8.0 GEOLOGY, SOILS, MINERAL RESOURCES, AND PALEONTOLOGY

8.1 INTRODUCTION

This chapter describes the existing geology, soils, mineral resources, and paleontology conditions within, and in the vicinity of, Pacific Gas and Electric Company's Windsor Substation Project and evaluates the potential geology, soils, mineral resources, and paleontology impacts associated with project construction and operation. Potential geology, soils, mineral resources, and paleontology impacts are less than significant for construction and operation of the project facilities.

8.2 METHODOLOGY

Information on geology, soils, minerals, and paleontological resource conditions in the project vicinity was compiled from existing published and unpublished literature, maps, and data. The area has been well studied and documented by various researchers and government entities, including the U.S. Geologic Survey (USGS), the California Geological Survey (formerly California Division of Mines and Geology), the Natural Resources Conservation Services (formerly U.S. Soil Conservation Service), and others. The General Plan for Sonoma County and the Town of Windsor General Plan were reviewed for their seismic and geologic hazards data. Planning documents and Environmental Impact Reports from adjacent areas to the Windsor Substation Project were also reviewed.

8.3 REGULATORY BACKGROUND

The regulatory requirements applicable to these resources include the following:

- The Alquist-Priolo Special Studies Act of 1972 which prohibits development within 50 feet of an active fault zone; and
- The California Public Utility Company (CPUC) General Order 95.

8.4 EXISTING CONDITIONS

8.4.1 Topographic Setting

The project is located in the Coast Ranges Geomorphic Province of California, approximately 63 miles northwest of San Francisco and 18 miles from the Pacific Ocean. The Town of Windsor is located in the Santa Rosa Valley, with the Russian River and Mendocino Range to the west, the northwest-southeast trending foothills of the Mayacmas and Sonoma Mountains to the east, and a valley through the central portion of the area. The project site is approximately 105 feet above mean sea level. The topography of the property and the vicinity is relatively level and slopes gently to the southeast. The main water body south of the project is Windsor Creek that flows to the west towards the Russian River.

8.4.2 Geologic Setting

The North Coast Ranges geomorphic province of California is characterized by a predominantly northwest trending physiography. The mountain ranges are underlain by thick, highly deformed Mesozoic sedimentary deposits that at some locations are covered by younger volcanic and sedimentary rocks. The mountains exhibit an irregular topography that was produced by landslides. The core of the North Coast Ranges consists of three major pre-Tertiary rock groups: the Franciscan Complex, the Coast Range ophiolite, and the Great Valley Sequence. All three pre-Tertiary rock groups, which overlap in age, were tectonically transported from a marine basin in the Pacific Ocean and accreted to the continental margin of California during Cretaceous to early Tertiary time. During and after accretion the rocks have been folded and faulted into mountain ranges and intervening valleys. Most of the valleys and ridges have formed in response to regional tectonic stresses which produced northwest-trending, right-lateral, strike-slip faults, high-angle reverse faults, and normal faults. These faults are related regionally to the San Andreas Fault system that occupies a wide strip of coastal California north of the San Francisco Bay.

Bedrock in the area consists of the Mesozoic Franciscan Complex of strongly deformed, weakly metamorphosed marine sedimentary rocks with volcanic oceanic crust tectonically mixed within the sedimentary materials. Overlying the bedrock is a thick sequence of volcanic and volcaniclastic rocks of late Tertiary age known as the Sonoma Volcanics. The Sonoma Volcanics (Miocene to Pliocene) are widely distributed throughout parts of Sonoma and Napa Counties. In some areas, the Sonoma Volcanics lie unconformably on rocks of the Franciscan Complex or on the younger sedimentary rocks of the Petaluma Formation. The Sonoma Volcanics were created from many vents that produced andesitic and basaltic flows with pumice beds and welded tuff layers.

Non-marine, transitional-marine, and marine sedimentary rocks of the Petaluma Formation and Wilson Grove (formerly known as Merced) Formation are interbedded with the Sonoma Volcanics. The Petaluma Formation (Late Miocene to Late Pliocene) is largely confined to a one to two mile exposure along the southwestern portion of the Sonoma Mountains. It is composed of strongly folded continental and brackish water sedimentary rocks with interbeds of tuff. The Wilson Grove Formation (formerly the Merced Formation; Late Miocene to Late Pliocene) consists of a thick sequence of clastic fossiliferous sedimentary rocks interfingering to the east with the Petaluma Formation. It is the major water-bearing unit in the Santa Rosa Valley Groundwater Basin. It extends beneath the western hills, crops out along the western side of the valley from the Russian River (Wilson Grove) south towards Petaluma, and dips beneath the center of the valley.

