3.6 Geology, Soils, Mineral Resources, and Paleontological Resources

This section describes the regulatory and environmental setting for geology, soils, mineral resources, and paleontological resources in the program and project areas. It also describes impacts on geology, soils, mineral resources, and paleontological resources that would result from implementation of the program and two individual projects. Mitigation measures are prescribed where feasible and appropriate.

3.6.1 Existing Conditions

Regulatory Setting

Federal

No federal regulations apply to mineral resources or paleontological resources in the APWRA. The following federal regulations are related to geologic hazards or soils.

International Building Code

The design and construction of engineered facilities in California must comply with the requirements of the International Building Code (IBC) (International Code Council 2011) and the adoptions of that code by the State of California (see *California Building Standards Code* under *State Regulations*).

U.S. Geological Survey Landslide Hazard Program

To fulfill the requirements of Public Law 106-113, the U.S. Geological Survey created the National Landslide Hazards Program to reduce long-term losses from landslide hazards by improving understanding of the causes of ground failure and suggesting mitigation strategies. The Federal Emergency Management Agency is the responsible agency for the long-term management of natural hazards.

Clean Water Act Section 402 (National Pollutant Discharge Elimination System Program)

Section 402 of the Clean Water Act (CWA) mandates that certain types of construction activity comply with the requirements of EPA's National Pollutant Discharge Elimination System (NPDES) program. EPA has delegated to the State Water Board the authority for the NPDES program in California, where it is implemented by the state's nine Regional Water Boards. Construction activity disturbing 1 acre or more must obtain coverage under the state's General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Order 2010-0014-DWQ). (See *Construction Activities Storm Water Construction General Permit [2010-0014-DWQ Permit]*).

Additional details of the CWA are described in Section 3.9, *Hydrology and Water Quality*.

State

Alquist-Priolo Earthquake Fault Zoning Act

California's Alquist-Priolo Earthquake Fault Zoning Act (Alquist-Priolo Act) (Public Resources Code [PRC] Section 2621 et seq.) is intended to reduce risks to life and property from surface fault rupture during earthquakes. The Alquist-Priolo Act prohibits the location of most types of structures intended for human occupancy[1] across the traces of active faults and strictly regulates construction in the corridors along active faults capable of surface rupture or fault creep (earthquake fault zones). Generally the required setback is 50 feet from an active fault trace. The act also defines criteria for identifying active faults, giving legal weight to terms such as *active*, and establishes a process for reviewing building proposals in and adjacent to earthquake fault zones.

Under the Alquist-Priolo Act, faults are zoned, and construction along or across them is strictly regulated if they are *sufficiently active* and *well defined*. A fault is considered sufficiently active if one or more of its segments or strands shows evidence of surface displacement during Holocene time (defined for purposes of the act as referring to approximately the last 11,000 years). A fault is considered well-defined if its trace can be identified clearly by a trained geologist at the ground surface, or in the shallow subsurface using standard professional techniques, criteria, and judgment (Bryant and Hart 2007).

Seismic Hazards Mapping Act

Like the Alquist-Priolo Act, the Seismic Hazards Mapping Act of 1990 (PRC Sections 2690–2699.6) is intended to reduce damage resulting from earthquakes. While the Alquist-Priolo Act addresses surface fault rupture, the Seismic Hazards Mapping Act addresses other earthquake-related hazards, including strong ground shaking, liquefaction, and seismically induced landslides. Its provisions are similar in concept to those of the Alquist-Priolo Act—the state is charged with identifying and mapping areas at risk of strong ground shaking, liquefaction, landslides, and other corollary hazards; and cities and counties are required to regulate development within mapped seismic hazard zones.

Under the Seismic Hazards Mapping Act, permit review is the primary mechanism for local regulation of development. Specifically, cities and counties are prohibited from issuing development permits for sites within seismic hazard zones until appropriate site-specific geologic and/or geotechnical investigations have been carried out and measures to reduce potential damage have been incorporated into the development plans. Geotechnical investigations conducted within seismic hazard zones must incorporate standards specified by California Geological Survey Special Publication 117a, *Guidelines for Evaluating and Mitigating Seismic Hazards in California* (California Geological Survey 2008).

Construction Activities Storm Water Construction General Permit (2010-0014-DWQ Permit)

Dischargers whose projects disturb 1 or more acres of soil, or whose projects disturb less than 1 acre but are part of a larger common plan of development that in total disturbs 1 or more acres, are required to obtain coverage under the General Permit Order 2010-0014-DWQ. Construction activity

[1] With reference to the Alquist-Priolo Act, a *structure for human occupancy* is defined as one "used or intended for supporting or sheltering any use or occupancy, which is expected to have a human occupancy rate of more than 2,000 person-hours per year" (California Code of Regulations, Title 14, Div. 2, Section 3601[e]).

subject to this permit includes clearing, grading, and disturbances to the ground such as stockpiling or excavation, but does not include regular maintenance activities performed to restore the original line, grade, or capacity of the facility.

Coverage under the General Permit is obtained by submitting permit registration documents to the State Water Board that include a risk level assessment and a site-specific stormwater pollution prevention plan (SWPPP) identifying an effective combination of erosion control, sediment control, and non-stormwater BMPs. The General Permit requires that the SWPPP define a program of regular inspections of the BMPs and, in some cases, sampling of water quality parameters. The San Francisco Bay Regional Water Quality Control Board administers the NPDES stormwater permit program in Alameda County. The 14 cities, the unincorporated area, and the two flood control districts of Alameda County share one NPDES permit that is managed through a consortium of agencies called the Alameda Countywide Clean Water Program.

2010 California Building Standards Code

The California Building Standards Code (CBSC) (24 California Code of Regulations) provides the minimum standards for structural design and construction. The CBSC is based on the IBC, which is used widely throughout United States (generally adopted on a state-by-state or district-by-district basis) and has been modified for California conditions with numerous, more detailed or more stringent regulations. The CBSC requires that "classification of the soil at each building site will be determined when required by the building official" and that "the classification will be based on observation and any necessary test of the materials disclosed by borings or excavations." In addition, the CBSC states that "the soil classification and design-bearing capacity will be shown on the (building) plans, unless the foundation conforms to specified requirements." The CBSC provides standards for various aspects of construction, including (i.e., not limited to) excavation, grading, and earthwork construction; fills and embankments; expansive soils; foundation investigations; and liquefaction potential and soil strength loss. In accordance with California law, certain aspects of the program would be required to comply with all provisions of the CBSC.

The CBSC requires extensive geotechnical analysis and engineering for grading, foundations, retaining walls, and other structures, including criteria for seismic design.

California Surface Mining and Reclamation Act of 1975

The principal legislation addressing mineral resources in California is the Surface Mining and Reclamation Act of 1975 (SMARA) (PRC Sections 2710–2719), which was enacted in response to land use conflicts between urban growth and essential mineral production. The stated purpose of SMARA is to provide a comprehensive surface mining and reclamation policy that will encourage the production and conservation of mineral resources while ensuring that adverse environmental effects of mining are prevented or minimized; to ensure that mined lands are reclaimed and residual hazards to public health and safety are eliminated; and to give consideration to recreation, watershed, wildlife, aesthetic, and other related values. SMARA governs the use and conservation of a wide variety of mineral resources, although some resources and activities are exempt from its provisions, including excavation and grading conducted for farming, construction, or recovery from flooding or other natural disaster.

