3.6 GEOLOGY, SOILS, AND MINERAL RESOURCES

3.6.1 Environmental Setting

Physiography and Topography

Regional

The proposed project would be located within the Coast Ranges Geomorphic Province, which extends along much of the California coast from the northern state boundary down to San Luis Obispo and encompasses inland areas to the edge of the Central Valley. The Coast Ranges Geomorphic Province consists of a series of mountain ranges and valleys subparallel to the San Andreas Fault that trend north to west. The mountains within the Coast Ranges Geomorphic Province generally range in elevation from 2,000 feet above mean sea level (amsl) to 4,000 feet amsl and occasionally reach up to 6,000 feet amsl. The San Andreas Fault extends for more than 600 miles along the Coast Ranges Geomorphic Province (California Geologic Survey 2002).

The project study area is in the northern portion of the San Francisco Bay in central Sonoma County. The topography of Sonoma County is varied and includes several mountain ranges, distinctive valleys, and coastal terraces. Sonoma County is bounded on the south by the San Pablo Bay and associated wetlands. A wide basin, consisting of the Cotati and Petaluma Valleys, spans from Santa Rosa to the San Francisco Bay. The rugged Mayacamas and Sonoma Mountains geographically form the eastern boundary and physically separate Sonoma County from Lake and Napa Counties. The land has been shaped by volcanic activity that occurred over 10,000 years ago, evidenced by Mount St. Helena, which dominates the northeastern part of Sonoma County. Recent erosion, sedimentation, and faulting have further shaped Sonoma County's landscape (County of Sonoma 2006).

Local

The project alignment would extend northward from the Cotati Valley floor through hills and then back down into the valley. Elevations along the project alignment range from approximately ~~130~~140 feet amsl to ~~500~~740 feet amsl.

Geologic Setting and Units

Regional

The geology of Sonoma County reflects the past tectonic, volcanic, erosional, and sedimentation processes of the California Coast Ranges Geomorphic Province. Ongoing tectonic forces resulting from the collision of the North American Plate with the Pacific Plate, combined with more geologically recent volcanic activity, has resulted in mountain building and down-dropping of parallel valleys. The margin of the two tectonic plates is defined by the San Andreas Fault system, which consists of a broad zone of active, dormant, and inactive faults dominated by the San Andreas Fault that trend along the western margin of Sonoma County. This fault system results in the northwestern structural alignment that controls the overall orientation of Sonoma County's ridges and valleys (County of Sonoma 2006).

The bedrock units in the San Francisco Bay region are primarily made up of older, highly deformed and displaced rocks (Mesozoic, 252 to 66 million years BP) and younger, less deformed and displaced rocks (Paleogene and Neogene, 66 to 2 million years BP). Most of central Sonoma County is underlain by the Franciscan Complex. ~~In t~~The northeastern end of the Cotati Valley~~, the northeastern portion of the City of Healdsburg~~ is underlain by the Great Valley Complex. The Great Valley Complex is the oldest rock assemblage in Sonoma County. The Great Valley and Franciscan Complexes are overlain by younger sedimentary and volcanic deposits. These deposits include the Clear Lake Volcanics and Sonoma Volcanics (USGS 2002). The bedrock units in Cotati Valley are overlain by alluvial deposits.

Local

The project alignment would primarily be underlain by alluvium; the most northern portion of the alignment would be underlain by volcanic rocks. Figure 3.6-1 shows the geologic units in the project study area.

Soil Types

The project alignment is located within the Cotati Valley. Soils found in the project study area include soils found in basins, flood plains, and alluvial fans. Soils in the project study area are shown on Figure 3.6-2 and Figure 3.6-3, and described in Table 3.6-1.

