4.5 GEOLOGY, SOILS, AND MINERAL RESOURCES

This section presents the environmental setting and impact analysis for geology, soils, and mineral resources that would be affected by the Proposed Project and its alternatives. This section addresses baseline data and known resources, applicable regulations, environmental impacts, and mitigation measures to reduce or avoid significant impacts. Appendix O of this EIR presents the geotechnical study performed for the Proposed Project.

4.5.1 Approach to Data Collection

The geology, soils, and mineral resources analysis focuses on the potential for the Proposed Project to result in impacts related to fault rupture, ground shaking, seismic-related ground failure, landslides, soil erosion and loss of topsoil, unstable geologic units or soils, expansive and collapsible soils, and mineral resources. These resources were evaluated by reviewing the following data sources:

- Aerial photography (Google Inc. 2015)
- USGS topographic maps and geology maps (Esri 2014)
- San Diego County Multi-jurisdiction Hazard Plan maps (Office of Emergency Services and Unified Disaster Council 2010)
- California Geologic Survey (CGS) fault maps, geology maps, and mineral resources maps (CGS 2008; CGS 2010)
- NRCS soils maps (NRCS 2015a; NRCS 2015b; NCRC 2015c)
- City and County General Plans (City of San Diego 2008; City of Poway 1991; County of San Diego 2011; City of Carlsbad 2014)
- Geotechnical reports previously prepared for portions of the Proposed Project alignment (Benton Engineering 1972a and 1972b; Geocon, Inc. 2012a and 2012b)
- Information provided by SDG&E in the PEA (2014)
- Geotechnical Study prepared for the Proposed Project (Trinity Geotechnical Engineering, Inc. 2015)

4.5.1.1 Geotechnical Study

SDG&E's consultant, Trinity Geotechnical Engineering, Inc., performed a geotechnical study for the Proposed Project in April 2015 to evaluate the subsurface conditions at the Proposed Project site and provide geotechnical recommendations for the design and construction of the Proposed Project (refer to Appendix O of this EIR). Specifically, the report provided recommendations for the design and construction of pole foundations, maintenance pads, access roads, and retaining walls as well as subsurface considerations pertinent to underground transmission line construction.

Review of Background Data

SDG&E's consultant reviewed previous geotechnical studies performed near or within the Proposed Project site to supplement the information obtained during the field exploration program and provide additional insight needed to formulate appropriate design parameters and recommendations. These studies were associated with the design and/or construction of Sycamore Substation, TL 6961, and Evergreen Nursery (Woodward Clyde 1992, Geocon 2012, and Owen Consultants 1990). The studies included seismic refraction line testing, test pits, borings, cone penetration testing, and associated laboratory testing.

Field Exploration Program and Laboratory Testing

SDG&E's consultant conducted a field exploration to obtain necessary design information regarding the subsurface conditions at various pole locations. SDG&E utilized the following methods during the field exploration:

- **Seismic Refraction Lines.** A hammer is used to put impulsive energy into the ground. Data gathered from measurements of the energy is used to determine whether layering in the subsurface is horizontal, dipping, or undulating.
- **Borings.** Drill rigs were used to obtain soil and geologic formation samples. Borings were extended to a maximum depth of approximately 50 feet below ground surface (bgs). Depth to groundwater was recorded during drilling.

Laboratory testing was performed on selected soil, geologic formation, and bedrock samples to evaluate the engineering properties of the pole foundation materials. Tests were performed to determine:

- In-situ density and moisture content
- Particle size
- Direct shear
- Thermal resistivity
- Unconfined compressive strength of the rock
- Corrosivity (sulfate content, chloride content, pH, and resistivity)

Engineering Evaluation

Various geotechnical and geologic considerations were developed for each pole site based on information obtained from the review of previous geotechnical studies, field exploration program, and laboratory testing. The geology and seismicity of the area was also considered during the evaluation. Geotechnical and geologic considerations included:

- Presence and depth of groundwater
- Slope instability
- Erosion
- Landslides
- Expansive soils
- Faulting
- Seismicity
- Liquefaction and seismically-induced settlement

4.5.2 Environmental Setting

4.5.2.1 Regional Setting

The Proposed Project area is located in the Peninsular Ranges geomorphic province, which consists of a series of northwest-trending, fault-bounded 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. Low-lying coastal plains are located in the western portion of the province. The San Diego County region generally is characterized by foothills ranging in elevation from 600 feet above mean sea level (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.

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.

4.5.2.2 Proposed Project Environmental Setting

Physiography and Topography

The Proposed Project alignment traverses variable terrain within the coastal margin in the western portion of the province, about 2.4 miles east of the Pacific Ocean at its closest point. The western portion of the Project corridor is dominated by gently sloped marine terraces incised by canyons and valleys with elevations ranging from about 200 to 350 feet amsl along Segment D and from 300 to 400 feet amsl along Segment C. The terrain transitions to foothills and valleys in the eastern portion of the Project corridor with elevations steadily increasing eastward from about 350 to 750 feet amsl along Segment B. Segment A traverses peak elevations of about 900 feet amsl at Black Mountain and at Sycamore Substation. The lowest elevations along Segment A are within the Los Peñasquitos Creek valley just north of the Segment A midpoint, east of I-15. Elevations typically are between 600 and 800 feet amsl between the peaks and the creek valley. Surface water within the Proposed Project alignment generally drains to the west or southwest toward Los Peñasquitos Lagoon and the Pacific Ocean.

Geologic Setting and Units

The Proposed Project is located on a block of basement rock bounded by the Elsinore fault zone to the northeast and the Newport-Inglewood-Rose Canyon fault zone to the west. The western portion of the Project alignment dominantly occurs on Tertiary sedimentary units (Tss) and Quaternary lacustrine, playa, and estuarine deposits (Qvol) (CGS 2010). Portions of the northern half of Segment A are located on older, Cretaceous and pre-Cretaceous metasedimentary units (pKm). The easternmost portion of the Proposed Project alignment is located on Tss. Localized landslide deposits are present near the Project alignment just north of the Segment A midpoint and also south of Segment D (CGS 2010). The mapped landslide deposits are associated with Los Peñasquitos Creek. Figures 4.5-1 through 4.5-3 show the geologic units in the Proposed Project area. The main geologic units in the Proposed Project area are described in Table 4.5-1.

Figure 4.5-1 Geologic Units in the Proposed Project Area (Transmission Corridor and Staging Yards)

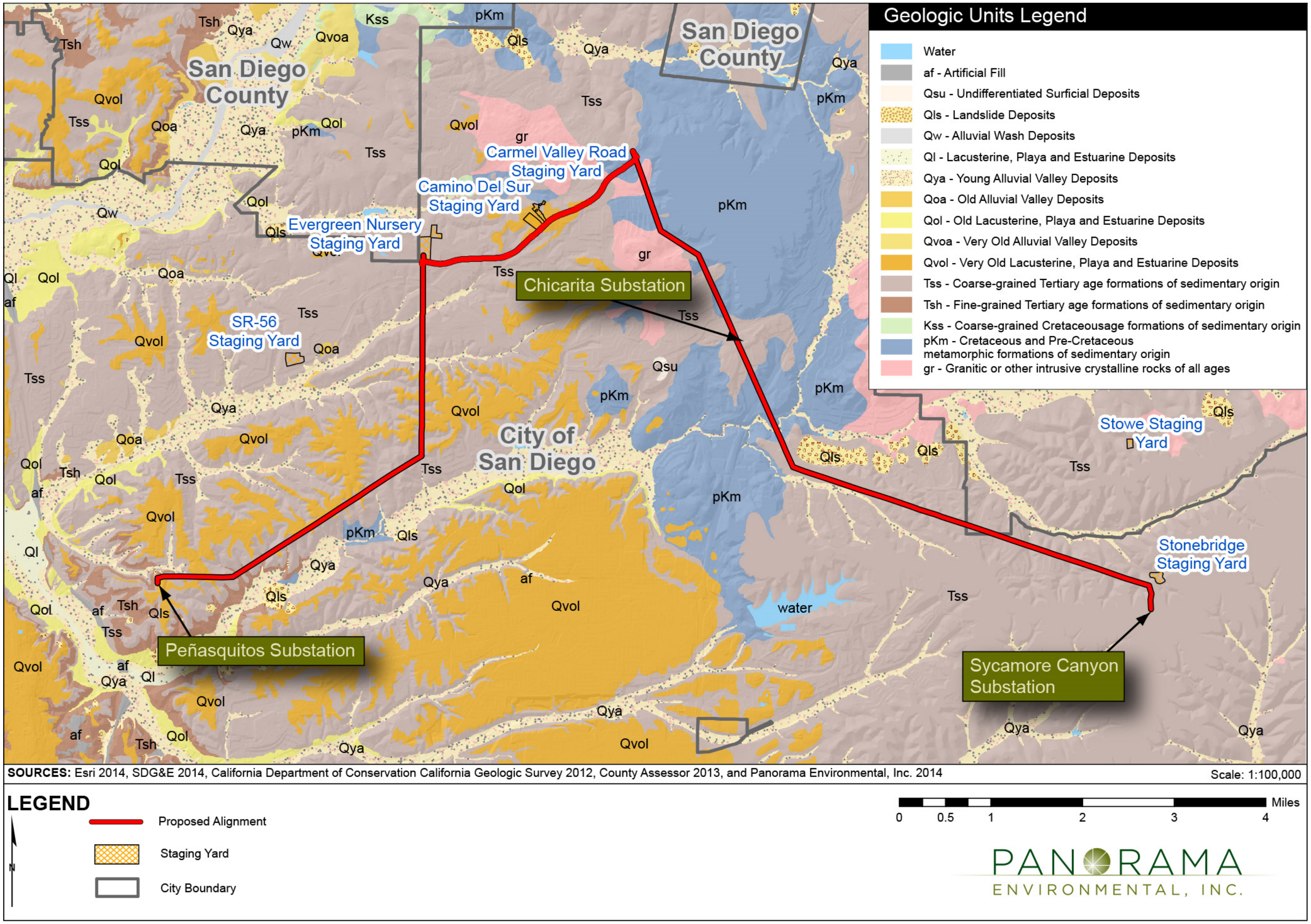


Figure 4.5-2 Geologic Units in the Proposed Project Area (Encina Hub)

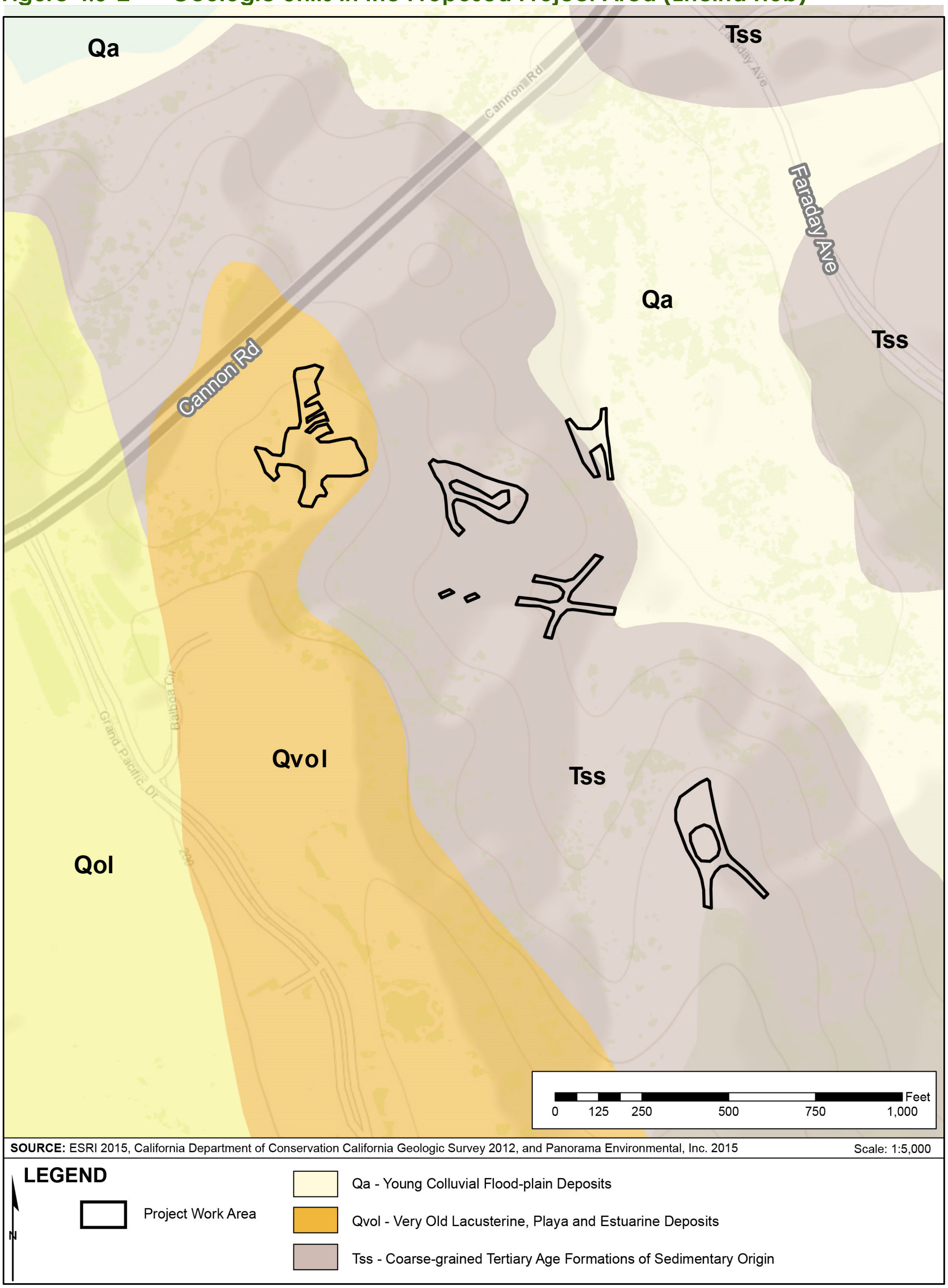
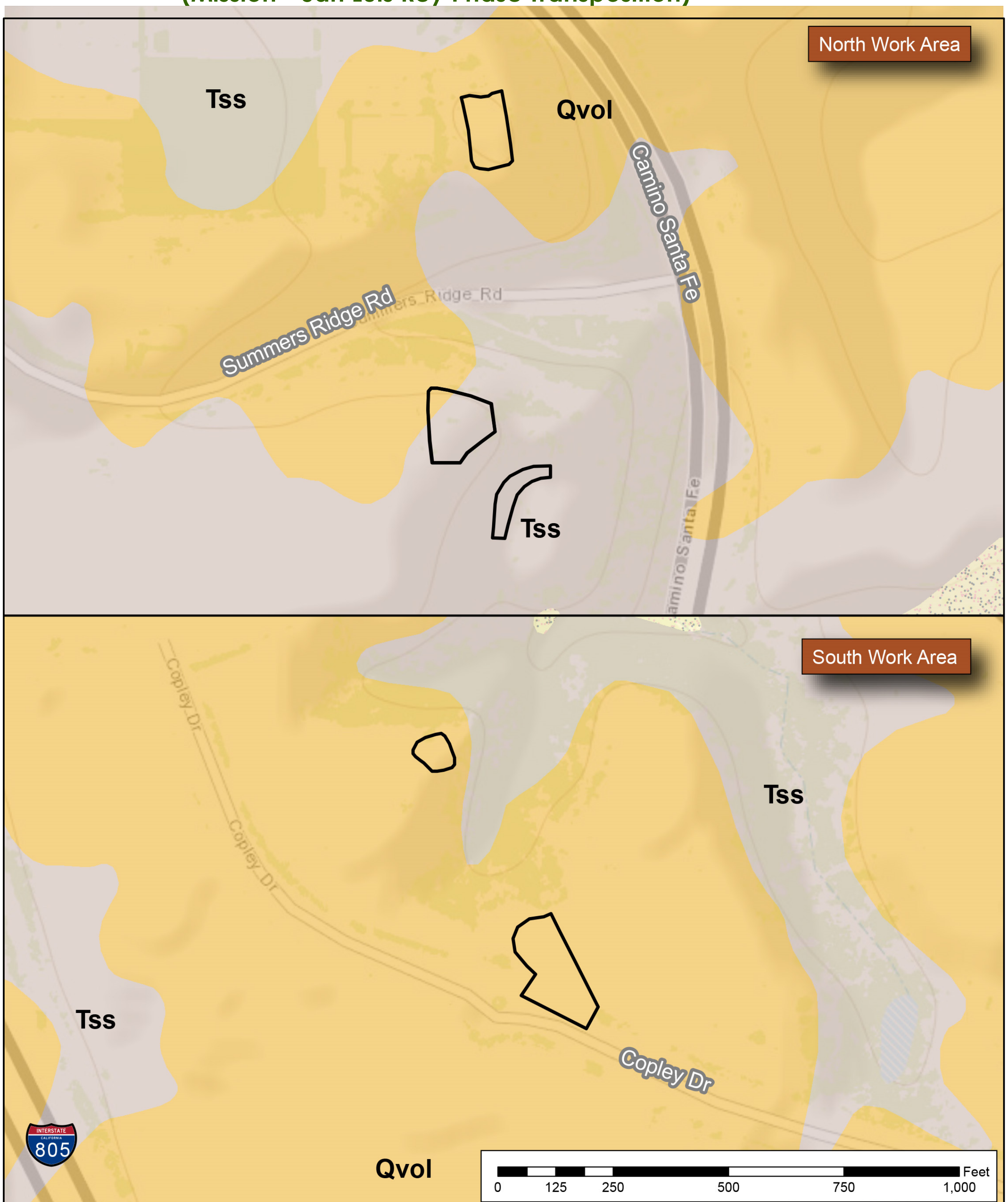


Figure 4.5-3 Geologic Units in the Proposed Project Area (Mission—San Luis Rey Phase Transposition)



SOURCE: ESRI 2015, California Department of Conservation California Geologic Survey 2012, and Panorama Environmental, Inc. 2015 Scale: 1:4,000

LEGEND

North and South Work Area

Qvol - Very Old Lacusterine, Playa and Estuarine Deposits

Tss - Coarse-grained Tertiary Age Formations of Sedimentary Origin

Table 4.5-1 Geologic Units in the Proposed Project Area

Age (from youngest to oldest)	Unit	Description
Quaternary: Holocene to Late Pleistocene	Qya	Young alluvial valley deposits: unconsolidated to slightly consolidated, undissected to slightly dissected clay, silt, sand, and gravel along stream valleys and alluvial flats of larger rivers
Quaternary: Middle to Early Pleistocene	Qvol	Very old lacustrine, playa, and estuarine deposits: moderately to well consolidated, moderately dissected, fine-grained sand, silt, mud, and clay from lake, playa, and estuarine deposits of various types
Tertiary	Tss	Coarse-grained formations of sedimentary origin – dominantly sandstone and conglomerate (e.g., Ardath Shale, Friars Formation)
Cretaceous and pre-Cretaceous	pKm	Metamorphic formations of sedimentary and volcanic origin
Various	gr	Granitic and other intrusive crystalline rocks of all ages

Source: CGS 2010

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 Proposed Project area is underlain by soils with a large coarse-grained component (e.g., cobbly loams and rocky silt loams). Granular soils have low expansive potential. Clay and clay loam soils with high shrink-swell potential comprise approximately 10 percent of the soils underlying Proposed Project areas.

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 or as generally low-density, fine-grained combinations of clay and sand left by mudflows that have dried, resulting in the formation of small air pockets in the subsurface. These soils typically consist of silt and sand, with minor amounts of clay. When moisture is added, the soils weaken, resulting in collapse or subsidence. Collapsible soil deposits are not anticipated to be present in the Proposed Project area because the majority of the Proposed Project area is along ridgelines and the soil types within the Proposed Project area have a low potential for collapse.

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 geologic parent material, soil type, 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 Proposed Project area is variable.

Soils underlying the Proposed Project area are classified as having low, moderate, and high erosion potential (Table 4.5-2). Figures 4.5-4 through 4.5-6 show the soil units in the Project area.

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 the Proposed Project area are mostly coarse-grained and sandy soils with no underlying aquifer; thus, the area has a low potential for subsidence. Subsidence presents a minor threat to limited parts of the County of San Diego. There is no historical record of subsidence in the Proposed Project region (County of San Diego 2011).

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 (slope over-steepening or overloading) and natural events (e.g., earthquakes, rainfall, and erosion).

The Proposed Project area is not located within a high landslide risk area, as defined by the County of San Diego (County of San Diego 2011). The transmission line alignment intersects a few areas of marginal landslide susceptibility, as defined by the County of San Diego. The Proposed Project alignment does not intersect any landslides or landslide deposits identified on geologic maps (CGS 2010) and no landslides have been identified within the Proposed Project area (Benton Engineering 1972b; Geocon, Inc. 2012a and 2012b). No landslides were identified in the vicinity of Project structures based on review of aerial photographs of Proposed Project area terrain in 2015. As discussed above, localized landslide deposits are present near the Project alignment just north of the Segment A midpoint and also south of Segment D. The mapped landslide deposits are associated with Los Peñasquitos Creek. The Proposed Project area includes several areas of locally steep terrain, which have the potential to be affected by landslides and other mass wasting.