SMARA provides for the evaluation of an area's mineral resources using a system of Mineral Resource Zone (MRZ) classifications that reflect the known or inferred presence and significance of a given mineral resource. The MRZ classifications are based on available geologic information,

including geologic mapping and other information on surface exposures, drilling records, and mine data, and on socioeconomic factors such as market conditions and urban development patterns. The MRZ classifications are defined as follows.

- **MRZ-1**—areas where adequate information indicates that no significant mineral deposits are present, or where it is judged that little likelihood exists for their presence.
- **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.
- **MRZ-3**—areas containing mineral deposits, the significance of which cannot be evaluated from available data.
- **MRZ-4**—areas where available information is inadequate for assignment into any other MRZ.

Although the State of California is responsible for identifying areas containing mineral resources, the county or city is responsible for SMARA implementation and enforcement by providing annual mining inspection reports and coordinating with the California Geological Survey (CGS).

Mining activities that disturb more than 1 acre or involve excavation of at least 1,000 cubic yards of material require a SMARA permit from the lead agency, which is the county, city, or board that is responsible for ensuring that adverse environmental effects of mining are prevented or minimized. The lead agency establishes its own local regulations and requires a mining applicant to obtain a surface mining permit, submit a reclamation plan, and provide financial assurances pursuant to SMARA.

Certain land-disturbing activities do not require a permit, such as excavation related to farming, grading related to restoring the site of a natural disaster, and grading related to construction.

California Public Resources Code

Several sections of the California Public Resources Code protect paleontological resources. Section 5097.5 prohibits "knowing and willful" excavation, removal, destruction, injury, and defacement of any paleontological feature on public lands (lands under state, county, city, district, or public authority jurisdiction, or the jurisdiction of a public corporation), except where the agency with jurisdiction has granted express permission. Section 30244 requires reasonable mitigation for impacts on paleontological resources that occur as a result of development on public lands.

Local

The policies and regulations of the county government that address issues related to geology, such as seismic hazards, slope stability, and erosion, and mineral resources are found in the Alameda General Plan, the ECAP, the Alameda County Code of Ordinances, and the Alameda County Stormwater Management Plan and are described below. There are no general plan policies related to paleontological resources.

Alameda County General Plan

The Safety Element of the Alameda County General Plan specifies numerous policies and action to meet its relevant goal, which is, "To minimize risks to lives and property due to seismic and geologic hazards." These policies and actions are listed below (Alameda County Community Development Agency 2013).

Policies

P1. To the extent possible, projects should be designed to accommodate seismic shaking and should be sited away from areas subject to hazards induced by seismic shaking (landsliding, liquefaction, lurking, etc.) where design measures to mitigate the hazards will be uneconomic or will not achieve a satisfactory degree of risk reduction.

P2. Structures should be located at an adequate distance away from active fault traces, such that surface faulting is not an unreasonable hazard.

P3. Aspects of all development in hillside areas, including grading, vegetation removal and drainage, should be carefully controlled in order to minimize erosion, disruption to natural slope stability, and landslide hazards.

P4. Within areas of demonstrated or potential slope instability, development should be undertaken with caution and only after existing geological and soil conditions are known and considered. In areas subject to possible widespread major landsliding, only very low density development should be permitted, consistent with site investigations; grading in these areas should be restricted to minimal amounts required to provide access.

P5. All existing structures or features of structures which are hazardous in terms of damage, threat to life or loss of critical and essential function in the event of an earthquake should be, to the extent feasible, brought into conformance with applicable seismic and related safety (fire, toxic materials storage and use) standards through rehabilitation, reconstruction, demolition, or the reduction in occupancy levels or change in use.

P6. The County shall not approve new development in areas with potential for seismic and geologic hazards unless the County can determine that feasible measures will be implemented to reduce the potential risk to acceptable levels, based on site-specific analysis. The County shall review new development proposals in terms of the risk caused by seismic and geologic activity.

P7. The County, prior to approving new development, shall evaluate the degree to which the development could result in loss of lives or property, both within the development and beyond its boundaries, in the event of a natural disaster.

P8. The County shall ensure that new major public facilities, including emergency response facilities (e.g., hospitals and fire stations), and water storage, wastewater treatment and communications facilities, are sited in areas of low geologic risk.

P9. Site specific geologic hazard assessments, conducted by a licensed geologist 21, shall be completed prior to development approval in areas with landslide and liquefaction hazards as indicated in Figures S-2 and S-4 and for development proposals submitted in Alquist-Priolo Zones as indicated in Figure S-1, hazards to be mapped include:

- Seismic features
- Landslide potential
- Liquefaction potential

Mitigation measures needed to reduce the risk to life and property from earthquake induced hazards should be included.

P10. Buildings shall be designed and constructed to withstand ground shaking forces of a minor earthquake (1–4 magnitude) without damage, of a moderate (5 magnitude) earthquake without structural damage, and of a major earthquake (6–8 magnitude) without collapse of the structure. The County shall require that critical facilities and structures (e.g., hospitals, emergency operations centers) be designed and constructed to remain standing and functional following an earthquake.

P11. All construction in unincorporated areas shall conform to the Alameda County Building Ordinance, which specifies requirements for the structural design of foundations and other building elements within seismic hazard areas.

P12. To the extent feasible, major infrastructure including transportation, pipelines, and water and natural gas mains, shall be designed to avoid or minimize crossings of active fault traces and to accommodate fault displacement without major damage that could result in long-term service disruptions.

P13. The County shall encourage the retrofitting of existing structures and other seismically unsafe buildings and structures to withstand earthquake ground-shaking.

P14. In order to minimize off-site impacts of hillside development, new construction on landslide-prone or potentially unstable slopes shall be required to implement drainage and erosion control provisions to avoid slope failure and mitigate potential hazards.

Actions

A1. Require all new construction to meet the most current, applicable, lateral force requirements.

A2. Require applications for development within Alquist-Priolo Study Zones to include geological data that the subject property is not traversed by an active or potentially active fault, or that an adequate setback can be maintained between the fault trace and the proposed new construction.

A3. Require sites to be developed in accordance with recommendations contained in the soil and geologic investigations reports.

A4. Establish standards for areas previously in Alquist-Priolo Study Zones, and eliminated in the last update.

A5. Regulate, with collaboration from utility owners, the extension of utility lines in fault zones.

A6. Establish (with collaboration from utility owners) and enforce design standards for transportation facilities and underground utility lines to be located in fault zones.

A7. Require soils and/or geologic reports for development proposed in areas of erodible soils and potential slope instability.

A8. Pursue programs to identify and correct existing structural hazards, with priority given to hazards in critical, essential and high occupancy structures and in structures built prior to the enactment of applicable local or state earthquake design standards.