Geologic Hazards

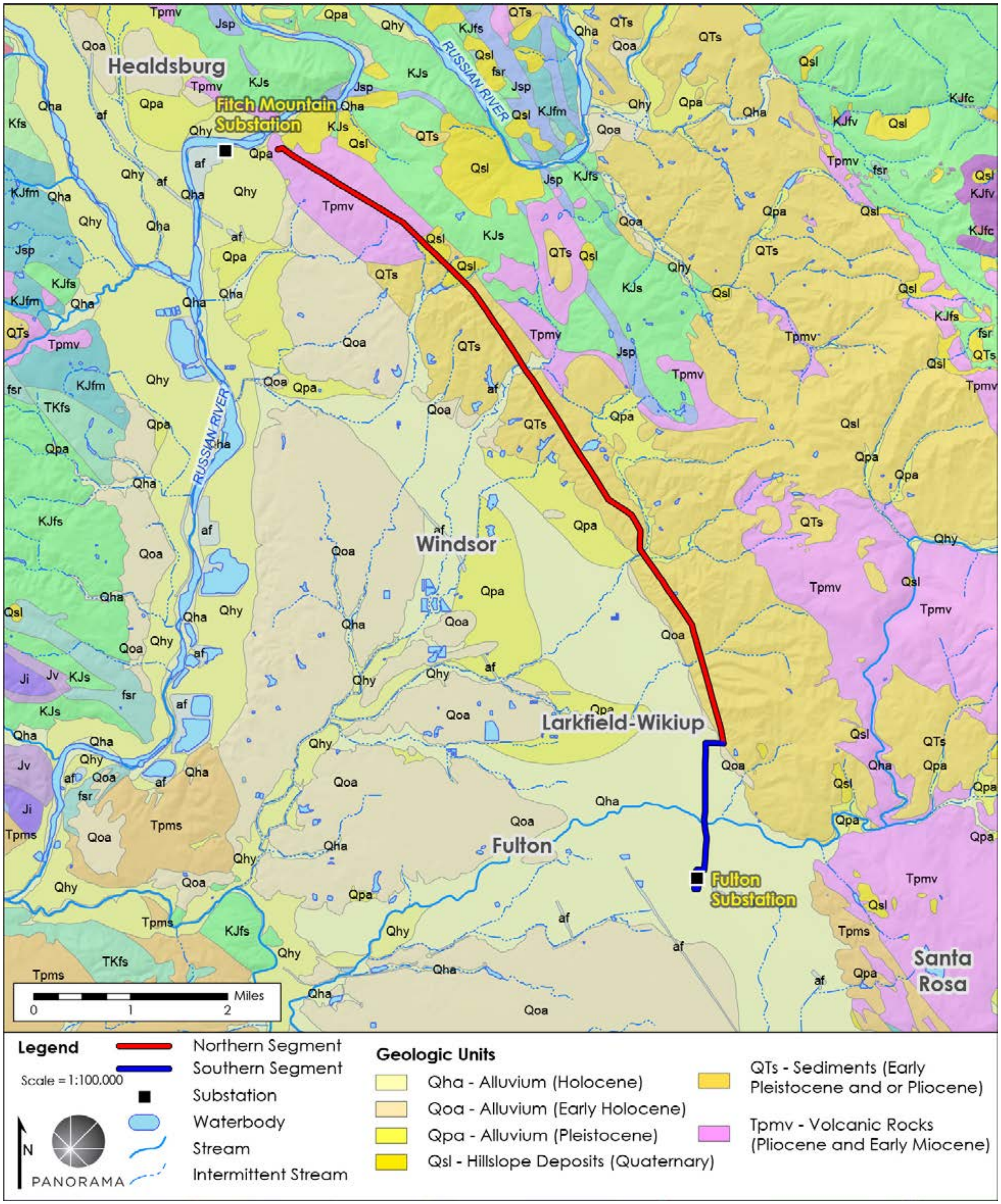
Fault Rupture

The Alquist-Priolo Earthquake Fault Zoning Act requires the establishment of "earthquake fault zones" along known active faults in California. Active faults are those that have resulted in surface rupture in the last 11,000 years (Holocene period, 11,700 years BP to present). A fault that has resulted in surface rupture historically (approximately the last 200 years) has the greatest probability for future activity. A fault is considered potentially active if there is evidence of fault displacement during the Quaternary period (approximately the last 1.6 million years). A fault is generally considered inactive if the most recent documented fault displacement pre-dates the Quaternary period (California Geologic Survey 2007).

Fault rupture occurs when movement on a fault deep within the earth breaks through to the surface. Surface rupture almost always follows pre-existing faults, which are zones of relative weakness in the earth's crust. Rupture may occur suddenly during an earthquake or slowly in the form of fault creep. Sudden ruptures are more damaging to structures because they can displace structures and are accompanied by shaking. Fault creep is slow and continuous movement along faults (USGS 2016a).

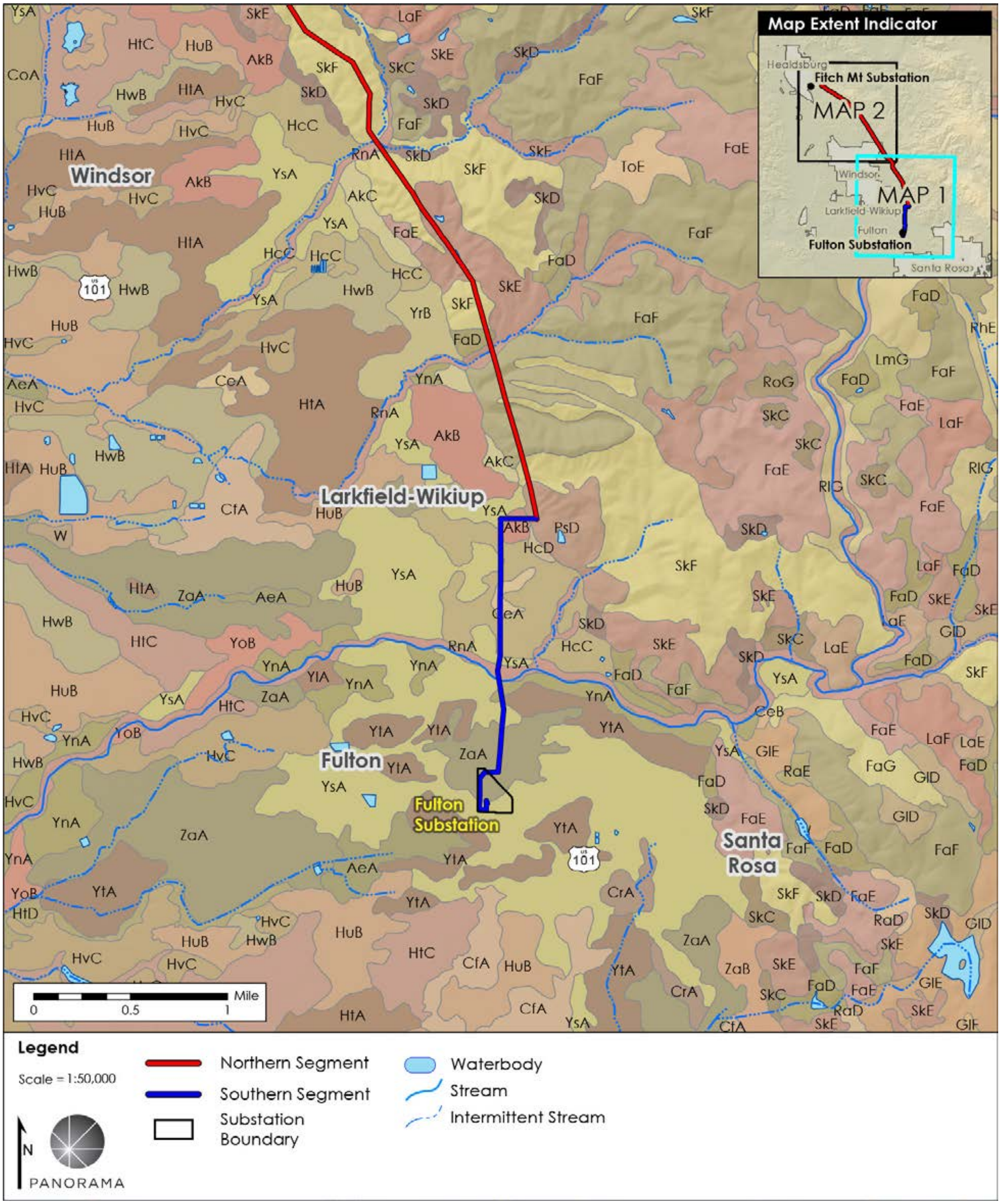
Several faults are located in the proposed project vicinity, as shown in Figure 3.6-4. Fault traces are color-coded to indicate the geologic period during which the last displacement has occurred. The primary active faults near the proposed project are shown in Table 3.6-2.

