5.6 Geology and Soils

This section describes the environmental and regulatory setting and discusses impacts associated with the construction and operation of the Sanger Substation Expansion Project (proposed project) proposed by Pacific Gas and Electric Company (PG&E, or the applicant) with respect to geology and soils.

No ground disturbing activities would be associated with the installation of two dishes on the existing tower at the Fence Meadow Repeater Station, nor would the additional dishes exacerbate existing conditions related to seismicity. Therefore, the antenna system at the Fence Meadow Repeater Station would not have any impact on geology or soils and is not discussed further in this section.

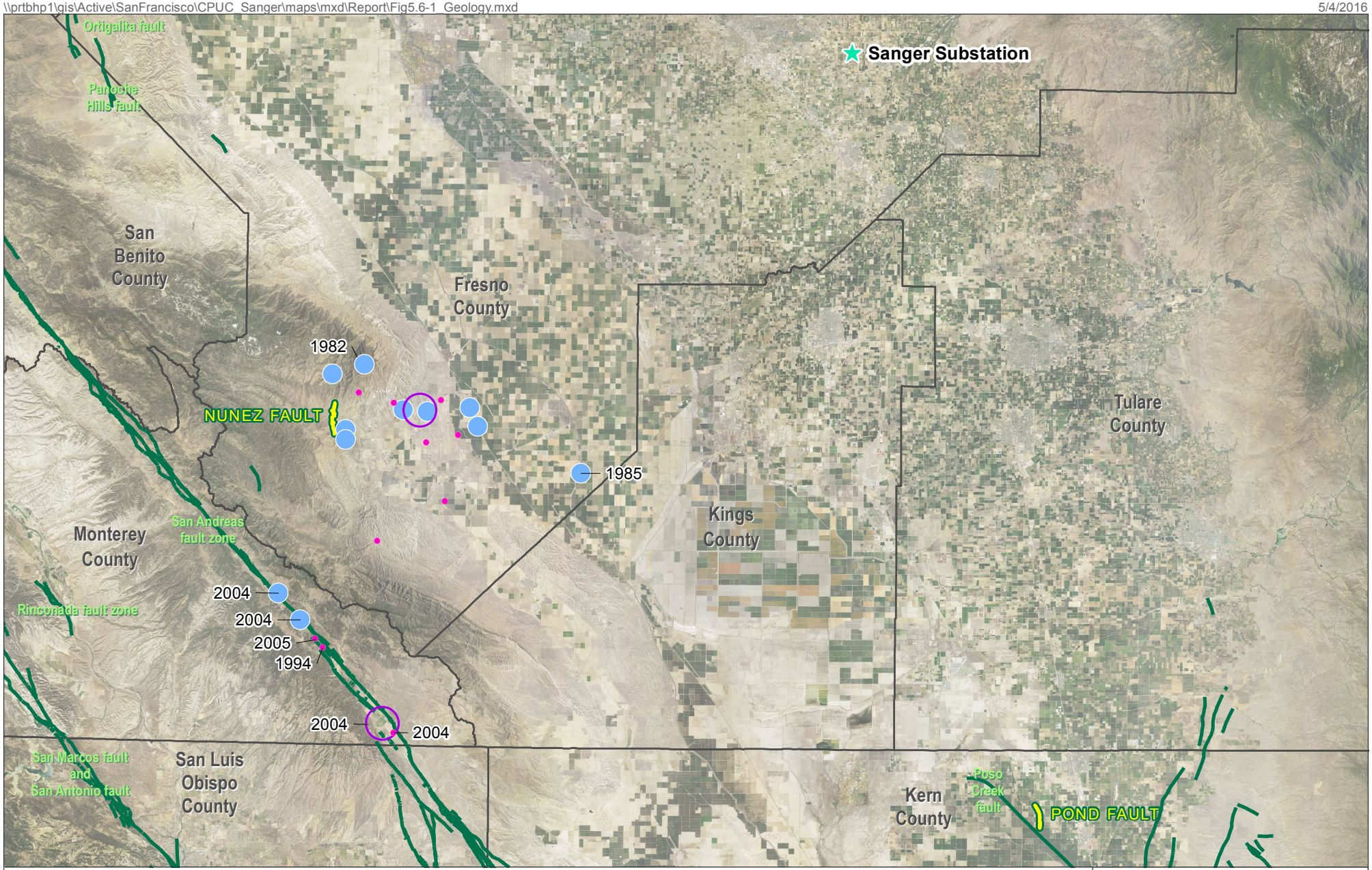
5.6.1 Environmental Setting

Topography and Geology

The proposed project would be located in the San Joaquin Valley of California, which composes the southern two-thirds of the Central Valley. The San Joaquin Valley is bounded to the east by the Sierra Nevada Mountains and to the west by the Coast Ranges. The valley's northern extent reaches to the Sacramento-San Joaquin River Delta and the City of Stockton. The proposed project would be located near the eastern margin of the San Joaquin Valley, at approximately 345 feet above mean sea level. Site topography is relatively flat with an overall slope of 0 to 1 percent (Kleinfelder 2015).

There are no known, active or potentially active faults in, near, or within 25 miles of the proposed project area. The nearest active faults are the Nuñez fault, approximately 47 miles southwest, and the Pond fault, approximately 65 miles south, near Delano, California. The Nuñez fault has recently shown activity and is associated with the 6.2-magnitude 1983 Coalinga Earthquake and subsequent aftershocks (Stover and Coffman 1993). Figure 5.6-1 presents a regional fault and epicenter map and the approximate location of the proposed project relative to active and potentially active faults, as well as past earthquakes. The Nuñez and Pond faults have been designated as Alquist-Priolo Earthquake faults (Hart 1984; Smith 1983).