A9. Support regional or statewide programs providing funding or technical assistance to local governments to allow identification of existing structural hazards in private development and providing assistance to public and private sectors to facilitate and to minimize the social and economic costs of hazards abatement.

A10. Continue to require the upgrading of buildings and facilities to achieve compliance with current earthquake bracing requirements as a condition of granting building permits for major additions and repairs.

A11. Continue, and as required, expand programs to provide the public information regarding seismic hazards and related structural hazards.

A12. Require geotechnical studies prior to development approval in geologic and/or seismic hazard areas as identified by future studies by federal, state, and regional agencies. Require or undertake comprehensive geologic and engineering studies for critical structures regardless of location.

A13. Adopt and amend as needed the most current version of the California Building Code (CBC) to ensure that new construction and renovation projects incorporate Earthquake-resistant design and materials that meet or exceed the current seismic engineering standards of the CBC.

A14. Periodically update detailed guidelines for preparation of site-specific geologic hazard assessments. These guidelines shall be prepared in consultation with the County Building Official, County Engineer, County Counsel and the County Risk Manager and shall ensure that site-specific assessments for development requiring discretionary permits are prepared according to consistent criteria.

A15. Develop and implement an earthquake retrofit plan to reduce hazards from earthquakes. The plan should identify and tally the seismically unsafe buildings and structures, including unreinforced masonry, unreinforced concrete and soft-story buildings, and require inspection for these structures. It should also identify sources of funding to help reconstruct or replace inadequate structures and assist homeowners with earthquake retrofitting.

A16. On sites with slopes greater than 30 percent, require all development to be clustered outside of the 30 percent slope area, with the exception that development upon any area outside of the Urban Growth Boundary where the slope exceeds 25% shall not be permitted.

A17. Aspects of all development in hillside areas, including grading, vegetation removal and drainage, should be carefully controlled in order to minimize erosion, disruption to natural slope stability, and landslide hazards. The County's development standards and guidelines, permit application review process, Section 15.08.240 of its Building Ordinance, the Grading Erosion and Sediment Control Ordinance (Chapter 15.36 of the Alameda County General Ordinance Code), the Stormwater Management and Discharge Control Ordinance (Chapter 13.08), and Subdivision Ordinance (Title 16) shall serve to implement this policy.

Alameda County Code of Ordinances

In the Code of Ordinances, Chapter 15.08, *Building Code*, the County sets forth requirements for new construction in areas affected by seismic and geologic hazards. The code requires that the project proponent submit soil and geotechnical reports before the County will permit construction of a foundation. In addition, Chapter 15.36, *Grading Erosion and Sediment Control*, known as the grading ordinance, sets forth requirements for grading, construction, and the control of erosion and sediments in order to safeguard human health and property, protect waterways, and ensure that the graded site is prepared in accordance with the general plan.

Alameda County Stormwater Management Plan

The Alameda County Clean Water Program's (ACCWP) Stormwater Management Plan for unincorporated Alameda County is discussed in Section 3.9, *Hydrology and Water Quality*.

Alameda County East County Area Plan

The ECAP sets forth the following goals, policies, and implementation programs to minimize the risks related to seismic hazards (Alameda County 2000) and open space.

Hazard Zones

Goal: To minimize the risks to lives and property due to environmental hazards.

Policy 134: The County shall not approve new development in areas with potential **natural hazards** (flooding, geologic, wildland fire, or other environmental hazards) unless the County can determine that feasible measures will be implemented to reduce the potential risk to acceptable levels, based on site-specific analysis.

Policy 135: The County, prior to approving new development, shall evaluate the degree to which the development could result in loss of lives or property, both within the development and beyond its boundaries, in the event of a **natural disaster**.

Environmental Hazards

Soil and Slope Stability

Goal: To minimize the risks to lives and property due to soil and slope instability hazards.

Policy 307: The County shall encourage Zone 7, cities, and agricultural groundwater users to limit the withdrawal of groundwater in order to minimize the potential for **land subsidence**.

Policy 308: The County shall not permit development within any area outside the Urban Growth Boundary exceeding 25 percent slopes to minimize hazards associated with slope instability.

Seismic and Geologic Hazards

Goal: To minimize the risks to lives and property due to seismic and geologic hazards.

Policy 309: The County shall not approve new development in areas with potential for seismic and geologic hazards unless the County can determine that feasible measures will be implemented to reduce the potential risk to acceptable levels, based on site-specific analysis. The County shall review new development proposals in terms of the risk caused by seismic and geologic activity.

Policy 310: The County, prior to approving new development, shall evaluate the degree to which the development could result in loss of lives or property, both within the development and beyond its boundaries, in the event of a **natural disaster.**

Policy 311: The County shall ensure that new major public facilities, including emergency response facilities (e.g., hospitals and fire stations), and water storage, wastewater treatment and communications facilities, are sited in areas of low geologic risk.

Policy 312: The County shall ensure that major transportation facilities and pipelines are designed, to the extent feasible, to avoid or minimize crossings of active fault traces and to accommodate fault displacement without major damage that could result in long-term disruption of service.

Policy 313: The County shall require development in **hilly areas** to minimize potential erosion and disruption of natural slope stability which could result from grading, vegetation removal, irrigation, and drainage.

Policy 314: The County shall prohibit the construction of any structure intended for human occupancy within 50 feet on either side of the Calaveras, Greenville, or Verona earthquake fault zones as defined by the Alquist-Priolo Earthquake Fault Zoning Act.

Policy 315: The County shall require that buildings be designed and constructed to withstand groundshaking forces of a minor earthquake without damage, of a moderate earthquake without structural damage, and of a major earthquake without collapse of the structure. The County shall require that critical facilities and structures (e.g., hospitals, emergency operations centers) be designed and constructed to remain standing and functional following an earthquake.

Implementation Programs:

Program 111: The County shall delineate areas within East County where the potential for geologic hazards (including seismic hazards, landslides, and liquefaction) warrants preparation of detailed site specific geologic hazard assessments. Areas shall be delineated based upon data from published sources and field investigations. Maps shall be maintained and updated as new data become available. These maps shall not be used by the County to determine where hazardous conditions exist, but instead to identify the presence of conditions which warrant further study.

Program 112: The County shall develop detailed guidelines for preparation of site-specific geologic hazard assessments. These guidelines shall be prepared in consultation with the County Building Official, the County Engineer, County Geologist, County Counsel, and the County Risk

Manager, and shall ensure that site-specific assessments for development requiring discretionary permits are prepared according to consistent criteria.

General Open Space

Goal: To protect regionally significant open space and agricultural land from development

Policy 52: The County shall preserve open space areas for the protection of public health and safety, provision of recreational opportunities, production of natural resources (e.g., agriculture, wind power, and mineral extraction), protection of sensitive viewsheds, preservation of biological resources, and the physical separation between neighboring communities.

Environmental Setting

Topography

The program area is located in the Altamont Hills in the Diablo Range of the Coast Ranges. The Altamont Hills are situated between the eastern edge of Livermore Valley and the western edge of the San Joaquin Valley. Elevations in the program area range from approximately 100 feet above mean sea level (msl) on the far northeastern side of the program area to more than 2,100 feet above msl in the south. The topography in the project areas varies but overall is steep, with generally more smooth, rounded hills and ridges in the northern portion of the program area and steeper, more sharp-crested terrain in the southern portion of the program area.