Figure 3.6-1 Geologic Units in the Project Study Area



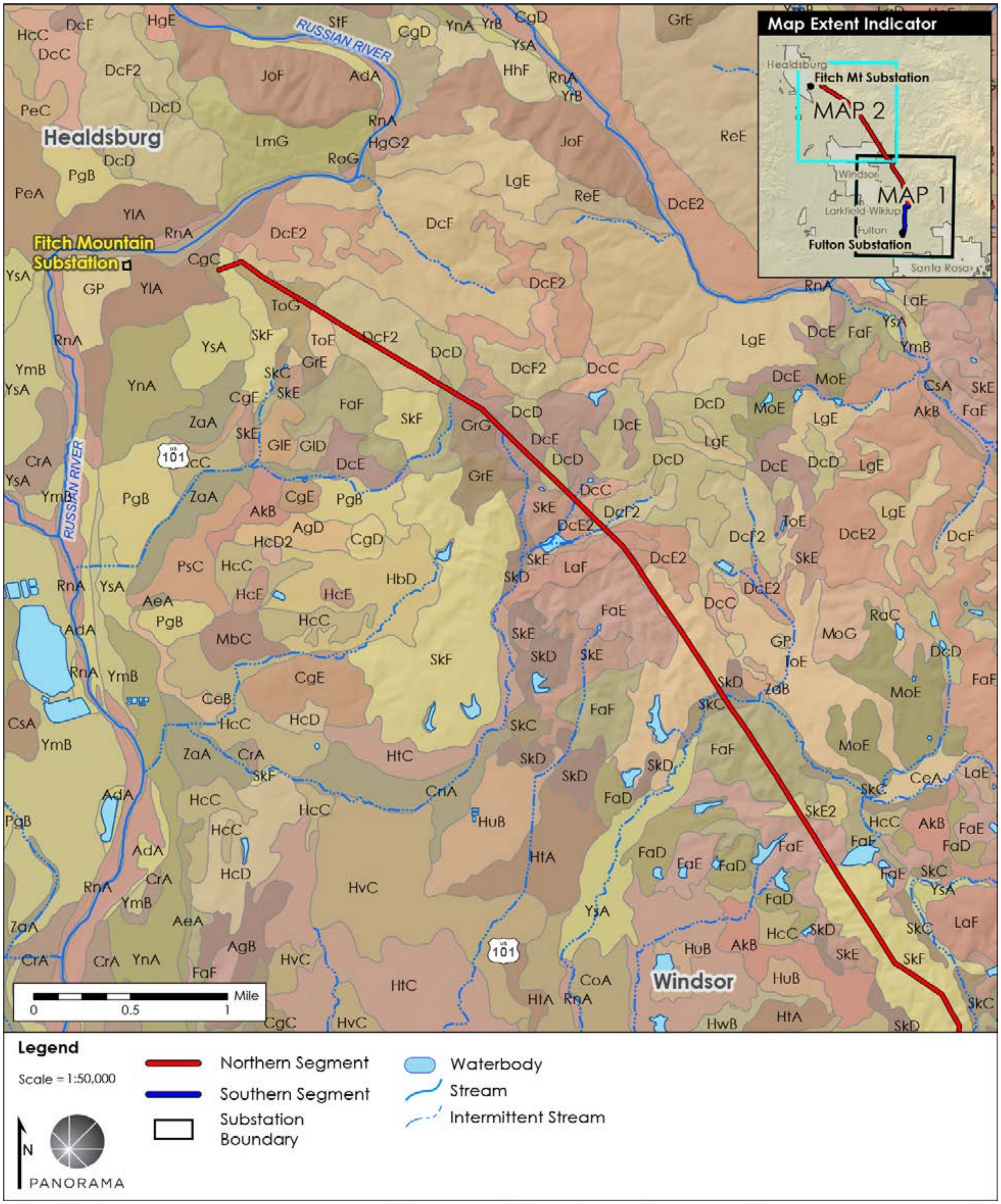
Sources: (California Geologic Survey 2012, USGS 2012, ESRI 2016)

Figure 3.6-2 Soils in the Project Study Area (Map 1 of 2)



Sources: (ESRI 2016, PG&E 2016, USGS 2012, US Department of Agriculture and California Geologic Survey 2013)

Figure 3.6-3 Soils in the Project Study Area (Map 2 of 2)



Sources: (ESRI 2016, PG&E 2016, USGS 2012, US Department of Agriculture and California Geologic Survey 2013)

Table 3.6-1 Major Soil Units in the Project Area

Soil Series and Description	Soil Unit	Acreage of Project Area	Percent Slope	Runoff Rate	Shrink-swell Potential	Erosion
Arbuckle gravelly loam. Well-drained soils, found on old bench terraces along stream and river channels at elevations of 50 to 200 feet above the stream bottoms.	AkB	0.7	0 to 5	Low	Low to Moderate	Slight
Clear Lake clay. Found in poorly-drained basins and on floodplains underlain by alluvium from basic and sedimentary rock.	CeA	1.2	0 to 2	High	High	Slight
Clough gravelly loam. Moderately well-drained soils. Found on bench terraces.	CgC	0.3	2 to 9	Very High	Low	Slight to Moderate
Dibble clay loam. Well-drained soils that have a clay subsoil underlain by fine-grained sandstone and brittle shale interbedded with siltstone. Found in rolling and hilly uplands.	DcC	0.3	2 to 9	Medium	Moderate to High [a]	Moderate
	DcD	1.0	9 to 15	Medium to Rapid		High
	DcE	2.0	15 to 30	Medium to Rapid		Moderate to High
	DcE2	0.2	15 to 30	Rapid		High
	DcF	0.9	30 to 50	Rapid		High
	DcF2	4.9	30 to 50	Rapid		High
Felta very gravelly loam. Well-drained soils that have a very gravelly clay loam subsoil, formed from volcanic tuffs mixed with uplifted river sediment and metamorphosed basic rock.	FaD	0.4	5 to 15	Slow to Medium	Low	Slight to Moderate
	FaE	2.4	15 to 30	Medium to Rapid		Moderate to High
	FaF	7.1	30 to 50	Rapid		High
Guernoc gravelly silt loam. Well-drained soils with a clay subsoil. Found on mountainous uplands.	GrG	1.6	30 to 75	Very High	Moderate	High to Very High
Haire clay loam. Moderately well-drained soils with clay subsoil, underlain by old terrace-alluvium from mixed sedimentary and basic rock sources. Found on terraces and rolling hills.	HcC	2.4	0 to 9	High	Moderate	Slight to Moderate
Laniger loam. Well-drained soils underlain by weathered rhyolite and rhyolitic tuff. Found on mountainous uplands.	LaF	0.7	30 to 50	High	Moderate	High