Interfingered and overlying these Tertiary units are Late Pliocene and Quaternary non-marine sedimentary deposits of fluvial lacustrine and alluvial origins. The Glen Ellen Formation (Plio-Pleistocene) is largely of fluvial origin and consists of partially cemented beds and lenses of alluvial fan and piedmont deposits interbedded with conglomerate and silicic tuffs. Beds are massive and most of the clasts and much of the matrix were derived from the Sonoma Volcanics, and include andesitic, basaltic, and obsidian particles. The Glenn Ellen Formation is the minor water bearing unit in the Santa Rosa Valley due to its lenticular bedding and faulted strata. The

Glen Ellen Formation is underlain by the Huichica and Sonoma Volcanic Formations, in a highly structurally complex area with numerous active and inactive faults. The Huichica Formation (Plio-Pleistocene) consists of massive yellow silt and yellow and blue clay with interbedded lenses of sand, gravel, and tuff beds. Sediments, derived from the Sonoma Volcanics, were deposited in alluvial fans by small streams and in small lakes or lagoons. This formation both unconformably overlies and in some places interfingers with the upper part of the Sonoma Volcanics. The stratigraphic relationship of the Glen Ellen and Huichica Formations are uncertain; although the Glen Ellen is mostly younger than the Huichica, it may interfinger with the upper part of the Huichica. The two formations were formed by similar geologic processes acting within different parts of the sedimentary basin. The Quaternary Alluvium (Recent) consists of poorly consolidated to unconsolidated clastic materials ranging from clay to boulders.

The geology in the vicinity of the project consists largely of Holocene and Pleistocene age sedimentary and volcanic rocks. The Windsor Syncline forms the main trough of the Santa Rosa Valley, which contains deposits of the Glenn Ellen Formation and Quaternary Alluvium. The Quaternary Alluvium generally underlies the flat-lying areas and waterways, with the youngest alluvial deposits located immediately adjacent to and within stream channels and older alluvial deposits beneath the flat terrain. The young alluvial deposits, and older alluvial deposits to a lesser extent, are susceptible to liquefaction and seismically-induced settlement. These two major geologic units, the Glen Ellen Formation and Quaternary Alluvium, comprise the main formations in the Windsor Area. Geologic units of most importance for groundwater supply are the Quaternary alluvial deposits, the Glen Ellen Formation, the Huichica Formation, and the Sonoma Volcanics. The geologic units discussed in this section are described in more detail in Table 8-1.

Table 8-1: Geologic Units

Symbol	Unit Name	Age	Description
Qal	Alluvium Older (Qo) and Younger (Q)	Holocene-Pleistocene	Unconsolidated stream channel deposits, stream terrace deposits, alluvial fan deposits, and flood plain deposits composed of boulders, cobbles, gravel, and sand; Q-interbedded layers of sand, silt, clay, and gravel; Qo-fine sand, silt, and silty clay, coarse sand and gravel, with gravel more abundant near fan heads
QTge	Glenn Ellen Formation	Pleistocene – Late Pliocene	Glenn Ellen formation consists of fluvial origin clay-rich stratified deposits of poorly sorted, loosely consolidated sand, silt and gravel interbedded with minor beds of matrix-supported conglomerate with basalt, andesite and obsidian clasts and silicic tuffs