Seismicity and Faults

Faults

Faults are fractures or lines of weakness in the Earth's crust. Sudden movement along a fault generates an earthquake. The Proposed 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 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

Table 4.5-2 Major Soil Units in the Proposed Project Area

Soil Series	Description	Acreage of Project Area[1]	Percent Slope	Runoff Rate	Shrink-swell Potential	Erosion Potential
Altamont clay	Deep, well-drained soils that formed in material weathered from fine-grained sandstone and shale. Found in gently sloping to very steep uplands.	0.68 0.01 0.71	5 to 9 15 to 30 30 to 50	Medium to rapid	High	Moderate to high
Auld clay	Deep, well-drained soils formed in residuum from basic igneous rocks. Found on foothills and uplands.	1.56 0.59	5 to 9 9 to 15	Medium	High	Moderate
Auld stony clay	Deep, well-drained soils consisting of 15-25% stones. Formed in residuum from basic igneous rocks. Found in strongly sloping to moderately steep uplands.	0.61	9 to 30	Medium	High	Moderate to high
Chesterton fine sandy loam	Moderately well-drained fine sandy loams. Formed in material weathered in place from soft ferruginous sandstone. Found on ridges and in swales.	0.56	2 to 5	Slow	Moderate	Slight
Diablo clay	Well-drained clay formed 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	3.18 4.62 4.82	2 to 9 9 to 15 15 to 30	Slow runoff when dry, medium to rapid when soils are moist	High	Low
Diablo-Olivenhain complex	50% Diablo clay (above) and 45% Olivenhain cobbly loams (below). Occurs on wetlands.	2.14	9 to 30	Medium to rapid	High	Moderate to high
Friant rocky fine sandy loam	Shallow to very shallow, well-drained fine sandy loams that formed in material weathered from fine-grained metasedimentary rock. Found on steep to very steep mountainous uplands.	1.67	30 to 70	Rapid to very rapid	Low	High to very high

Soil Series	Description	Acreage of Project Area[1]	Percent Slope	Runoff Rate	Shrink-swell Potential	Erosion Potential
Gaviota fine sandy loam	Well-drained, shallow fine sandy loams that formed in material weathered from marine sandstone. Found on uplands.	5.83	30 to 50	Rapid	Low	High
Huerhuero loam, eroded	Moderately well-drained loams that have a clay subsoil. Calcareous alluvium formed from sedimentary rock; found on marine terraces as valley deposits	8.6 0.1	5 to 9 15 to 30	Very rapid	Low (surface) to moderate	High
Las Flores loamy fine sand	Moderately well-drained. Residuum weathered from siliceous calcareous marine sandstone; found on backslopes of uplands and marine terraces	0.14 17.3 16.72 4.66	2 to 9 5 to 9 9 to 15 15 to 30	Medium to very rapid	Low (surface) to moderate	Moderate
Linne clay loam	Well drained, moderately deep clay loams derived from soft calcareous sandstone and shale. Found on uplands.	1.01	9 to 30	Medium to rapid	Moderate	Moderate to high
Olivenhain cobbly loam	Moderately well-drained, moderately deep to deep cobbly loams that consist of very cobbly clay subsoil. Alluvium found on gently to strongly sloping terrain and on dissected marine terraces	13.31 35.85 6.01	2 to 9 9 to 30 30 to 50	Slow to medium	Low to moderate	Low
Redding gravelly loam	Well drained gravelly loams that have a hardpan. Includes duripan horizon (cemented soil); forms in alluvium derived from mixed sources; found on nearly level or dissected and undulating to hilly high terraces	16.75	2 to 9	Very low to rapid	Low (surface) to moderate	Low
Redding cobbly loam	See above	1.37 41.74	9 to 30 15 to 50	Very low to rapid	Low (surface) to moderate	Low
Riverwash	Excessively drained material that is typically sandy, gravelly, or cobbly. Found in intermittent streams.	0.83	N/A	N/A	Low	N/A

Soil Series	Description	Acreage of Project Area[1]	Percent Slope	Runoff Rate	Shrink-swell Potential	Erosion Potential
Salinas clay loam	Well-drained to moderately well-drained clay loams that formed in sediments washed from Diablo, Linne, Las Flores, Huerhuero, and Olivenhain soils. Found in flood plains and alluvial fans.	0.19	2 to 9	Slow to medium	Moderate	Slight to moderate
San Miguel rocky silt loam	Well-drained, shallow to moderately deep silt loams with a clay subsoil. Derived from metavolcanic rock. Found in mountainous areas.	2.77	9 to 30	Medium to rapid	High	Moderate to high
San Miguel-Exchequer rocky silt loam	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	7.99	9 to 70	Medium to very rapid	San Miguel: Moderate to high due to smectitic clay content Exchequer: low	High
Terrace escarp-ments	Long, narrow, rocky areas with steep faces that rise abruptly from mean tide line to coastal plain terraces or plateaus; composed of soft coastal sandstone, hard shale, or hard, weather-resistant, fine-grained sandstone	5.33	N/A	N/A	Variable	Variable
Visalia gravelly sandy loam	Moderately well-drained, very deep sandy loams derived from granitic alluvium. Found in alluvial fans and flood plains.	3.7	2 to 5	Slow	Low	Slight

Note:

1 For the purpose of the soils data, Project area refers to the land occupied by Proposed Project components, which includes the transmission line alignment, temporary working areas, staging areas, vault locations, and stringing sites. The transmission line alignment includes a 6-foot-wide buffer.

Sources: NRCS 2015b, 2015c

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Figure 4.5-4 Soil Units in the Proposed Project Area (Map 1 of 3)

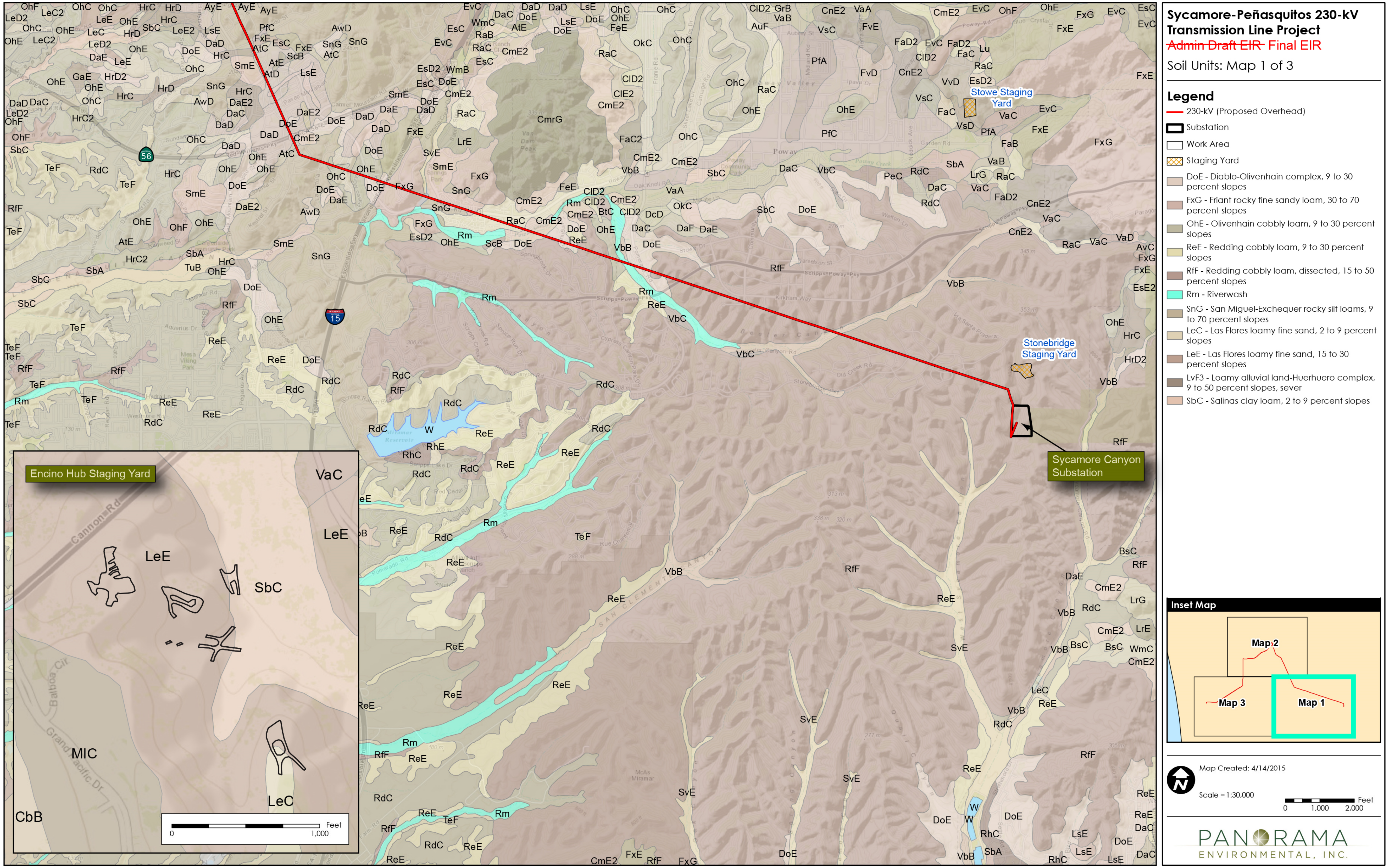


Figure 4.5-5 Soil Units in the Proposed Project Area (Map 2 of 3)

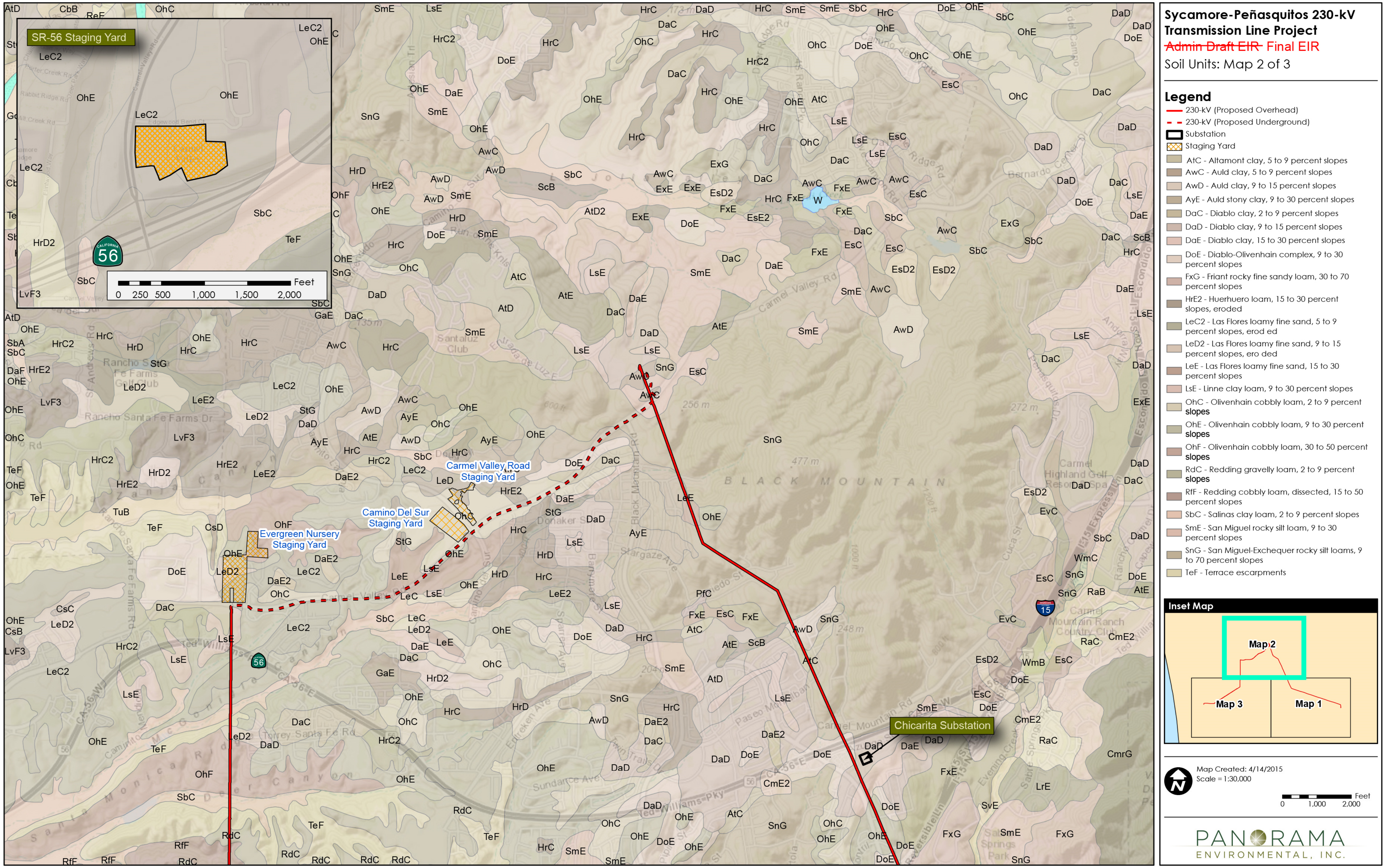
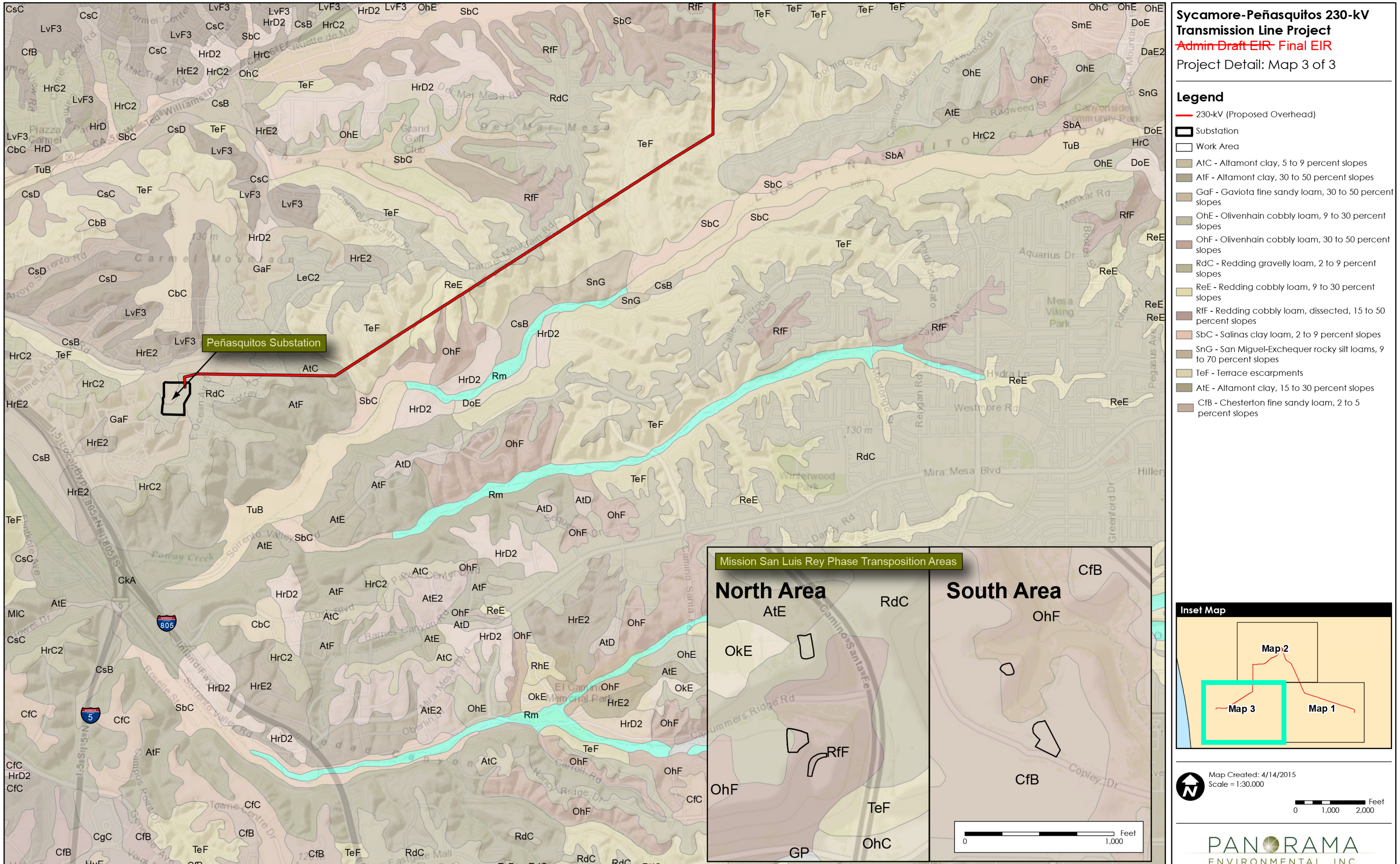


Figure 4.5-6 Soil Units in the Proposed Project Area (Map 3 of 3)



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evidence of surface displacement within Holocene time (about the last 11,000 years) (Bryant and Hart 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 Proposed Project area (CGS 2010).

There are a number of active and potentially active major regional fault systems within and adjacent to San Diego County (Jennings and Bryant 2010). Fault locations are illustrated on Figure 4.5-7. Table 4.5-3 lists the approximate distance of the active fault systems nearest to the Proposed Project area, as well as known maximum value of magnitude (Mw_{max}) and slip rate. No active or potentially active faults underlie the Proposed Project area.

The Rose Canyon fault is the active fault closest to the project corridor (CGS 2010), located approximately 5 miles to the southwest. It trends northwest, generally parallel to the coast (Figure 4.5-7). The potentially active Coronado Bank, San Diego Trough, Elsinore, and San Jacinto fault zones are located within 60 miles of the Proposed 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 Elsinore and San Jacinto 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.

Table 4.5-3 Major Active Faults in the Proposed Project Region

Fault Name	Distance and Direction from Site[1]	Maximum Moment Magnitude[2]	Slip Rate (millimeters/year)
Rose Canyon (Silver Strand segment)	4 miles west of Mission Substation staging yard	7.2	1.5
Coronado Bank (Coronado segment)	16 miles southwest of Mission—San Luis Rey Phase Transposition South	7.3	3.0
San Diego Trough	24 miles southwest of Mission—San Luis Rey Transposition South	No data	No data
Elsinore (Julian segment)	26 miles northeast of Stowe staging yard	7.1	5.0
San Jacinto (Coyote Creek segment)	47 miles east of Stowe staging yard	6.8	4.0

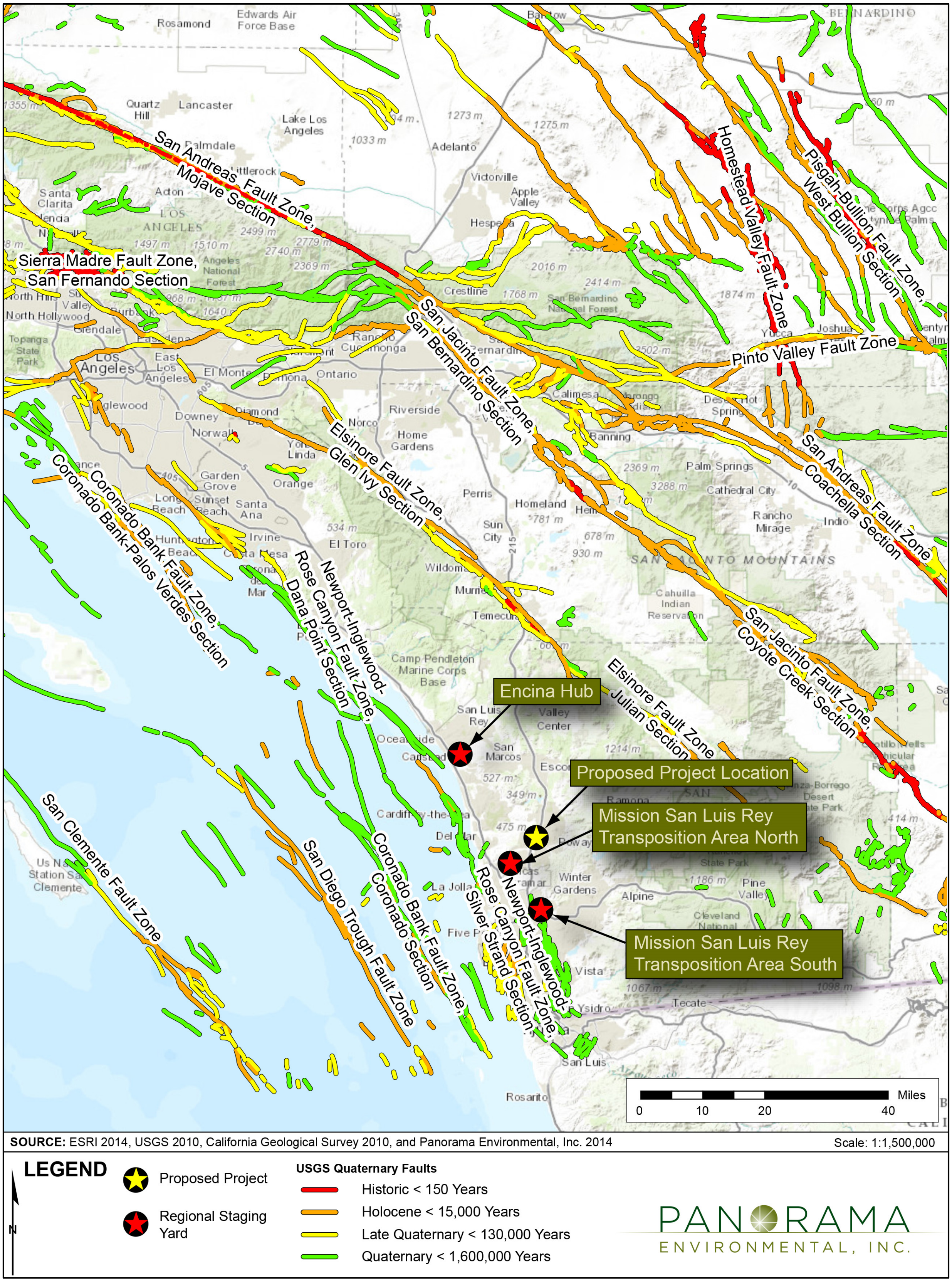
Notes:

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 [CGS 2003].

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

Figure 4.5-7 Major Faults in the Proposed Project Region



SOURCE: ESRI 2014, USGS 2010, California Geological Survey 2010, and Panorama Environmental, Inc. 2014

Scale: 1:1,500,000

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:
  - Coronado Bank 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 Proposed Project area is not underlain by any known active faults.

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 the Project region have the potential to produce high-magnitude earthquakes, 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 residuum, which typically experience stronger ground shaking than areas located on hard rock.

Approximate ground motion parameters were estimated for the western and eastern extents of the Proposed Project area (i.e., Peñasquitos Substation and Sycamore Substation). The parameters presented in Table 4.5-4 are expressed as a fraction of shear wave velocity (g). 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

Table 4.5-4 Estimated Ground Motion Parameters in the Proposed Project Area[1]

Ground Motion Parameter[1]	Geologic Material[2] High Shear Wave Velocity (g)[3]	Moderate Shear Wave Velocity (g)	Low Shear Wave Velocity (g)
Peñasquitos Substation[4]			
PGA	0.193	0.219	0.258
Sa (0.2-second)	0.443	0.510	0.573
Sa (1.0-second)	0.150	0.198	0.321
Sycamore Substation[5]			
PGA	0.180	0.204	0.247
Sa (0.2-second)	0.411	0.476	0.554
Sa (1.0-second)	0.139	0.184	0.302

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 The following parameters were used to estimate ground motion parameters:

- High shear wave velocity: 900 meters/second (approximates firm rock)
- Moderate shear wave velocity: 550 meters/second (approximates soft rock)
- Low shear wave velocity: 270 meters/second (approximates dry alluvium)

3 g = acceleration due to gravity.

4 Coordinates: 32.918798, -117.217899.

5 Coordinates: 32.916293, -117.031889.

Source: CGS 2015

provide a measure of the seismic hazard in a given geographic area.[1] Each ground motion value is shown for three shear wave velocities. Shear wave velocities are generally lower for softer, less consolidated geologic material and higher for harder, more competent geologic material. The three shear wave velocities used to calculate the ground motion parameters are meant to represent firm rock, soft rock, and alluvium. The Proposed 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 during a seismic event. 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

1 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.

density, and grain size; 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. Liquefaction is most common in areas with shallow groundwater (i.e., less than 50 feet ~~below ground surface [~~bgs~~]~~) dominated by granular, unconsolidated materials.

Liquefaction and ground failure or structural damage resulting from liquefaction are not known to have occurred historically in San Diego County (Office of Emergency Services and Unified Disaster Council 2010). Seismic shaking has not been of sufficient magnitude to trigger liquefaction. The San Diego County Multi-Jurisdiction Hazard Plan identifies "liquefaction layers" along the southwest-flowing creeks within the Proposed Project area (Office of Emergency Services and Unified Disaster Council 2010). These layers are characterized by soft soils and shallow groundwater (i.e., along creek beds). The Proposed Project area is not located within a high liquefaction risk area defined by the County of San Diego as areas with PGAs that exceed 0.50 (Office of Emergency Services and Unified Disaster Council 2010). The closest liquefaction hazard area is located about 4 miles west of the Proposed Project area, within the Rose Canyon fault zone.