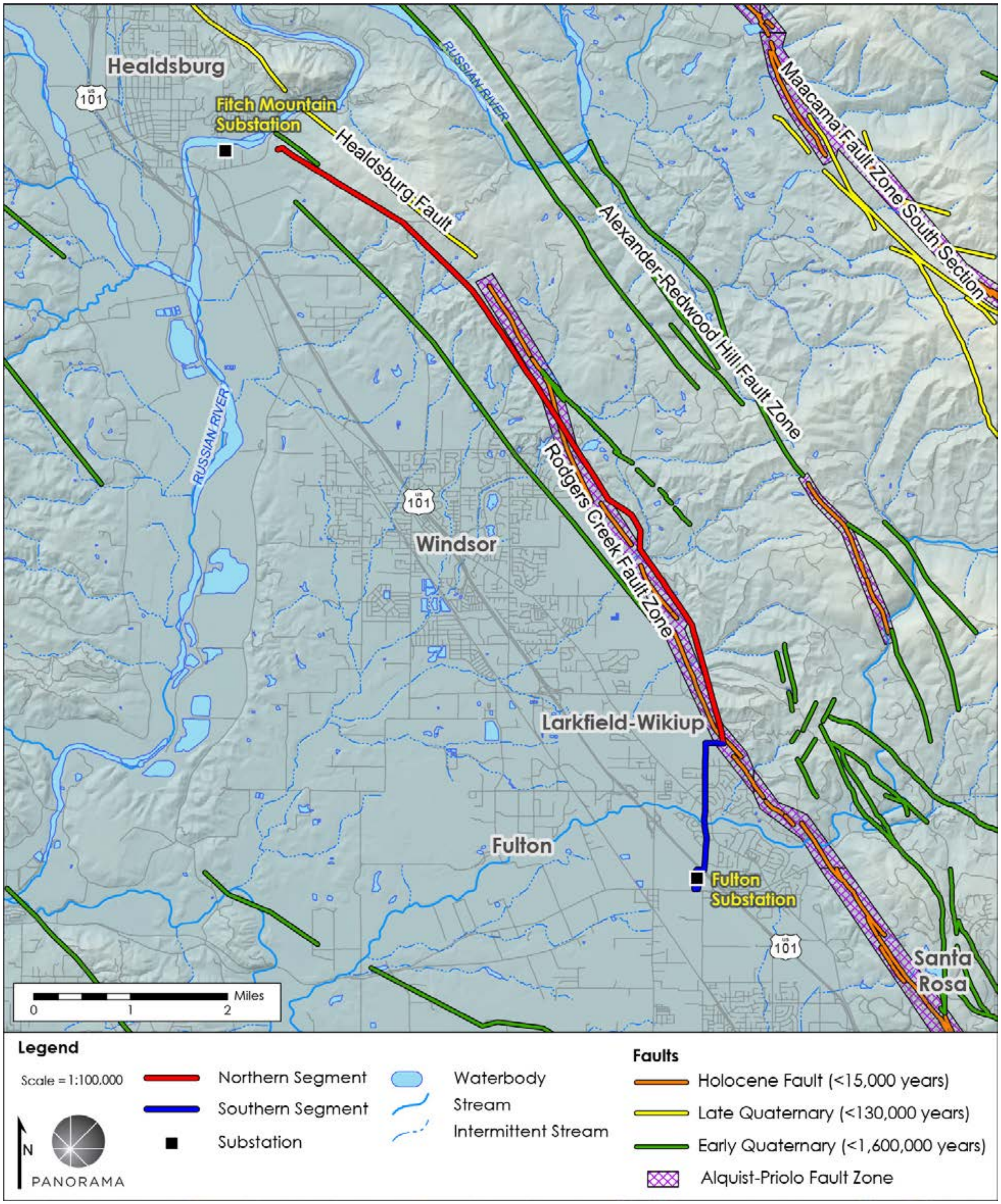
Soil Series and Description	Soil Unit	Acreage of Project Area	Percent Slope	Runoff Rate	Shrink-swell Potential	Erosion
Positas gravelly loam. Well-drained soils with a clay subsoil, underlain by old alluvium of mixed sedimentary and basic igneous materials. Found on river valley terraces.	PsD	1.5	9 to 15	High	Moderate	Moderate
Riverwash. Recent depositions of gravel, sand, and silt alluvium along major streams and their tributaries.	RnA	0.8	--	Negligible	--	--
Spreckels loam. Well-drained soils with a clay subsoil underlain by volcanic tuffs mixed with uplifted river sediment and weathered basic igneous rock. Found on terraces and mountainous uplands.	SkC	0.5	2 to 9	Medium	Low	Slight
	SkD	0.3	9 to 15	Medium		Moderate
	SkE	4.6	15 to 30	--		--
	SkE2	0.6	15 to 30	Medium to Rapid		Moderate to High
	SkF	12.9	30 to 50	Rapid		High
Toomes rocky loam. Well-drained soils underlain by shattered and weathered andesitic basalt and volcanic breccia. Found on gently sloping ridgetops to very steep mountain uplands.	ToE	4.9	2 to 30	Slow to Medium	Moderate	Slight to Moderate
	ToG	2.0	30 to 75	Rapid to Very Rapid		High to Very High
Yolo loam, Yolo silt loam, Yolo clay loam. Well-drained soils underlain by recent alluvium from sandstone and shale. Found on alluvial fans and flood plains in the valleys.	YnA	0.3	0 to 10	Slow to Medium	Low	Slight to Moderate
	YsA	4.1	0 to 5	--		--
	YtA	0.2	0 to 5	--		--
Zamora silty clay loam. Well-drained soils with a mainly clay loam subsoil formed in recent alluvium from mixed sedimentary sources. Found on alluvial fans in large valleys and drainageways.	ZaA	2.8	0 to 2	Slow	Moderate	Slight

Notes:

[a] Clay soils with a high shrink-swell potential are present, starting several feet below the clay loam soils in this series.