The topography of the two project areas is summarized below.

- Golden Hills Project—The northern portion of the Golden Hills project area is in the more rounded hills of the program area, and elevations range from approximately 200 to 700 feet above msl. The southern portion of the project area is in the steeper terrain of the program area, and elevations here range from 500 to nearly 1,600 feet above msl.
- Patterson Pass Project—The Patterson Pass project area is the central portion of the program area in fairly steep, sharp-crested terrain. Elevations range from approximately 700 to 2,000 feet above msl.

Geology

Regional

The program area is in the east-central portion of California's Coast Ranges geomorphic province (e.g., Norris and Webb 1990: 359–363; California Geological Survey 2002: 3). The Coast Ranges province is characterized by en echelon (i.e., parallel to subparallel) northwest-trending mountain ranges formed by active uplift related to complex tectonics of the San Andreas fault/plate boundary system (Norris and Webb 1990: 359–380).

The eastern Coast Ranges are broadly antiformal (i.e., fold is convex, with oldest geologic units in the core). At the general latitude of the program area, they consist of a central *core* of Mesozoic units—primarily the Cretaceous Panoche Formation—flanked on the east by an upward younging sequence of marine and terrestrial sedimentary units that include the San Pablo Formation, a Miocene fanglomerate, and Quaternary alluvial deposits (Wagner et al. 1991).

Local

The bedrock geology of the program vicinity is shown in Figure 3.6-1. Graymer et al. have divided the geology of Alameda County into nine stratigraphic assemblages, each of which is a fault-bounded block. Two of these assemblages, VI and XI, occur in the program area. A description of these assemblages, rather than the individual geologic units, is provided here because of the large extent of the program area.

Assemblage VI makes up most of the program area. This assemblage is bounded by the Greenville fault to the west and the Carnegie fault to the south. The northern half of the assemblage is made up of the Great Valley Sequence, which consists primarily of sandstone and interbedded sandstone and shale of Cretaceous age. The southern half of the assemblage is made up of massive marine sandstone and basal conglomerate of the late Miocene Cierbo Sandstone (Tc) and Neroly Formation (Tn) (California Geological Survey 2009a: 27–30). The Cierbo Sandstone is a light gray to white, thick-bedded, fine- to coarse-grained, moderately consolidated, quartz sandstone. In some locations it contains abundant mollusk fossils. The Neroly Sandstone is a blue sandstone with minor conglomerate (Graymer et al. 1996: 12).

Assemblage XI is a wedge-shaped block in the southwest corner of the program area, bounded by the Carnegie fault to north and the Greenville fault to the west. Most of this assemblage is made up of Miocene sedimentary deposits, primarily the Neroly sandstone and Tesla Formation. The Tesla Formation is a marine to brackish water sandstone. The extreme southern edge of the assemblage in the program area is made up the sandstones of the Great Valley Sequence (California Geological Survey 2009a: 27–30).

The geology of the two project areas is summarized below.

- Golden Hills Project—In the northern portion of the Golden Hills project area, the geologic unit exposed at the surface is a Cretaceous sandstone (Kd on Figure 3.6-1). In the southern portion of the project area, the units exposed are a Cretaceous shale in the center (Kcu), the Cretaceous sandstone (Kd) to the west and east of the shale, the Miocene Cierbo sandstone (Tc) to the west and east of the Cretaceous sandstone, and the Miocene Neroly Formation (Tn) on the eastern edge of the Cierbo Sandstone.
- Patterson Pass Project—The geologic units exposed at the surface in the Patterson Pass project area are the Cretaceous shale (Kcu on Figure 3.6-1) to the north, the Miocene Cierbo Sandstone (Tc) in the center, and the Miocene Neroly Formation (Tn) to the south.

Seismicity

Primary Seismic Hazards

The State of California considers two aspects of earthquake events as primary seismic hazards: surface fault rupture (i.e., visual disruption of the Earth's surface as a result of fault activity) and seismic ground shaking.

Surface Fault Rupture

There is a risk of surface rupture in the program area because two active faults (the Marsh Creek section of the Greenville fault zone and the Corral Hollow-Carnegie fault zone) occur in the program area. In addition, another active fault (the Los Positas fault) is just west of the program area. Alameda County is in a seismically active region and Alquist-Priolo earthquake fault zone maps have

been prepared for much of the county (California Geological Survey 2007). One of these maps covers the western portion of the program area, which is in an Alquist-Priolo earthquake fault zone. Two active faults have been mapped as part of this study: the Greenville fault zone (California Division of Mines and Geology 1982), specifically the Marsh Creek-Greenville section, and the Los Positas fault (Figure 3.6-2). The Greenville fault zone is a northwest trending strike-slip fault zone that is approximately 30 miles long, extending from the Tassajara quadrangle (just north of Livermore quadrangle) to the Eylar quadrangle (in Santa Clara County) along the western side of the Diablo Range (California Division of Mines and Geology 1981: 3; Bryant and Cluett 2002: 1; California Geological Survey 2007). The Marsh Creek section of the Greenville fault occurs on the western edge of the program area. The fault is active, with some segments having been active historically (including portions that showed minor rupture during the Livermore Valley quake in 1980) and other segments active in the last 11,000 to 15,000 years (California Geological Survey 2010; Bryant and Cluett 2002: 1) (Figure 3.6-2). The Los Positas fault is an east-west trending fault just west of the APWRA that has been active in the last 200 years (California Division of Mines and Geology 1981).

The third active fault in the program area is the Corral Hollow-Carnegie fault zone, portions of which have been active in the last 15,000 years (California Geological Survey 2010; U.S. Geological Survey 2013a) (Figure 3.6-2).

It should also be noted that the Midway fault extends through the eastern edge of the program area. Although the U.S. Geological Survey (USGS) Quaternary Fault Database (2013b) and California Geological Survey (2010) designate this fault as potentially active (i.e., experienced movement in the last 130,000 years), rather than active (i.e., experienced movement in the last 11,000 years), work conducted by Unruh and Krug (2007:17) for the USGS concluded "that the Midway fault is an active structure that primarily accommodates strike-slip displacement."

The surface fault rupture potential of the two project areas is summarized below.

- Golden Hills Project—Although no portion of the Golden Hills project area is within an Alquist-Priolo earthquake fault zone or near a segment of a fault designated as active, a portion of the Golden Hills project area does overlie a segment of the Corral Hollow-Carnegie fault zone designated as Quaternary undifferentiated (i.e., the date of the most recent rupture has not been determined) (California Geological Survey 2010) (Figure 3.6-2). This occurs at the northern end of the fault trace. The Marsh Creek section of the Greenville fault zone is near the Golden Hills project area, but the project area does not cross or come within 50 feet of this fault zone.
- Patterson Pass Project—No portion of the Patterson Pass project area is located near a Quaternary fault trace.