Symbol	Unit Name	Age	Description
QTh	Huichica Formation	Pleistocene – Late Pliocene	Huichica Formation consists of alluvial fan and fluvial deposits of massive yellow silt and yellow and blue clay with interbedded lenses of sand, gravel, and interbedded Roblar tuff beds
Tsv (Psv)	Sonoma Volcanics	Pliocene – Miocene	The Sonoma Volcanics consist of a thick sequence of continental volcanic and volcaniclastic rocks including basalt, andesite, and rhyolite lavas interbedded with tuffs, lahar deposits, debris avalanche deposits, mudflow units, reworked tuffs, sedimentary breccia deposits derived from volcanic rocks, and lacustrine deposits
Tm (Pwg)	Wilson Grove (formerly Merced) Formation	Late Pliocene - Late Miocene	Shallow marine (brackish bay) to deep-water marine deposits of fine sand and sandstone, thin interbeds of clay and silty-clay, some lenses of gravel, and localized fossils (foraminifers, brachiopods, pelecypods, mollusks, arthropods and echinoids)
Tp (Pp)	Petaluma Formation	Late Pliocene - Late Miocene	Continental and shallow marine to brackish water deposits of clay, shale, and sandstone, conglomerate, nodular limestone and diatomite, with interbedded tuffs; Contains mammalian and ostrocod fossils of Miocene age; Lower member contains shale with nonmarine and marine microfauna (diatomites) and is prone to sliding; Middle member contains conglomerate derived from Franciscan sources; Upper member contains conglomerate derived from Monterey Group; Highly folded and faulted and interfingers with Wilson Grove Formation to the west
KJf	Franciscan Complex	Cretaceous – Jurassic	Melange with blocks of greywacke, chert, greenstone, and metamorphic rocks; Intrusive sills of diabase, gabbro, and serpentinite, glaucophane and related schists

Sources: Gealey, 1950; Cardwell, 1958; Kunkel and Upson, 1960; California Division of Mines and Geology, 1981; Wagner and Bortugno, 1982; Farrar et al, 2006.
Note: Map symbols vary with authors and maps from different dates; symbols in ( ) are consistent with geologic time and unit name.

8.4.3 Faulting and Seismicity and Related Hazards

The project site is located in the tectonically active Coast Ranges Geomorphic Province of Northern California, within the Santa Rosa Plain, bound on the west by the San Andreas Fault and on the east by the active Rodgers Creek-Healdsburg fault. Active deformation is expressed along the boundary margin through discrete movement along faults of the San Andreas Fault System; it is the sudden large movements that generate earthquakes.

Within Sonoma County, faults are characterized by both horizontal and vertical displacement, and most faults strike northwest to southeast. The 1997 Uniform Building code (UBC) locates the entire Bay Area within Seismic Risk Zone 4; areas within Zone 4 are expected to experience maximum magnitudes and damage in the event of an earthquake.

There are three active fault zones that have the potential to affect the project: the Healdsburg-Rodgers Creek, the San Andreas, and the Maacama. The Healdsburg-Rodgers Creek Fault Zone runs northwest to southeast and is located about 3 miles east of the Town of Windsor. The Maacama Fault Zone is located approximately 5 miles northeast of Windsor. The San Andreas Fault Zone is locates about 19 miles southwest of Windsor and is considered to be the major seismic hazard in California. According to the Earthquake Hazard Map for Windsor, the shaking severity level is expected to be strong if a major earthquake occurs. Several active faults have the potential to cause widespread damage to the project region and are listed in Table 8-2. An active fault is defined by the state of California as a fault that has had surface displacement within approximately the last 11,000 years.

Table 8-2: Known Active Faults

Fault	Approximate Distance and Direction to Closest Surface Trace (miles)	Fault Type	Slip Rate (millimeters per year)	Maximum Earthquake Magnitude[1]
Rodgers Creek - Healdsburg	3 E	SS	9	7.0
Maacama Fault – (south segment)	5 NE	SS	9	6.9
San Andreas – North Coast South	19 SW	SS	24	8.0
West Napa	32 SE	SS	1	6.5
Concord-Green Valley	32 SE	SS	6	6.9
Hayward Fault (north segment)	42 SE	SS	9	6.9

Sources: ESA, 2008; Hart, 2007; Ogden (Windsor GP), 1993 and 1995

Direction

E	East
NE	Northeast
SW	Southwest
SE	Southeast

Fault Type

SS	Fault Type is a Strike Slip; approximately a vertical fault plane where the rock on one side of the fault slides horizontally past the other.

[1] Maximum moment magnitude with a 90 percent probability of not being exceeded in 50 years.

Settlement of the ground surface can be affected directly by earthquakes, where soil grains undergo rapid rearrangement, compaction, and settling of subsurface materials. Soils developing on formational materials, such as the Glenn Ellen formation, may possess a low to moderate potential for settlement, a moderate expansion potential, and a slight to severe erosion potential. This can all be affected by ground movement and shaking during an earthquake event. According to the Liquefaction Hazard Map for Windsor, the project site is depicted within an area of moderately low to very low liquefaction hazard.