Sources: (US Department of Agriculture 1972, Natural Resource Conservation Service 2015)

Figure 3.6-4 Faults Near the Proposed Project



Source: (ESRI 2016, PG&E 2016, USGS 2012, California Geologic Survey and USGS 2010, California Geologic Survey 2001)

Table 3.6-2 Active Faults Near the Proposed Project

Fault Zone	Distance from Project Alignment (miles)	30-Year Mean Probability of at least a Magnitude 6.7 Earthquake (%)	Maximum Moment Magnitude (M)	Slip Rate (mm/year)
Rodgers Creek	Crosses Alignment	~~3~~19 [a]	7.07	9.0
Alexander-Redwood Hill	2	ND	ND	ND
Maacama	4	~~13~~15	7.4	9.0
West Napa	15	~~ND~~2	6.7	1.0
Konocti Bay	19	ND	ND	ND
Hunting Creek-Berryessa	23	5~~9~~	7.1	6.0
Big Valley	24	ND	ND	ND
San Andreas (North Coast section)	24	17~~22~~	7.51	24
Green Valley	30	~~3~~5	6.8	5

Notes:

ND = no data

[a] The probability of a 6.7 Magnitude Earthquake was determined for Rodgers Creek Fault Zone in tandem with the Healdsburg Fault, together referred to as the Rodgers Creek – Healdsburg Fault.

Source: (~~USGS 2012,~~ California Geologic Survey and USGS 2010, USGS 2008a, USGS 2008b, USGS 2013, USGS 2016b)

The San Andreas Fault is the only fault with historic surface displacement in Sonoma County. The Healdsburg, Rodgers Creek, and Maacama Faults show evidence of surface displacement between 200 and 11,000 years BP (County of Sonoma 2011). The Santa Rosa Earthquakes were the strongest earthquakes experienced in Sonoma County since 1906. These earthquakes occurred on October 1, 1969 from the southern end of the Healdsburg Fault[1] and were moderate earthquakes with magnitudes of 5.6 and 5.7 (County of Sonoma 2006).

Seismic Shaking

The intensity of the seismic shaking, or strong ground motion, during an earthquake affecting the project study area would depend on the distance to the epicenter of the earthquake, the magnitude of the earthquake, and the geologic conditions underlying and surrounding the area. Earthquakes occurring on faults closest to the project area would have the potential to generate the largest ground motions. Seismic waves attenuate with distance from their sources, so estimated bedrock accelerations are highest in areas closest to the source. Local soil conditions

[1] The fault traces that originated the 1969 earthquakes are encompassed within the historically active Rodgers Creek Fault Zone in Figure 3.6-4, in accordance with the Alquist-Priolo Fault Zone mapping.

may amplify or dampen seismic waves as they travel from the underlying bedrock to the ground surface.

Portions of the project alignment would be located within the Rodgers Creek active fault zone, as defined by the Alquist-Priolo Earthquake Fault Zoning Act (California Geologic Survey 2001) (refer to Figure 3.6-4). The proposed project would be within an area that is subject to ground shaking from earthquakes generated on the Rodgers Creek Fault and other faults associated with the Coast Ranges listed in Table 3.6-2.

Liquefaction
Liquefaction occurs during the intense ground-shaking that accompanies an earthquake when water-saturated sand and silt takes on the characteristics of a liquid. The susceptibility of a soil to liquefaction is a function of the type of soil, depth, density, and water content of the granular sediments, and the magnitude of earthquakes likely to affect the area. Saturated, loose, granular sediment within the upper 50 feet are most susceptible to liquefaction. The potential for liquefaction increases with shallower groundwater (Caltrans 2014).

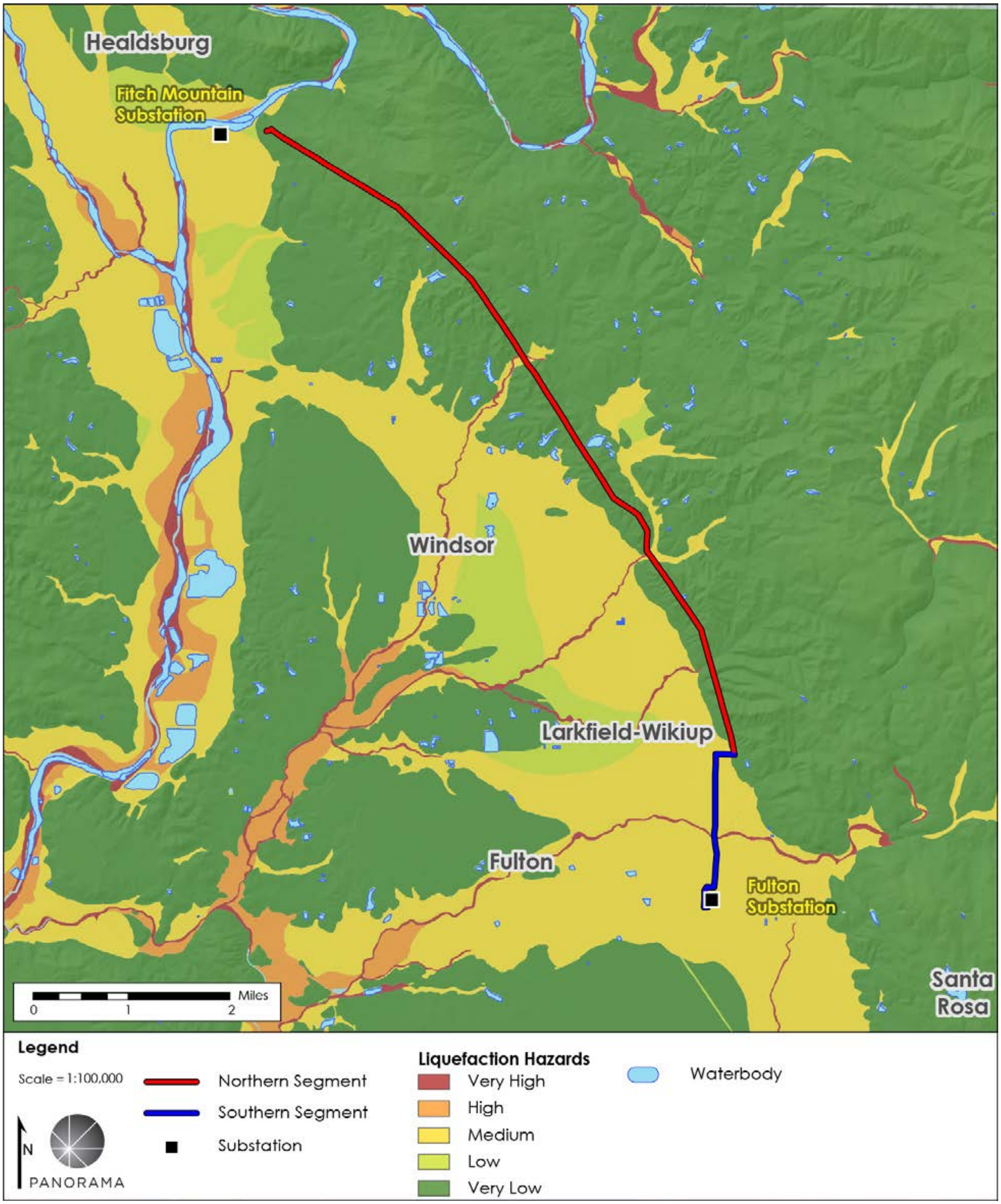
In alluvial basins, such as Cotati Valley, the potential for liquefaction increases in the winter and spring when the groundwater table is higher. The Southern Segment would be located within an area identified as having medium liquefaction susceptibility, as shown in Figure 3.6-5. Most of the Northern Segment would be located in an area mapped as having a very low liquefaction susceptibility (USGS and California Geologic Survey 2006, USGS 2012).