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 can occur in fine-grained, sensitive soils such as quick clays, particularly if remolded or disturbed by construction and grading. Loose, granular soils present on gentle slopes and underlain by a shallow water table commonly produce lateral spreads through liquefaction. 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 liquefaction hazard in the Proposed Project area is low and therefore the potential for lateral spreading also generally is low. Marine terraces are present in the Proposed Project area, however. These terraces are a type of free-face terrain that have the potential for lateral spreading.

Mineral Resources

The main mineral resources within the Project region are construction materials (e.g., sand, gravel, and crushed rock), industrial and chemical mineral materials (e.g., limestone, marble, gypsum, and dimension stone), and metallic and rare minerals (e.g., precious metals, lead, zinc, and gemstones) (County of San Diego 2011).

The California Surface Mining and Reclamation Act (SMARA) of 1975 requires that the State Geologist classify land into mineral resource zones (MRZs) according to the known or inferred mineral potential of the land. MRZs are defined as follows:

- MRZ 1: Areas where adequate information indicates that no significant mineral deposits are present or where it is judged that there is little likelihood for their presence

- MRZ 2: Areas where adequate information indicates significant mineral deposits are present or where it is judged that there is a high likelihood for their presence
- MRZ 3: Areas containing mineral deposits, the significance of which cannot be evaluated from available data
- MRZ 4: Areas where available information is inadequate for assignment to any other MRZ.

Portions of the Proposed Project area, including much of the Proposed Project area east of I-15, are classified as MRZ 2 as shown in Figure 4.5-8.

Geotechnical Study Results and Design Recommendations

Deep Foundation Design

Compression wave velocity profiles and results from borings were used to develop subsurface material profiles (i.e., soil, bedrock, and rock layers) for each proposed pole location. The geotechnical report included a recommendation to use the subsurface material profiles and associated engineering properties for each pole location during pier foundation design. Micropile foundations may be used as an alternative to drilled pier foundations. All pole excavations should be observed by the engineer during excavation.

Construction Dewatering

Groundwater was encountered at three of the boring test sites, one of which was located along the Segment B underground transmission line route. The depths to groundwater (approximately 35 and 22 feet bgs) were deeper than proposed construction activities; however, dewatering may be required during construction. If necessary, the means and method of dewatering shall comply with RWQCB requirements.

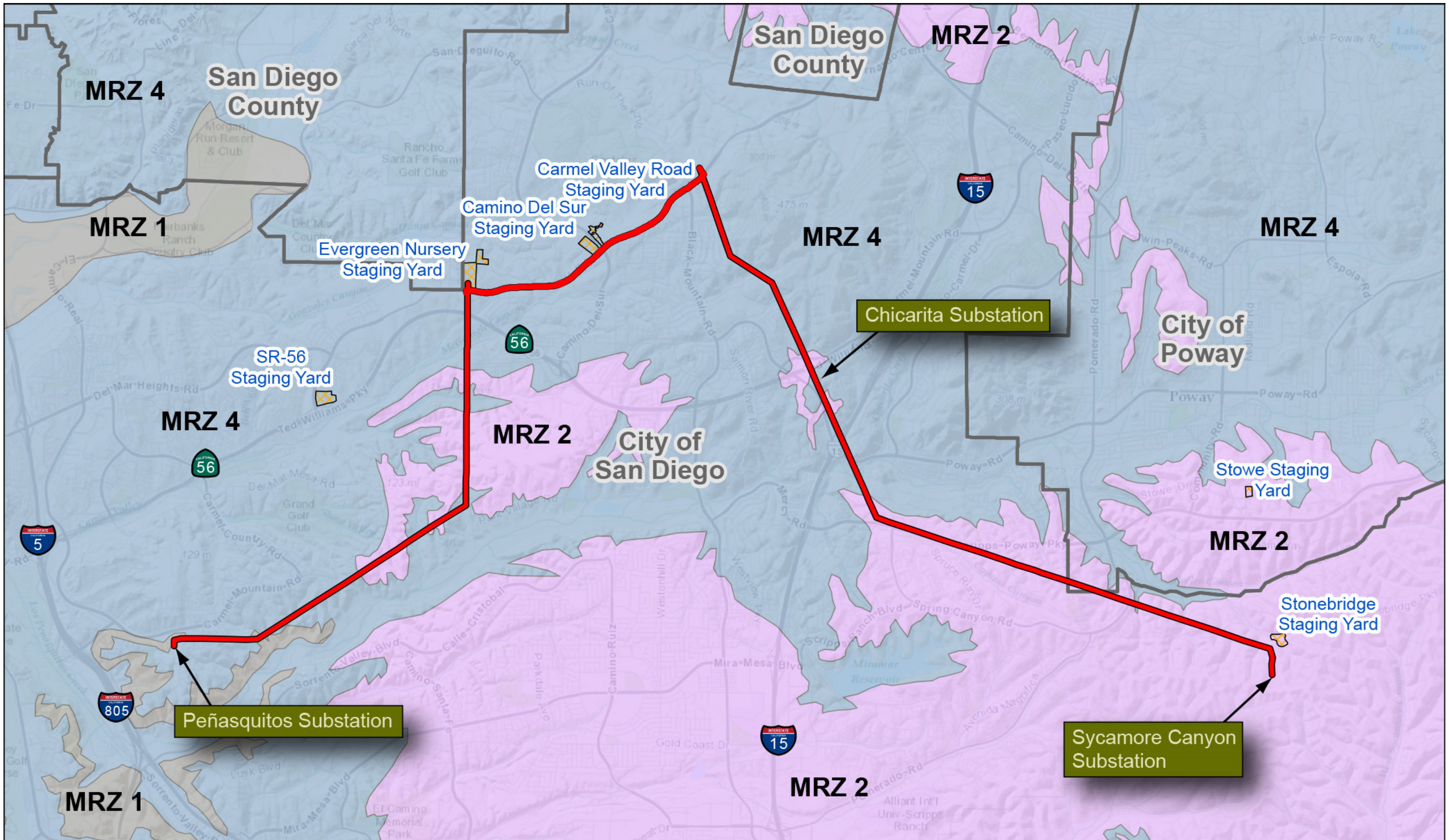
Retaining Walls

The geotechnical study included recommended locations for retaining walls to accommodate maintenance pads for poles. The geotechnical engineer should consider the load from lateral earth pressure and any surcharges from adjacent loads in the design of retaining walls. The earth pressure metrics used during retaining wall design should assume a drainage system will be installed behind the retaining walls such that external water pressure would not develop. Walls greater than 6 feet in height should be designed to support a seismic active pressure. The study also included a recommendation that SDG&E contact their contractor for additional evaluation specific to each retaining wall location prior to final engineering of the walls.

Soil Corrosion

Laboratory tests indicated that there was generally a negligible potential for sulfate attack on concrete structures and a moderate potential at one location. Recommendations included the use of Type II cement and concrete covers over reinforced steel structures. The tests indicated a low potential for chloride attack on concrete structures. It may be necessary to implement

Figure 4.5-8 Mineral Resource Classifications Near the Proposed Project



SOURCES: Esri 2015, SDG&E 2014, County of San Diego Planning and Development Services 2015, County Assessor 2013, and Panorama Environmental, Inc. 2015

Scale: 1:100,000

LEGEND

- Proposed Alignment
- Staging Yard
- City Boundary
- MRZ 1 - Resource not present
- MRZ 2 - Resource present
- MRZ 4 - Resource potentially present

0 0.5 1 2 3 4 Miles

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methods of protection again corrosion due to pH levels of the soil, which could include increased concrete cover or a low water-cement ratio. The tests also indicated very low electrical resistivity in the soils; to protect against corrosion, metallic project elements (i.e., steep poles) should be reviewed by a corrosion engineer.

4.5.3 Applicable Regulations, Plans, and Standards

4.5.3.1 Federal

A federal agency is not approving, implementing, or funding the Proposed Project or any element of it. There are no federal geology, soils, or mineral resources regulations that apply to the Proposed Project.

4.5.3.2 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.

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. No seismic hazard maps have been completed by the State for the County of San Diego.

California Building Code

The 2013 California Building Code (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 California Code of Regulations, 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. The Proposed Project would include these types of improvements and, therefore, the building code would be applicable.

4.5.3.3 Local

City of San Diego General Plan

The City of San Diego General Plan Public Facilities, Services, and Safety Element contains policies related to geologic and seismic hazards. The following policy would pertain to the Proposed Project:

PF-Q.1. Protect public health and safety through the application of effective seismic, geologic and structural considerations.

a. Ensure that current and future community planning and other specific land use planning studies continue to include consideration of seismic and other geologic hazards. This information should be disclosed, when applicable, in the California Environmental Quality Act (CEQA) document accompanying a discretionary action.
b. Maintain updated citywide maps showing faults, geologic hazards, and land use capabilities, and related studies used to determine suitable land uses.
c. Require the submission of geologic and seismic reports, as well as soils engineering reports, in relation to applications for land development permits whenever seismic or geologic problems are suspected.
d. Utilize the findings of a beach and cliff erosion survey to determine the appropriate rate and amount of coastline modification permissible in the City.
e. Coordinate with other jurisdictions to establish and maintain a geologic "data bank" for the San Diego area.
f. Regularly review local lifeline utility systems to ascertain their vulnerability to disruption caused by seismic or geologic hazards and implement measures to reduce any vulnerability.
g. Adhere to state laws pertaining to seismic and geologic hazards.

City of Poway General Plan

The City of Poway General Plan establishes goals and policies to provide guidance in the growth of the City. The following geology and soils resources policies were identified under Goal VIII in the City of Poway General Plan. Goal VIII states that it is the goal of the City of Poway to minimize injuries and loss of life, and property damage resulting from natural and man-made hazards.

Policy B – Geologic Hazards

The community should be projected against the hazards associated with geologic formations particularly landslides, through proper land use policies and mitigation. Strategies include:

1. Compare all development applications with the Geographic Information Management Systems (GIMS) mapping system to determine if significant geologic hazards exist.
2. Investigations performed by a qualified engineering geologist or soil engineer shall be required for all new development review applications.
3. Include, as a condition of approval, the recommendations of the engineering geologist for geologic hazard mitigation and the soils engineer for soils related issues.
4. Development within unstable slope and landslide areas will be prohibited unless adequate measures are taken to protect against slippage.
5. Establish and maintain proper soil management techniques to reduce the adverse effects of soil related problems such as shrink swell behavior erosion run off potential and septic tank failure

Policy C – Seismic Safety

Seismic hazards should be controlled to a level of acceptable risk through the identification and recognition of potentially hazardous conditions and areas. Strategies include:

1. Take all appropriate actions to identify and mitigate seismic hazards such as ground shaking, ground rupture, landslides, liquefaction and structural hazards.
2. The GIMS Mapping System and the Seismic Matrix shall be used to determine if the probability of a seismic hazard exists.
3. Where it has been determined that there is the probability of a seismic hazard an investigation by a qualified engineering geologist shall be required.

City of Carlsbad

The Draft City of Carlsbad General Plan Update includes policies for geologic and seismic investigation in the Public Safety Element. The following policy would pertain to the Proposed Project:

6-P.16 Require qualified geotechnical engineering professionals to review grading plans and inspect areas of excavation during and after grading, to evaluate slope stability and other geotechnical conditions that may affect site development and public safety. In areas of known or suspected landslides and/or adverse geologic conditions, the following determinations should be made: extent of landslide, depth-to-slide plane, soil types and strengths, presence of clay seams and ground water conditions.

4.5.4 Applicant Proposed Measures

SDG&E has proposed measures to reduce environmental impacts. The significance of the impact is first considered prior to application of APMs, and a significance determination is made. The implementation of the APMs 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 project approval, and SDG&E would be required to adhere to the APMs as well as any identified mitigation measures. The APMs are included in the MMRP for the Project (refer to Chapter 9 of this EIR), and the implementation of the measures would be monitored and documented in the same manner as mitigation measures. The APMs that are applicable to the geology, soils, and mineral resources analysis are provided in Table 4.5-5.

Table 4.5-5 Applicant Proposed Measures for Geology, Soils, and Mineral Resources Impacts

APM Number	Requirements
APM GEO-1: Seismic Standards	Design and construction of overhead facilities would conform to CPUC General Order 95, industry practice, and SDG&E internal structural design requirements to minimize damage from seismic shaking.
AMP GEO-2: Geotechnical Recommendations	A geotechnical study will be conducted for the Proposed Project under the direction of a California-licensed Geotechnical Engineer or Certified Engineer Geologist, and recommendations identified in the geotechnical report will be carried out.
APM GEO-3: Minimize Soil Disturbance	Ground and soil disturbance will be minimized through the use of existing access routes, to the extent feasible. Soil erosion and topsoil loss would be controlled by implementing SDG&E's *BMP Manual* during the construction of the Proposed Project. Additionally, the Proposed Project would comply with the Construction General Permit, which would include the preparation of SWPPP. Topsoil would be salvaged from areas where grading would otherwise result in loss of topsoil, and the salvaged soil would be used to reclaim areas of temporary construction disturbance.

APM Number	Requirements
APM HYDRO-1: Temporary BMPs	SDG&E's Water Quality Construction BMPs Manual (BMP Manual) organizes and presents SDG&E's standard water quality protection procedures for various specific actions that routinely occur as part of SDG&E's ongoing construction, operations, and maintenance activities. The primary focus of most BMPs is the reduction and/or elimination of potential water quality impacts during construction of linear projects such as the Proposed Project. The BMPs described within the BMP Manual were derived from several sources including the State of California guidelines as well as the Caltrans Water Quality BMPs. The BMP Manual will be utilized during construction (by way of preparation and implementation of the SWPPP), operation, and maintenance of the Proposed Project to ensure compliance with all relevant SDG&E and government-mandated regulatory water quality standards. Additionally SDG&E will follow the BMPs in the SDG&E Subregional NCCP.
APM HYDRO-2: Permanent BMPs	Once temporary surface disturbances are complete, areas that would not be subject to additional disturbance will be stabilized to control soil erosion. Disturbed areas must be stabilized per the project SWPPP.

4.5.5 CEQA Significance Criteria

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

Also consistent with Appendix G, the Proposed Project would have a significant impact on mineral resources if it would:

h. Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.
i. Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan.

4.5.6 Approach to Impact Analysis

This impact analysis considers whether implementation of the Proposed Project or alternatives would result in significant impacts to geology, soils and mineral resources. The analysis focuses on reasonably foreseeable effects of the Proposed Project and alternatives as compared with baseline conditions. The analysis uses significance criteria based on the CEQA Appendix G Guidelines. The potential direct and indirect effects of the Proposed Project and alternatives are addressed; cumulative effects are addressed in Chapter 5: Cumulative Impacts. Effects that would result from operation and maintenance of the Proposed Project and alternatives are also addressed. Applicable APMs are identified and mitigation is defined to avoid or reduce significant impacts to geology, soils, and mineral resources.

4.5.7 Proposed Project Impacts and Mitigation Measures

Table 4.5-6 provides a summary of the significance of the Project's impacts to geology, soils, and mineral resources prior to application of APMs, after application of APMs and before implementation of mitigation measures, and after the implementation of mitigation measures.

Table 4.5-6 Summary of Proposed Project Impacts to Geology, Soils, and Mineral Resources

Significance Criteria	Project Phase	Significance prior to APMs	Significance after APMs and before Mitigation	Significance after Mitigation
Impact Geology Soils Minerals -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; strong seismic ground-shaking; seismic-related ground failure including liquefaction; or landslides	Construction	Less than significant	---	---
	Operation and Maintenance	Significant	Significant APM GEO-1 APM GEO-2	Less than significant MM Geology-1 MM Geology-2
Impact Geology Soils Minerals-2: Result in substantial soil erosion or the loss of topsoil	Construction	Significant	Significant APM GEO-3 APM HYDRO-1 APM HYDRO-2	Less than significant MM Biology-6
	Operation and Maintenance	Less than significant	---	---

Significance Criteria	Project Phase	Significance prior to APMs	Significance after APMs and before Mitigation	Significance after Mitigation
Impact Geology Soils Minerals-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.	Construction, Operation and Maintenance	Significant	Significant APM GEO-1 APM GEO-2	Less than significant MM Geology-1 MM Geology-2 MM Geology-3
Impact Geology Soils Minerals-4: 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.	Construction	Significant	Significant APM GEO-1 APM GEO-2	Less than significant MM Geology-3
	Operation and Maintenance	Less than significant	---	---
Impact Geology Soils-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.	Construction, Operation and Maintenance	No impact	---	---
Impact Geology Soils Minerals-6: Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state	Construction, Operation and Maintenance	No impact	---	---
Impact Geology Soils Minerals-7: Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan	Construction, Operation and Maintenance	No impact	---	---

Impact Geology Soils Minerals-1: Would the Proposed Project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: rupture of a known earthquake fault; strong seismic ground-shaking; seismic-related ground failure including liquefaction; or landslides? (*Less than significant with mitigation*)

Construction

The Proposed Project is located in a region with several active and potentially active fault zones with 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 Proposed Project area is the Rose Canyon Fault, which is approximately 5 miles southwest of the Proposed Project alignment at its closest point and 4 miles west of the Mission Substation staging yard; therefore impacts from fault rupture would not occur.

In the unlikely event of an earthquake, construction workers could be exposed to hazards from strong seismic ground shaking. Project construction would not substantially increase these risks of exposure over typical risks of exposure throughout the region. Earthquake safety training pursuant to Occupational Safety and Health Administration (OSHA) regulations would minimize potential for impacts to workers. Due to the short duration of construction (12 months), the low probability of a strong seismic event occurring during this timeframe, and safety training for construction crews, the potential for impacts would be less than significant. No mitigation is required.

Operation and Maintenance

Transmission Line

Seismic Shaking. A significant seismic event is likely to occur over the lifetime of the Proposed Project. During operation and maintenance, the number of power poles located within the transmission corridor would be similar to existing conditions. However, the project would include replacing wood poles with steel poles in Segments A and D. The new poles in Segment A would be farther from residences than the existing wood poles; however, the new poles would be larger and taller than the existing wood poles. The new double-circuit 69-kV poles in Segment D would be closer to existing residences than the existing wood poles; however, the 69-kV poles would be shorter and farther from residences than the adjacent steel lattice towers. The risk to property and life as a result of a downed power pole due to a seismic event would increase if SDG&E did not implement seismic design standards in the foundation design. The increased risk to life and property would be a significant impact. SDG&E would implement APM GEO-1 as part of the Proposed Project. APM GEO-1 requires that SDG&E design project components in accordance with CPUC GO 95, which specifies minimum construction material requirements and calculations for foundations for utility safety, and industry standards (e.g., Institute of Electrical and Electronics Engineers, Inc., Standard 693) to withstand damage from ground rupture and seismic shaking. APM GEO-1 would reduce the risk of loss, injury or death from seismic events. Impacts from seismic shaking would be less than significant. No mitigation is required.

Liquefaction and Seismic-Induced Landslides. The slopes most susceptible to earthquake-induced failure are those composed of highly weathered and unconsolidated materials that are moderately steep to steep. The Proposed Project area includes steep terrain. Liquefaction is most common in areas with shallow groundwater (i.e., less than 50 feet bgs) dominated by granular, unconsolidated materials. Areas with the highest risk for liquefaction occur along the creeks where groundwater is expected to occur near the surface. Project areas with the highest risk for liquefaction occur along the creeks where groundwater is expected to occur near the surface.

Proposed Project structures would be constructed on high points within areas of steep terrain, which could be subject to seismic related landslides. Similarly, structures may be located in areas subject to liquefaction if there is shallow groundwater near the foundation. The risk to property and life as a result of seismic related ground failure or liquefaction would increase relative to baseline conditions if the site soils are not handled properly and in accordance with appropriate engineering procedures, or if the foundations are not designed properly to address liquefaction, particularly in areas with shallow groundwater. These impacts would be significant. SDG&E would implement APM GEO-2 as part of the Proposed Project. APM GEO-2 requires that SDG&E conduct a geotechnical study under the direction of a California-licensed Geotechnical Engineer or Certified Engineering Geologist and to implement the recommendations included in the geotechnical report. Impacts would remain significant if the geotechnical investigation specified in APM GEO-2 did not assess the potential for seismic related landslides and liquefaction or incorporate the results into the final Project design. Mitigation Measure Geology-1 requires consideration of liquefaction and implementation of the necessary design modifications in the Final Design. It further requires SDG&E to submit the study results and recommendations to the CPUC for review and approval 60 days prior to Final Design to reduce impacts. Mitigation Measure Geology-2 requires geotechnical investigation for landslides and implementation of protection measures to protect against slope instability. Impacts related to seismic-related landslides and liquefaction would be minimized through implementation of the geotechnical recommendations in the Final Design and construction. Impacts would be less than significant with mitigation.

Substations

The Proposed Project improvements at the Peñasquitos and Sycamore Substations would be located entirely within the fenced substation yards. Minimal grading is proposed to install the new racks at the Sycamore and Peñasquitos Substations. The work would occur within the substation pad, which is at low risk for seismic induced ground failure or liquefaction. The substation is not located near any development. The new racks would be similar in height to the existing racks and their installation and operation would not increase any seismic risks associated with operation of the facilities. The risk of loss, injury or death from seismic-related ground failure or liquefactions from the Proposed Project work at the substations is exceptionally low and less than significant. No mitigation is required.

Encina Hub

Work in the Encina Hub area would include removal of existing equipment, which would not increase impacts of strong seismic shaking. The Encina Hub is located in an area that likely has shallow groundwater and could be subject to liquefaction; however, no grading is proposed at Encina Hub and one existing pole may be replaced. This pole would not be located near development or areas of public use. The pole replacement would not increase the risk of loss, injury, or death associated with a seismic event, seismic-related ground failure, or liquefaction over the existing conditions. The impact would therefore be less than significant. No mitigation is required.

Mission—San Luis Rey Phase Transposition and Staging Yards

There would be no new structures in the Mission—San Luis Rey phase transposition areas or at the proposed staging yards. The Project would have no impact associated with fault rupture, strong seismic shaking, and would not increase the risk of loss, injury or death from seismic-related ground failure or liquefaction in these areas. There would be no impact.

Mitigation Measures: Geology-1 and Geology-2

Mitigation Measure Geology-1: Geotechnical Investigation for Liquefaction. The design level geotechnical investigations to be performed by SDG&E shall include investigations that assess the potential for liquefaction to affect the Project and all associated facilities, specifically at tubular steel pole locations in areas with potential liquefaction-related impacts. Where these hazards are found to occur, appropriate engineering design and construction measures shall be incorporated into the project designs as deemed appropriate by the a California-licensed Geotechnical Engineer or Certified Engineering Geologist. Design measures that would mitigate liquefaction-related impacts could include construction of pile foundations, ground improvement of liquefiable zones, and incorporation of slack in cables to allow ground deformations without damage to structures. Study results and proposed solutions to mitigate liquefaction shall be provided to the CPUC for review and approval at least 60 days before final project design.

