a flat pad. The regraded area around the substation pad would have retaining walls up to 40 feet compared with the proposed substation retaining walls of up to 23 feet.

Approximately 39,100 CY of cut and approximately 148,400 CY of fill would be required to create a flat pad for the 230-kV substation and access road, which is approximately 22,500 CY less cut and 65,300 CY more fill compared to the proposed substation. Similar to the proposed project, retaining walls are proposed along the expanded access road and along the southeast corner of the substation pad. Vegetation would be cleared from approximately 10.2 acres of the substation parcel.

Staging Yards. Alternative 1 would involve the same activities and impacts at the Hunte Parkway staging yard and the OTC staging yards as the proposed project. There would be no impact at the Eastlake Parkway or Miguel staging yards because these staging yards would not be required for Alternative 1.

Faults and Seismic Shaking. Alternative 1 would have the same risk of movement on regional faults and associated risk of ground shaking and ground failure as the proposed project. The potential for seismic-related impacts would increase slightly for the 230/12-kV substation compared to the proposed 69/12-kV substation because the construction period would be up to 12 months longer, exposing workers for an additional 12 months. The potential for seismic-related impacts would remain the same as for the proposed substation during operation and maintenance. The potential for a major earthquake to occur that would result in seismic-induced geologic hazards at the Alternative 1 substation would be low; however, the impact would be significant if a major seismic event were to occur. Such an event could result in injury to personnel and damage to site equipment. SDG&E would adhere to all applicable building codes and seismic standards per APM GEO-2 and would adhere to all recommendations in the geotechnical reports during construction per APM GEO-1, which would reduce impacts to less than significant. Impacts from a seismic event would be less than significant and no mitigation is required.

Slope Stability. Destabilization of natural or constructed slopes could result from construction activities, such as grading and excavation. Slope destabilization would be a significant effect; however, the risk of slope movement associated with landslides at the Alternative 1 substation site is low. The risk of slope failure would be similar to the proposed project because the same construction techniques would be used, including retaining walls. Impacts from slope failure would be reduced by APMs GEO-1 and GEO-2. Impacts would be less than significant and no mitigation is required.

Erosion. The Alternative 1 substation would include steeper slopes and larger retaining walls than the proposed project substation. Alternative 1 would have a greater risk of substantial erosion and loss of topsoil at the substation site relative to the proposed project due to the greater quantities of cut and fill, steeper slopes, and longer construction period at the substation facility. Substantial erosion and loss of topsoil would be a significant impact. Similar to the proposed project, APMs GEO-1 and HYDRO-1 would reduce soil loss by requiring implementation of the geotechnical recommendations included in the geotechnical report and the BMPs required in the SWPPP. The project could still result in substantial loss of topsoil if landscaping and revegetation of the slopes fails or is inconsistent with the geotechnical requirements for slope stabilization. Mitigation Measure Aesthetics-1 requires that the Landscaping and Irrigation Plan be reviewed by a geotechnical engineer for consistency with the geotechnical approach and that revegetation achieves the success criteria defined in the Plan.

Operation and Maintenance
Maintenance activities would be reduced under Alternative 1 because no power line would be constructed; therefore maintenance would only be required for the substation. Maintenance activities would not result in new areas of disturbance and would not cause substantial erosion or loss of topsoil because all maintenance activities would be conducted within the substation pad and on the buried distribution lines. Impacts would be less than significant.

Expansive Soils. Moderately expansive soils are present at the substation site (Kleinfelder 2008). Expansive soils can damage foundations by shrinking and swelling if moisture collects beneath structures. Geotechnical recommendations and measures to minimize effects to people and structures from the presence of unstable geologic units and soils, including expansive and collapsible soils, would be implemented in the final design, as described in APM GEO-1. Implementation of APM GEO-1 would reduce impacts from expansive soils. Impacts would be less than significant and no mitigation is required.

TL 6965. Alternative 1 would not involve installation of a 5-mile-long, 69-kV power line along existing ROW. Temporary impacts to geology and soil resources resulting from use of the Eastlake Parkway and Miguel Substation staging yards would not occur, nor would temporary and permanent impacts associated with poles and work pads and use of new and temporary access roads along the transmission route. Alternative 1 would avoid unstable soils units only found along the transmission line corridor, including Linne clay loam and San Miguel-Exchequer rocky silt loam. All soil disturbance and erosion associated with the construction and maintenance of TL 6965 would be avoided.