Seismic Ground Shaking

Unlike surface rupture, ground shaking is not confined to the trace of a fault, but rather ground shaking propagates into the surrounding areas during an earthquake. The intensity of ground shaking typically diminishes with distance from the fault, but ground shaking may be locally amplified and/or prolonged by some types of substrate materials. These factors are used to map the probabilistic shaking hazards throughout the state.

Based on the probabilistic seismic hazard map, which depicts the peak horizontal ground acceleration values exceeded at a 10% probability in 50 years (California Geological Survey 2003; Cao et al. 2003), the probabilistic peak horizontal ground acceleration values for the program area

range from 0.2g to 0.5g (where g equals the acceleration of gravity) (Figure 3.6-3). As a point of comparison, probabilistic peak horizontal ground acceleration values for the San Francisco Bay Area range from 0.4g to more than 0.8g. The acceleration value for the program area indicates a moderate ground-shaking hazard (Figure 3.6-3).

The main source of strong ground shaking is the Greenville fault zone, which has experienced movement as recently as 1980 during the Livermore Valley earthquake (Figure 3.6-2). The Greenville fault zone extends along the eastern edge of the Livermore Valley and is considered to be part of the larger San Andreas fault system (Bryant and Cluett 2002: 1). Other active faults in the project vicinity include the Hayward-Rogers Creek fault, the Los Positas fault (associated with the Greenville fault), and the Calaveras fault.

The seismic ground-shaking potential of the two project areas is summarized below.

- Golden Hills Project—The probabilistic peak horizontal ground acceleration values for the Golden Hills project area range from 0.2g to 0.5g—the same as for the entire program area.
- Patterson Pass Project— The probabilistic peak horizontal ground acceleration values for the Patterson Pass project area also range from 0.2g to 0.5g, with most of the project area in the higher end of the shaking intensity range.

Secondary Seismic Hazards

Secondary seismic hazards are seismically induced landslide, liquefaction, and related types of ground failure events. As discussed in *Regulatory Setting* in Section 3.6.1, *Existing Conditions*, the State of California maps areas that are subject to secondary seismic hazards pursuant to the Seismic Hazards Mapping Act. These hazards are addressed briefly below based on available information.

Landslide and Other Slope Stability Hazards

Several square miles on the western side of the program area are in earthquake-induced landslide hazard zones (California Geological Survey 2009a, 2000b) (Figure 3.6-4). These zones are designated as a Zone of Required Investigation for landslide hazard by the State of California.

According to the California Geological Survey (2009b: Section 2, page 25):

> Earthquake-induced landslide zone maps are intended to prompt more detailed, site-specific geotechnical investigations as required by the Act. As such, these zone maps identify areas where the potential for earthquake-induced landslides is relatively high. Due to limitations in methodology, it should be noted that these zone maps do not necessarily capture all potential earthquake-induced landslide hazards. Earthquake-induced ground failures that are not addressed by this map include those associated with ridge-top spreading and shattered ridges. It should also be noted that no attempt has been made to map potential run-out areas of triggered landslides. It is possible that run out areas extend beyond the zone boundaries.

The landslide zones tend to be concentrated in areas where the slopes are steeper and/or rock strengths are weaker. Numerous historically active landslides occur along the Greenville fault. Many of the moderate to large rockslides are underlain by the Miocene units of the Neroly Sandstone (Tn), Oro Loma Formation (Tol), and Tesla Formation (Tte), and also the Cierbo Sandstone (Tc) but to a lesser extent. Steep slopes and proximity to faults appear to be the predominant causes of landsliding in the area (California Geological Survey 2009a: v and Section 2, pages 31–32).

Although the remainder of the program area is not in an earthquake-induced landslide hazard zone (California Geological Survey 2007), several factors make slope instability (both seismically and nonseismically induced) a concern in this area. These factors include the steep topography, the potential for moderate ground shaking, and the proximity to areas designated as landslide hazard zones. In addition, slope stability related to precipitation is also factor in the program area (see *Slope Stability [Nonseismic-Related]* below).

Liquefaction and Related Ground Failure

Liquefaction is the process in which soils and sediments lose shear strength and fail during seismic ground shaking. The vibration caused by an earthquake can increase pore pressure in saturated materials. If the pore pressure is raised to be equivalent to the load pressure, this causes a temporary loss of shear strength, allowing the material to flow as a fluid. This temporary condition can result in severe settlement of foundations and slope failure. The susceptibility of an area to liquefaction is determined largely by the depth to groundwater and the properties (e.g., grain size, density, degree of consolidation) of the soil and sediment within and above the groundwater. The sediments most susceptible to liquefaction are saturated, unconsolidated sand and silt within 40 feet of the ground surface. According to the CGS report prepared for the adjacent Altamont quadrangle, CGS evaluations focus on areas covered by Quaternary (less than about 1.6 million years) sedimentary deposits (California Geological Survey 2009a : Section1, pages 2–4). Improperly compacted artificial fill may also be susceptible to liquefaction.

Although a portion of the program area is in a seismic hazard zone (California Geological Survey 2007), no liquefaction hazard zones are mapped in the program area (Figure 3.6-4). Because the depth to groundwater in the foothills, which are outside the groundwater basin, is generally greater than 60 feet (California Geological Survey 2009a: Section 1, page 9), the liquefaction hazard in the program area is likely low. In addition, the ages of the rock units in the APWRA are generally Tertiary and Cretaceous, which are older than most liquefiable sediments. However, landslide deposits may be less consolidated and, therefore, more susceptible to liquefaction.

Other types of ground failure related to liquefaction include lateral spreading and differential settlement. Lateral spreading is a failure of soil/sediment within a nearly horizontal zone that causes the soil to move toward a free face (such as a streambank or canal) or down a gentle slope. Lateral spreading can occur on slopes as gentle as 0.5%. Even a relatively thin layer of liquefiable sediment can create planes of weakness that could cause continuous lateral spreading over large areas (California Geological Survey 2008: 36).

The potential for lateral spreading in the project area is unknown.

Differential settlement—the uneven settling of soil—is the most common fill displacement hazard (California Geological Survey 2008: 56). The potential for differential settlement is unknown because its determination requires site-specific testing.

Slope Stability (Nonseismic-Related)

Nonseismic-related landsliding is common in the APWRA.

In 1998, heavy rainfall caused widespread landsliding in the 10-county San Francisco Bay region. As a result, USGS geologists conducted a landslide inventory of the affected counties, including Alameda County. Figure 3.6-5 shows the landslides that were mapped in and near the program area, including one very near the Patterson Pass project area. However, because of the extent of the landsliding,

only landslides associated with damage to the built environment were mapped (U.S. Geological Survey 1999: 2 and map). Because the program area is in a rural area, many landslides are not shown.

In addition, the wide extent of landsliding in and around the program area is further exemplified by the omission of landslides from the bedrock geologic map of Alameda County "because they are so numerous they would conceal much of the information on bedrock geology" (Graymer et al. 1996:6).

Soils

Because the program area is large, the soils are best described at a landscape scale, rather than at a detailed scale. Natural Resources Conservation Service maps soils at a landscape scale by mapping soil associations. Soil associations are groupings of individual soils that occur together in a repeating pattern on the landscape and are typically named after the two or three dominant soil series.