Mitigation Measure Geology -2: Geotechnical Investigation for Landslides. The design-level geotechnical surveys conducted by SDG&E shall include slope stability analyses in areas of planned grading and excavation that cross and are immediately adjacent to hills and mountains. These surveys shall acquire data that shall allow identification of specific areas with the potential for unstable slopes, landslides, earth flows, and debris flows along the approved transmission line route and in other areas of ground disturbance, such as grading for access and spur roads. The investigations shall include an evaluation of subsurface conditions, identification of potential landslide hazards, and shall provide information for development of excavation plans and procedures. If the results of the geotechnical survey indicate the presence of unstable slopes at or adjacent to Project structures, appropriate support and protection measures shall be designed and implemented to maintain the stability of slopes adjacent to newly graded or re-graded access roads, work areas, and project structures during and after construction, and to minimize potential for damage to project facilities. These design measures shall include, but are not limited to, retaining walls, visquene, removal of unstable materials, and avoidance of highly unstable areas. SDG&E shall document compliance with this measure prior to the final project design by submitting a report to the CPUC for review and approval at least 60 days before construction. The report shall document the investigations and detail the specific support and protection measures that shall be implemented.

Significance after mitigation: Less than significant.

Impact Geology Soils Minerals-2: Would the Proposed Project result in substantial soil erosion or the loss of topsoil? (*Less than significant with mitigation*)

Construction

Transmission Line

Ground disturbance would occur while preparing new structure sites and excavating holes for foundation and pole installation. Ground disturbance also would occur, to a limited extent, during use of existing unpaved access roads and during road refreshing and reestablishment. 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 transmission line corridor generally is characterized by gently sloping terrain with steeper terrain more prevalent in the western portion of the corridor. Ground disturbance on steep slopes where vegetation has been removed would increase the potential for erosion. Construction of the transmission line would result in a significant impact if the work areas are not properly stabilized and substantial erosion occurs at one or more work areas. SDG&E would implement APMs HYDRO-1, HYDRO-2 and GEO-3 as part of the Proposed Project. APM HYDRO-1 would reduce erosion and sedimentation through the use of BMPs as directed in the site-specific SWPPP that would be prepared prior to initiation of construction (e.g., construction scheduling, fence grading limits, fiber rolls, erosion control blankets, sediment barriers). APM GEO-3 would require minimization of ground and soil disturbance, as well as topsoil loss. APM HYDRO-2 would reduce the potential for erosion through the stabilization of temporarily disturbed areas with permanent BMPs (e.g., revegetation). Areas of the transmission corridor subject to temporary disturbance may be subject to soil erosion over the long term if the restoration and revegetation of temporary disturbance areas were to fail, resulting in a significant impact. Mitigation Measure Biology-6 in Section 4.1: Biological Resources requires implementation of a restoration and revegetation plan to ensure successful revegetation and stabilization of the site. Impacts from erosion would be less than significant with mitigation.

Substations, Encina Hub, and Mission—San Luis Rey Phase Transposition

Substation modifications, Encina Hub, and Mission—San Luis Rey phase transposition work would involve minor surface disturbance and would not result in substantial erosion or loss of topsoil due to the very small area of earth disturbance. Impacts from erosion would be less than significant. While impacts would be less than significant, SDG&E would implement soil and erosion control BMPs as identified in APM HYDRO-1 (e.g., construction scheduling, fence grading limits, fiber rolls, erosion control blankets, sediment barriers) as part of the Proposed Project.

Staging Yards

The surface disturbance, vegetation removal, and grading at the staging yards could result in substantial soil erosion or loss of top soil if the soil surface were not stabilized, which would be a significant impact. APM HYDRO-1 and HYDRO-2 would reduce impacts from soil erosion and top soil loss. APM HYDRO-1 requires that SDG&E implement soil and erosion control BMPs consistent with the SWPPP (e.g., construction scheduling, fence grading limits, fiber rolls, erosion control blankets, sediment barriers). APM HYDRO-2 requires SDG&E to implement permanent BMPs in areas of surface disturbance (e.g., revegetation). Impacts from soil erosion and topsoil loss at staging yards would be less than significant. No mitigation is required.

Operation and Maintenance

Operation and maintenance activities would involve use of existing access routes and would not involve any new ground disturbance that could result in erosion or sedimentation or that would otherwise affect water quality in the Project area. SDG&E currently operates and maintains similar transmission facilities along all of the Proposed Project alignment except Segment B. SDG&E would continue to regularly inspect, maintain, and repair the new and reconstructed transmission line, power line, and distribution line facilities and substations following completion of Proposed Project construction. Segment B would be inspected ~~annually~~ approximately every three years from the ten new vaults by visual examination and using diagnostic instrumentation. Operation and maintenance work would not result in increased erosion or topsoil loss. Impacts would be less than significant. No mitigation is required.

Mitigation Measures: Biology-6 (refer to Section 4.1: Biological Resources)

Significance after mitigation: Less than significant.

Impact Geology Soils Minerals-3: Would the Proposed 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 with mitigation*)

Transmission Line

Landslides

Two formations have been identified as having high potential for landslides: the Ardath Shale and the Friars Formation. The Ardath Shale would be spanned by conductors in the west end of the alignment but no structures would be installed within this formation. One Project structure would be located on the Friars Formation (structure E5); however, it would be located in an area of gently sloping terrain with limited landslide potential. Potential for landslide impacts associated with unstable formations would therefore be low. The Proposed Project area includes several areas of locally steep terrain. The risk of landslides associated with the geologic formations in this steep terrain is generally low; however, the risk of destabilization of soils that could result in landslides is high. The steep terrain within segments A and D are therefore susceptible to landslides.

Destabilization of natural or constructed slopes in these areas of steep terrain could result from project construction activities, such as grading and excavation. Grading could alter existing slope profiles, making them unstable. The Proposed Project could expose people or structures to adverse effects involving landslides if the soils at the foundations and work pads are not properly engineered in these areas of steep slopes, which would be a significant impact. SDG&E

would implement APMs GEO-1 and GEO-2 as part of the Proposed Project. APM GEO-1 requires design in accordance with GO 95 and industry seismic standards and APM GEO-2 requires that SDG&E conduct a geotechnical study under the direction of a California-licensed Geotechnical Engineer or Certified Engineering Geologist and to implement the recommendations included in the geotechnical report. Impacts would remain significant after APMs if the geotechnical investigation does not assess the potential for unstable slopes, landslides, earth flows, or debris flows, or incorporate the results into the final Project design. Mitigation Measure Geology-2 requires geotechnical investigation for landslides and implementation of protection measures to protect against slope instability. Impacts from landslides and other ground failures would be less than significant with mitigation.

Lateral Spreading and Liquefaction

Lateral spreading and liquefaction could occur within areas of shallow groundwater (e.g. near Los Peñasquitos Creek). The new transmission line and poles would increase the risk of loss, injury, or death from lateral spreading and liquefaction if the soils were not handled properly or the pole foundations were not properly designed. SDG&E would implement APMs GEO-1 and GEO-2 as part of the Proposed Project. APM GEO-1 requires design in accordance with GO 95 and industry seismic standards and APM GEO-2 requires that SDG&E conduct a geotechnical study under the direction of a California-licensed Geotechnical Engineer or Certified Engineering Geologist and to implement the recommendations included in the geotechnical report. Impacts would remain significant after APMs if the geotechnical investigation and design did not assess the potential for lateral spreading or liquefaction, or incorporate the results into the final Project design. Impacts would remain significant if the geotechnical investigation did not assess the potential for liquefaction or incorporate the results into the final Project design. Mitigation Measure Geology-1 requires consideration of liquefaction in the Project design and CPUC approval to reduce impacts. Impacts related to seismic-related ground failure and liquefaction would be minimized through implementation of the recommendations included in the geotechnical report. Impacts from lateral spreading and liquefaction would be less than significant with mitigation.

Soil Collapse

Soil units with high shrink-swell potential (i.e., Altamont clay, Auld clay, Auld stony clay, Diablo clay, Diablo-Olivenhain complex, and San Miguel rocky silt loam) underlie approximately 10 percent of the areas of temporary and permanent disturbance. Foundation failure as a result of soil collapse could expose people or structures to risks including loss, injury, or death from a falling power line or structure, which would be a significant impact. SDG&E would implement APMs GEO-1 and GEO-2 as part of the Proposed Project. APM GEO-1 requires design in accordance with GO 95 and industry seismic standards and APM GEO-2 requires that SDG&E conduct a geotechnical study under the direction of a California-licensed Geotechnical Engineer or Certified Engineering Geologist and implement the recommendations included in the geotechnical report. Impacts related to lateral spreading or collapsible soils could still be significant if the geotechnical investigation and final design did not adequately evaluate potential collapsible soils. Mitigation Measure Geology-3 requires that

SDG&E assess the potential for collapsible soils in their foundation design and defines methods for CPUC approval. Impacts from soil collapse would be less than significant with mitigation.

Subsidence
There is no potential for subsidence as a result of the project. There is no aquifer underlying the Proposed Project area. The water required for the Project would not be obtained from groundwater supplies. Groundwater could be withdrawn to dewater the foundation excavation if shallow groundwater is encountered. The short-term localized dewatering of the foundation excavation during foundation construction would not cause subsidence due to the limited volume of water that would be removed from the soil. The Proposed Project would not cause subsidence. There would be no impact from subsidence. No mitigation is required.

Substations
All work within the Sycamore and Peñasquitos Substations would occur within the previously graded substation pads, which are located on soil units with low shrink-swell potential and low risk for liquefaction or subsidence. There would be no risk of landslides, lateral spreading, subsidence, liquefaction, or collapse as a result of the Proposed Project activities within the substation; therefore, there would be no impact.

Encina Hub
The Encina Hub area is relatively flat. No grading is proposed within the Encina Hub work area. The Encina Hub Project element would not increase the risk of landslides, lateral spreading, subsidence, liquefaction, or collapse; therefore, there would be no impact.

Mission—San Luis Rey Phase Transposition
No earth disturbance is proposed for the Mission—San Luis Rey phase transposition work. The transposition of the existing conductors would not increase the risk of landslides, lateral spreading, subsidence, liquefaction, or collapse; therefore, there would be no impact.

Staging Yards
Limited earth disturbance is proposed within the staging yards to construct a new entrance and smooth the surface of the staging yard for storage of materials. The staging yards are not in steeply sloping areas. The limited grading would not create new slopes and there would be no permanent structures within the staging yards. There would be no increased risk of loss, injury or death as a result of landslides, lateral spreading, liquefaction, or collapse within the staging yards; therefore, there would be no impact.

Mitigation Measures: Geology-1 (refer to Impact Geology Soils Minerals-1), Geology-2 (refer to Impact Geology Soils Minerals-1), and Geology-3

> **Mitigation Measure Geology-3: Assess Potential for Collapsible and Expansive Soils.** The design-level geotechnical surveys shall identify areas with potentially expansive or collapsible soils and include appropriate design features, including excavation of potentially expansive or collapsible soils during construction and replacement with engineered backfill, ground-treatment processes, and

redirection of surface water and drainage away from expansive foundation soils. Studies shall conform to industry standards of care and American Society for Testing and Materials standards for field and laboratory testing. Study results and proposed solutions shall be provided to the CPUC for review and approval at least 60 days before construction. The report shall document the investigations and detail the specific support and protection measures that shall be implemented.

Significance after mitigation: Less than significant.

Impact Geology Soils Minerals-4: Would the Proposed Project 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? (*Less than significant with mitigation*)

Transmission Line

Expansive soils shrink and swell and can damage foundations if moisture collects beneath structures. The majority of the Proposed Project area is underlain by soils with a large coarse-grained component (e.g., cobbly loams and rocky silt loams). Granular soils have low expansive potential. The Project area includes the following soils with high shrink-swell potential, comprising 10 percent of the soils underlying the Project:

- Altamont clay
- Auld clay
- Auld stony clay
- Diablo clay
- Diablo-Olivenhain complex
- San Miguel rocky silt loam

If the site soils are not handled properly and in accordance with appropriate engineering procedures, seismic-related impacts resulting in ground failure could occur and impacts would be significant. SDG&E would implement APMs GEO-1 and GEO-2 as part of the Proposed Project. APM GEO-1 requires design in accordance with GO 95 and industry seismic standards and APM GEO-2 requires that SDG&E conduct a geotechnical study under the direction of a California-licensed Geotechnical Engineer or Certified Engineering Geologist and implement the recommendations included in the geotechnical report. Impacts related to expansive soils could still be significant if the geotechnical investigation and final design did not adequately evaluate potential expansive soils. Mitigation Measure Geology-3 requires that SDG&E assess the potential for expansive soils in their foundation design and defines methods for CPUC approval. This mitigation reduces impacts from expansive soils by requiring that the foundation be designed for expansive soils in locations where expansive soils occur. Impacts from expansive soils would be less than significant with mitigation.

Substations

The Sycamore and Peñasquitos Substations are located on soils with low shrink-swell potential. Substation modifications would not result in risks to life or property. There would be no impact from expansive soils.

Encina Hub

The Encina Hub does not include soils with high shrink-swell potential. There would be no impact from expansive soils.

Mission—San Luis Rey Phase Transposition

No new structures are proposed at the staging yards or Mission—San Luis Rey phase transposition area. The transposition of the existing conductors and staging of materials would have no risk to life or property related to soils with shrink-swell potential. There would be no impact from expansive soils.

Mitigation Measures: Geology-3 (refer to Impact Geology Soils Minerals-3)

Significance after mitigation: Less than significant.

Impact Geology Soils Minerals-5: Would the Proposed 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? (*No impact*)

No septic tanks or alternative wastewater disposal systems (e.g., leach fields) would be constructed as part of the Proposed Project. No impact would occur from use of septic tanks or wastewater disposal.

Mitigation Measures: None required.

Impact Geology Soils Minerals-6: Would the Proposed Project result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state? (*No impact*)

All of the Proposed Project transmission alignment would be located within SDG&E easements and franchise agreement rights, and all access would be via SDG&E easements and franchise rights. These areas are not currently available for mineral extraction and the Proposed Project would not result in a change in land use. Construction and operation would not result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.

Mitigation Measures: None required.

Impact Geology Soils Minerals-7: Would the Proposed Project result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan? (*No impact*)

All of the Proposed Project transmission alignment would be located within SDG&E easements and franchise agreement rights, and all access would be via SDG&E easements and franchise rights. These areas are not currently available for mineral extraction and the Proposed Project would not result in a change in land use. No locally important mineral resource recovery sites would be affected. No impact would occur from the loss of a locally important mineral resource.

Mitigation Measures: None required.

4.5.8 Alternative 1: Eastern Cable Pole at Carmel Valley Road (Avoids Cable Pole in Black Mountain Ranch Community Park)

Alternative 1 would involve installation of a new cable pole immediately south of and adjoining Carmel Valley Road within existing SDG&E ROW, transitioning the Segment A overhead transmission line directly into the proposed Carmel Valley Road Segment B underground alignment. Alternative 1 would avoid installation of a cable pole and underground duct bank within the Black Mountain Ranch Community Park. This alternative is described in more detail in Chapter 3: Alternatives.

4.5.8.1 Alternative 1 Environmental Setting

Geology

The Alternative 1 cable pole is located on a steeply graded slope directly adjacent to Carmel Valley Road. The Alternative 1 cable pole would be underlain by the Santiago Peak Volcanics geologic formation, which is a cretaceous and pre-cretaceous metamorphic formation of volcanic origin.

Slope Stability

Alternative 1 is located on a slope that has been constructed adjacent to the road. The cable pole is not located in a mapped landslide and is not located in a landslide prone geologic unit. The constructed hill slope could be subject to failure due to the steep nature of the hill slope.

Soils

Alternative 1 is underlain by Auld clay. Auld clay is well-drained and formed in igneous rocks. The soil unit has a high shrink-swell potential and a moderate erosion potential.

Seismicity

The alternative does not cross any known or active faults and is thus not likely to experience damage due to fault rupture and/or offset. No active faults are located in the immediate vicinity of the alternative; however, the cable pole is located in an area that could experience minor to moderate ground-shaking from an earthquake nearby on significant active faults (i.e., Elsinore or Rose Canyon faults). The alternative has a low potential for liquefaction because it is underlain by an older consolidated bedrock unit.

Earthquake-Induced Landslides

The alternative is located adjacent on a steep slope that could be damaged by seismically induced landslides in the event of a large earthquake on a nearby regional fault.

Mineral Resources

The alternative is not located in the vicinity of any known mineral resource (Refer to Figure 4.5-8).

4.5.8.2 Alternative 1 Impacts and Mitigation Measures

Table 4.5-7 summarizes the impacts to geology, soils, and mineral resources from Alternative 1.

Table 4.5-7 Summary of Alternative 1 Impacts on Geology, Soils, and Mineral Resources

Significance Criteria	Project Phase	Significance Prior to APMs	Significance after APMs and before Mitigation	Significance after Mitigation
Impact Geology Soils Minerals -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; strong seismic ground-shaking; seismic-related ground failure including liquefaction; or landslides	Construction	Less than significant	---	---
	Operation and Maintenance	Significant	Significant APM GEO-1 APM GEO-2	Less than significant MM Geology-2
Impact Geology Soils Minerals-2: Result in substantial soil erosion or the loss of topsoil	Construction	Significant	Less than significant APM GEO-3 APM HYDRO-1 APM HYDRO-2	---
	Operation and Maintenance	Less than significant	---	---
Impact Geology Soils Minerals-3: Be located on a geologic unit of soil that is unstable, or that would become unstable as a result of the project, and expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse	Construction, Operation and Maintenance	Significant	Significant APM GEO-1 APM GEO-2	Less than significant MM Geology-2 MM Geology-3
Impact Geology Soils Minerals-4: Be located on expansive soil, as defined in Table 181-B of the Uniform Building Code (1994), creating substantial risks to life or property	Construction, Operation and Maintenance	Significant	Significant APM GEO-1 APM GEO-2	Less than significant MM Geology-3

Significance Criteria	Project Phase	Significance Prior to APMs	Significance after APMs and before Mitigation	Significance after Mitigation
Impact Geology Soils Minerals-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	Construction	No impact	---	---
	Operation and Maintenance	No impact	---	---
Impact Geology Soils Minerals-6: Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state	Construction, Operation and Maintenance	No impact	---	---
Impact Geology Soils Minerals-7: Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan	Construction, Operation and Maintenance	No impact	---	---

Alternative 1 would have no impact on three CEQA significance criteria for geology, soils, and mineral resources: Impacts Geology Soils Minerals -5, -6, and -7, as indicated in Table 4.5-7 above. Alternative 1 would have no impact on these criteria because Alternative 1 does not involve the use of a septic tank or alternative wastewater disposal and Alternative 1 is not located in an area of known mineral resources; therefore the alternative would not cause the loss of availability of a mineral resource. The impacts of construction, operation, and maintenance are not analyzed separately for Impacts Geology Soils Minerals-3, -4, -6, and -7 because the impact analysis is based on the physical location of the Alternative. The location of Alternative 1 will not change between construction and operation and maintenance.

Impact Geology Soils Minerals-1: Would Alternative 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; strong seismic ground shaking; seismic-related ground failure including liquefaction; or landslides? (*Less than significant with mitigation*)

Construction

Alternative 1 is located in a region with several active and potentially active fault zones with a history of strong earthquakes. The active faults closest to Alternative 1 are the Rose Canyon Fault and Elsinore Fault. These faults are miles from Alternative 1 therefore, impacts from fault rupture would not occur.

In the unlikely event of an earthquake during the Alternative 1 construction period (a few weeks), construction workers could be exposed to hazards from strong seismic ground shaking or seismic-induced ground failure. Construction of Alternative 1 would not increase these risks of exposure over typical risks of exposure throughout the region. Earthquake safety training pursuant to OSHA regulations would minimize potential for impacts to workers. Due to the short duration of construction at the cable pole, the low probability of a strong seismic event occurring during this timeframe, and safety training for construction crews, impacts would be less than significant. No mitigation is required.

Operation and Maintenance

A significant seismic event is likely to occur over the operational lifetime of Alternative 1. The cable pole at Carmel Valley Road could become unstable during a seismic event and increase the risk to drivers, bicyclists, or pedestrians on Carmel Valley Road if SDG&E did not implement seismic design standards in the foundation design of new poles. The risk to property or life from seismic ground failure, liquefaction, or landslides would increase if the site soils are not handled properly and in accordance with appropriate engineering procedures, or if the foundations are not designed properly to address landslides given that the cable pole is located on a steep slope. The increased risk to life and property would be a significant impact. Implementation of APMs GEO-1 (design in accordance with GO 95 and industry seismic standards) and GEO-2 (geotechnical recommendations) would reduce the risk of loss, injury, or death from seismic events; however, there could still be a significant impact if the geotechnical investigation does not specifically address landslides. Mitigation Measures Geology-2 would minimize impacts from potential landslides through geotechnical investigation for landslides. Impacts would be less than significant with mitigation.

Mitigation Measures: Geology-2 (refer to Section 4.5.7)

Significance after mitigation: Less than significant.

Impact Geology Soils Minerals-2: Would Alternative 1 result in substantial soil erosion or the loss of topsoil? (*Less than significant with mitigation*)

Construction

Alternative 1 ground disturbing activities at the cable pole would have the potential to result in soil erosion or loss of topsoil.

Construction of the cable pole and access pad on the steep slope would result in a significant impact if the work area and slope around the cable pole is not properly stabilized and substantial erosion occurs. Implementation of APM HYDRO-1, APM HYDRO-2, and APM GEO-3 would reduce the potential for erosion from soil disturbing activities by requiring SDG&E to implement sediment and erosion control practices in compliance with a project SWPPP and SWRCB requirements. Impact would be less than significant with these APMs. No mitigation is required.

Operation and Maintenance

Alternative 1 operation and maintenance activities would involve use of Carmel Valley Road and the driveway and maintenance pad around the cable pole. Operation and maintenance activities would not involve any new ground disturbance that could result in erosion, sedimentation or topsoil loss in the Alternative 1 area. Impacts would be less than significant. No mitigation is required.

Mitigation Measures: None required.

Impact Geology Soils Minerals-3: Would Alternative 1 be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse? (*Less than significant with mitigation*)

Lateral Spreading, Liquefaction, and Subsidence

The cable pole is not located in an area with shallow groundwater or on a geologic unit that is subject to lateral spreading or liquefaction. There is not a groundwater basin in the Alternative 1 area and there is no potential for subsidence. There would no impact from lateral spreading, liquefaction, or subsidence.

Landslides

Alternative 1would be located on a hill slope within a geologic unit of volcanic origin. The risk of landslides associated with the geologic formation underlying Alternative 1 is generally low; however, the risk of soil destabilization that could result in landslides is high due to the steep slope around the cable pole. Alternative 1 could expose people or structures to adverse effects involving landslides if the soils at the cable pole foundations and work pad are not properly engineered, which would be a significant impact. APM GEO-1 requires design in accordance with GO 95 and industry seismic standards and APM GEO-2 (geotechnical recommendations) would reduce impacts from landslides. Impacts after implementation of APMs would remain significant because the APMs do not require the geotechnical investigation to assess the potential for unstable slopes or landslides or incorporate the results into the final Alternative 1 design. Implementation of Mitigation Measure Geology-2 would minimize impacts from landslides and other ground failures as it requires the geotechnical investigation to include a slope stability analysis of planned grading and excavation immediately adjacent to hills. The mitigation measure also requires identification of specific areas with the potential for unstable slopes and landslides and requires incorporation of the results into design of the project. Impacts from landslides would be less than significant with mitigation.