Summary. Impacts to geology and soil resources would be less than significant with implementation of APMs GEO-1, GEO-2, and HYDRO-1 and Mitigation Measure Aesthetics-1. Impacts would be less than those associated with the proposed project. Additional grading and site disturbance would occur, and slopes would be steeper at the larger 230/12-kV substation; however, the area of disturbance would be restricted to the substation site only, and all geology and soils impacts associated with the transmission line and other staging yards north of the substation site would be avoided.

Alternative 2: 69/12-kV Substation and Generation at Border and Larkspur Electric Generating Facilities

Environmental Setting
Alternative 2 would involve construction of a substation, distribution lines, and TL 6910 loop-in in the same manner as the proposed project. The existing geology and soil conditions for the proposed substation and the Hunte Parkway and OTC staging yards, described in Section 4.6.1, would apply to this alternative. The geotechnical analysis and testing that was conducted to characterize subsurface conditions at the substation site would apply to Alternative 2.

TL 6965 would not be constructed and the corridor would not be included as part of the project area under this alternative.

Impacts and Mitigation Measures
Geologic impacts associated with Alternative 2 would be less than those for the proposed project because the alternative would avoid all ground disturbance associated with construction of a new power line.

69/12-kV Substation. Similar to the proposed project, construction of the substation would require cut-and-fill and construction of steep slopes. Alternative 2 would result in the same impacts from seismic events, landslides, liquefaction, and expansive and collapsible soils as the proposed substation. Geotechnical recommendations and measures to minimize effects to people and structures from the presence of unstable geologic units and soils would be implemented in the final design, as described in APM GEO-1. APM GEO-2 requires SDG&E to follow applicable building codes and seismic standards. APMs GEO-1 and GEO-2 would reduce impacts associated with unstable geologic units and soils. Impacts from seismic events and unstable geologic units and soils would be less than significant, and no mitigation is required.

Similar to the proposed project substation, ground disturbance associated with Alternative 2 construction could result in soil erosion and downstream waterway sedimentation, which would be a significant effect. Soil erosion would be minimized through APMs GEO-1 and HYDRO-1, which respectively require a geotechnical engineer to assess the slope compaction and require preparation and adherence to a SWPPP, including use of BMPs. Even with implementation of these APMs, the substation slope could cause soil erosion and soil loss if not properly stabilized, which would be a significant impact. Mitigation Measure Aesthetics-1 requires SDG&E to prepare and implement a Landscape and Irrigation Plan that would be reviewed by a geotechnical engineer. Impacts from erosion would be less than significant with mitigation.

Maintenance work would be conducted within the gravel substation facility or access roads and would not result in new areas of disturbance. Maintenance would have no impact on geology and soils.

Power Generation at Border and Larkspur. Use of the existing gas turbines located at the Border and Larkspur electric generating facilities would have no impact to geology and soil resources because these are existing electric generation facilities, and no additional ground disturbance or construction would be required.

Alternative 2 would not involve installation of a 5-mile-long, 69-kV power line along the existing SDG&E ROW. Impacts to geology and soil resources resulting from construction of the power line and use of the Eastlake and Miguel Substation staging yards would not occur. Alternative 2 would avoid unstable soils units only found along the transmission line corridor, including Linne clay loam and San Miguel-Exchequer rocky silt loam.

Summary. Impacts to geology and soil resources would be less than significant with implementation of APMs GEO-1, GEO-2, and HYDRO-1 and Mitigation Measure Aesthetics-1. Impacts would be less than those associated with the proposed project because the area of disturbance would be restricted to the proposed substation site, and all geology and soils impacts associated with the power line and other staging yards north of the substation site would be avoided.

Alternative 3: 69/12-kV Substation and Underground 69-kV Power Line within Public ROW

Environmental Setting
Alternative 3 would involve construction of a substation, distribution lines, and TL 6910 loop-in in the same manner as the proposed project. Alternative 3 also includes construction of an underground 69-kV power line. The Alternative 3 power line would be located underground within public ROW along Hunte Parkway, Proctor Valley Road, and Mountain Miguel Road. The 69-kV power line would be overhead within Miguel Substation and would be installed in the same configuration within Miguel Substation as the proposed project.

The underground component of the transmission route would be 1 mile longer than the overhead route selected for the proposed project. The existing geology and soils conditions for the proposed substation, Miguel Substation, and Miguel Substation, Hunte Parkway, and OTC staging yards described in Section 4.6.1, would apply to this alternative.