8.4.3.1 Fault Surface Rupture

Fault rupture is displacement at the earth's surface resulting from fault movement associated with an earthquake. Earthquake Fault Zones (EFZs) have been established in accordance with the Alquist-Priolo Earthquake Fault Zoning Act (A-P Act), which prohibits development near the surface traces of active faults. Principal faults zoned under the A-P Act include the Rodgers Creek - Healdsburg, Maacama (south segment), San Andreas (North Coast South), West Napa, Concord-Green Valley, and Hayward faults. The project site is approximately 3 miles away from the nearest active fault (Rodgers Creek-Healdsburg), is not within a designated EFZ and no mapped active fault traces are known to transverse the site. It should be noted, however, that surface fault rupture is not necessarily restricted to the area within an EFZ.

8.4.4 Geologic Hazards

8.4.4.1 Subsidence

The primary causes of most subsidence are human activities: underground mining of coal, groundwater or petroleum withdrawal, and drainage of organic soils. Regional lowering of land elevation occurs gradually over time. Generally, subsidence poses a greater risk to property than to life. Damage usually consists of direct structural damage and property loss and depreciation of land values, but also includes business and personal losses that accrue during periods of repair.

8.4.4.2 Landslides

Landslides are often triggered by other natural events such as floods, earthquakes, and volcanic eruptions. Other human factors contributing to landslides are cut-and-fill, construction of highways, construction of buildings and railroads, and mining operations. Landslides and mudflows are common events in California because of active mountain-building processes, rock characteristics, earthquakes, and intense storms. Landslides are classified by type of movement and type of material. The types of movement are slides, flows, lateral spreads, falls, and topples. The types of material are bedrock soil and debris (mixtures of rock, soil, and vegetation).

8.4.4.3 Liquefaction

Liquefaction is a seismic phenomenon in which loose, saturated, fine-grained granular soils behave similar to a fluid when subjected to high-intensity ground shaking. An increase in pore pressure occurs as the soil attempts to compact in response to the shaking, resulting in less grain-to-grain soil contact, and therefore, loss of strength. Liquefaction occurs when three general conditions exist: shallow groundwater (40 feet below ground surface or less); low density, fine-grained sandy soils; and high-intensity ground motion. Effects of liquefaction on level ground can include sand boils, settlement, and bearing capacity failures below structural foundations.

8.4.5 Soils

The project site is located on relatively flat ground in an area of soils belonging to the Huichica Series as mapped by the Natural Resources Conservation Service. The Huichica soils occur in gently sloping smooth to hummocky floodplains under grass and scattered oaks, at elevations of

100 to 150 feet. This series consists of loamy soils that formed from volcanic rocks and alluvial deposits. The soil characteristics indicate the Huichica Series are imperfectly drained, runoff and permeability are moderately slow to very slow, erosion hazard is slight, and the expansion potential is low to medium. The main soil types in the vicinity of the project site are Huichica Loam (ponded) HuB, the Huichica loam (shallow) HvC, and Huichica loam (shallow, ponded) HwB.

The Huichica Loam (ponded) HuB, is alluvium derived from igneous, metamorphic and sedimentary rock, has slopes ranging from 0 to 5 percent, is moderately well drained, and has a low to moderately low capacity to transmit water.

The Huichica loam (shallow) HvC, is alluvium derived from igneous, metamorphic and sedimentary rock, has slopes ranging from 0 to 9 percent, is moderately well drained, and has a very low to moderately low capacity to transmit water.

The Huichica loam (shallow, ponded) HwB, is alluvium derived from igneous, metamorphic and sedimentary rock, has slopes ranging from 0 to 5 percent, is moderately well drained, and has a very low to moderately low capacity to transmit water.

The Natural Resources Conservation Service land capability classification system rates soils by various characteristics dependent on location, slope, parent rock, climate, and drainage. Certain soils may have characteristics that limit development or are problematic to existing structures; such as low permeability, susceptibility to expansion, or soil erosion. The Huichica Series is classified as a Class III to Class IV soil, with low permeability, moderate shrink-swell potential, moderate-high corrosivity, and medium compressibility. Soils categorized as Class III and above have limitations that make them unsuitable for cultivation, require conservation practices, and careful management.