Soil Collapse

Foundation failure as a result of soil collapse could expose people or structures to risks including loss, injury, or death from a falling power line or cable pole, which would be a significant impact. Implementation of APMs GEO-1 (design in accordance with GO 95 and industry seismic standards) and GEO-2 (geotechnical recommendations) would reduce impacts. Impacts would remain significant because the APM do not require the geotechnical investigation and final design to evaluate the potential for collapsible soils. However, implementation of Mitigation Measure Geology-3 would reduce impacts from soil collapse because it requires assessment of the potential for collapsible and expansive soils. Impacts from soil collapse would be less than significant with mitigation.

Mitigation Measures: Geology-2 and Geology-3 (refer to Section 4.5.7)

Significance after mitigation: Less than significant.

Impact Geology Soils Minerals-4: Would Alternative 1 be located on expansive soil as defined in Table 181-B of the Uniform Building Code (1994), creating substantial risks to life or property? (*Less than significant with mitigation*)

The Alternative 1 area is underlain by Auld clay which has high shrink-swell potential. The cable pole could create substantial risk to life if the soils are not handled properly and in accordance with appropriate engineering procedures. Implementation of APMs GEO-1 (design in accordance with GO 95 and industry seismic standards) and GEO-2 (geotechnical recommendations) would reduce impacts because they require conducting a geotechnical study under the direction of a California-licensed Geotechnical Engineer or Certified Engineering Geologist. Impacts would still remain significant because the geotechnical investigation required under APM GEO-2 does not require adequate evaluation of potential expansive soils. Mitigation Measure Geology-3, which mandates the geotechnical investigation to assess potential for collapsible and expansive soils and apply appropriate design features, would reduce impacts from expansive soils to less than significant. Impacts from expansive soils would be less than significant with mitigation.

Mitigation Measures: Geology-3 (refer to Section 4.5.7)

Significance after mitigation: Less than significant.

4.5.9 Alternatives 2a and 2b: Eastern Cable Pole at Pole P40 and Underground Alignment through City Open Space or City Water Utility Service Road (Avoids Cable Pole in Black Mountain Ranch Community Park)

Alternative 2 would involve installation of a new cable pole in the same location for both Alternatives 2a and 2b, approximately 300 feet south of Carmel Valley Road within existing SDG&E ROW, transitioning the Segment A overhead transmission line into the proposed Carmel Valley Road Segment B underground alignment via one of two underground alignment options. Alternative 2a would locate the underground duct bank west of SDG&E ROW through City of San Diego open space and into Carmel Valley Road. Alternative 2b would locate the underground duct bank east of SDG&E ROW through a City of San Diego water utility service road and into Carmel Valley Road. Both Alternative 2a and 2b would avoid installation of a cable pole and underground duct bank within the Black Mountain Ranch Community Park. This alternative is described in more detail in Chapter 3: Alternatives.

4.5.9.1 Alternative 2 Environmental Setting

Geology

The Alternative 2 cable pole is located on top of a slope south of Carmel Valley Road. The Alternative 2 cable pole and underground alignment options 2a and 2b are underlain by the Santiago Peak Volcanics geologic formation, which is a cretaceous and pre-cretaceous metamorphic formation of volcanic origin.

Slope Stability

Alternative 2 is located on a moderately sloping area south of Carmel Valley Road. The cable pole and underground alignments are not located in a mapped landslide and are not located in a landslide prone geologic unit.

Soils

Alternative 2, options 2a and 2b are underlain by Auld clay. Auld clay is well-drained and formed in igneous rocks. The soil unit has a high shrink-swell potential and a moderate erosion potential.

Seismicity

Alternative 2 does not cross any known or active faults and is thus not likely to experience damage due to fault rupture and/or offset. No active faults are located in the immediate vicinity of the alternative; however, the cable pole is located in an area that could experience minor to moderate ground-shaking from an earthquake nearby on significant active faults (i.e., Elsinore or Rose Canyon faults). The alternative has a low potential for liquefaction because it is underlain by an older consolidated bedrock unit.

Earthquake-Induced Landslides

The alternative is located at the top of a steep slope that could be damaged by seismically induced landslides in the event of a large earthquake on a nearby regional fault.

Mineral Resources

The alternative is not located in the vicinity of any known mineral resource (Refer to Figure 4.5-8).

4.5.9.2 Alternative 2 Impacts and Mitigation Measures

Table 4.5-8 summarizes the impacts to geology, soils, and mineral resources from Alternative 2.

Table 4.5-8 Summary of Alternative 2 Impacts on Geology, Soils, and Mineral Resources

Significance Criteria	Project Phase	Significance Prior to APMs	Significance after APMs and before Mitigation	Significance after Mitigation
Impact Geology Soils Minerals -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; strong seismic ground-shaking; seismic-related ground failure including liquefaction; or landslides	Construction	Less than significant	---	---
	Operation and Maintenance	Significant	Less than significant APM GEO-1 APM GEO-2	---
Impact Geology Soils Minerals-2: Result in substantial soil erosion or the loss of topsoil	Construction	Less than significant	---	---
	Operation and Maintenance	Less than significant	---	---
Impact Geology Soils Minerals-3: Be located on a geologic unit of soil that is unstable, or that would become unstable as a result of the project, and expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse	Construction, Operation and Maintenance	Significant	Significant APM GEO-1 APM GEO-2	Less than significant MM Geology-3
Impact Geology Soils Minerals-4: Be located on expansive soil, as defined in Table 181-B of the Uniform Building Code (1994), creating substantial risks to life or property	Construction, Operation and Maintenance	Significant	Significant APM GEO-1 APM GEO-2	Less than significant MM Geology-3
Impact Geology Soils Minerals-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	Construction	No impact	---	---
	Operation and Maintenance	No impact	---	---
Impact Geology Soils Minerals-6: Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state	Construction, Operation and Maintenance	No impact	---	---

Significance Criteria	Project Phase	Significance Prior to APMs	Significance after APMs and before Mitigation	Significance after Mitigation
Impact Geology Soils Minerals-7: Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan	Construction, Operation and Maintenance	No impact	---	---

Alternative 2 would have no impact on three CEQA significance criteria for geology, soils, and mineral resources: Impacts Geology Soils Minerals -5, -6, and -7 as indicated in Table 4.5-8 above. Alternative 2 would have no impact on these criteria because Alternative 2 does not involve the use of a septic tank or alternative wastewater disposal and Alternative 2 is not located in an area of known mineral resources; therefore, the alternative would not cause the loss of availability of a mineral resource. The impacts of construction, operation, and maintenance are not analyzed separately for Impacts Geology Soils Minerals-3, -4, -6, and -7 because the impact analysis is based on the physical location of the Alternative. The different alignments for the underground transmission line to Segment B would not modify the analysis. The location of Alternative 2 will not change between construction and operation and maintenance.

Impact Geology Soils Minerals-1: Would Alternative 2 expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: rupture of a known earthquake fault; strong seismic ground shaking; seismic-related ground failure including liquefaction; or landslides? (*Less than significant; no mitigation required*)

Construction

Alternative 2 is located in a region with several active and potentially active fault zones with a history of strong earthquakes. The active faults closest to Alternative 2 are the Rose Canyon Fault and Elsinore Fault. These faults are miles from Alternative 2; therefore, impacts from fault rupture would not occur.

In the unlikely event of an earthquake during the Alternative 2 construction period (a few weeks), construction workers could be exposed to hazards from strong seismic ground shaking or seismic-induced ground failure. Construction of Alternative 2 would not increase these risks of exposure over typical risks of exposure throughout the region. Earthquake safety training pursuant to OSHA regulations would minimize potential for impacts to workers. Due to the short duration of construction at the cable pole and underground alignment, the low probability of a strong seismic event occurring during this timeframe, and safety training for construction crews, impacts would be less than significant. No mitigation is required.

Operation and Maintenance

A significant seismic event is likely to occur over the operational lifetime of Alternative 2. The cable pole is located on a volcanic geologic unit that is not prone to liquefaction or seismic induced landslides; however, the cable pole could damage adjacent transmission structures if the pole were not constructed in accordance with appropriate engineering procedures, or if the foundations are not designed properly for seismic events. The increased risk to property would be a significant impact. Implementation of APMs GEO-1 (design in accordance with GO 95 and industry seismic standards) and GEO-2 (geotechnical recommendations) would reduce the risk of loss from seismic events. Impacts would be less than significant with APMs GEO-1 and GEO-2. No mitigation is required.

Mitigation Measures: None required.

Impact Geology Soils Minerals-2: Would Alternative 2 result in substantial soil erosion or the loss of topsoil? (*Less than significant; no mitigation required*)

Construction

Construction of Alternative 2 would result in a significant impact if the work area around the pole and underground alignment are not properly stabilized resulting in erosion and topsoil loss. Implementation of APMs HYDRO-1 (temporary BMPs), HYDRO-2 (permanent BMPs), and GEO-3 (minimize soil disturbance) would reduce the potential for erosion from soil disturbing activities by requiring SDG&E to implement sediment and erosion control practices in compliance with a project SWPPP and SWRCB requirements. Impact would be less than significant with these APMs. No mitigation is required.

Operation and Maintenance

Operation and maintenance activities would involve use of existing access routes and would not involve any new ground disturbance that could result in erosion or sedimentation or topsoil loss in the Alternative 2 area. Impacts would be less than significant. No mitigation is required.

Mitigation Measures: None required.

Impact Geology Soils Minerals-3: Would Alternative 2 be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse? (*Less than significant with mitigation*)

Lateral Spreading, Liquefaction, and Subsidence

The cable pole is not located in an area with shallow groundwater or on a geologic unit that is subject to lateral spreading or liquefaction. There is no groundwater basin in the Alternative 2 area and there is no potential for subsidence. There would no impact from lateral spreading, liquefaction, or subsidence.

Landslides

Alternative 2 cable pole and underground alignment options would be located on a moderately sloping area within a geologic unit of volcanic origin. The risk of landslides associated with the geologic formation underlying Alternative 2 is low and the cable pole is set back from the slope adjacent to Carmel Valley Road in an area that is at low risk for landslides. Alternative 2 impacts from landslides would be less than significant. No mitigation is required.

Soil Collapse

Alternative 2 is located in a soil unit with high shrink-swell potential. Failure of the cable pole foundation and downing of the cable pole as a result of soil collapse could expose the adjacent transmission structure to risks including loss, which would be a significant impact. Implementation of APMs GEO-1 (design in accordance with GO 95 and industry seismic standards) and GEO-2 (geotechnical recommendations) would reduce impacts. Impacts would remain significant because the APMs do not require the geotechnical investigation and final design to evaluate the potential for collapsible soils. However, implementation of Mitigation Measure Geology-3 would reduce impacts from soil collapse because it requires assessment of the potential for collapsible and expansive soils. Impacts from soil collapse would be less than significant with mitigation.

Mitigation Measures: Geology-3 (refer to Section 4.5.7)

Significance after mitigation: Less than significant.

Impact Geology Soils Minerals-4: Would Alternative 2 be located on expansive soil, as defined in Table 181-B of the Uniform Building Code (1994), creating substantial risks to life or property? (*Less than significant with mitigation*)

The Alternative 2 area is underlain by Auld clay, which has a high shrink-swell potential. The Alternative 2 cable pole could damage the adjacent transmission structure if the cable pole foundation was not properly engineered and the cable pole fell into the adjacent structure, resulting in a significant impact. Implementation of APMs GEO-1 (design in accordance with GO 95 and industry seismic standards) and GEO-2 (geotechnical recommendations) would reduce impacts; however, impacts would remain significant if the geotechnical investigation does not adequately evaluate potential expansive soils. Implementation of Mitigation Measure Geology-3 would reduce impacts from expansive soils to less than significant because it requires assessment of expansive soils. Impacts would be less than significant with mitigation.

Mitigation Measures: Geology-3 (refer to Section 4.5.7)

Significance after mitigation: Less than significant.

4.5.10 Alternative 3: Los Peñasquitos Canyon Preserve – Mercy Road Underground (Avoids Overhead in Northern Half of Segment A, Underground in Segment B, and Overhead in Segment C)

Alternative 3 would include installing an underground alignment starting at a new cable pole where the existing SDG&E ROW crosses Ivy Hill Road and ending at a new cable pole approximately 550 feet west of the Peñasquitos Junction (i.e., where Proposed Project Segments C and D meet). The underground alignment would follow Scripps Poway Parkway, Mercy

Road, Black Mountain Road, and finally Park Village Road. Alternative 3 would bypass the northern half of Proposed Project Segment A and all of Proposed Project Segments B and C. This alternative is described in more detail in Chapter 3: Alternatives.

4.5.10.1 Alternative 3 Environmental Setting

Geology

The Alternative 3 route consists of an underground transmission line that traverses a mix of sloping hillsides, mesa and terraces, along and within developed and graded roadways. Geologic units crossed by this alternative alignment are shown on Figure 4.5-9 and listed in Table 4.5-9.

Slope Stability

The Alternative 3 route traverses within graded roads across level to gently sloping mesas and terraces. This alignment does not cross any mapped landslides; however, portions of this alternative near Los Peñasquitos Creek are underlain by the landslide-prone alluvial deposits and segments of the alignment adjacent to and along hills and slopes underlain by alluvial deposits may be susceptible to landslides and slope failures if disturbed during construction (CGS 2010).

Soils

Mapped soil units along the Alternative 3 route are shown on Figure 4.5-10 and described in Table 4.5-10. This alternative is underlain by soils formed in marine terraces and by soils formed in alluvium. The hazard of offroad/ off-trail soil erosion ranges from slight to very severe and for on-road/on-trail ranges from slight to severe. Shrink/swell (expansive) potential of the soils associations along Alternative 3 varies from low to high.

Mineral Resources

No known mineral resources are identified along the Alternative 3 alignment.

Table 4.5-9 Geologic Units in the Alternative 3 Area

Age (from youngest to oldest)	Unit	Description
Quaternary: Holocene to Late Pleistocene	Qya	Young alluvial valley deposits: unconsolidated to slightly consolidated, undissected to slightly dissected clay, silt, sand, and gravel along stream valleys and alluvial flats of larger rivers
Quaternary: Middle to Early Pleistocene	Qvol	Very old lacustrine, playa, and estuarine deposits: moderately to well consolidated, moderately dissected, fine-grained sand, silt, mud, and clay from lake, playa, and estuarine deposits of various types
Tertiary	Tss	Coarse-grained formations of sedimentary origin – dominantly sandstone and conglomerate (e.g., Ardath Shale, Friars Formation)
Tertiary	Tsh	Fine-grained formations of sedimentary origin
Cretaceous and pre-Cretaceous	pKm	Metamorphic formations of sedimentary and volcanic origin

Source: CGS 2010

Figure 4.5-9 Geologic Units of Alternative 3 Alignment

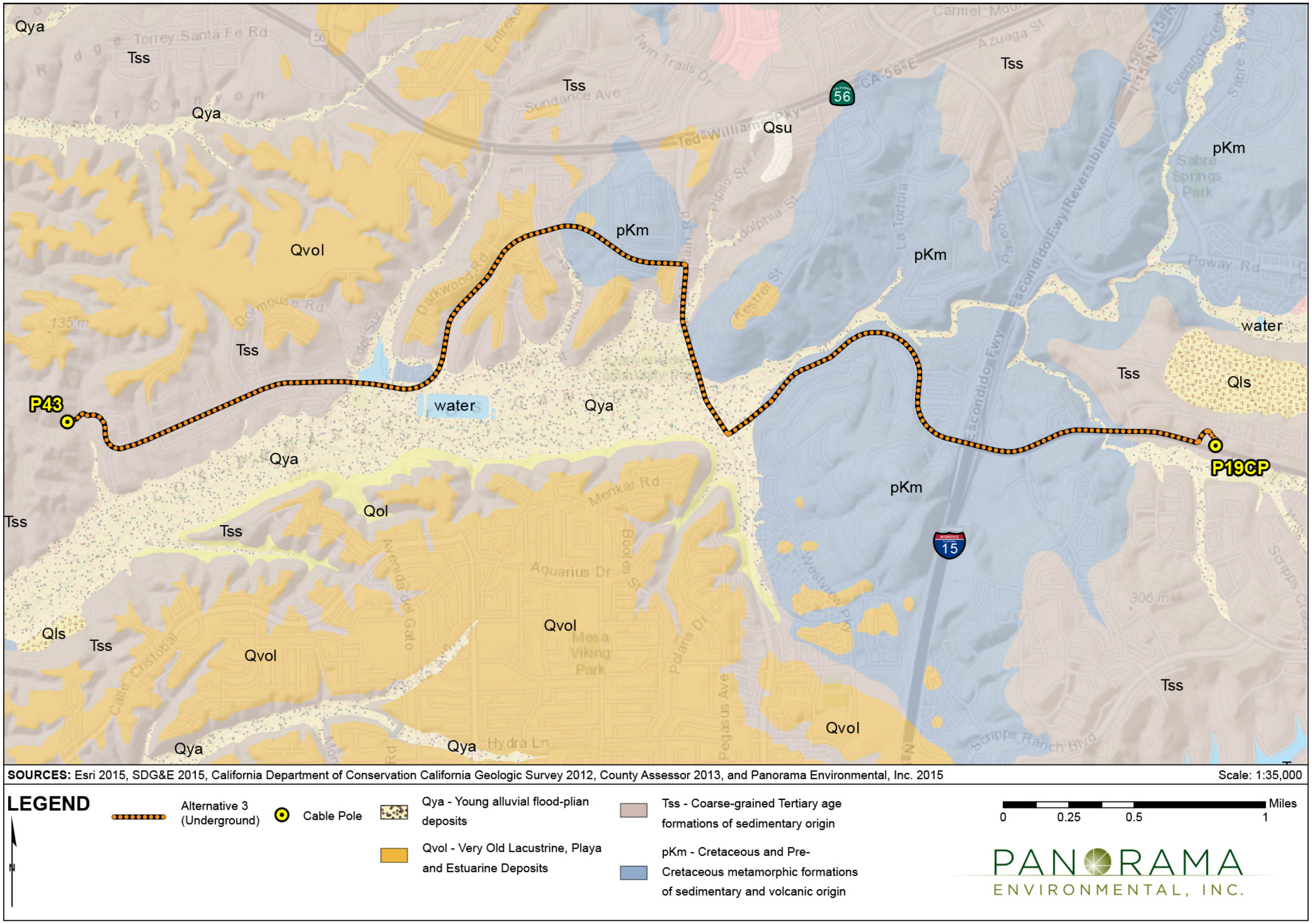

Figure 4.5-10 Soil Units of Alternative 3 Alignment

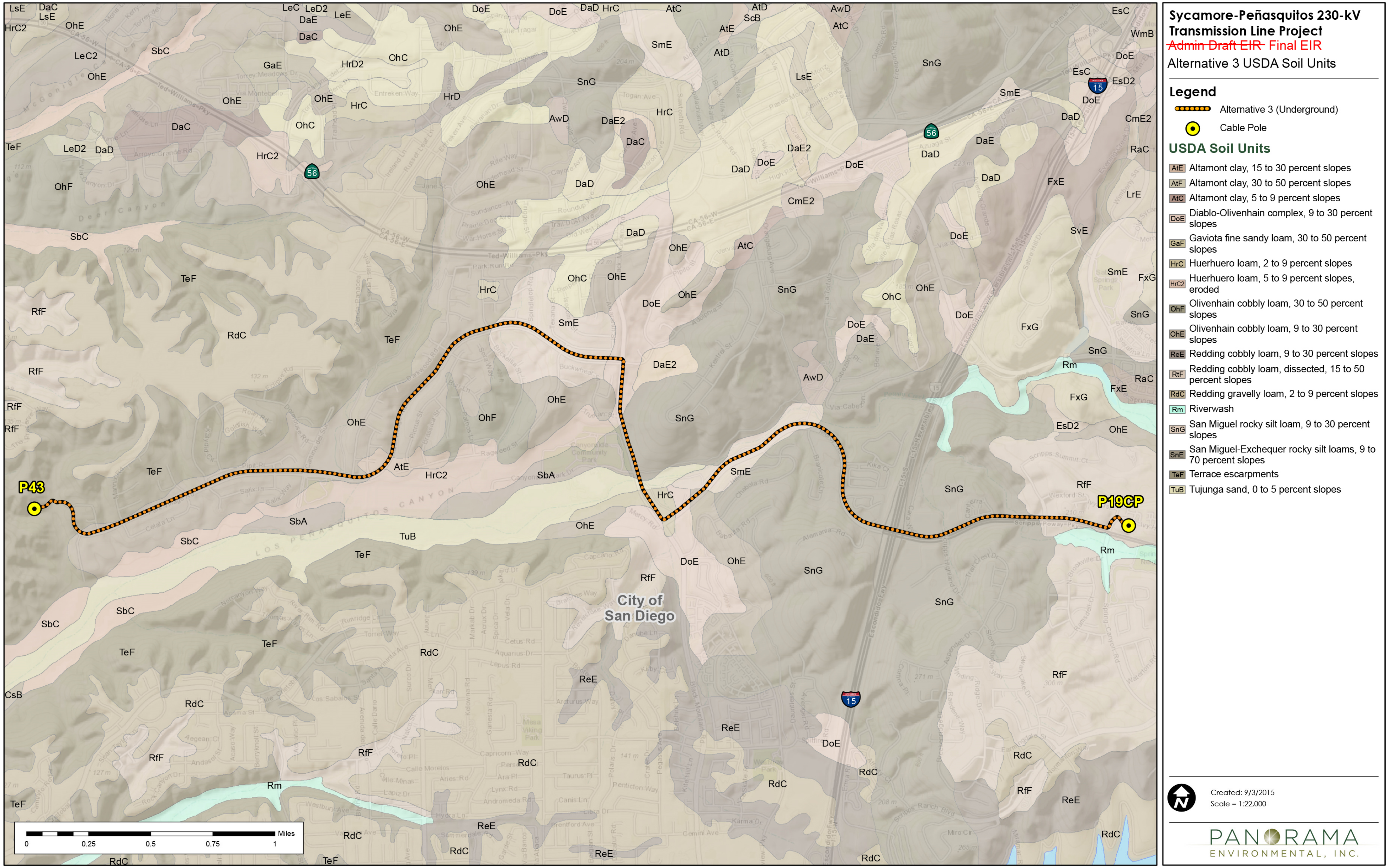

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Table 4.5-10 Major Soil Units in the Alternative 3 Area

Soil Series	Description	Slope Percent	Runoff Rate	Shrink-swell Potential	Erosion Potential
Diablo-Olivenhain complex	50% Diablo clay (above) and 45% Olivenhain cobbly loams (below). Occurs on wetlands.	9 to 30	Medium to rapid	High	Moderate to high
Gaviota fine sandy loam	Well-drained, shallow fine sandy loams that formed in material weathered from marine sandstone. Found on uplands.	30 to 50	Rapid	Low	High
Huerhuero loam, eroded	Moderately well-drained loams that have a clay subsoil. Calcareous alluvium formed from sedimentary rock; found on marine terraces as valley deposits	2 to 9 5 to 9	Very rapid	Low (surface) to moderate	High
Olivenhain cobbly loam	Moderately well-drained, moderately deep to deep cobbly loams that consist of very cobbly clay subsoil. Alluvium found on gently to strongly sloping terrain and on dissected marine terraces	9 to 30 30 to 50	Slow to medium	Low to moderate	Low
Redding cobbly loam	Well-drained gravelly loams with a hard-pan. Includes duripan horizon (cemented soil); forms in alluvium derived from mixed sources; found on nearly level or dissect-ed and undulating to hilly high terraces	9 to 30 15 to 50	Very low to rapid	Low (surface) to moderate	Low
Riverwash	Excessively drained material that is typically sandy, gravelly, or cobbly. Found in intermittent streams.	N/A	N/A	Low	N/A
San Miguel rocky silt loam	Well-drained, shallow to moderately deep silt loams with a clay subsoil. Derived from metavolcanic rock. Found in mountainous areas.	9 to 30	Medium to rapid	High	Moderate to high
San Miguel-Exchequer rocky silt loam	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	9 to 70	Medium to very rapid	San Miguel: Moderate to high due to smectitic clay content Exchequer: low	High
Terrace escarpments	Long, narrow, rocky areas with steep faces that rise abruptly from mean tide line to coastal plain terraces or plateaus; composed of soft coastal sandstone, hard shale, or hard, weather-resistant, fine-grained sandstone	N/A	N/A	Variable	Variable
Tujunga sand	Very deep, excessively drained sands derived from granitic alluvium; occurs on alluvial fans and flood plains	0 to 5	Low	Low	High

Sources: NRCS 2015b, 2015c

Seismicity

The alternative does not cross any known or active faults and is thus not likely to experience damage due to fault rupture and/or offset. No active faults are located in the immediate vicinity of the alternative; however, the cable poles could experience minor to moderate ground-shaking from an earthquake on nearby significant active faults (i.e., Elsinore or Rose Canyon faults).