Several soil associations occur in the program area (Figure 3.6-6). Table 3.6-1 summarizes important issues of concern related to suitability for construction. The primary issue of concern is the shrink-swell potential of the soils (i.e., linear extensibility or expansiveness). Many of the soils that make up the Fontana-Diablo-Altamont soil association, which occurs over most of the program area, have a high shrink-swell potential. Several other minor soil associations also have a high shrink-swell potential.

The soil associations of the two project areas are summarized below.

- Golden Hills Project—All of the Golden Hills project area is underlain by the Fontana-Diablo-Altamont soil association. As described in Table 3.6-1, two construction issues associated with the soils in this association are high shrink-swell potential and susceptibility to water erosion.
- Patterson Pass Project—Much of the Patterson Pass project area is also underlain by the Fontana-Diablo-Altamont soil association. In addition, the southeastern portion of the project area is underlain by the Carbona-Calla soil association. Some soils in this association have a high shrink-swell potential (Table 3.6-1).

Table 3.6-1. General Characteristics of Soil Associations in the Program Area

Map Symbol	Soil Association	Location and Characteristics
s697	San Ysidro-Rincon	Occurs in northeast corner of program area. Some soils in this association are susceptible to wind erosion.
s694	Fontana-Diablo-Altamont	Dominant soil association in program area; occurs over most of the area. Most soils in this association have a high shrink-swell potential. Some soils in this association have a higher susceptibility to water erosion.
s863	Carbona-Capay-Calla	Occurs in the east-central edge of program area. All soils in this association have a moderate to high shrink-swell potential.
s864	Carbona-Calla	Occurs in the east-central portion of program area. Most soils in this association have a moderate to very high shrink-swell potential.
s792	Wisflat-Badland-Arburua	Small area occurs in the southeast edge of program area. Several soils in this association have a high shrink-swell potential. Some soils in this association have a higher susceptibility to water erosion.
s892	Vallecitos-Honker-Gonzaga-Franciscan	Small area occurs in the south edge of program area. Most soils in this association have a moderate to high shrink-swell potential.
s970	Vallecitos-Parrish-Los Gatos-Gaviota	Small area occurs in the southwest edge of program area. Most soils in this association have a moderate to high shrink-swell potential.

Source: Natural Resources Conservation Service 2006.

Mineral Resources

There are no known mineral resources in the program area. According to the California Division of Mines and Geology land classification map prepared for the South San Francisco Bay Production-Consumption (P-C) Region, which includes Alameda County, there no areas designated as MRZ-2 (Kohler-Antablin 1996: viii and Plate 17). No mining is known to occur in the area. In addition, the general plan does not identify mineral resources in the program area.

Paleontological Resources

Paleontological sensitivity is a qualitative assessment based on the paleontological potential of the stratigraphic units present, the local geology and geomorphology, and other factors relevant to fossil preservation and potential yield. According to the Society of Vertebrate Paleontology (SVP) (2010), standard guidelines for sensitivity are (1) the potential for a geological unit to yield abundant or significant vertebrate fossils or to yield a few significant fossils, large or small, vertebrate, invertebrate, or paleobotanical remains and (2) the importance of recovered evidence for new and significant taxonomic, phylogenetic, paleoecological, or stratigraphic data (Table 3.6-2).

Table 3.6-2. Paleontological Sensitivity Ratings

Potential	Definition
High	Rock units from which vertebrate or significant invertebrate, plant, or trace fossils have been recovered are considered to have a high potential for containing additional significant paleontological resources…Paleontological potential consists of both (a) the potential for yielding abundant or significant vertebrate fossils or for yielding a few significant fossils, large or small, vertebrate, invertebrate, plant, or trace fossils and (b) the importance of recovered evidence for new and significant taxonomic, phylogenetic, paleoecologic, taphonomic, biochronologic, or stratigraphic data.
Undetermined	Rock units for which little information is available concerning their paleontological content, geologic age, and depositional environment are considered to have undetermined potential. Further study is necessary to determine if these rock units have high or low potential to contain significant paleontological resources.
Low	Reports in the paleontological literature or field surveys by a qualified professional paleontologist may allow determination that some rock units have low potential for yielding significant fossils. Such rock units will be poorly represented by fossil specimens in institutional collections, or based on general scientific consensus, will only preserve fossils in rare circumstances and the presence of fossils is the exception not the rule.
No	Some rock units, such as high-grade metamorphic rocks (such as gneisses and schists) and plutonic igneous rocks (such as granites and diorites), have no potential to contain significant paleontological resources. Rock units with no potential require neither protection nor impact mitigation measures relative to paleontological resources.

Source: Society of Vertebrate Paleontology 2010.

Because of the large area of the program area and the many geologic units that occur in that area, it is not possible to make a determination of the sensitivity for paleontological resources of each unit. However, most of the geologic units in the APWRA are likely highly sensitive for paleontological resources, based primarily on rock type. Both assemblages in the APWRA (see discussion under *Geology*) are made up of sedimentary rocks, such as sandstone and shale. These rocks, in general, have a high potential to contain paleontological resources. In addition, some of these units are known to contain fossils. For example, the University of California Museum of Paleontology (UCMP) database contains four records of mammal fossils in the Neroly Formation (University of California Museum of Paleontology 2013a). Another example is the Great Valley Sequence, which contains units with a diverse assemblage of invertebrates, plus marine reptiles and numerous types of plants (Paleo Portal 2013).

It should also be noted that the UCMP database contains 1,241 records of vertebrate fossils in Alameda County. However, most of these records are from geologic units not found in the program area. (University of California Museum of Paleontology 2013b).

The paleontological resources of the two project areas is summarized below.

- Golden Hills Project—The Golden Hills project area is underlain by Cretaceous and Miocene sedimentary units with potential to contain sensitive paleontological resources. These units include Cretaceous sandstone and shale (Kd and Kcu on Figure 3.6-1), the Miocene Cierbo Sandstone (Tc), and the Miocene Neroly Formation (Tn).

- Patterson Pass Project—The Patterson Pass project area is also underlain by Cretaceous and Miocene sedimentary units with potential to contain sensitive paleontological resources. These units include Cretaceous shale (Kcu on Figure 3.6-1), the Miocene Cierbo Sandstone (Tc), and the Miocene Neroly Formation (Tn).

3.6.2 Environmental Impacts

The impacts associated with the exposure of the program and two individual projects to the existing known geologic and soil hazards, mineral resources, and paleontological resources are discussed below. Mitigation measures are provided, where appropriate.

Methods for Analysis

Evaluation of the geology and soil impacts in this section is based on information from published maps, reports, and other documents that describe the geologic, seismic, soil, and mineral resource conditions of the program area, and on professional judgment. The analysis assumes that the project proponents will conform to the latest CBSC standards, county general plan seismic safety standards, county grading ordinance, and NPDES requirements.

The primary source of information used in developing the paleontological resources section is the paleontological database at the University of California, Berkeley. Effects on paleontological resources were analyzed qualitatively on a large-scale level, based on professional judgment and the SVP guidelines below.