Landslide
A landslide is a downward and outward movement of slope-forming materials composed of rock, soils, artificial fills, or a combination of these. Most of Sonoma County, except the flat-lying alluvial valleys, are subject to landslides. Landslides vary in size, speed of movement, and mechanism. Many landslides occur as smaller slumps or flows within older larger slide masses. Large numbers of landslides have been common in Sonoma County during years of very high rainfall. Many of these landslides were the reactivation of pre-existing landslides (County of Sonoma 2006). The Southern Segment is relatively free of landslide susceptibility, whereas the Northern Segment would traverse numerous areas susceptible to landslides and earthflows (County of Sonoma 2011).

Subsidence
Subsidence is the downward displacement of a large portion of land. Subsidence is caused by the withdrawal of fluids (e.g., ground water or oil) from subsurface reservoirs. As the water is removed, fluid pressure is reduced and the pore spaces between the grains in the aquifer collapse (County of Sonoma 2006). Data collected to study faults in areas near the project alignment has not detected a trend of lowering of the land surface between 2008 to 2014 (Santa Rosa Plain Basin Advisory Panel 2014).

Expansive Soils
Expansive soils generally contain fine-grained clays that can absorb greater amounts of water than other soils, which swell and expand the soil's volume during the wet season. During the

Figure 3.6-5 Areas Prone to Liquefaction in the Project Study Area



Sources: (ESRI 2016, PG&E 2016, USGS 2012, USGS and California Geologic Survey 2006) dry season, the soil shrinks and contracts as it sheds water that was absorbed during the wet season. This behavior results in cyclical shrink-swell. The repeated expansion and contraction of expansive soils can result in damage to structures, such as cracking (American Geosciences Institute 2009). Soils in the project area generally have a low to moderate shrink-swell potential, with one high shrink-swell potential soil, as shown in Table 3.6-1. Moderate shrink-swell soils are located in the most southern and northern portions of the project alignment. Soil with high shrink-swell potential is in a small portion of the Southern Segment.

Mineral Resources

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

- **MRZ-1.** Areas where available geologic information indicates that little likelihood exists for the presence of significant mineral resources.
- **MRZ-2.** Areas where adequate information indicates that significant mineral deposits are present, or where it is judged that a high likelihood for their presence exists. This zone shall be applied to known mineral deposits or where well-developed lines of reasoning, based upon economic-geologic principles and adequate data, demonstrate that the likelihood for occurrence of significant mineral deposits is high.
- **MRZ-3.** Areas containing mineral occurrences of undetermined mineral resource significance.
- **MRZ-4.** Areas where available information is inadequate for assignment to any other MRZ category.

Fitch Mountain Substation is located within an area classified as MRZ-2 for known mineral resources based upon sand and gravel reserves. The substation is bordered on the west by an active sand and gravel processing plant operated by Syar Industries (2016).

The Southern and Northern Segments would be located within areas that have been classified primarily as MRZ-3 for aggregate resources. The northern portion of the Southern Segment is classified as MRZ-1. Aggregate resources consist of sand, gravel, and crushed rock that are physically and chemically suited for use in construction. Aggregates are used to provide bulk and strength to concrete and can be used for subbase, drain rock, and fill. Rock groups along the project alignment that contain crushed stone aggregate resources include younger volcanic rocks of the Sonoma Volcanic group and Pleistocene alluvial terrace deposits along major streams and rivers (California Geologic Survey 2005, California Geologic Survey 2013).

Locally important mineral resources are not found within the project alignment. Sonoma County recognizes two aggregate mineral resources, sand and gravel, along Windsor Creek and the Russian River. Active extraction along Windsor Creek occurs approximately 0.25 mile from the project alignment. Extraction operations are present on the south bank of the Russian River directly west of Fitch Mountain Substation.

3.6.2 Impact Analysis

Summary of Impacts

Table 3.6-3 presents a summary of the CEQA significance criteria and impacts on geology, soils, and mineral resources that would occur during construction, operation, and maintenance of the proposed project.