The geologic units and soil units for the Alternative 3 underground power line alignment are shown on Figures 4.6-6 and 4.6-7. The underground route would be located in the Otay Formation, fanglomerate, and Santiago Peak Volcanics. The Otay Formation and Santiago Peak Volcanics are described in Section 4.6.1. The fanglomerate unit is an alluvial deposit composed of rounded rock fragments in a finer-grained matrix. The soil units within the Alternative 3 underground power line alignment are described in Table 4.6.-2. These soils include:

- Diablo clay
- San Miguel-Exchequer rocky silt loams
- Olivenhain cobbly loam

Impacts and Mitigation Measures
Geologic impacts associated with Alternative 3 would be similar to the proposed project. The impacts of the substation would be essentially the same as the proposed project substation. Seismic shaking would have less effect on the buried power line than it would on an overhead power line.

69/12-kV Substation. Similar to the proposed project, construction of the substation would require cut-and-fill and construction of steep slopes. Alternative 2 would result in the same impacts from seismic events, landslides, liquefaction, and expansive and collapsible soils as the proposed substation. Geotechnical recommendations and measures to minimize effects to people and structures from the presence of unstable geologic units and soils would be implemented in the final design, as described in APMs GEO-1. APM GEO-2 requires SDG&E to follow applicable building codes and seismic standards. APMs GEO-1 and GEO-2 would reduce impacts associated with unstable geologic units and soils. Impacts from seismic events and unstable geologic units and soils would be less than significant, and no mitigation is required.