While an earthquake's magnitude describes the strength of the forces released at the epicenter, seismic shaking experienced at a specific location depends on many factors, including distance from the epicenter of the earthquake, magnitude of the earthquake, response of the underlying soils, and characteristics of the structures being shaken. Structures located on thick, poorly consolidated materials commonly experience higher levels of shaking and subsequent damage than structures built on more stable and consolidated bedrock. The degree of seismic shaking felt at a specific location on the ground—described as ground acceleration—is measured as a percent of gravitational acceleration (equivalent to g-force [g], 1g = 9.8 meters per second squared). The California Geological Survey (CGS) created the Ground Motion Interpolator in 2008 to provide estimates of peak ground acceleration that may be felt at different locations throughout the state. CGS's Ground Motion Interpolator has estimated that the proposed project site has a 10 percent chance of experiencing peak ground acceleration of 0.161g and a 2 percent chance of experiencing peak ground acceleration of 0.279g over a 50-year period (CGS 2008). The United States Geological Survey considers peak ground acceleration below 0.08g to be weak and above 0.24g to be strong (USGS 2016). Therefore, the project has a 2 percent chance of experiencing strong ground shaking in a 50-year period. Severe ground shaking can cause landslides; can cause fissures and cracks to open in the ground; and can cause loose, saturated material to liquefy.



Epicenters of Earthquakes in the last 35 years

Magnitude (in 1983 unless labeled with year)

- 4.5 - 4.9 (Light)
- 5 - 5.9 (Moderate)
- 6 - 6.1 (Strong)

- Project area
- Alquist-Priolo zoned faults
- Other faults

0 2.5 5 10 Miles

Sources: ESRI 2010, PG&E 2015, USGS 2010, 2016
Basemap: NAIP 2014

Figure 5.6-1
Seismic Hazards
Sanger Substation
Fresno County, CA

A landslide is a mass of rock, soil, or debris that has been displaced downslope by sliding, flowing, or falling. While Fresno County has identified areas of landslide hazard, the proposed project area is not within these areas (Fresno County 2000a). Additionally, the relatively flat topography (i.e., 0 to 1 percent grade) of the proposed project site and distance from hills, mountains, or slopes make landslides unlikely.