8.4.6 Mineral Resources

Minerals that have been found in substantial quantities in Sonoma County include chromic iron, copper, quicksilver, galena, lignite, borax, kaolinite, agate, gypsum, and limestone. Geothermal resources in Sonoma County consist of hot water, steam, and heat found at or below the earth's surface. The Geyser Geothermal Resource Area is located in northeastern Sonoma County in the Mayacamas Mountains, and is the largest steam-powered geothermal developments in the world. Sand, gravel, crushed rock, and building stone are considered the most valuable mineral resources in the county.

The California Surface Mining and Reclamation Act (SMARA) of 1975 require that the State Geologist classify land into mineral resource zones (MRZ) according to the known or inferred mineral potential of the land. Aggregate resources associated with river deposits, mainly the Russian River and other major streams, are the dominant minerals mined in this area to use in concrete and high-quality base and fill. Portions along the Russian River, west of the project site, contain MRZ-2 zones for areas where adequate information indicates that significant mineral deposits are present, or where it is judged that a high likelihood exists for their presence. The project site is not in a classified MRZ and there are no known important mineral resources in the immediate vicinity of the project site, nor are there active mining operations.

In addition, according to the Sonoma County Aggregate Resources Management Plan there are no known economically viable sources of rock materials in the immediate project area. In addition, there are no unique geologic features identified within the project area.

8.4.7 Paleontology

Paleontology is the study of life forms existing in prehistoric or geologic times, as represented by the fossil remains of plants, animals, and other organisms. Paleontological remains are fairly common in Sonoma County and include plants, invertebrates, and vertebrates ranging in age from the Jurassic to Pleistocene. Within Sonoma County, paleontological remains have been primarily recovered from the following geologic formations:

- Franciscan Complex (Jurassic) – this formation covers the northern part of the county and the greywacke matrix has been shown to yield Late Jurassic fossils;
- Wilson Grove and Petaluma Formations (Miocene-Pliocene) – this marine formation is known for its diverse paleontological remains (localized beds of gravel and gastropod and mollusk shell hash, fossiliferous sandstone and siltstone, and well-cemented shell beds) and is largely located in the western part of the county, along with the non-marine Petaluma Formation (known to contain mammalian and ostrocod fossils of Miocene age); and
- Sonoma Volcanics (Miocene-Pliocene) – portions of this formation have been identified as a black volcanic sandstone, ashy clay, tuffaceous sandstone, and diatomite. The diatomite has been used to date the formation based on the plant fossils contained within the strata. This is the formation of the Sonoma and Napa Mountains that form the western border of the county.

The project site is located on Quaternary sedimentary units which include alluvium, Glenn Ellen, Huichica, and Sonoma Volcanics Formations. The alluvial sediments are unlikely to contain any significant fossil resources. The sedimentary rocks of the Glenn Ellen and Huichica Formations were probably deposited in the form of alluvial fans and piedmont, and have not been identified as important paleontological formations. Due to their depth beneath the project location, the Sonoma Volcanics are not anticipated to be encountered during site construction activities.

The University of California Museum of Paleontology (UCMP) databases of known paleontological sites in Sonoma County were reviewed to identify the occurrence of fossils in these formations and to determine the likelihood that paleontological resources might be impacted during excavation and grading of the site. The UCMP records search indicated that there are 503 fossil localities within Sonoma County, with two specimens collected from locations west of the project. The majority of fossils within Sonoma County were identified in the Wilson Grove and Petaluma Formations that are not anticipated to be encountered during site activities. None of the fossil locations identified occurs on or in the vicinity of the project site.

8.5 IMPACTS

8.5.1 Significance Criteria

Standards of significance were derived from Appendix G of the California Environmental Quality Act (CEQA) Guidelines.

8.5.1.1 Geology

Impacts to geology may be considered significant if they were to:

- result in severe damage or destruction to one or more project components as a direct consequence of a geologic event;
- result in exposure of 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; or
- are located on a geologic unit that is unstable, or that would become unstable as a result of the project, and potentially result in on-site or off-site landsliding, lateral spreading, subsidence, liquefaction, or collapse.