Figure 4.6-6 Alternative 3 Geologic Units

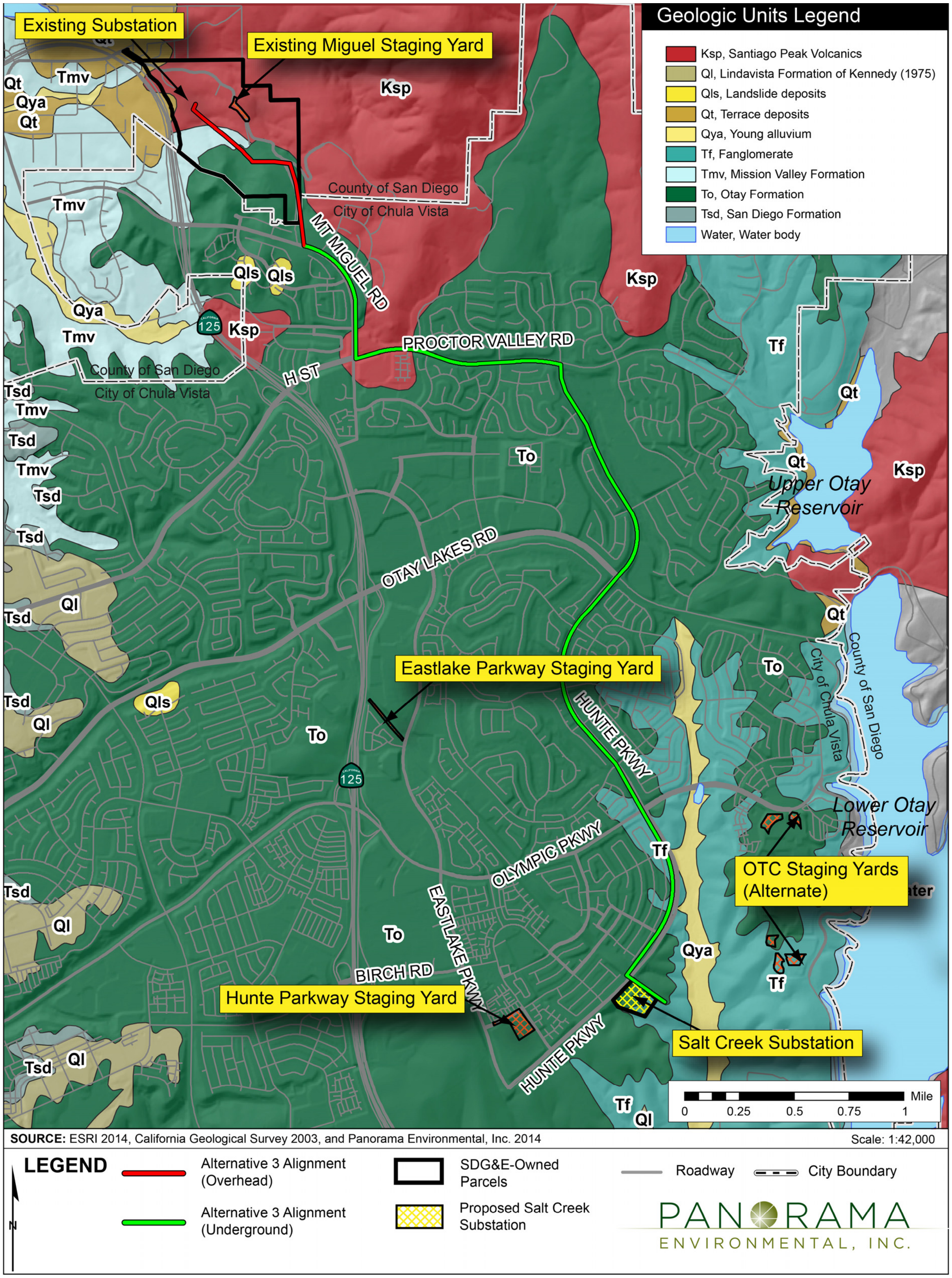
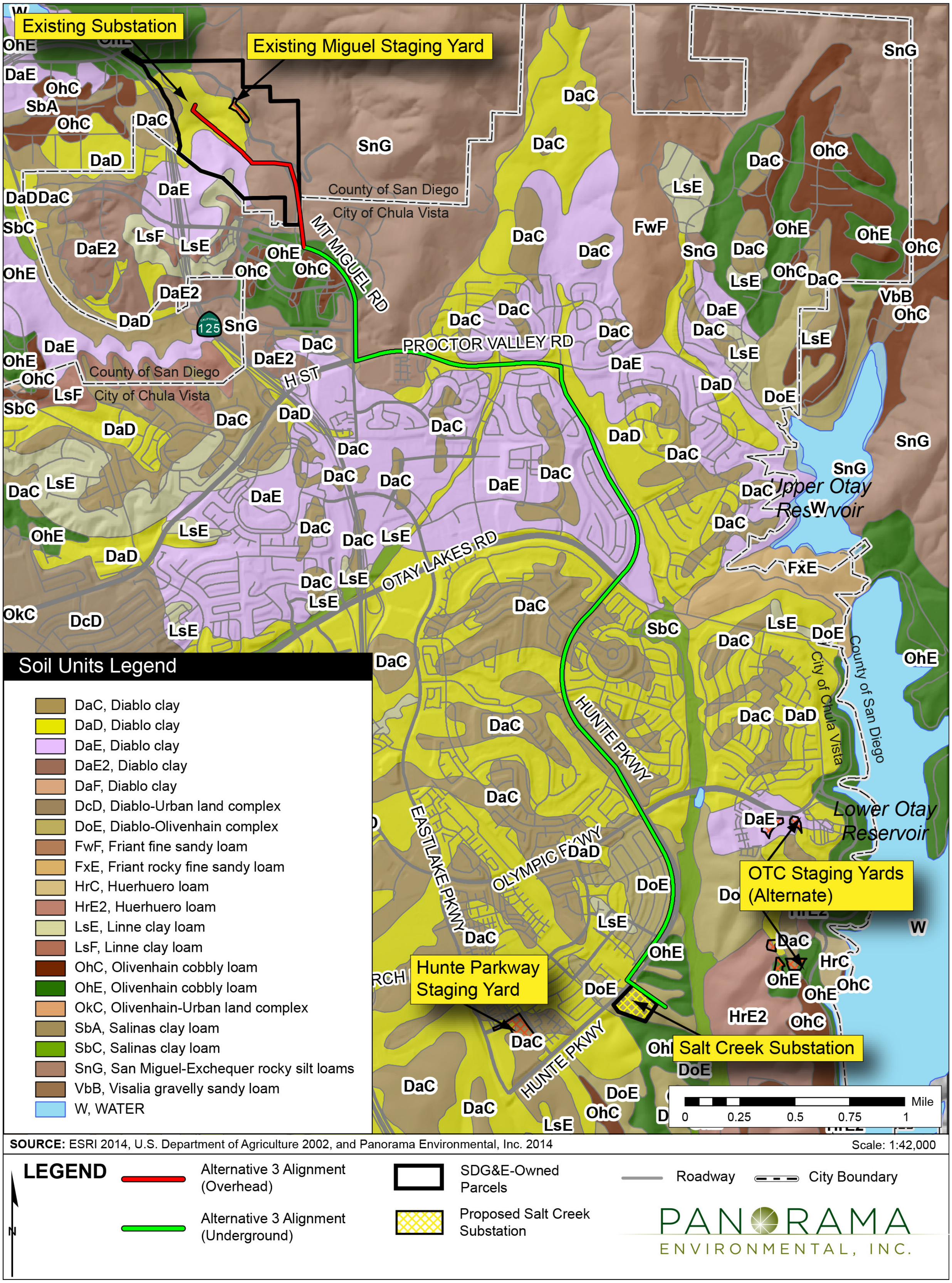