Most of this alternative has no to low potential for liquefaction as it is primarily underlain by older consolidated sedimentary and igneous (volcanic and granitic) bedrock units. The alluvial deposits where the alignment crosses Los Peñasquitos Creek may have moderate potential liquefaction in areas with local pockets of saturated loose sandy soils and could potentially liquefy during a large earthquake.

Earthquake-Induced Landslides

Most of the Alternative 3 alignment traverses gently sloping graded roads and does not cross areas with significant slopes. However, portions of this alternative are underlain by landslide-prone alluvial deposits and sections of the alignment that are along or near the edge of slopes could be damaged by seismically induced landslides in the event of a large earthquake on nearby faults.

4.5.10.2 Alternative 3 Impacts and Mitigation Measures

Table 4.5-11 summarizes the impacts to geology, soils, and mineral resources from Alternative 3.

Table 4.5-11 Summary of Alternative 3 Impacts on Geology, Soils, and Mineral Resources

Significance Criteria	Project Phase	Significance Prior to APMs	Significance after APMs and before Mitigation	Significance after Mitigation
Impact Geology Soils Minerals -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; strong seismic ground-shaking; seismic-related ground failure including liquefaction; or landslides	Construction	Less than significant	---	---
	Operation and Maintenance	Significant	Less than significant APM GEO-1 APM GEO-2	---
Impact Geology Soils Minerals-2: Result in substantial soil erosion or the loss of topsoil	Construction	Significant	Less than significant APM GEO-3 APM HYDRO-1 APM HYDRO-2	---
	Operation and Maintenance	Less than significant	---	---

Significance Criteria	Project Phase	Significance Prior to APMs	Significance after APMs and before Mitigation	Significance after Mitigation
Impact Geology Soils Minerals-3: Be located on a geologic unit of soil that is unstable, or that would become unstable as a result of the project, and expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse	Construction, Operation and Maintenance	Significant	Significant APM GEO-1 APM GEO-2	Less than significant MM Geology-2 MM Geology-3
Impact Geology Soils Minerals-4: Be located on expansive soil, as defined in Table 181-B of the Uniform Building Code (1994), creating substantial risks to life or property	Construction, Operation and Maintenance	Significant	Significant APM GEO-1 APM GEO-2	Less than significant MM Geology-3
Impact Geology Soils Minerals-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	Construction	No impact	---	---
	Operation and Maintenance	No impact	---	---
Impact Geology Soils Minerals-6: Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state	Construction, Operation and Maintenance	No impact	---	---
Impact Geology Soils Minerals-7: Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan	Construction, Operation and Maintenance	No impact	---	---

Alternative 3 would have no impact on three CEQA significance criteria for geology, soils, and mineral resources: Impacts Geology Soils Minerals -5, -6, and -7 as indicated in Table 4.5-11 above. Alternative 3 would have no impact on these criteria because Alternative 3 does not involve the use of a septic tank or alternative wastewater disposal and Alternative 3 is not located in an area of known mineral resources; therefore, the alternative would not cause the loss of availability of a mineral resource. The impacts of construction, operation, and maintenance are not analyzed separately for Impacts Geology Soils Minerals-3, -4, -6, and -7 because the impact analysis is based on the physical location of the Alternative. The location of Alternative 3 will not change between construction and operation and maintenance.

Impact Geology Soils Minerals-1: Would Alternative 3 expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: rupture of a known earthquake fault; strong seismic ground-shaking; seismic-related ground failure including liquefaction; or landslides? (*Less than significant; no mitigation required*)

Construction

Alternative 3 is located in a region with several active and potentially active fault zones with a history of strong earthquakes. The active fault closest to the Alternative 3 area is the Rose Canyon Fault, which is approximately 8 miles southwest of the Alternative 3 alignment at its closest point; therefore, impacts from fault rupture would not occur.

In the unlikely event of an earthquake, construction workers could be exposed to hazards from strong seismic ground-shaking or seismic-induced ground failure. Construction of Alternative 3 would not substantially increase these risks of exposure over typical risks of exposure throughout the region. Earthquake safety training pursuant to OSHA regulations would minimize potential for impacts to workers. Due to the short duration of construction (10 months), the low probability of a strong seismic event occurring during this timeframe, and safety training for construction crews, the potential for impacts would be less than significant. No mitigation is required.

Operation and Maintenance

A significant seismic event is likely to occur over the operational lifetime of Alternative 3. Alternative 3 would reduce the potential for impacts as a result of a downed power pole or transmission line due to seismic related ground failure because the majority of Alternative 3 would be located underground. The Alternative 3 eastern cable pole is located in proximity to roads and structures and the western cable pole is located near trails. The risk to life and property would increase if the cable pole were not constructed in accordance with appropriate engineering procedures, or if the foundations are not designed properly for seismic events. The increased risk to life and property would be a significant impact. Implementation of APMs GEO-1 (design in accordance with GO 95 and industry seismic standards) and GEO-2 (geotechnical recommendations) would reduce the risk of loss, injury or death from seismic events. The cable poles would not be located in areas that are subject to liquefaction or landslides. Impacts would be less than significant with APMs GEO-1 and GEO-2. No mitigation is required.

Mitigation Measures: None required.

Impact Geology Soils Minerals-2: Would Alternative 3 result in substantial soil erosion or the loss of topsoil? (*Less than significant; no mitigation required*)

Construction

Excavation for the cable poles and trenching for the underground transmission line would loosen soil and accelerate erosion if soils from the underground construction were not properly managed or the cable pole locations were not properly stabilized, resulting in a significant impact. Implementation of APMs HYDRO-1 (temporary BMPs), HYDRO-2 (permanent BMPs), and GEO-3 (minimize soil disturbance) would reduce the potential for erosion from soil disturbing activities by requiring SDG&E to implement sediment and erosion control practices in compliance with a project SWPPP and SWRCB requirements. Impact would be less than significant with these APMs. No mitigation is required.

Operation and Maintenance

Operation and maintenance activities would involve use of existing access routes and would not involve any new ground disturbance that could result in erosion or sedimentation or topsoil loss in the Alternative 3 area. Impacts would be less than significant. No mitigation is required.

Mitigation Measures: None required.

Impact Geology Soils Minerals-3: Would Alternative 3 be located on a geologic unit of soil that is unstable, or that would become unstable as a result of the project, and expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse? (*Less than significant with mitigation*)

Landslides

Alternative 3 would be constructed primarily underground within area roadways. The cable poles at the eastern and western end of the alignment are the only new aboveground structures that would be installed for Alternative 3. The eastern cable pole is not located on a steep slope and is not prone to landslides. The western cable pole would be located in Los Peñasquitos Canyon in a steeply sloping are that may be subject to landslides. Alternative 3 could expose people or structures to adverse effects involving landslides if the soils at the western cable pole foundation and retaining wall are not properly engineered, which would be a significant impact. Implementation of APMs GEO-1 (design in accordance with GO 95 and industry seismic standards) and GEO-2 (geotechnical recommendations) would reduce impacts. Impacts would remain significant because the geotechnical investigation required under APM GEO-2 does not assess the potential for unstable slopes, landslides, earth flows, or debris flows, or incorporate the results into the final Alternative 3 design. Implementation of Mitigation Measure Geology-2 would further reduce impacts from landslides and other ground failures because it requires the geotechnical investigation to assess the potential for landslides. Impacts from landslides would be less than significant with mitigation.

Lateral Spreading, Liquefaction, and Subsidence

Lateral spreading and liquefaction could occur within areas of shallow groundwater (e.g. near Los Peñasquitos Creek). No overhead structures are proposed near Los Peñasquitos Creek because the transmission line would be located underground in the existing roadways in areas that could be subject to lateral spreading or liquefaction. There would be no risk of loss, injury, or death from lateral spreading or liquefaction. There is no aquifer underlying the Alternative 3 area; therefore, the alternative alignment is not located in an area that is prone to subsidence. There would be no impact from lateral spreading, liquefaction or subsidence.

Soil Collapse

The eastern cable pole would be installed within Redding cobbly loam and the western cable pole would be installed within terrace escarpment soil units. Both soils have a low clay content and low to moderate shrink-swell potential. There is no risk of impact from soil collapse along the underground transmission line because the underground line would be constructed in existing roads. The cable poles could present a substantial risk to life or property if the cable pole foundation failed due to soil collapse resulting in a significant impact. Implementation of APMs GEO-1 (design in accordance with GO 95 and industry seismic standards) and GEO-2 (geotechnical investigation) would reduce the impact, but the impact would remain significant because the APM does not require evaluation of collapsible soils. Mitigation Measure Geology-3 would reduce impacts from collapsible soils to less than significant because it requires the geotechnical investigation to assess the potential for collapsible soils. Impacts would be less than significant with mitigation.

Mitigation Measures: Geology-2, Geology-3 (refer to Section 4.5.7)

Significance after mitigation: Less than significant.

Impact Geology Soils Minerals-4: Would Alternative 3 be located on expansive soil, as defined in Table 181-B of the Uniform Building Code (1994), creating substantial risks to life or property? (*Less than significant with mitigation*)

The eastern cable pole would be installed within Redding cobbly loam and the western cable pole would be installed within terrace escarpment soil units. Both soils have a low clay content and low to moderate shrink-swell potential. There is no risk to life or property from expansive soils along the underground transmission line because the underground line would be constructed in existing roads on engineered fill. The cable poles could present a substantial risk to life or property if the cable pole foundation failed due to soil expansion resulting in a significant impact. Implementation of APMs GEO-1 (design in accordance with GO 95 and industry seismic standards) and GEO-2 (geotechnical investigation) would reduce the impact, but the impact would remain significant because the APMs do not require evaluation of expansive soils. Mitigation Measure Geology-3 would reduce impacts from expansive soils to less than significant because it requires the geotechnical investigation to assess the potential for expansive soils. Impacts would be less than significant with mitigation.

Mitigation Measures: Geology-3 (refer to Section 4.5.7)

Significance after mitigation: Less than significant.

4.5.11 Alternative 4: Segment D 69-kV Partial Underground Alignment (Reduces New TSPs in Segment D)

Alternative 4 would include the installation of a double 69-kV underground alignment starting at two new cable poles (P48AA and P48BB) in Proposed Project Segment D near existing lattice tower E17. The underground alignment would follow Carmel Mountain Road and East Ocean Air Drive, ending at the Peñasquitos Substation. Within Proposed Project Segment D, an existing 69-kV line would be removed from the existing steel lattice towers, and a second 69-kV power line on existing H-frame structures would be de-energized and left in place.

Construction within Proposed Project Segment D would be reduced under Alternative 4. The 230-kV transmission line would be installed on the existing steel lattice towers similar to the Proposed Project; however, the H-frame structures would not be removed, and no new TSPs would be installed between lattice tower E17 and the Peñasquitos Substation. This alternative is described in more detail in Chapter 3: Alternatives.

4.5.11.1 Alternative 4 Environmental Setting

Geology

Geologic units crossed by this alternative alignment are shown on Figure 4.5-11 and listed in Table 4.5-12.

Table 4.5-12 Geologic Units in the Alternative 4 Area

Age (from youngest to oldest)	Unit	Description
Quaternary: Holocene to Late Pleistocene	Qya	Young alluvial valley deposits: unconsolidated to slightly consolidated, undissected to slightly dissected clay, silt, sand, and gravel along stream valleys and alluvial flats of larger rivers
Quaternary: Middle to Early Pleistocene	Qvol	Very old lacustrine, playa, and estuarine deposits: moderately to well consolidated, moderately dissected, fine-grained sand, silt, mud, and clay from lake, playa, and estuarine deposits of various types
Tertiary	Tss	Coarse-grained formations of sedimentary origin – dominantly sandstone and conglomerate (e.g., Ardath Shale, Friars Formation)

Source: CGS 2010

Slope Stability

Alternative 4 is located within graded roads across level to gently sloping mesas and terraces and overhead along steeply sloping Los Peñasquitos Canyon. This alignment does not cross any mapped landslides and the geologic deposits along the alternative alignment are not prone to landslides.

Soils

Mapped soil units along the Alternative 4 route are shown on Figure 4.5-12 and described in Table 4.5-13. This alternative is underlain by soils formed in marine terraces and by soils formed in alluvium. The hazard of offroad/ off-trail soil erosion ranges from slight to very severe and for on-road/on-trail ranges from slight to severe. Shrink/swell (expansive) potential of the soils associations along this link varies from low to high.

Mineral Resources

No known mineral resources are identified along the Alternative 4.

Seismicity

The alternative does not cross any known or active faults and is thus not likely to experience damage due to fault rupture and/or offset. No active faults are located in the immediate vicinity of the alternative; however, the cable poles could experience minor to moderate ground-shaking from an earthquake on nearby significant active faults (i.e., Elsinore or Rose Canyon faults).

Figure 4.5-11 Geologic Units of Alternative 4 Alignment

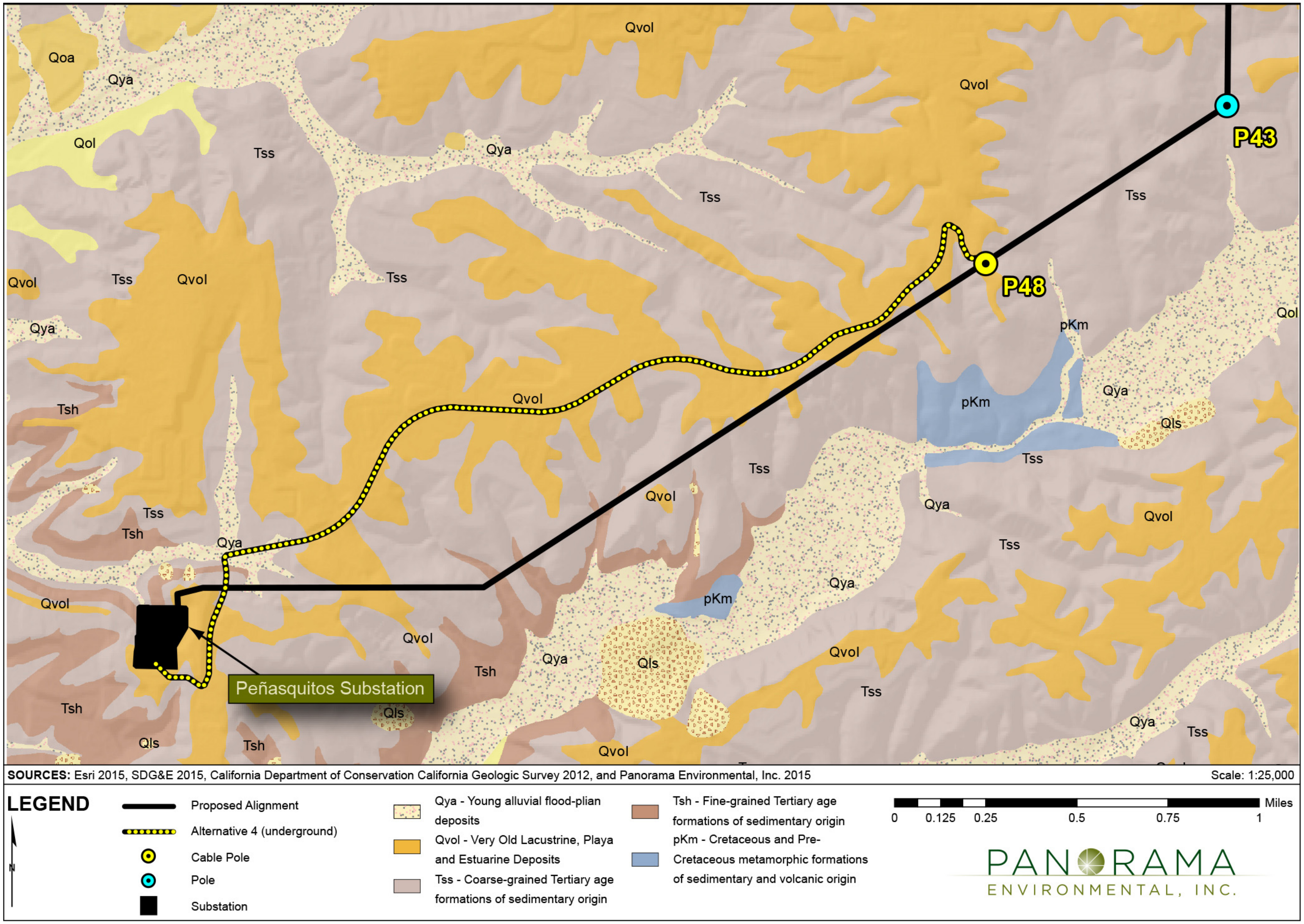

Figure 4.5-12 Soil Units of Alternative 4 Alignment

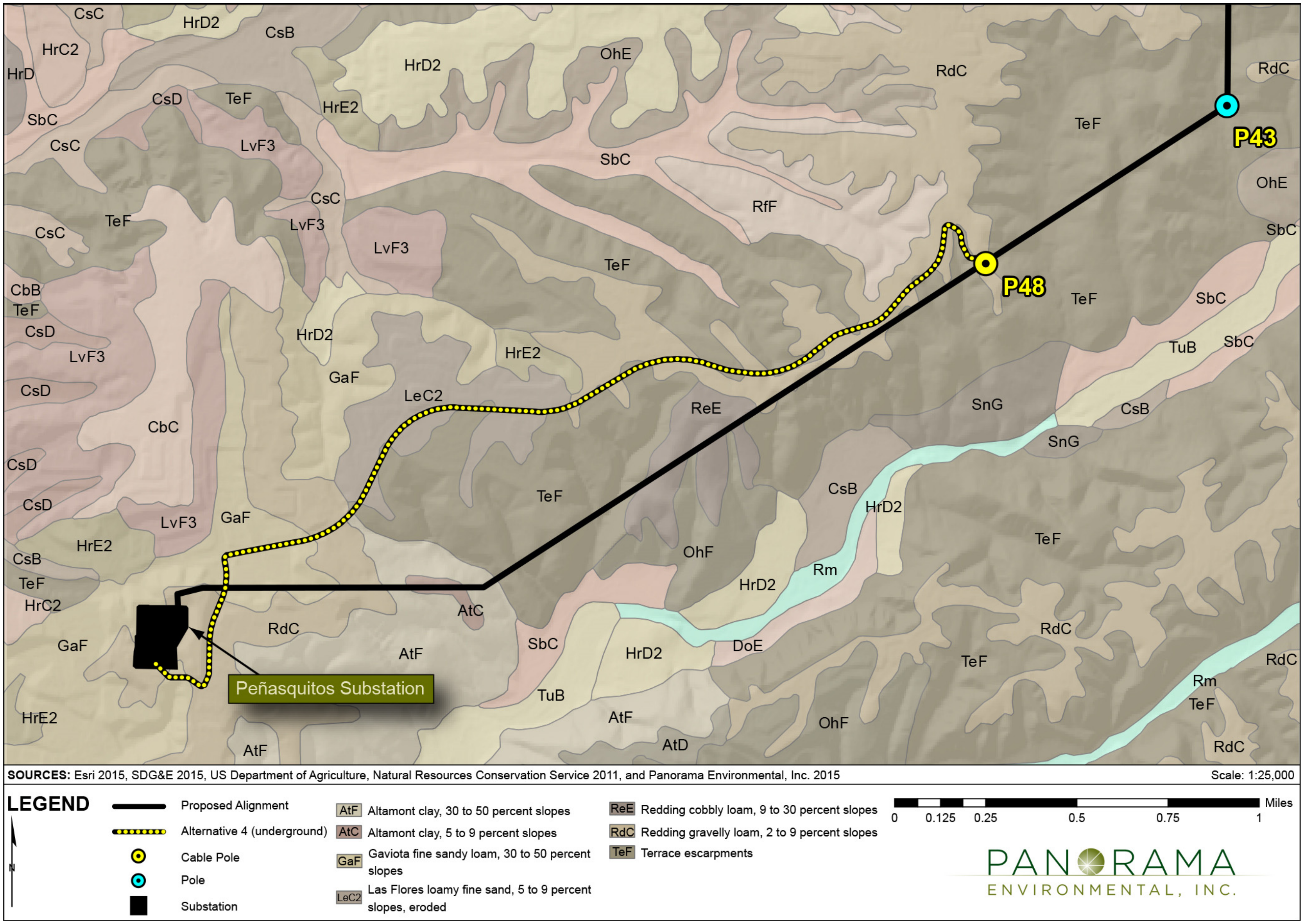

Table 4.5-13 Major Soil Units in the Alternative 4 Area

Soil Series	Description	Slope Percent	Runoff Rate	Shrink-swell Potential	Erosion Potential
Altamont clay	Deep, well-drained soils that formed in material weathered from fine-grained sandstone and shale. Found in gently sloping to very steep uplands.	5 to 9	Medium to rapid	High	Moderate to high
Gaviota fine sandy loam	Well-drained, shallow fine sandy loams that formed in material weathered from marine sandstone. Found on uplands.	30 to 50	Rapid	Low	High
Las Flores loamy fine sand, eroded	Moderately well-drained. Residuum weathered from siliceous calcareous marine sandstone; found on backslopes of uplands and marine terraces	5 to 9 9 to 15 15 to 30	Medium to very rapid	Low (surface) to moderate	Moderate
Redding gravelly loam	Well drained gravelly loams that have a hardpan. Includes duripan horizon (cemented soil); forms in alluvium derived from mixed sources; found on nearly level or dissected and undulating to hilly high terraces	2 to 9	Very low to rapid	Low (surface) to moderate	Low
Redding cobbly loam	See above	9 to 30 15 to 50	Very low to rapid	Low (surface) to moderate	Low
Terrace escarp-ments	Long, narrow, rocky areas with steep faces that rise abruptly from mean tide line to coastal plain terraces or plateaus; composed of soft coastal sandstone, hard shale, or hard, weather-resistant, fine-grained sandstone	N/A	N/A	Variable	Variable

Sources: NRCS 2015b, 2015c

This alternative has no potential for liquefaction as it is primarily underlain by older consolidated sedimentary bedrock units with no underlying aquifer.