8.5.1.2 Soils

Impacts to soils may be considered significant if they were to:

- result in a substantial soil erosion or loss of topsoil;
- are located on a soil that is unstable, or that would become unstable as a result of the project, and potentially result in on-site or off-site landsliding, lateral spreading, subsidence, liquefaction, or collapse; or
- create a substantial risk to life or property due to the presence of expansive soils.

CEQA also includes the potential for consideration of significant impacts due to the presence of soils incapable of supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available; however, this consideration is not applicable to the project because no sanitary wastewater will be produced.

8.5.1.3 Mineral Resources

Impacts to mineral resources may be considered significant if they were to:

- result in the loss of availability of a known mineral resource classified MRZ-2 by the State Geologist and of value to the region and residents of the state, or
- result in the loss of availability of a locally important mineral resource recovery site.

8.5.1.4 Paleontological Resources

Impacts to paleontological resources may be considered significant if they result in physical changes to the landscape, directly affecting or changing the context within which a paleontological resource or unique geologic feature exists.

8.5.2 Substation Construction

8.5.2.1 Geology

The following geologic hazards were evaluated for impacts due to substation construction.

8.5.2.1.1 Fault Rupture

In the Windsor area, A-P Act EFZs have been established for both the Rodgers Creek-Healdsburg and Maacama faults. Based on data reviewed, there are no A-P EFZs or active surface-fault traces at the project site. Therefore, the potential for surface-fault rupture to affect the project is low and no impact is expected.

8.5.2.1.2 Strong Ground Shaking and Related Effects

Various faults in the area are capable of generating strong ground shaking in the project area but the likelihood for strong ground shaking during the short construction period is low. Project facilities will be engineered to withstand expected ground motions without substantial adverse affects. As described in Section 8.4 Existing Conditions, the potential for liquefaction in the project area is moderately low to very low.

Project construction will not affect any existing geologic feature or expose people to geologic hazards. However, should a significant seismic event occur near the project area, existing and proposed project facilities could be affected. Project design will be in accordance with the CPUC's General Order 95 and all other applicable state requirements. Conformance to design standards developed for the project site would minimize the effect of strong seismic shaking that could occur. As such, seismic impacts would be considered less than significant.

The project will be located in relatively flat terrain and conditions prone to lateral spreading, landslides, and other seismically induced ground failures do not occur. Based on these considerations, any impacts related to ground shaking would be less than significant. This includes direct (i.e., shaking) and secondary effects of ground shaking, including seismically induced liquefaction, lateral spreading, landslides, and other ground failures. Considering these factors, the potential for an impact due to strong ground shaking is less than significant.

8.5.2.1.3 Landslides

The project is located in a relatively flat area so slope stability risks are not a significant concern and no impact is expected.

8.5.2.1.4 Unstable Geologic Units

There are no unstable geologic units in the project area and, therefore, no impact is expected.

8.5.2.1.5 Subsidence

Project construction will have no subsidence impact because the project does not involve the withdrawal of subsurface fluids that can cause subsidence, nor will it impact sedimentary materials that are particularly prone to subsidence.

8.5.2.2 Soils

Construction will occur in relatively flat terrain and will involve minimal grading. Surface disturbance will be minimized to the extent consistent with safe and efficient completion of the project scope of work. Erosion control best management practices (BMPs) will be used where grading occurs. Topsoil will be salvaged from areas where grading would otherwise result in loss of topsoil, and the salvaged soil will be used to reclaim areas of temporary construction disturbance. Once temporary surface disturbances are complete, areas that will not be subject to additional disturbance will be stabilized by landscaping or gravel. Considering these factors, the following soil impacts were evaluated for construction impacts.

8.5.2.2.1 Substantial Soil Erosion or Loss of Topsoil

There will be minimal soil disturbance and grading, and topsoil will be salvaged and used for reclaiming areas of temporary disturbance. The appropriate BMPs and APMs (see Section 10.5) will be used also during all project-related construction as necessary to prevent off-site sedimentation. Therefore, the loss of topsoil will be negligible. Based on these considerations, any impacts of soil erosion or loss of topsoil would be less than significant.

8.5.2.2.2 Expansive Soils

Based on soil data in the project area, the soils at the proposed substation site are loam and clay which are listed as having a low to medium expansion potential. Potential for expansive soil conditions will be accounted for in the design and construction practices of the project, thereby ensuring that any impacts are less than significant.