Figure 4.6-7 Alternative 3 Soil Units



Ground disturbance associated with Alternative 3 substation, distribution line, and TL 6910 loop-in construction could result in soil erosion and downstream waterway sedimentation, which would be a significant effect. Erosion impacts could be especially high during periods of high precipitation or high soil moisture. Soil erosion would be minimized through the implementation of BMPs included in the site-specific SWPPP, which would be prepared prior to initiation of construction per APM HYDRO-1. Erosion from the substation slope could still be significant if the slope were not adequately stabilized. Mitigation Measure Aesthetics-1 requires successful revegetation of the substation slope, which would reduce erosion. Impacts would be less than significant with mitigation.

If grading is required for maintenance, SDG&E would implement the measures provided in its BMP Manual (Appendix H).

69-kV Underground Power Line. Construction of the underground power line within roadways would primarily occur in Diablo clay soils, which have a high expansive clay component. The Otay Formation underlies these soils, and has low expansion potential but is prone to landslides due to its granular nature. No collapsible soils have been mapped in the area. Geologic hazards associated with unstable geologic units and soils along the underground power line route, including expansive soils, could exist and could present significant impacts during project construction. Construction of the underground power line within roadways could destabilize soils, which would be a significant impact. The existing geotechnical reports did not address the Alternative 3 underground route. Significant impacts could occur if a geotechnical investigation is not conducted for the underground route and if the recommended measures are not implemented. Mitigation Measure Geology-Alt 3-1 requires SDG&E to perform a geotechnical investigation and implement the recommendations in the geotechnical report. Impacts would be less than significant with mitigation.

> **Mitigation Measure Geology-Alt 3-1:** SDG&E shall enlist a professional geotechnical engineer or engineering geologist to plan and perform a geotechnical investigation along the proposed underground power line route prior to initiating construction. The investigation shall evaluate soil stability, erosion potential, soil expansion potential, and other factors relevant to assessment of geologic hazards for the underground portion of the power line. The assessment shall use standard methodology and procedures that are acceptable to the industry. The professional geotechnical engineer or engineering geologist shall prepare a report describing the investigation methodology, results, and analysis, and shall include recommendations to be followed during project construction. The report shall be provided to CPUC for review at least 30 days prior to initiation of construction. The recommendations included in the report shall be implemented during construction.

Summary. Impacts to geology and soil resources would be less than significant with implementation of APMs GEO-1, GEO-2, and HYDRO-1 and Mitigation Measures Aesthetics-1 and Geology-Alt 3-1. Impacts to geology and soils would be slightly greater than the proposed project because the Alternative 3 underground power line requires more ground disturbance than the proposed project overhead power line.

No Project Alternative

Under the No Project Alternative, SDG&E would meet energy needs of the southeast Chula Vista area by adding two additional transformer banks at the existing Proctor Valley Substation and installing 6 to 7 miles of distribution circuits. Distribution circuits would likely be installed underground along various routes in the Otay Ranch area. None of the facilities associated with the proposed project or alternatives evaluated in this Draft EIR would be constructed. Therefore, none of the impacts associated with geology and soils described in this section would occur.

The two transformer banks at Proctor Valley Substation are currently approved and would be constructed even if the proposed project was not constructed. There would be no additional impacts to geology and soils from construction of the transformer banks at Proctor Valley Substation under the No Project Alternative.

Construction of the 6 to 7 miles of distribution circuits would result in trenching into similar geologic units as the proposed project. Impacts from underground distribution construction would be minimal because the distribution circuits would be installed within existing roadways which include compacted engineered fill materials. Impacts from the No Project Alternative would be less than significant.

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