SVP's *Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources* provides standard guidelines that are widely followed (Society of Vertebrate Paleontology 2010). These guidelines reflect the accepted standard of care for paleontological resources. The SVP guidelines identify two key phases in the process for protecting paleontological resources from project impacts.

- Assess the likelihood that the area contains significant nonrenewable paleontological resources that could be directly or indirectly impacted, damaged, or destroyed as a result of the project.
- Formulate and implement measures to mitigate potential adverse impacts.

An important strength of SVP's approach to assessing potential impacts on paleontological resources is that the SVP guidelines provide some standardization in evaluating paleontological sensitivity. Table 3.6-3 defines the SVP's sensitivity categories for paleontological resources and summarizes SVP's recommended treatments to avoid adverse effects in each sensitivity category.

No new field work, research, or engineering level design was conducted for the preparation of this EIR.

Table 3.6-3. Society of Vertebrate Paleontology's Recommended Treatment for Paleontological Resources

Sensitivity Category	Mitigation Treatment
High or Undetermined	• An intensive field survey and surface salvage prior to earthmoving, if applicable. • Monitoring by a qualified paleontological resource monitor of excavations. • Salvage of unearthed fossil remains and/or traces (e.g., tracks, trails, burrows). • Screen washing to recover small specimens, if applicable. • Preliminary survey and surface salvage before construction begins. • Preparation of salvaged fossils to a point of being ready for curation (i.e., removal of enclosing matrix, stabilization and repair of specimens, and construction of reinforced support cradles where appropriate). • Identification, cataloging, curation, and provision for repository storage of prepared fossil specimens. • A final report of the finds and their significance.
Low or no	Rock units with low or no potential typically will not require impact mitigation measures to protect fossils.

Source: Society of Vertebrate Paleontology 2010.

Determination of Significance

In accordance with Appendix G of the State CEQA Guidelines, program Alternative 1, program Alternative 2, the Golden Hills project, or the Patterson Pass project would be considered to have a significant effect if it would result in any of the conditions listed below.

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving any of the following.
    - 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).
    - Strong seismic ground shaking.
    - Seismic-related ground failure, including liquefaction.
    - Landslides.
- Result in substantial soil erosion or the loss of topsoil.
- Be located on expansive soil, creating substantial risks to life or property.
- Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems in areas where sewers are not available for the disposal of wastewater?
- 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.
- 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.

- Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.

The program would not include installation of septic systems or alternative wastewater disposal. Therefore this topic was dismissed from further discussion during the scoping period and there is no need to address impacts related to this CEQA checklist criterion.

In addition, the program would not affect mineral resources because there are no known mineral resources in the program area and no mining is known to occur in the area. Therefore, there is no need to address impacts related to this CEQA checklist criterion.

Impacts and Mitigation Measures

Impact GEO-1a-1: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, as a result of rupture of a known earthquake fault—program Alternative 1: 417 MW (less than significant with mitigation)

Placement of a turbine or power collection system on or near a fault could result in damage or destruction of the turbine. If a turbine were constructed on or near a fault, rupture of that fault could damage a turbine or cause harm to personnel on the site. The turbine could be damaged or collapse and possibly injure personnel or property in the immediate area.

Two active faults, two of which are zoned under the Alquist-Priolo Act, are present in the program area. In addition, a third, the Midway fault, though designated only as potentially active, also occurs in the program area. Rupture of a fault and the subsequent damage and harm that could result would be a significant impact.

A portion of the Greenville fault zone in the program area is a Special Studies Zone; however, because the turbines are not designed for human occupancy, they are not regulated by the Alquist-Priolo Act. The County would nevertheless require geotechnical investigation before the County approves construction near the Greenville and Corral Hollow-Carnegie fault zones because they are designated as active by the state. However, this may not address all seismic-related safety issues and may not apply to the Midway fault, which is designated as potentially active by the state. If the turbine foundation and power collection system design and construction were not based on rigorous, detailed, site-specific geotechnical investigation, the foundation or collection system could be located on or near a fault trace that ruptures and causes damage to or collapse of the turbine or collection system.

This impact would be significant, but implementation of Mitigation Measure GEO-1 would reduce this impact to a less-than-significant level.

Mitigation Measure GEO-1: Conduct site-specific geotechnical investigation and implement design recommendations in subsequent geotechnical report

Prior to construction activities at any site, the project proponent will retain a geotechnical firm with local expertise in geotechnical investigation and design to prepare a site-specific geotechnical report. This report will be prepared by a licensed geotechnical engineer or engineering geologist and will be submitted to the County building department as part of the approval process. This report will be based on data collected from subsurface exploration, laboratory testing of samples, and surface mapping and will address the following issues.

- Potential for surface fault rupture and turbine site location: The geotechnical report will investigate the Greenville, Corral Hollow-Carnegie, and the Midway faults (as appropriate to the location) and determine whether they pose a risk of surface rupture. Turbine foundations and power collection systems will be sited according to recommendations in this report.
- Strong ground shaking: The geotechnical report will analyze the potential for strong ground shaking in project area and provide turbine foundation design recommendations, as well as recommendations for power collection systems.
- Slope failure: The geotechnical report will investigate the potential for slope failure (both seismically and nonseismically induced) and develop site-specific turbine foundation and power collection system plans engineered for the terrain, rock and soil types, and other conditions present at the program area in order to provide long-term stability.
- Expansive soils: The geotechnical report will assess the soil types in the program area and determine the best engineering designs to accommodate the soil conditions.
- Unstable cut or fill slopes: The geotechnical report will address geologic hazards related to the potential for grading to create unstable cut or fill slopes and make site-specific recommendations related to design and engineering.

Impact GEO-1a-2: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, as a result of rupture of a known earthquake fault—program Alternative 2: 450 MW (less than significant with mitigation)

Placement of a turbine or power collection system on or near a fault could result in damage or destruction of the turbine. If a turbine were constructed on or near a fault, rupture of that fault could damage a turbine or cause harm to personnel on the site. The turbine could be damaged or collapse and possibly injure personnel or property in the immediate area.

Two active faults, two of which are zoned under the Alquist-Priolo Act, are present in the program area. In addition, a third, the Midway fault, though designated only as potentially active, also occurs in the program area. Rupture of a fault and the subsequent damage and harm that could result would be a significant impact.

A portion of the Greenville fault zone in the program area is a Special Studies Zone; however, because the turbines are not designed for human occupancy, they are not regulated by the Alquist-Priolo Act. The County would nevertheless require geotechnical investigation before the County approves construction near the Greenville and Corral Hollow-Carnegie fault zones because they are designated as active by the state. However, this may not address all seismic-related safety issues and may not apply to the Midway fault, which is designated as potentially active by the state. If the turbine foundation and power collection system design and construction were not based on rigorous, detailed, site-specific geotechnical investigation, the foundation or collection system could be located on or near a fault trace that ruptures and causes damage to or collapse of the turbine or collection system.

This impact would be significant, but implementation of Mitigation Measure GEO-1 would reduce this impact to a less-than-significant level.