Earthquake-Induced Landslides

Alternative 4 traverses gently sloping graded roads and does not cross areas with significant slopes. However, cable poles P48AA and P48BB in Los Peñasquitos Canyon would be located on the edge of slopes could be damaged by seismically induced landslides in the event of a large earthquake on nearby faults.

4.5.11.2 Alternative 4 Impacts and Mitigation Measures

Table 4.5-14 summarizes the impacts to geology, soils, and mineral resources from Alternative 4.

Table 4.5-14 Summary of Alternative 4 Impacts on Geology, Soils, and Mineral Resources

Significance Criteria	Project Phase	Significance Prior to APMs	Significance after APMs and before Mitigation	Significance after Mitigation
Impact Geology Soils Minerals -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; strong seismic ground-shaking; seismic-related ground failure including liquefaction; or landslides	Construction	Less than significant	---	---
	Operation and Maintenance	Significant	Significant APM GEO-1 APM GEO-2	Less than significant MM Geology-2
Impact Geology Soils Minerals-2: Result in substantial soil erosion or the loss of topsoil	Construction	Significant	Less than significant APM GEO-3 APM HYDRO-1 APM HYDRO-2	---
	Operation and Maintenance	Less than significant	---	---
Impact Geology Soils Minerals-3: Be located on a geologic unit of soil that is unstable, or that would become unstable as a result of the project, and expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse	Construction, Operation and Maintenance	Significant	Significant APM GEO-1 APM GEO-2	Less than significant MM Geology-2 MM Geology-3
Impact Geology Soils Minerals-4: Be located on expansive soil, as defined in Table 181-B of the Uniform Building Code (1994), creating substantial risks to life or property	Construction, Operation and Maintenance	Significant	Significant APM GEO-1 APM GEO-2	Less than significant MM Geology-3
Impact Geology Soils Minerals-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	Construction	No impact	---	---
	Operation and Maintenance	No impact	---	---
Impact Geology Soils Minerals-6: Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state	Construction, Operation and Maintenance	No impact	---	---

Significance Criteria	Project Phase	Significance Prior to APMs	Significance after APMs and before Mitigation	Significance after Mitigation
Impact Geology Soils Minerals-7: Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan	Construction, Operation and Maintenance	No impact	---	---

Alternative 4 would have no impact on three CEQA significance criteria for geology, soils, and mineral resources: Impacts Geology Soils Minerals -5, -6, and -7 as indicated in Table 4.5-14 above. Alternative 4 would have no impact on these criteria because Alternative 4 does not involve the use of a septic tank or alternative wastewater disposal and Alternative 4 is not located in an area of known mineral resources; therefore, the alternative would not cause the loss of availability of a mineral resource. The impacts of construction, operation, and maintenance are not analyzed separately for Impacts Geology Soils Minerals-3, -4, -6, and -7 because the impact analysis is based on the physical location of the Alternative. The location of Alternative 4 will not change between construction and operation and maintenance.

Impact Geology Soils Minerals-1: Would Alternative 4 expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: rupture of a known earthquake fault; strong seismic ground-shaking; seismic-related ground failure including liquefaction; or landslides? (*Less than significant with mitigation*)

Construction

Alternative 4 is located in a region with several active and potentially active fault zones with a history of strong earthquakes. The active fault closest to the Alternative 4 area is the Rose Canyon Fault, which is approximately 5 miles southwest of the Alternative 4 alignment at its closest point; therefore, impacts from fault rupture would not occur.

In the unlikely event of an earthquake, construction workers could be exposed to hazards from strong seismic ground shaking. Construction of Alternative 4 would not increase these risks of exposure over typical risks of exposure throughout the region. Earthquake safety training pursuant to OSHA regulations would minimize potential for impacts to workers. Due to the short duration of construction (9 months), the low probability of a strong seismic event occurring during this timeframe, and safety training for construction crews, the potential for impacts would be less than significant. No mitigation is required.

Operation and Maintenance

A significant seismic event is likely to occur over the operational lifetime of Alternative 4. The Alternative 4 cable poles, P48AA and P48BB, are located in proximity to trails and other SDG&E structures. The Alternative 4 underground alignment would be located under existing roadways and would not increase the risk to life or property from a seismic event. The cable poles would not be located in areas that are subject to liquefaction, but the steep slope at the cable pole would be susceptible to seismic-induced landslides. The risk to life and property would increase if the cable pole were not constructed in accordance with appropriate engineering procedures, or if the foundations are not designed properly for seismic events. The increased risk to life and property would be a significant impact. Implementation of APMs GEO-1 (design in accordance with GO 95 and industry seismic standards) and GEO-2 (geotechnical recommendations) would reduce impacts, but impacts would remain significant because the geotechnical investigation and design is not required to assess the potential for landslides or incorporate the results into the final Alternative 4 design. Implementation of Mitigation Measure Geology-2 would reduce impacts from landslides to less than significant because it would assess the potential for unstable slopes, landslides, earth flows, or debris flows, and incorporate the results into the final Alternative 4 design. Impacts would be less than significant with mitigation.

Mitigation Measures: Geology-2 (refer to Section 4.5.7)

Significance after mitigation: Less than significant.

Impact Geology Soils Minerals-2: Would Alternative 4 result in substantial soil erosion or the loss of topsoil? (*Less than significant; no mitigation required*)

Construction

Excavation for the cable poles and trenching for the underground power line would loosen soil and accelerate erosion if soils from the underground construction were not properly managed or the cable pole locations were not properly stabilized, resulting in a significant impact. Implementation of APMs HYDRO-1 (temporary BMPs), HYDRO-2 (permanent BMPs), and GEO-3 (minimize soil disturbance) would reduce the potential for erosion from soil disturbing activities by requiring SDG&E to implement sediment and erosion control practices in compliance with a project SWPPP and SWRCB requirements. Impact would be less than significant with these APMs. No mitigation is required.

Operation and Maintenance

Operation and maintenance activities would involve use of existing access routes and would not involve any new ground disturbance that could result in erosion or sedimentation or topsoil loss in the Alternative 4 area. Impacts would be less than significant. No mitigation is required.

Mitigation Measures: None required.

Impact Geology Soils Minerals-3: Would Alternative 4 be located on a geologic unit of soil that is unstable, or that would become unstable as a result of the project, and expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse? (*Less than significant with mitigation*)

Landslides

There are no mapped landslides in the Alternative 4 area; however, the risk of soil destabilization that could result in landslides is high. The steep terrain at cable poles P48AA and P48BB is susceptible to landslides. Alternative 4 could expose people or structures to adverse effects involving landslides if the cable poles are not properly engineered in these areas of steep slopes, which would be a significant impact. Implementation of APMs GEO-1 (design in accordance with GO 95 and industry seismic standards) and GEO-2 (geotechnical recommendations) would reduce impacts, but impacts would remain significant because the geotechnical investigation in APM GEO-2 is not required to assess the potential for unstable slopes, landslides, earth flows, or debris flows, or incorporate the results into the final Alternative 4 design. Implementation of Mitigation Measure Geology-2 would reduce impacts from landslides and other ground failures to less than significant because it requires SDG&E to assess the potential for unstable slopes, landslides, earth flows, or debris flows, and incorporate the results into the final Alternative 4 design. Impacts would be less than significant with mitigation.

The underground duct bank would not increase the risk of landslides because the underground duct bank would be constructed within existing roadway fill, which is not susceptible to landslides. There would be no impact from Alternative 4.

Lateral Spreading, Liquefaction, and Subsidence

Alternative 4 is not located on a geologic unit that is subject to lateral spreading or liquefaction. There is no potential for subsidence in the Alternative 4 area because there is no groundwater basin underlying Alternative 4. There would be no impact from lateral spreading, liquefaction, or subsidence.

Soil Collapse

The cable poles would be located on Redding gravelly loam. Redding gravelly loam has a low to moderate shrink-swell potential. There would be no impact from soil collapse along the underground power line because the underground power line would be installed below roadways in engineered fill. The cable poles could present a substantial risk to life or property if the cable pole foundation failed due to soil collapse resulting in a significant impact. Implementation of APMs GEO-1 (design in accordance with GO 95 and industry seismic standards) and GEO-2 (geotechnical investigation) would reduce the impact, but the impact would remain significant because the APM does not require evaluation of collapsible soils. Mitigation Measure Geology-3 would reduce impacts from collapsible soils to less than significant because it requires SDG&E to assess the potential for collapsible soils. Impacts would be less than significant with mitigation.

Mitigation Measures: Geology-2 and Geology-3 (refer to Section 4.5.7)

Significance after mitigation: Less than significant.

Impact Geology Soils Minerals-4: Would Alternative 4 be located on expansive soil, as defined in Table 181-B of the Uniform Building Code (1994), creating substantial risks to life or property? (*Less than significant with mitigation*)

The Alternative 4 cable poles would be installed on Redding gravelly loam, which has a low clay content and a low to moderate shrink-swell potential. The underground alignment would be installed beneath area roads within engineered fill, which is not expansive. The cable poles could present a substantial risk to life or property if the cable pole foundation failed due to soil expansion resulting in a significant impact. Implementation of APMs GEO-1 (design in accordance with GO 95 and industry seismic standards) and GEO-2 (geotechnical investigation) would reduce the impact, but the impact would remain significant because the APMs do not require evaluation of expansive soils. Mitigation Measure Geology-3 would reduce impacts from expansive soils to less than significant because it requires SDG&E to assess the potential for expansive soils. Impacts would be less than significant with mitigation.

Mitigation Measures: Geology-3 (refer to Section 4.5.7)

Significance after mitigation: Less than significant.

4.5.12 Alternative 5: Pomerado Road to Miramar Area North Combination Underground/Overhead (Avoids All Proposed Project Segments)

Alternative 5 would include underground installation of the transmission line with the exception of the east and west ends where the transmission line would be installed in an overhead position within existing SDG&E ROWs. Under this alternative, the alignment would exit the Sycamore Canyon Substation at MCAS Miramar an overhead line and travel westerly within an existing SDG&E ROW toward Stonebridge Parkway. The transmission line would transition to underground beneath Stonebridge Parkway in the vicinity of Greenstone Court, then continue underground on Pomerado Road, Miramar Road, Kearny Villa Road, Black Mountain Road, Activity Road, Camino Ruiz, Miralani Drive, Arjons Drive, Trade Place, Camino Santa Fe, Carroll Road/Carroll Canyon Road and Scranton Road. The transmission line would either remain underground within the Pomerado/Miramar bridge or temporarily transition to an overhead alignment via two new cable poles and potentially two new interset poles, where it would cross I-15. At the western end of the underground portion, the line would transition back to overhead structures located within an existing SDG&E ROW heading northward into the Peñasquitos Substation. Alternative 5 would avoid construction within the Proposed Project alignment with the exception of approximately 3,400 feet of existing SDG&E ROW in Segment A connecting to the Sycamore Canyon Substation. SDG&E may use up to eight other staging yards during construction of Alternative 5 in addition to the Proposed Project staging yards. The Alternative 5 staging yards would be located within the Conrock and Hanson Aggregates Pacific Southwest quarries north of the Alternative 5 underground alignment, within the cul-de-sac west of Birch Canyon Place, off of Summers Ridge Road, and behind the Sorrento Canyon Golf Center. This alternative is described in more detail in Chapter 3: Alternatives.

4.5.12.1 Alternative 5 Environmental Setting

Geology

Alternative 5 consists of both overhead and underground transmission line segments that traverse a mix of sloping hillsides, mesas and terraces, and valleys along the entire length. The underground potion of the alignment is within developed and graded roadways along mesas and terraces near Carroll Canyon. The overhead portion traverses northwesterly across mesas, terraces and hillslopes on the southern and northern side of Los Peñasquitos Canyon. Geologic units crossed by this alternative alignment are listed in Table 4.5-15. The locations of these units along the overhead and underground portions of Alternative 5 are shown in Figure 4.5-13. The geologic units that underlay Alternative 5 staging yards are shown in Figure 4.5-14.

Slope Stability

The Alternative 5 route traverses level to gently sloping mesas and terraces and moderately sloping hillside terrain. This alignment does not cross any mapped landslides; however, most of this alternative is underlain by landslide prone sedimentary rocks. Underground portions of the alignment near and along the edges of natural slopes and overhead portions of the alignment crossing hills and slopes may be susceptible to landslides and slope failures. The Alternative 5 staging yards are located on graded, flat lands.

Table 4.5-15 Geologic Units in the Alternative 5 Area

Age (from youngest to oldest)	Unit	Description
Quaternary: Holocene to Late Pleistocene	Qya	Young alluvial valley deposits: unconsolidated to slightly consolidated, undissected to slightly dissected clay, silt, sand, and gravel along stream valleys and alluvial flats of larger rivers
Quaternary: Late Holocene to Pleistocene	Ql	Lacustrine, playa, and estuarine deposits
Quaternary: Late Holocene to Early Pleistocene	Qol	Old lacustrine, playa, and estuarine deposits
Quaternary: Middle to Early Pleistocene	Qvol	Very old lacustrine, playa, and estuarine deposits: moderately to well consolidated, moderately dissected, fine-grained sand, silt, mud, and clay from lake, playa, and estuarine deposits of various types
Tertiary	Tss	Coarse-grained formations of sedimentary origin – dominantly sandstone and conglomerate (e.g., Ardath Shale, Friars Formation)
Tertiary	Tsh	Fine-grained formations of sedimentary origin
Cretaceous and pre-Cretaceous	pKm	Metamorphic formations of sedimentary and volcanic origin

Source: CGS 2010

Soils

Mapped soil units along the Alternative 5 route and staging yards are described in Table 4.5-16 and shown on Figures 4.5-14 4.5-15 and 4.5-16. This alternative is The Alternative 5 alignment and staging yards are underlain by soils formed in marine terraces and by soils formed in alluvium. The hazard of off-road/ off-trail soil erosion ranges from slight to very severe and for on-road/on-trail ranges from slight to severe. Shrink/swell (expansive) potential of the soils associations along this link varies from low to high.

Mineral Resources

No active mining claims are located within the Alternative 5 alignment. One mineral resource site is located within 1000 feet of this alternative alignment,; the Carroll Canyon sand and gravel pit operated by Vulcan Materials (Vulcan Materials 2015). This is an active sand and gravel quarry; however, this site is located within Carroll Canyon, approximately 700 to 1000 feet north of this alternative alignment on Black Mountain Road. The Alternative 5 alignment would not interfere with access to this location because the route would be constructed in existing city streets and would not infringe on the boundaries of the sand and gravel operation.

Three of the Alternative 5 staging yards, Conrock (staging yards 1A and 1B) and Hanson Aggregates (staging yard 3), would be located within active quarries. Hanson Aggregates Pacific Southwest manufactures and supplies aggregates, asphalt, and ready-mixed concrete for the construction industry. Conrock manufactures, distributes, and sells aggregates (crushed rock, sand, and gravel), hot-mix asphalt, and ready-mixed concrete. These properties are designated as MRZ-2, which are defined as areas where adequate information exists to indicate the presence of significant mineral deposits (City of San Diego 2008).

Seismicity

This alternative does not cross any known active faults and is thus not likely to experience damage due to fault rupture and/or offset. No active faults are located in the immediate vicinity of this alternative. Structures for this alternative alignment could experience minor to moderate ground-shaking from an earthquake on nearby significant active faults (i.e., the Elsinore or Rose Canyon faults).

Most of this alternative has zero to low potential for liquefaction as it is primarily underlain by older consolidated sedimentary bedrock units. The alluvial deposits in Los Peñasquitos Canyon may have moderate potential liquefaction in areas with local pockets of saturated loose sandy soils, which could liquefy during a large earthquake.

Earthquake-Induced Landslides

Most of the Alternative 5 alignment does not cross areas with significant slopes; however, this alternative is almost underlain by alluvial sediments that would be prone to seismically induced landslides in the event of a large earthquake on nearby regional faults.

Figure 4.5-13 Geologic Units of Alternative 5 Alignment

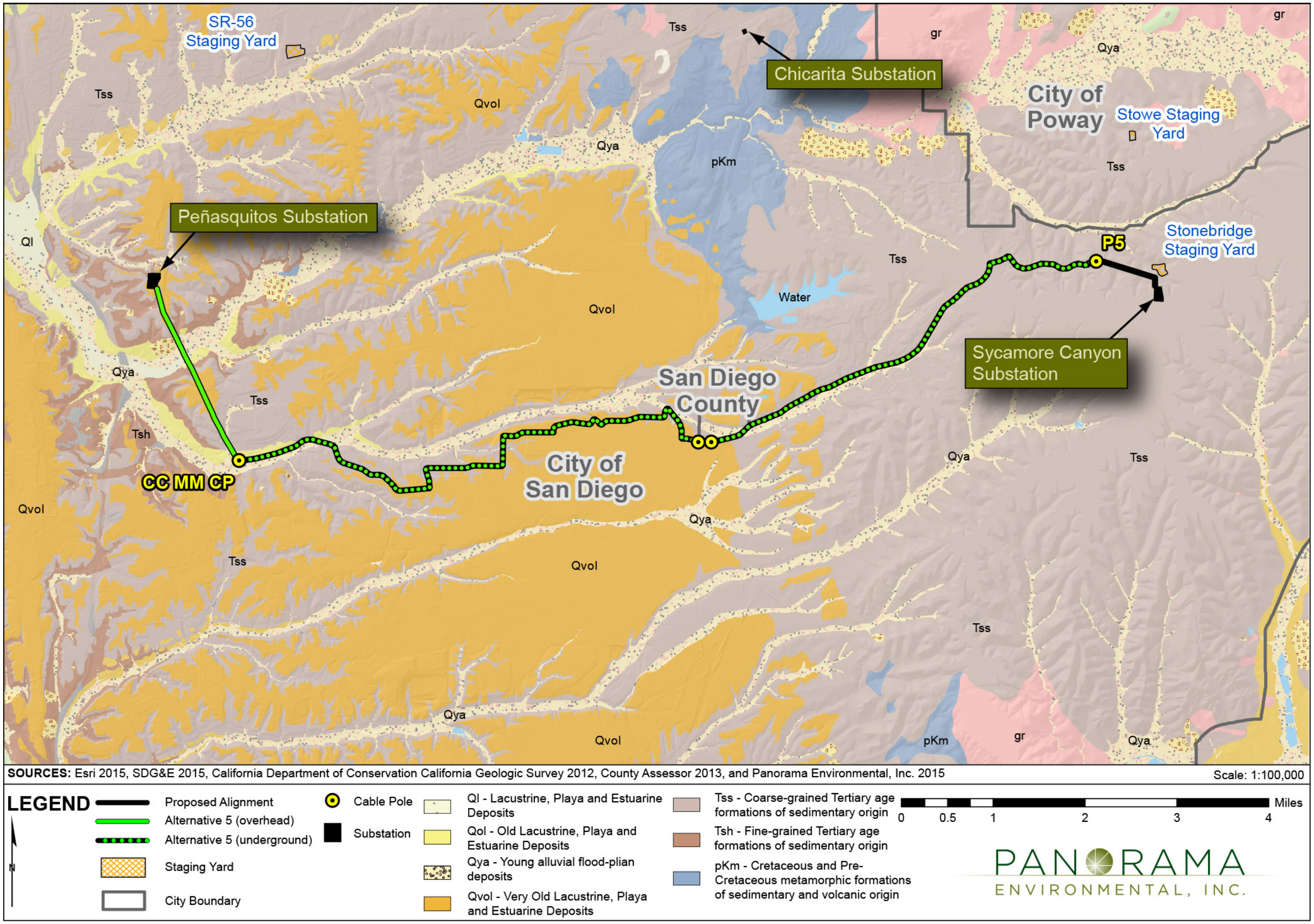

Figure 4.5-14 Geologic Units of Alternative 5 Staging Yards

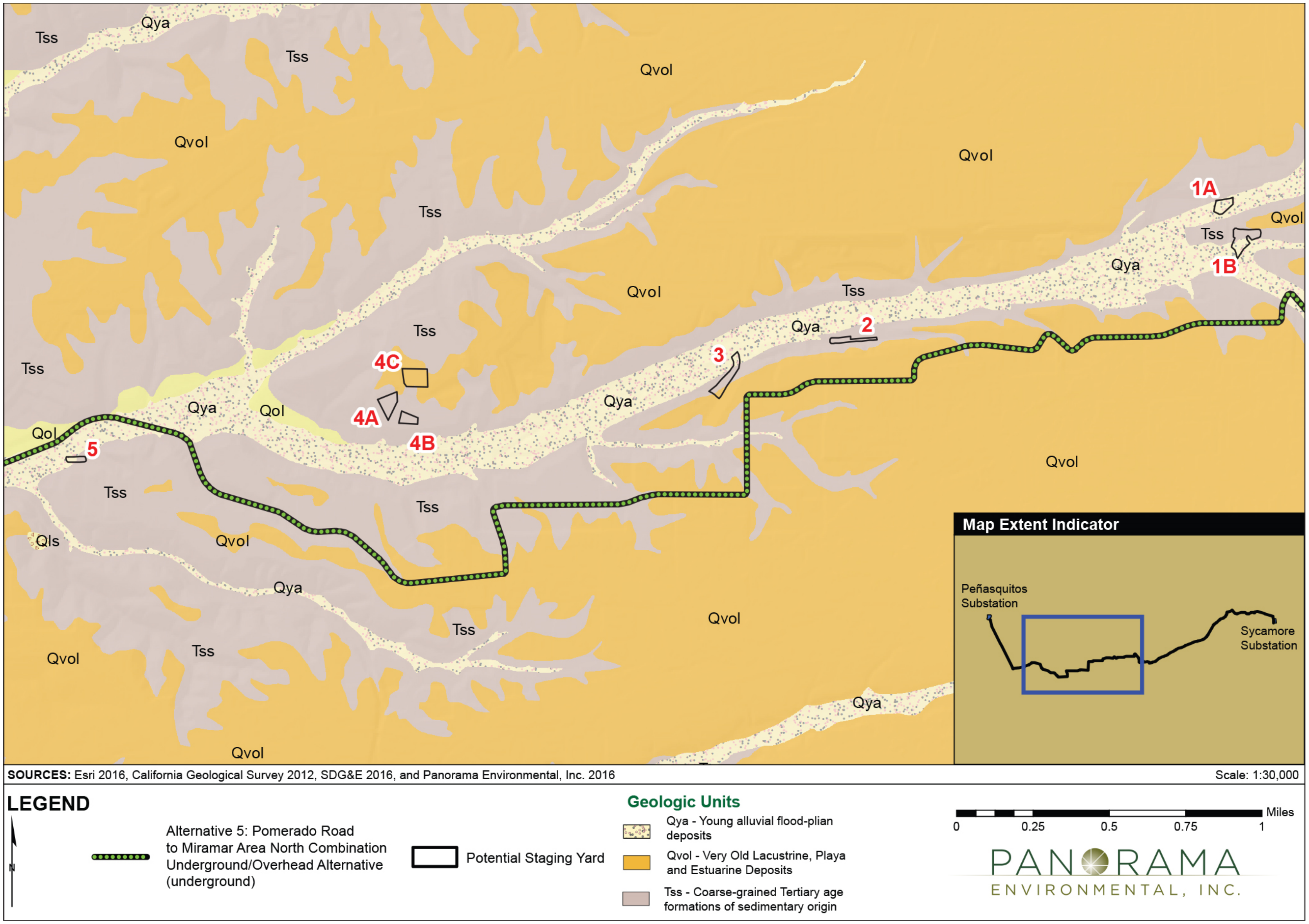

Table 4.5-16 Major Soil Units in the ~~Proposed Project~~ Alternative 5 Area

Soil Series	Description	Slope Percent	Runoff Rate	Shrink-swell Potential	Erosion Potential
Altamont clay	Deep, well-drained soils that formed in material weathered from fine-grained sandstone and shale. Found in gently sloping to very steep uplands.	15 to 30 30 to 50	Medium to rapid	High	Moderate to high
Carlsbad gravelly loamy sand	Moderately well-drained and well-drained gravelly loamy sands that are moderately deep over hardpan. These soils formed in material weathered in place from soft ferruginous sandstone. Found on ridges.	5 to 9	Medium to rapid	Low	High
Chesterton fine sandy loam	Moderately well-drained fine sandy loams. Formed in material weathered in place from soft ferruginous sandstone. Found on ridges and in swales.	5 to 9	Slow	Moderate	Slight
Gaviota fine sandy loam	Well-drained, shallow fine sandy loams that formed in material weathered from marine sandstone. Found on uplands.	30 to 50	Rapid	Low	High
Huerhuero loam, eroded	Moderately well-drained loams that have a clay subsoil. Calcareous alluvium formed from sedimentary rock; found on marine terraces as valley deposits	5 to 9 15 to 30	Very rapid	Low (surface) to moderate	High
Olivenhain cobbly loam	Moderately well-drained, moderately deep to deep cobbly loams that consist of very cobbly clay subsoil. Alluvium found on gently to strongly sloping terrain and on dissected marine terraces	9 to 30 30 to 50	Slow to medium	Low to moderate	Low
Redding gravelly loam	Well drained gravelly loams that have a hardpan. Includes duripan horizon (cemented soil); forms in alluvium derived from mixed sources; found on nearly level or dissected and undulating to hilly high terraces	2 to 9	Very low to rapid	Low (surface) to moderate	Low
Redding cobbly loam	See above	9 to 30 15 to 50	Very low to rapid	Low (surface) to moderate	Low
Riverwash	Excessively drained material that is typically sandy, gravelly, or cobbly. Found in intermittent streams.	N/A	N/A	Low	N/A
Salinas clay loam	Well-drained to moderately well-drained clay loams that formed in sediments washed from Diablo, Linne, Las Flores, Huerhuero, and Olivenhain soils. Found in flood plains and alluvial fans.	2 to 9	Slow to medium	Moderate	Slight to moderate
Terrace escarpments	Long, narrow, rocky areas with steep faces that rise abruptly from mean tide line to coastal plain terraces or plateaus; composed of soft coastal sandstone, hard shale, or hard, weather-resistant, fine-grained sandstone	N/A	N/A	Variable	Variable
Tujunga sand	Very deep, excessively drained sands derived from granitic alluvium; occurs on alluvial fans and flood plains	0 to 5	Low	Low	High