8.5.2.2.3 Soil Permeability

Based on soil data reviewed, the Huichica Series is present in the project area. Runoff is slow and permeability is moderately slow to very slow (estimated at 60 minutes per inch), which is not appropriate drainage for onsite wastewater disposal systems. Consideration of soil conditions will be accounted for in the design of these facilities, thereby ensuring that any impacts are less than significant.

8.5.3 Pole Replacement and Undergrounding for Distribution Line Installation

8.5.3.1 Geology

The following geologic hazards were evaluated for pole replacement and undergrounding activity impacts.

8.5.3.1.1 Fault Rupture

As previously stated above in Section 8.5.2.1.1, there are no A-P EFZs or active surface-fault traces along the pole replacement and undergrounding route. Therefore, the potential for surface-fault rupture to affect the project is low and no impact is expected.

8.5.3.1.2 Strong Ground Shaking and Related Effects

As previously stated above in Section 8.5.2.1.2, the likelihood for strong ground shaking during the pole replacement and undergrounding construction period is low. Project field work will be halted if an earthquake occurs and any open trenches or directional boring locations will be inspected for competency before work continues as long as ground motions do not pose substantial adverse affects. As described in Section 8.4 Existing Conditions, the potential for liquefaction in the pole replacement and undergrounding route is moderately low to very low.

Pole replacement (drilling) and undergrounding (shallow trenching) activities will not affect any existing geologic feature or expose people to geologic hazards. Railroad crossing bore pits will be constructed with proper OSHA support structures and required seismic safety features for deep trenches. Project construction design for this phase of work will be in accordance with the CPUC's General Order 95 and all other applicable state requirements. Conformance to design standards developed for the project site would minimize the effect of strong seismic shaking that could occur. As such, seismic impacts would be considered less than significant.

The pole replacement and undergrounding route is located in relatively flat terrain and conditions prone to lateral spreading, landslides, and other seismically induced ground failures do not occur. Based on these considerations, any impacts related to ground shaking would be less than significant. This includes direct (i.e., shaking) and secondary effects of ground shaking, including seismically induced liquefaction, lateral spreading, landslides, and other ground failures. Considering these factors, the potential for an impact due to strong ground shaking is less than significant.

8.5.3.1.3 Landslides

The pole replacement and undergrounding route is located in a relatively flat area so associated slope stability risks are not of significant concern and no impact is expected.

8.5.3.1.4 Unstable Geologic Units

There are no unstable geologic units identified along the pole replacement and undergrounding route and, therefore, no impact is expected.

8.5.3.1.5 Subsidence

The pole replacement and undergrounding route will have no subsidence impact because the project does not involve the withdrawal of subsurface fluids that can cause subsidence, nor will it impact sedimentary materials that are particularly prone to subsidence.

8.5.3.2 Soils

The pole replacement and undergrounding route is located in relatively flat terrain and will involve minimal grading. Surface disturbance will be minimized to the extent consistent with safe and efficient completion of the project scope of work. Soil disturbance and removal is anticipated during the drilling and trenching activities for pole replacement and undergrounding, respectively. Excavated soil from pole replacement drilling activities will be placed in spoil piles adjacent to each hole and used for backfilling purposes and properly compacted. Excavated soil from trenching activities will be stockpiled and new thermal select or controlled backfill will be imported, installed and compacted. A road-based backfill or slurry concrete cap will be installed and the road will be restored in compliance with the encroachment permit from the Town of Windsor. Considering these factors, the following soil impacts were evaluated for pole replacement and undergrounding impacts.

8.5.3.2.1 Substantial Soil Erosion or Loss of Topsoil

There will be minimal soil disturbance and grading, and topsoil will be salvaged and used for reclaiming areas of temporary disturbance. The appropriate BMPs and APMs (see Section 10.5) will be used also during all project-related construction as necessary to prevent off-site sedimentation. Therefore, the loss of topsoil will be negligible. Based on these considerations, any impacts of soil erosion or loss of topsoil would be less than significant.