Liquefaction susceptibility reflects the relative resistance of soils to loss of strength when subjected to ground shaking and occurs primarily in saturated, loose, fine-to-medium-grained soils in areas where the groundwater table is within approximately 50 feet of the ground surface. Shaking causes the soils to lose strength and behave as a liquid. Fresno County has determined that soils in the proposed project area are not susceptible to liquefaction due to either the coarse grain size or the high clay content. (Fresno County 2000b)

Subsidence, the gradual sinking or caving of landmass, affects many areas of California, particularly the San Joaquin Valley. Some portions of the San Joaquin Valley have subsided more than 20 feet. The greatest cause of subsidence is aquifer compaction from sustained ground water overdraft, which lowers ground water levels (Galloway and Riley 1999). While subsidence is evident in portions of western Fresno County, the proposed project area is not within an area where subsidence has occurred (Fresno County 2000a).

Soils

The soils in the project area reflect the rock types present in the hills and mountains east of the San Joaquin Valley, extent of weathering of the rock, degree of slope, and degree of modification by humans. Characteristics and description of the major soil units underlying the Sanger Substation and associated conductor alignment areas are presented in Table 5.6-1.

Table 5.6-1 Soil Types and Characteristics

Soil Series or Association	Description	K Factor	Wind Erodibility Index (tons per acre)	Linear Extensibility (Percent)	Shrink-Swell Class
Sanger Substation Area					
Ramona (Rb)	Ramona sandy loam	.24	86	1.5	Low
GuA	Greenfield sandy loam, moderately deep, 0 to 3 percent slopes	.24	86	1.5	Low
Power Line Reconfiguration Area					
Ramona (Ra)	Sandy Loam, hard substratum	.24	86	1.5	Low
GtA	Greenfield sandy loam, 0 to 3 percent slopes	.24	86	1.5	Low

Source: NRCS 2013
Notes:
Erosion K Factor indicates the susceptibility of a soil to sheet and rill erosion by water.
The Wind Erodibility Index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion.
Linear Extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state and determines shrink-swell class.
Soils with shrink-swell class that are rated moderate to high can damage buildings, roads, and other structures.

Soils in the project area have been mapped as consisting primarily of well-drained, sandy loams of the Ramona and Greenfield series (NRCS 2013). Sandy loams are not expansive (i.e., they have low linear extensibility) and compact well for construction. These soils are slightly corrosive to concrete and moderately corrosive to uncoated steel. They are moderately susceptible to erosion from wind and water.

5.6.2 Regulatory Setting

Federal

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy (Bryant 2009). The law requires establishment of regulatory zones—known as Earthquake Fault Zones—around the surface traces of active faults and issuance of appropriate maps for use in planning and controlling new or renewed construction. While the substation would not be used for human occupancy, the maps help define areas where fault rupture is most likely to occur by grouping faults as active, potentially active, or inactive.

State

Seismic Hazards Mapping Act of 1990

The Seismic Hazards Mapping Act of 1990 directs the CGS to delineate Seismic Hazard Zones and requires site-specific geotechnical investigations prior to permitting most urban development projects within seismic hazard zones. The act addresses the effects of strong ground shaking, liquefaction, landslides, and other ground failure and seismic hazards caused by earthquakes, as well as tsunamis and seiches. City, county, and state agencies are directed to use seismic hazard zone maps developed by CGS in their land use planning and permitting processes.

California Building Standards

The California Building Standards Commission is responsible for coordinating, managing, adopting, and approving building codes in California. The State of California provides minimum standards for building design through the 2010 California Building Standards Code (CBC) per California Code of Regulations, Title 24. Chapter 18 of the CBC regulates the excavation of foundations and retaining walls and specifies when geological reports are required. Appendix J of the 2013 CBC regulates grading activities, including drainage and erosion control and construction on unstable soils, such as expansive soils and areas subject to liquefaction.

Local

The Fresno County General Plan contains several policies related to geological hazards and development. These policies are directed at meeting the county's goal to "[minimize] the loss of life, injury, and property damage due to seismic and geologic hazards" (Fresno County 2000a). These policies are not applicable to the proposed project, given the absence of expansive soils in the project area, slopes greater than 30 degrees, an Alquist-Priolo Fault Zone, and potential landslide hazard.