Sources: NRCS 2015b, 2015c

Figure 4.5-15 ~~14~~ Soil Units of Alternative 5 Alignment (Revised)

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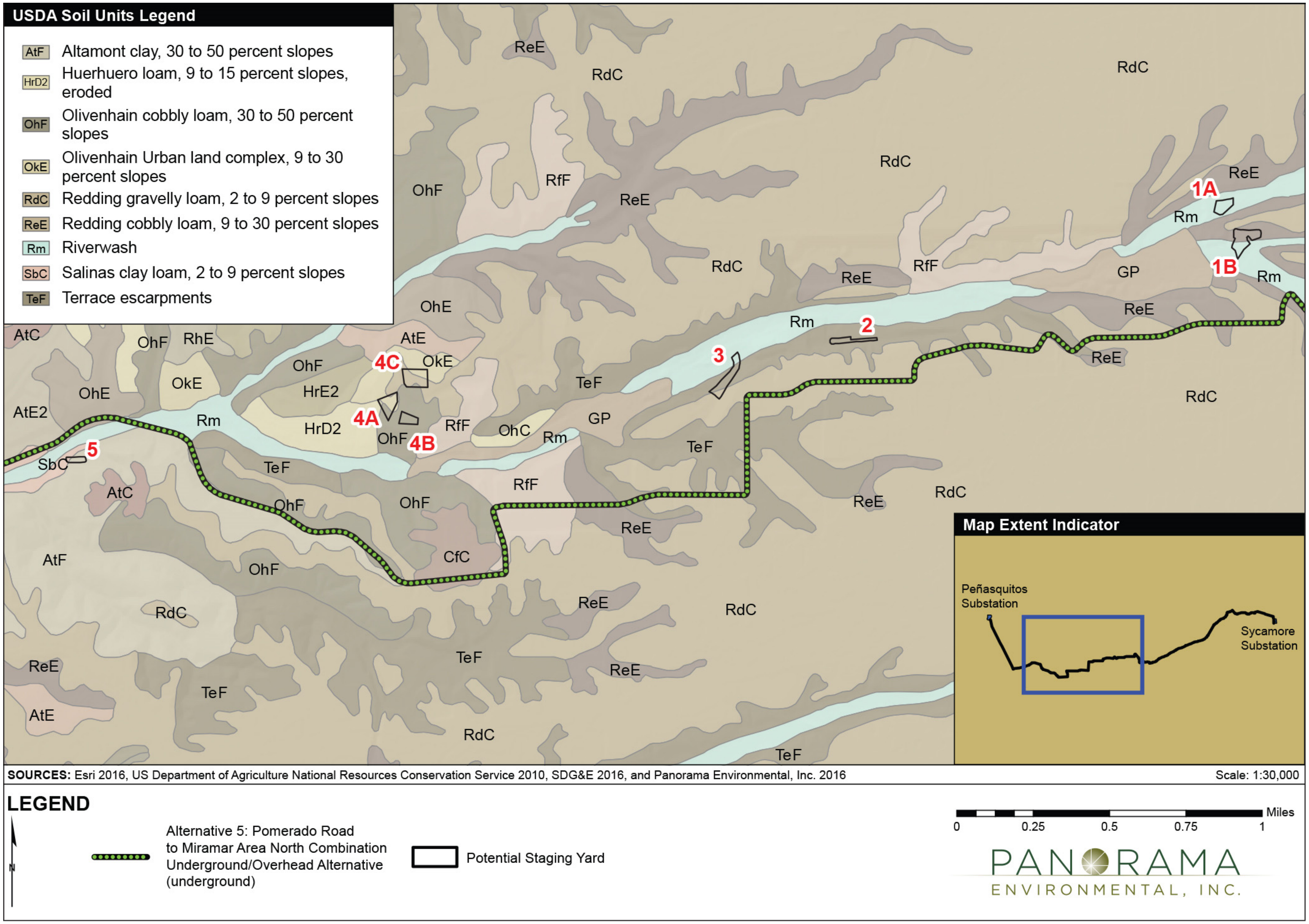
Figure 4.5-16 Soil Units of Alternative 5 Staging Yards



4.5.12.2 Alternative 5 Impacts and Mitigation Measures

Table 4.5-17 summarizes the impacts to geology, soils, and mineral resources from Alternative 5.

Table 4.5-17 Summary of Alternative 5 Impacts on Geology, Soils, and Mineral Resources

Significance Criteria	Project Phase	Significance Prior to APMs	Significance after APMs and before Mitigation	Significance after Mitigation
Impact Geology Soils Minerals -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; strong seismic ground-shaking; seismic-related ground failure including liquefaction; or landslides	Construction	Less than significant	---	---
	Operation and Maintenance	Significant	Significant APM GEO-1 APM GEO-2	Less than significant MM Geology-1 MM Geology-2
Impact Geology Soils Minerals-2: Result in substantial soil erosion or the loss of topsoil	Construction	Significant	Less than significant APM GEO-3 APM HYDRO-1 APM HYDRO-2	---
	Operation and Maintenance	Less than significant	---	---
Impact Geology Soils Minerals-3: Be located on a geologic unit of soil that is unstable, or that would become unstable as a result of the project, and expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse	Construction, Operation and Maintenance	Significant	Significant APM GEO-1 APM GEO-2	Less than significant MM Geology-1 MM Geology-2 MM Geology-3
Impact Geology Soils Minerals-4: Be located on expansive soil, as defined in Table 181-B of the Uniform Building Code (1994), creating substantial risks to life or property	Construction, Operation and Maintenance	Significant	Significant APM GEO-1 APM GEO-2	Less than significant MM Geology-3
Impact Geology Soils Minerals-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	Construction, Operation and Maintenance	No impact	---	---

Significance Criteria	Project Phase	Significance Prior to APMs	Significance after APMs and before Mitigation	Significance after Mitigation
Impact Geology Soils Minerals-6: Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state	Construction, Operation and Maintenance	No impact	---	---
Impact Geology Soils Minerals-7: Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan	Construction, Operation and Maintenance	No impact	---	---

Alternative 5 would have no impact on three CEQA significance criteria for geology, soils, and mineral resources: Impacts Geology Soils Minerals -5, -6, and -7 as indicated in Table 4.5-17 above. Alternative 5 does not involve the use of a septic tank or alternative wastewater disposal. Although three of the Alternative 5 staging yards would be located within active quarries (1A, 1B, and 3), Alternative 5 would not preclude access to any mineral resources found in the vicinity because staging activities would be temporary (for approximately 12 months) and use of the quarry would be contingent on approval from the landowner; ~~and~~ therefore construction and operation of the transmission line along this alignment and use of the Alternative 5 staging yards ~~is~~ would not be expected to interfere with future access or result in the loss of availability of any mineral resources. The impacts of construction, operation, and maintenance are not analyzed separately for Impacts Geology Soils Minerals-3, -4, -6, and -7 because the impact analysis is based on the physical location of the Alternative. The location of Alternative 5 would not change between construction and operation and maintenance.

Impact Geology Soils Minerals-1: Would Alternative 5 expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: rupture of a known earthquake fault; strong seismic ground-shaking; seismic-related ground failure including liquefaction; or landslides? (*Less than significant with mitigation*)

Construction

Alternative 5 is located in a region with several active and potentially active fault zones with a history of strong earthquakes. The active fault closest to the Alternative 5 area is the Rose Canyon Fault, which is approximately 4 miles west of the Alternative 5 alignment at its closest point; therefore, impacts from fault rupture would not occur.

In the unlikely event of an earthquake, construction workers could be exposed to hazards from strong seismic ground shaking. Construction of Alternative 5 would not substantially increase these risks of exposure over typical risks of exposure throughout the region. Earthquake safety training pursuant to OSHA regulations would minimize potential for impacts to workers. Due to the short duration of construction (12 months), the low probability of a strong seismic event or landslide occurring during this timeframe, and safety training for construction crews, the potential for impacts would be less than significant. No mitigation is required.

Operation and Maintenance
A significant seismic event is likely to occur over the operational lifetime of Alternative 5. Alternative 5 would require a total of four new cable poles and six new TSPs. There would be no risk to property or life from the underground transmission line because the transmission line would be located within existing roads constructed on engineered fill and road base. The risk to property and life as a result of a downed power pole due to a seismic event would increase relative to existing conditions if SDG&E does not implement seismic design standards in the foundation design of new poles. The cable pole at Carroll Canyon Road in particular is located on a geologic unit that is prone to liquefaction and seismic induced landslides. The risk to property or life from seismic ground failure, liquefaction, or landslides would also increase if the foundations were not designed in accordance with appropriate engineering procedures or to address liquefaction and landslides. The increased risk to life and property would be a significant impact. Implementation of APMs GEO-1 (design in accordance with GO 95 and industry seismic standards) and GEO-2 (geotechnical recommendations) would reduce the risk of loss, injury, or death from seismic events, but a significant impact would still exist because the geotechnical investigation required under APMs GEO-1 and GEO-2 does not specifically address liquefaction and landslides. Mitigation Measures Geology-1 and Geology-2 would minimize impacts from potential liquefaction and landslides because they require the geotechnical investigation to assess potential for liquefaction and landslides. Impacts would be less than significant with mitigation.

Mitigation Measures: Geology-1 and Geology-2 (refer to Section 4.5.7)

Significance after mitigation: Less than significant.

Impact Geology Soils Minerals-2: Would Alternative 5 result in substantial soil erosion or the loss of topsoil? (*Less than significant; no mitigation required*)

Construction
Ground disturbing activities for the overhead and underground portions of Alternative 5 including excavation, trenching, equipment and material staging, and soil stockpiles would have the potential to result in soil erosion or loss of topsoil. Construction of the ~~overhead~~ transmission line would result in a significant impact if the work areas are not properly stabilized and substantial erosion occurs. Implementation of APMs HYDRO-1 (temporary BMPs), HYDRO-2 (permanent BMPs), and GEO-3 (minimize soil disturbance) would reduce the potential for erosion from soil disturbing activities. Impacts from soil erosion and topsoil loss as a result of Alternative 5 would be less than significant with APMs. No mitigation is required.

Operation and Maintenance

Operation and maintenance activities would involve use of existing access routes and would not involve any new ground disturbance that could result in erosion or topsoil loss in the Alternative 5 area. Impacts would be less than significant. No mitigation is required.

Mitigation Measures: None required.

Impact Geology Soils Minerals-3: Would Alternative 5 be located on a geologic unit of soil that is unstable, or that would become unstable as a result of the project, and expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse? (*Less than significant with mitigation*)

Landslides

There are no mapped landslides in the Alternative 5 area or the Alternative 5 staging yards. The Alternative 5 alignment and staging yards would be located on geologic formations including alluvial sediments, which have a potential for landslide in areas of steep terrain. There is a risk of landslide associated with construction of the new cable poles and TSPs, particularly where the new poles would be constructed on steep terrain (e.g., P5 and the cable pole at Carmel Valley Road).

Alternative 5 could expose people or structures to adverse effects involving landslides if the soils at the foundations and work pads are not properly engineered in these areas of steep slopes, which would be a significant impact. Implementation of APMs GEO-1 (design in accordance with GO 95 and industry seismic standards) and GEO-2 (geotechnical recommendations) would reduce impacts, but they would remain significant because the geotechnical investigation does not assess the potential for unstable slopes, landslides, earth flows, or debris flows, or incorporate the results into the final Alternative 5 design. Implementation of Mitigation Measure Geology-2 would further reduce impacts from landslides and other ground failures because it requires the geotechnical investigation to assess potential for landslides. Impacts would be less than significant with mitigation.

Lateral Spreading and Liquefaction

Lateral spreading and liquefaction could occur within areas of shallow groundwater. While shallow groundwater is not anticipated at the location of the Alternative 5 foundations due to the distance from streams, a geotechnical investigation has not been performed so the depth to groundwater is uncertain. Alternative 5 route is located near surface water resources (Carroll Canyon Creek) where shallow groundwater would be expected; therefore, it is assumed that these areas could be subject to lateral spreading or liquefaction.

The overhead transmission line poles would increase the risk of loss, injury, or death from lateral spreading and liquefaction if the soils were not handled properly or the pole foundations were not properly designed. Implementation of APMs GEO-1 (design in accordance with GO 95 and industry seismic standards) and GEO-2 (geotechnical recommendations) would reduce the impact; however, impacts would remain significant because the geotechnical investigation does not require an assessment of the potential for lateral spreading or liquefaction, or incorporate the results into the final Alternative 5 design. Implementation of Mitigation Measure Geology-1 would minimize these impacts because it requires the geotechnical investigation to assess potential for seismic-related lateral spreading and liquefaction and incorporate the results into the Final design. Impacts would be less than significant with mitigation.

Soil Collapse

The TSPs and cable poles would be located in areas of low to moderate shrink-swell (collapsible) potential. A small portion of the underground transmission would be located in an area with Altamont clay soils, which have a high potential for collapse. The underground transmission line would be constructed in existing roadways with underlying road base and the transmission line installation under the roads would not increase the risk to life or property. Foundation failure at the TSPs or cable poles as a result of soil collapse could expose people or structures to risks including loss, injury, or death from a falling power line or structure, which would be a significant impact. Implementation of APMs GEO-1 (design in accordance with GO 95 and industry seismic standards) and GEO-2 (geotechnical recommendations) would reduce impacts; however, impacts would still be significant because the geotechnical investigation and final design do not evaluate potential collapsible soils. Implementation of Mitigation Measure Geology-3 would reduce impacts because it requires the geotechnical investigation to assess potential for soil collapse and expansive soils. Impacts would be less than significant with mitigation.

Subsidence

There is no potential for subsidence as a result of Alternative 5 because there is no aquifer underlying the area. Groundwater could be withdrawn locally to dewater the foundation excavation if shallow groundwater is encountered, which is likely in proximity to Carroll Canyon and surface waters along the alignment. The short-term localized dewatering of the foundation excavation during construction would not cause subsidence due to the limited volume of water that would be removed from the soil. There would be no impact from subsidence.

Mitigation Measures: Geology-1, Geology-2, and Geology-3 (refer to Section 4.5.7)

Significance after mitigation: Less than significant.

Impact Geology Soils Minerals-4: Would Alternative 5 be located on expansive soil, as defined in Table 181-B of the Uniform Building Code (1994), creating substantial risks to life or property? (*Less than significant with mitigation*)

The Alternative 5 area is underlain by soils with a low to moderate shrink-swell (expansive) potential and Auld clay, which has a high shrink-swell potential. Auld clay only occurs within the underground alignment area where the risk to life or property would not increase as a result of the project because the underground transmission line would be installed in existing roads, which are constructed on road base. The cable poles and TSPs would be located in areas of low to moderate expansive soils. Foundation failure at the TSPs or cable poles as a result of soil expansion could expose people or structures to risks including loss, injury, or death from a falling power line or structure, which would be a significant impact. Implementation of APMs GEO-1 (design in accordance with GO 95 and industry seismic standards) and GEO-2 (geotechnical recommendations) would reduce impacts; however, impacts would remain significant because the geotechnical investigation does not adequately evaluate potential expansive soils. Implementation of Mitigation Measure Geology-3 would reduce impacts because it requires the geotechnical investigation to assess the potential for collapsible and expansive soils. Impacts from expansive soils would be less than significant with mitigation.

Mitigation Measures: Geology-3 (refer to Section 4.5.7)

Significance after mitigation: Less than significant.

4.5.13 No Project Alternative

The No Project Alternative would include construction of the CAISO approved Mission—Peñasquitos 230-kV transmission line, and Second Poway—Pomerado 69-kV power line, Second Miguel—Bay Boulevard 230-kV transmission line, and Second Sycamore Canyon—Scripps 69-kV power line, and upgrades of the Miguel—Mission 230-kV, Bernardo—Felicita Tap—Felicita 69-kV, and Artesian—Bernardo 69-kV lines. The No Project Alternative would result in a greater impact on geology and soils than the Proposed Project because the No Project Alternative would require installation of new poles/structures for approximately 35 miles in SDG&E ROW. The No Project Alternative would also involve approximately 48 miles of reconductoring, which may require the replacement of existing poles/structures. Construction of new pole/structures and replacement of existing poles/structures would increase erosion and top soil loss. The No Project Alternative would also involve installation of a series reactor at Sycamore Canyon Substation. The No Project Alternative would result in a lesser impact on geology and soils than the Proposed Project because the No Project Alternative would require approximately 1 less mile of pole/structure replacements, resulting in less loss of top soil and potential for erosion. This alternative is described in more detail in Chapter 3: Alternatives.

4.5.13.1 Mission—Peñasquitos 230-kV Transmission Line

The Mission—Peñasquitos 230-kV transmission line would require replacement of wood H-frames with steel H-frames for 4.2 miles within and near MCAS Miramar and installation of new 69-kV TSPs for 3.3 miles in Los Peñasquitos Canyon (Segment D of the Proposed Project). The removal and installation of new poles/structures for approximately 8 miles would involve ground disturbance, which would increase erosion and top soil loss and result in a significant impact. The poles would also be installed in steeply sloping areas in Los Peñasquitos Canyon and on soils that are prone to landslide once disturbed. The impact from landslide and soil expansion would be significant. These impacts could be reduced to less than significant through implementation of standard mitigation measures similar to those defined for the Proposed Project.

4.5.13.2 Second Poway—Pomerado 69-kV Power Line

The Second Poway—Pomerado 69-kV power line would involve replacement of existing wood poles with new double-circuit 69-kV poles or installation of new single-circuit 69-kV poles for approximately 2.6 miles to accommodate a second 69-kV line. The pole removal and installation would involve ground disturbance, which would increase erosion and top soil loss resulting in a significant impact. The poles would also be located in areas prone to liquefaction (i.e., near Los Peñasquitos Creek), in steeply sloping areas that are prone to landslide, and on soils that could contain expansive elements. These impacts would be significant. These impacts could be reduced to less than significant through implementation of standard mitigation measures similar to those defined for the Proposed Project.

4.5.13.3 Second Miguel—Bay Boulevard 230-kV Transmission Line

The Second Miguel—Bay Boulevard 230-kV transmission line would involve the construction and installation of new poles/structures for approximately 10 miles within existing SDG&E ROW. Pole installation would involve ground disturbance, which would increase erosion and top soil loss resulting in a significant impact. The line would also be located in areas prone to landslide (near Sweetwater Reservoir), liquefaction (near Bay Boulevard Substation), and on soils that could contain expansive elements. These impacts would be significant. These impacts could be reduced to less than significant through implementation of standard mitigation measures similar to those defined for the Proposed Project.

4.5.13.4 Second Sycamore Canyon—Scripps 69-kV Power Line

The Second Sycamore Canyon—Scripps power line would involve the construction and installation of new poles/structures for approximately 7 miles within existing SDG&E ROW. Pole installation would involve ground disturbance, which would increase erosion and top soil loss resulting in a significant impact. The line would traverse steep slopes that have the potential for landslide as it travels through the Scripps Ranch mountainous terrain from Sycamore Canyon Substation toward Scripps Substation. These impacts would be significant but could be reduced to less than significant through implementation of standard mitigation measures similar to those defined for the Proposed Project.

4.5.13.5 Reconductoring of Three Existing Lines

The No Project Alternative would involve reconductoring 48 miles of transmission and power lines across San Diego County. Reconductoring would be conducted on the Miguel—Mission transmission line, Bernardo—Felicita Tap—Felicita power line, and Artesian—Bernardo power line. Reconductoring would not cause significant impacts to geology, soils, or mineral resources unless existing towers are not adequate to support new conductor. If existing structures cannot support new conductor, then new structures would need to be constructed and old structures would be removed. Construction of new structures would involve impacts similar to the Proposed Project including erosion and top soil loss. Reconductoring may also increase the risk of loss, injury, or death if new structures are constructed in areas prone to liquefaction, landslide, soil collapse, or subsidence. These impacts would be significant but could be reduced to less than significant through implementation of standard mitigation measures similar to those defined for the Proposed Project.

~~4.5.13.6 Series Reactor at Sycamore Canyon Substation~~

~~Installation of a series reactor at Sycamore Substation would have a less than significant impact on geology and soils because the upgrade would be conducted within the previously graded substation pad and would not result in the loss of topsoil or create a geologic hazard.~~

4.5.14 References

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