8.5.3.2.2 Expansive Soils

Based on soil data in the project area, the soils at the proposed substation site are loam and clay which are listed as having a low to medium expansion potential. Construction practices will be in accordance with all applicable state and local building and construction codes and ordinances. Potential for expansive soil conditions will be accounted for in the design of the pole replacement and undergrounding routes/locations, thereby ensuring that any impacts are less than significant.

8.5.3.2.3 Soil Stability

Based on soil data reviewed, the Huichica Series is present along the pole replacement and undergrounding route. The Huichica soil is clay and loam with very slow infiltration rates. Pole replacement will be confined to the areas around the base of existing poles to the extent feasible, which will minimize soil disturbance and any impacts will be less than significant. Undergrounding will be conducted along existing roads in the Town of Windsor, and directional bore techniques will be used to install steel casings. Minimal soil disturbance will occur with this type of drilling and any impacts will be less than significant.

Trenching methods will include removal and digging with a backhoe to approximately five feet below grade. The bore pits for the railroad crossings will be slightly deeper and wider. Standard OSHA safety requirements for trenches five feet and deeper require a protective system which includes shoring and shielding to prevent soil movement and cave-ins. OSHA standards require that trenches be inspected daily and as conditions change by a competent person prior to worker entry to ensure elimination of excavation hazards. A competent person is an individual who is capable of identifying existing and predictable hazards and is authorized to take prompt corrective measures to eliminate or control these hazards and conditions. Consideration of soil conditions and OSHA safety requirements will be accounted for during the trenching activities, thereby ensuring that any impacts are less than significant.

8.5.3.3 Mineral Resources

There are no known important mineral resources that would be impacted by the project. There are no MRZ-2 zones in the project vicinity. Therefore, the project will have no impacts on mineral resources.

8.5.3.4 Paleontology

Construction will occur in relatively flat terrain, which is underlain by the Quaternary sedimentary units, and will involve minimal grading and excavation. Surface disturbance will be minimized to the extent consistent with safe and efficient completion of the project scope of work.

Impacts to paleontological resources are rated in this report as low based on the resource sensitivity of impacted formations (Quaternary Alluvium). The specific criteria applied for the paleontology sensitivity analysis are summarized below.

- **High sensitivity:** High sensitivity is assigned to geologic formations known to contain paleontological localities with rare, well-preserved, critical fossil materials for stratigraphic or paleoenvironmental interpretation, and fossils providing important information about the paleobiology and evolutionary history (phylogeny) of animal and plant groups. Generally, highly sensitive formations produce vertebrate fossil remains or are considered to have the potential to produce such remains.

- **Moderate sensitivity:** Moderate sensitivity is assigned to geologic formations known to contain paleontological localities with poorly preserved, common elsewhere, or stratigraphically unimportant fossil material. The moderate sensitivity category is also applied to geologic formations that are judged to have a strong but unproven potential for producing important fossil remains.

- **Low sensitivity:** Low sensitivity is assigned to geologic formations that, based on their relatively youthful age and/or high-energy depositional history, are judged unlikely to produce important fossil remains. Typically, low-sensitivity formations produce poorly preserved invertebrate fossil remains in low abundance.

There are no geologic formations at this site that are anticipated to be at the high sensitivity level. The predominant formation expected to be graded and excavated at the substation site, the Quaternary sedimentary units, are classified as low sensitivity and of low significance. Due to the minimal amount of disturbance, the low likelihood of intersecting fossiliferous beds, and the lack of significant fossil discoveries in this vicinity, any impacts on paleontology would be less than significant.

8.5.4 Operations and Maintenance

8.5.4.1 Geology

Operation and maintenance of the project will not have geologic hazard-related impacts.

8.5.4.2 Soils

Operation and maintenance of the project will not have an impact to soils except for occasional surface disturbances that may be required along the interconnection and occasionally for inspections and maintenance. These disturbances will have a negligible impact on soils and will be less than significant.

8.5.4.3 Mineral Resources

There will be no operations and maintenance impacts to mineral resources.

8.5.4.4 Paleontology

There will be no operations and maintenance impacts to paleontological resources.

8.6 AVOIDANCE AND PROTECTION MEASURES

Based on the analysis of impacts and the design features that have been incorporated into the project, and standard construction BMPs incorporating OSHA requirements, the project will not have significant impacts related to geology, soils, mineral resources, or paleontology. Therefore, no avoidance and protection measures are required.

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