Table 3.6-3 Summary of Project Impacts on Geology, Soils, and Mineral Resources

Would the proposed project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	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 or 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 water?	☐	☐	☐	☒
f) 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?	☐	☐	☐	☒

Would the proposed project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
g) 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?	☐	☐	☐	☒

Impact Discussion

a) 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?	Significance Determination
	Less than significant

Construction

The proposed project would be in a region with active and potentially active fault zones that have a history of strong earthquakes. The project alignment would cross the Rodgers Creek Fault, which has been designated as an Alquist-Priolo Zone (refer to Figure 3.6-4). Fault rupture in the project alignment could occur during construction. The potential for construction crews to experience impacts from fault rupture or other seismic ground shaking would be minimal. In the unlikely event of an earthquake, construction workers could be exposed to hazards from strong seismic ground shaking or ground failure. Project construction would not substantially increase the risks of seismic hazard exposure over typical seismic hazard risks throughout the region. Earthquake safety training pursuant to Occupational Safety and Health Administration regulations would minimize potential for impacts on workers.

Seismically-induced liquefaction and landslide potential varies across the project alignment. All project poles and work areas would be in locations with a medium or very low potential for liquefaction, and the project power lines would completely span three alluvium-filled stream channels with very high potential for liquefaction, as shown on Figure 3.6-5. Portions of the Northern Segment, particularly areas with canyons and ravine channels, would be susceptible to landslide hazards due to steeper slopes composed of highly weathered and unconsolidated materials that may be more susceptible to landslides during seismic events. Poles in the Northern Segment would generally be located on stable hilltops, but some poles would be located near the edge of canyons and channels where there is a potential for ground failure within a landslide head scarp. Due to the short duration of construction (approximately 18 months), the low probability of a seismic event occurring during this time, and safety training for construction crews, the potential for construction crews and structures to be exposed to seismically-induced liquefaction, landslides, or other types of ground failure would be minimal and less than significant.

Operation and Maintenance

A significant seismic event and fault rupture along the Rodgers Creek fault zone could occur during operation and maintenance of the proposed project. Generally, overhead power lines are not significantly impacted by fault rupture since the lines are located above the ground surface. Seismic events in the region could cause ground failure at pole locations, resulting in downed poles and power lines that could pose a risk to the public from injury or death. The proposed project would be designed in accordance with CPUC GO 95 and the Institute of Electrical and Electronics Engineers, Inc. Standard 693 to withstand damage from ground rupture and strong seismic shaking. PG&E would implement APM GS-3 as part of the proposed project, which requires a geotechnical investigation to evaluate the potential for surface fault rupture and to adjust pole locations where possible to minimize damage from surface fault rupture. Implementation of APM GS-3 would reduce impacts to less than significant.

Operation and maintenance activities for the reconductored line and substation modifications would be similar in scope to existing activities. The impact from exposure to seismic hazards during maintenance activities would be similar to existing conditions and less than significant.

Required APMs and MMs: APM GS-3

b) Would the proposed project result in substantial soil erosion or the loss of topsoil?	Significance Determination
	Less than significant

Construction

Ground disturbance would occur during conductor and pole replacement at construction work areas and unpaved access routes. All unpaved surfaces could be disturbed by construction equipment driving over the ground surface, and work areas and unpaved access roads may be graded and cleared of vegetation to establish access, where necessary. More intensive earth-moving activities would include excavating new pole holes and minor cut-and-fill where the ground is uneven. The proposed project has the potential to result in approximately 82 to 117.4 acres of ground disturbance, and approximately 6,595 to 21,950 cubic yards of cut-and-fill. Ground disturbance and excavation during construction would occur at locations with slopes that range from flat to very steep (0 to 75 percent slopes), and in soils that have slight to high wind and/or water erosion potential, as described in Table 3.6-1.

Erosion of soil and topsoil loss because of construction activities would be potentially significant. Gravel and geotextile fabric would be installed at work areas and access routes with loose soil to stabilize the surface and facilitate all-weather access. These soil stabilization techniques would not be sufficient for all scenarios, and the impact would remain potentially significant. APM GS-1 requires replacement of soft or loose soils that have the potential to erode easily, installation of material over access roads, and other measures to reduce soil erosion. Implementation of APM GS-1 would reduce the impact to less than significant.

Operation and Maintenance

Operation and maintenance activities of the proposed project would be the same as for the existing lines and substation. PG&E would continue to regularly inspect, maintain, and repair conductor, poles, and substation facilities, as well as maintain vegetation clearances from all facilities in the project alignment. Poles and conductor in the project alignment would be accessed using existing and overland access routes or by helicopter. New access routes would not be required. Operation and maintenance would not result in increased erosion or topsoil loss. The impact would be less than significant.

Required APMs and MMs: APM GS-1

c) 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?	Significance Determination
	Less than significant with mitigation

Construction

Portions of the Northern Segment, especially areas with steep slopes, would be susceptible to landslide hazards. Grading and pole excavations in the Northern Segment at work areas and along access routes could alter existing landslide-prone slope profiles and make them unstable because of over-excavating slope material, steepening slopes, or increasing loads. Damage to property that could occur from increased instability and landslides caused by construction would be a potentially significant impact. APM GS-2 addresses slope instability during construction; however, it does not ensure that a geotechnical engineer make the evaluations. Therefore, construction could still result in a significant impact. APM GS-2 is superseded by MM Geology-1. MM Geology-1 requires PG&E to prepare a geotechnical investigation to identify unstable slopes in the Northern Segment and recommend methods to avoid or stabilize the areas. Implementation of MM Geology-1 would reduce the impact from landslides during construction to less than significant.

Liquefaction susceptibility ranges from low to medium along the project alignment. The Southern Segment would be located within an area identified as having medium liquefaction susceptibility. Ground disturbance in the Southern Segment would be limited to minor surface grading, if necessary to establish construction access, and excavating pole holes for one new LDSP and two relocated distribution poles. Pole excavation would occur in highly disturbed areas with a high likelihood of existing fill soil, limiting the potential for liquefaction. Most the Northern Segment is in an area mapped as having a very low liquefaction susceptibility. The project alignment would span very localized areas mapped as having a medium liquefaction potential where alluvial stream channels are located. No poles would be located within alluvium stream channels. Fitch Mountain Substation is within an area mapped as having medium liquefaction potential. The surface of the existing substation has previously been improved and is covered with 95 percent compacted fill, which minimizes the potential for liquefaction in this area. The potential for lateral spreading at any proposed project work areas is very low given the relatively low potential for liquefaction in areas where ground disturbing activities would occur.

Construction activities would not exacerbate existing liquefaction and lateral spreading in the area. The impact from liquefaction and lateral spread would be less than significant.