5.6.3 Environmental Impacts and Assessment

Applicant Proposed Measures

The applicant has incorporated applicant proposed measures (APMs) into the proposed project to specifically minimize or avoid impacts on geology and soils; these are listed below. APM GEO-1 was not applied to reduce significant impacts to geological resources because no impacts were identified that could be minimized through application of APM GEO-1. A list of all APMs is included in Table 4-5.

APM GEO-1: Geotechnical evaluation and soils report. A geotechnical evaluation and soils report has been prepared for PG&E. The report concluded that the substation site is geotechnically suitable for construction of the proposed improvements using conventional grading, shallow and deep foundation systems. A copy of the report will be provided separately to CPUC staff.

APM GEO-2/APM WQ-1: Development and Implementation of Stormwater Pollution Prevention Plan. Because the project involves more than an acre of soil disturbance, a Stormwater Pollution Prevention Plan (SWPPP) will be prepared for the project, as required by the state National Pollutant Discharge Elimination System General Permit for Discharges of Stormwater Associated with Construction Activity. This plan will be prepared in accordance with Water Board guidelines and other applicable erosion and sediment control best management practices (BMPs). Implementation of the plan will help stabilize disturbed areas and will reduce erosion and sedimentation. The SWPPP will designate BMPs that will be followed during and after construction of the project. Examples of erosion-minimizing measures that may be identified in the SWPPP include the following:

- Using drainage control structures (e.g., straw wattles or silt fencing) to direct surface runoff away from disturbed areas;
- Strictly controlling vehicular traffic;
- Implementing a dust-control program during construction;
- Restricting access to sensitive areas;
- Using vehicle mats in wet areas; and
- Revegetating disturbed areas, where applicable, following construction.

In areas where soils are to be temporarily stockpiled, soils will be placed in a controlled area and managed with similar erosion control techniques. Where construction activities occur near a surface waterbody or drainage channel and drainage from these areas flows towards a waterbody or wetland, stockpiles will be placed at least 100 feet from the waterbody or will be properly contained by, for example, berming or covering to minimize risk of sediment transport to the drainage. Mulching or other suitable stabilization measures will be used to protect exposed areas during and after construction activities. Erosion-control measures will be installed, as necessary, before any clearing during the wet season and before the onset of winter rains. Temporary measures, such as silt fences or wattles intended to minimize erosion from temporarily disturbed areas, will remain in place until disturbed areas have stabilized.

The SWPPP will be designed specifically for the hydrologic setting of the project.

Impacts on Geology and Soils

Table 5.6-2 includes the significance criteria from Appendix G of the California Environmental Quality Act Guidelines' geology and soils section to evaluate the environmental impacts of the proposed project. A detailed analysis for significance criteria item (e) is not provided below as the proposed project would

not involve the construction of septic tanks or the use of existing septic tanks during construction or operation and, therefore, would have no impact.

Table 5.6-2 Geology and Soils Checklist

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
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 waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☒

a. Would the project 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.

NO IMPACT

The proposed project would not lie within an Alquist-Priolo Earthquake Fault Zone. The closest mapped Alquist-Priolo fault, the Nuñez fault, is approximately 47 miles away (CGS 2015; Figure 5.6-1). Furthermore, the project would not exacerbate fault rupture conditions. There would be no impact under this criterion.

ii) Strong seismic ground shaking?

LESS THAN SIGNIFICANT IMPACT

The proposed project would not be located near known active faults; however, Fresno County has determined that a strong earthquake on a regional fault could result in moderate ground shaking in valley portions of the county where expansive soils tend to experience greater ground shaking intensities than areas underlain directly by hard rock (Fresno County 2000b). CGS's Ground Motion Interpolator suggests that the probability for strong seismic shaking in the proposed project area is low (CGS 2008). The proposed project area is only susceptible to moderate or lesser ground shaking as a result of a strong earthquake on one of the nearest active faults. Furthermore, the proposed project would not exacerbate conditions related to strong seismic ground shaking. The proposed project involves the expansion of an existing substation that would be unmanned during operation. The project is located in a rural agricultural area with a sparse population. Therefore, in the event that strong seismic shaking were to occur, the potential to expose the public to injury or death would be similar to existing conditions. Impacts under this criterion are less than significant.

iii) Seismic-related ground failure, including liquefaction?