Soil collapse occurs when shrink-swell soils shrink during the dry season. Clear Lake clay soil identified in Table 3.6-1 has a high shrink-swell potential. Dibble clay loam soil has a moderate shrink-swell potential, but is underlain by Dibble clay, which has a high shrink-swell potential. ~~This soil~~Clear Lake clay soil is in a small portion of the Southern Segment where no ground-disturbing activities would occur. Soils with a moderate or moderate to high shrink-swell potential are located along the northern half of the Northern Segment ~~under the most northern~~ and a small portion of the Southern Segment~~southern portions of the project alignment~~.~~;~~ T~~t~~he remaining portions of the project alignment would be underlain by soils with low shrink-swell potential. Construction activities such as pole replacement and grading along access in the Northern Segment would be unlikely to increase the risk of soil collapse in the area~~.~~since these activities would not result in increasing water in the soils that causes collapse. Construction, as proposed, in soils with moderate to high shrink-well potential would not increase the potential for the soils to collapse beyond existing conditions. Impacts would be less than significant.

Operation and Maintenance

Operation and maintenance activities for the proposed project would be similar in scope to existing activities. Impacts on property or life that could result from exposure to unstable soils, including expansive and collapsible soils, during operation and maintenance activities would not be greater than existing conditions. The impact would be less than significant.

Required APMs and MMs: MM Geology-1

d) 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?	**Significance Determination**
	No impact

Construction

Expansive soils would not affect construction methods or cause a risk to life or property. No impact would occur.

Operation and Maintenance

Soils that underlay the project alignment generally have a low or moderate shrink-swell potential, and ~~only one~~a few soils haves a high shrink-swell potential, as listed in Table 3.6-1. Soils with moderate shrink-swell potential are in the most northern and southern portions of the project alignment, and the soil with high shrink-swell potential is found in a small portion of the Southern Segment. Soils that exhibit moderate to high shrink-swell potential are found in the most northern portion of the project alignment. Although some pole replacements ~~in the Southern Segment is~~are proposed to occur in ~~an~~ areas underlain by moderate or high shrink-swell soil, the risk to life and property would not increase. No impact on life or property from expansive soil would occur.

Required APMs and MMs: None

e) Would the proposed project 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 water?	Significance Determination
	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.

Required APMs and MMs: None

f) 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?	Significance Determination
	No impact

The entire project alignment, as well as ingress and egress to the alignment, would be located within PG&E easements, as described in greater detail under Section 2.4.2 of the Project Description. Although access routes and some staging areas would require temporary easements, none of these areas are 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.

Required APMs and MMs: None

g) 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?	Significance Determination
	No impact

The entire project alignment, as well as ingress and egress to the alignment, would be located within PG&E easements, as described in Section 2.4.2 of the Project Description. Although access routes and some staging areas would require temporary easements, none of these areas are currently available for mineral extraction, and the proposed project would not result in a change in land use or restrict future access to mineral resources. No locally important mineral resource recovery sites would be affected. No impact would occur.

Required APMs and MMs: None

3.6.3 Required Applicant Proposed Measures and Mitigation Measures

APM GS-1: Soft or Loose Soils
Where soft or loose soils are encountered during project construction, appropriate measures will be implemented to avoid, accommodate, replace, or improve such soils. Depending on site-specific conditions and permit requirements, these measures may include: • Locating construction facilities and operations away from areas of soft and loose soil; • Over-excavating soft or loose soils and replacing them with engineered backfill materials; • Increasing the density and strength of soft or loose soils through mechanical vibration and/or compaction; • Installing material over access roads such as aggregate rock, steel plates, or timber mats; and • Treating soft or loose soils in place with binding or cementing agents.
Applicable Locations: All project areas
Performance Standards and Timing: • **Before Construction:** N/A • **During Construction**: ~~(1) Soft or loose soils are avoided in project work areas and access routes where approved alternate locations are available, and (2)~~ Appropriate measures are implemented that adequately stabilize soft and loose soils where they cannot be feasibly avoided • **After Construction:** N/A

APM GS-3: Site-specific Geotechnical Investigation
A geotechnical investigation will be conducted to evaluate the potential for surface fault rupture for poles within and adjacent to potentially active fault traces and earthquake fault zones. Where significant potential for surface fault rupture exists, pole locations will be adjusted, where possible, to minimize any potential for damage based on the conclusions in the report.
Applicable Locations: All project areas in the Northern Segment
Performance Standards and Timing: • **Before Construction:** New poles are positioned after considering the findings in the geotechnical report • **During Construction:** N/A • **After Construction:** N/A

MM Geology-1: Geotechnical Investigation Report (Supersedes APM GS-2)
PG&E shall have a professional geotechnical engineer conduct a geotechnical investigation in areas that are suspected to have unstable soils or landslide susceptibility and shall add the analysis to the Geotechnical Investigation Report required by APM GS-3. The Geotechnical Investigation Report shall provide site-specific recommendations for poles, work areas, and access routes where there is an elevated risk of geologic hazards. PG&E shall submit the Geotechnical Investigation Report to the CPUC no less than 60 days prior to construction. Where geotechnical hazards are found to occur, appropriate engineering design and construction measures from the Geotechnical Investigation Report shall be incorporated into the final project designs, as deemed appropriate by a California-licensed Geotechnical Engineer or Certified Engineering Geologist. Design measures that would mitigate seismic and landslide-related impacts shall include, but are not limited to, retaining walls, removal of unstable materials, and avoidance of highly unstable areas. Disturbed and engineered slopes shall be monitored by qualified construction personnel on an occasional basis (bi-monthly or as needed) until the slope is fully stabilized and no longer poses an increased risk of failure or erosion as compared to similar undisturbed slopes in the immediate vicinity.

Applicable Locations: All project areas that are suspected to have unstable soils or landslide susceptibility, underlain by a fault, or that could be subject to strong ground shaking and ground failure
Performance Standards and Timing: • **Before Construction:** (1) Geotechnical Investigation Report is submitted to the CPUC no less than 60 days prior to construction, and (2) Appropriate engineering design and construction measures from the Geotechnical Investigation Report are incorporated into final project designs • **During Construction:** Disturbed and engineered slopes are adequately monitored by qualified construction personnel • **After Construction:** N/A

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