LESS THAN SIGNIFICANT IMPACT

The proposed project area is not underlain by expansive or liquefiable soils (Fresno County 2000a; Kleinfelder 2015). The applicant completed a geotechnical evaluation to identify site-specific geologic conditions and some potential geologic hazards; groundwater was not detected during test boring (Kleinfelder 2015). Due to the absence of shallow groundwater, the lack of expansive soils, and the proposed project's location 47 miles or more from known active faults, the proposed project is not considered susceptible to liquefaction or other seismically induced ground failures. The proposed project would not exacerbate existing conditions related to seismic-related ground failure. Risk of loss, injury, or death from seismic-related ground failure, including liquefaction, would be less than significant.

iv) Landslides?

NO IMPACT

According to the Fresno County General Plan, the valley portion of the county is not at risk of large seismically induced landslides or rock falls due to its flat topography (Fresno County 2000b). Construction of the proposed project would not produce slopes susceptible to landslides. The minimal slope of the proposed site (0 to 1 percent) and lack of nearby hill slopes indicates that the risk of landslides is improbable. Furthermore, the proposed project would not result in creation of slopes that may create landslides. There would be no impact to the risk of loss, injury, or death from landslides.

b. Would the project result in substantial soil erosion or the loss of topsoil?

LESS THAN SIGNIFICANT IMPACT

As indicated in Table 5.6-1, soil on the proposed project site is moderately susceptible to erosion by wind and water. Earth-moving activities, including trenching, excavating, stockpiling, and grading would occur during construction. Additionally, soil would be stockpiled within the expanded substation. Each earth-moving and ground-disturbing activity mobilizes the soil and increases the chance of erosion, which would be a significant impact given the size and continuity of the substation area and the mobility of the agricultural soils. As detailed in APM GEO-2/WQ-1, the applicant would prepare and implement a

SWPPP in accordance with National Pollutant Discharge Elimination System to minimize the potential for soil erosion. Additionally, as detailed in APM AIR-1, the applicant would develop a Dust Control Plan per San Joaquin Valley Air Pollution Control Board Regulation VIII. The Dust Control Plan would include BMPs for limiting track-out onto roadways and reducing erosion due to wind (see Table 4-5). While the soils on the proposed site are susceptible to erosion, implementation of recommendations contained in the SWPPP and Dust Control Plan, prepared under APM AIR-1 and APM GEO-2/WQ-1, would minimize erosion. The proposed project would, therefore, result in less than significant impacts from soil erosion or loss of topsoil.

c. Would the project be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?

LESS THAN SIGNIFICANT IMPACT

The substation site and power line routes would be located on land with low topographic relief. The applicant completed a geotechnical evaluation to identify site-specific geologic conditions and some potential geologic hazards at the project site. The geotechnical evaluation provided design and construction recommendations to reduce potential impacts from geologic hazards or soil conditions. Soils on the proposed site are described as silty sand with adequate drainage (Kleinfelder 2015). Soils in the proposed project area compact well for construction and are not significantly susceptible to on- or off-site landslides or lateral spreading due to the low topographic relief of the existing site and the proposed substation (USGS 2012). Project site soils are not susceptible to liquefaction due to the relatively deep water table. The proposed project area is not located in an area that has experienced subsidence or collapse (Fresno County 2000a). Furthermore, the proposed project would not exacerbate unstable soil conditions. Impacts under this criterion would be less than significant.

d. Would the 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?

NO IMPACT

All project site soils are sandy loams, which are characterized as having a low shrink-swell class and low linear extensibility of 1.5 percent. Both available measures of soil expansiveness indicate that site soils are not considered expansive. The proposed project would not exacerbate or cause expansive soil conditions. There would be no impact under this criterion.