Mitigation Measure GEO-1: Conduct site-specific geotechnical investigation and implement design recommendations in subsequent geotechnical report

Impact GEO-1b: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, as a result of rupture of a known earthquake fault—Golden Hills Project (less than significant with mitigation)

Placement of a turbine or power collection system on or near a fault could result in damage or destruction of the turbine. If a turbine were constructed on or near a fault, rupture of that fault could damage a turbine or cause harm to personnel on the site. The turbine could be damaged or collapse and possibly injure personnel or property in the immediate area.

A portion of the Golden Hills project area overlies a segment of the Corral Hollow-Carnegie fault zone designated as Quaternary undifferentiated (i.e., the date of the most recent rupture has not been determined). As discussed under Impact GEO-1a-1 and GEO-1a-2, if a turbine were constructed on or near a fault, rupture of that fault could damage a turbine or cause harm to personnel on the site. The turbine could be damaged or collapse and possibly injure personnel or property in the immediate area. If the turbine foundation and power collection system design and construction were not based on rigorous, detailed, site-specific geotechnical investigation, the foundation or collection system could be located on or near a fault trace that ruptures and causes damage to or collapse of the turbine or collection system.

This impact would be significant, but implementation of Mitigation Measure GEO-1 would reduce this impact to a less-than-significant level.

Mitigation Measure GEO-1: Conduct site-specific geotechnical investigation and implement design recommendations in subsequent geotechnical report

Impact GEO-1c: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, as a result of rupture of a known earthquake fault—Patterson Pass Project (less than significant)

Placement of a turbine or power collection system on or near a fault could result in damage or destruction of the turbine. If a turbine were constructed on or near a fault, rupture of that fault could damage a turbine or cause harm to personnel on the site. The turbine could be damaged or collapse and possibly injure personnel or property in the immediate area.

There are no active fault traces in or near the Patterson Pass project area. Therefore, construction of the project would be unlikely to expose people or structures to potential substantial adverse effects as a result of rupture of a known fault. This impact would be less than significant. No mitigation is required.

Impact GEO-2a-1: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, as a result of strong seismic ground shaking—program Alternative 1: 417 MW (less than significant with mitigation)

Construction of turbines or power collection systems in areas with potential to experience strong ground shaking could expose people or structures to potential substantial adverse effects. If turbine foundations were not properly designed to withstand the appropriate level of ground shaking, they could fail and cause damage to or collapse of the turbine towers. This damage or collapse could cause harm to personnel or property in the immediate area.

The program area is in a seismically active area, with the potential for moderately strong ground shaking from sources such as the Greenville fault and the Calaveras fault. The potential damage and harm that could result from moderately strong ground shaking would be a significant impact.

Both the State of California and Alameda County have stringent building safety requirements, and all construction would have to comply with the CBSC. However, this may not address all seismic-related safety issues. If the turbine foundation and power collection system design and construction were not based on rigorous, detailed, site-specific geotechnical investigation, the foundation or collection system could fail during strong ground shaking and cause damage to or collapse of the turbine or collection system.

This impact would be significant, but implementation of Mitigation Measure GEO-1 would reduce this impact to a less-than-significant level.

Mitigation Measure GEO-1: Conduct site-specific geotechnical investigation and implement design recommendations in subsequent geotechnical report

Impact GEO-2a-2: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, as a result of strong seismic ground shaking—program Alternative 2: 450 MW (less than significant with mitigation)

Construction of turbines or power collection systems in areas with potential to experience strong ground shaking could expose people or structures to potential substantial adverse effects. If turbine foundations were not properly designed to withstand the appropriate level of ground shaking, they could fail and cause damage to or collapse of the turbine towers. This damage or collapse could cause harm to personnel or property in the immediate area.

The program area is in a seismically active area, with the potential for moderately strong ground shaking from sources such as the Greenville fault and the Calaveras fault. The potential damage and harm that could result from moderately strong ground shaking would be a significant impact.

Both the State of California and Alameda County have stringent building safety requirements, and all construction would have to comply with the CBSC. However, this may not address all seismic-related safety issues. If the turbine foundation and power collection system design and construction were not based on rigorous, detailed, site-specific geotechnical investigation, the foundation or collection system could fail during strong ground shaking and cause damage to or collapse of the turbine or collection system.

This impact would be significant, but implementation of Mitigation Measure GEO-1 would reduce this impact to a less-than-significant level.

Mitigation Measure GEO-1: Conduct site-specific geotechnical investigation and implement design recommendations in subsequent geotechnical report

Impact GEO-2b: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, as a result of strong seismic ground shaking—Golden Hills Project (less than significant with mitigation)

Construction of turbines or power collection systems in areas with potential to experience strong ground shaking could expose people or structures to potential substantial adverse effects. If turbine foundations were not properly designed to withstand the appropriate level of ground shaking, they

could fail and cause damage to or collapse of the turbine towers. This damage or collapse could cause harm to personnel or property in the immediate area.

The range of shaking intensity in the Golden Hills project area extends across all shaking intensities experienced in the program area, from low to high. The potential damage and harm that could result from moderately strong ground shaking would be a significant impact.

Both the State of California and Alameda County have stringent building safety requirements, and all construction would have to comply with the CBSC. However, this may not address all seismic-related safety issues. If the turbine foundation and power collection system design and construction were not based on rigorous, detailed, site-specific geotechnical investigation, the foundation or collection system could fail during strong ground shaking and cause damage to or collapse of the turbine or collection system.

Implementation of Mitigation Measure GEO-1 would reduce this impact to a less-than-significant level.

Mitigation Measure GEO-1: Conduct site-specific geotechnical investigation and implement design recommendations in subsequent geotechnical report

Impact GEO-2c: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, as a result of strong seismic ground shaking—Patterson Pass Project (less than significant with mitigation)

Construction of turbines or power collection systems in areas with potential to experience strong ground shaking could expose people or structures to potential substantial adverse effects. If turbine foundations were not properly designed to withstand the appropriate level of ground shaking, they could fail and cause damage to or collapse of the turbine towers. This damage or collapse could cause harm to personnel or property in the immediate area.

The range of shaking intensity in the Patterson Pass project area is on the higher end of shaking intensities experienced in the program area. The potential damage and harm that could result from moderately strong ground shaking would be a significant impact.

Both the State of California and Alameda County have stringent building safety requirements, and all construction would have to comply with the CBSC. However, this may not address all seismic-related safety issues. If the turbine foundation and power collection system design and construction were not based on rigorous, detailed, site-specific geotechnical investigation, the foundation or collection system could fail during strong ground shaking and cause damage to or collapse of the turbine or collection system.

Implementation of Mitigation Measure GEO-1 would reduce this impact to a less-than-significant level.

Mitigation Measure GEO-1: Conduct site-specific geotechnical investigation and implement design recommendations in subsequent geotechnical report

Impact GEO-3a-1: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, as a result of seismic-related ground failure, including landsliding and liquefaction—program Alternative 1: 417 MW (less than significant with mitigation)

Construction of turbines or power collection systems in areas with potential to experience seismic-related ground failure, such as landsliding, liquefaction, lateral spread, and differential settlement, could expose people or structures to potential substantial adverse effects. If turbine foundations or power collection systems were not properly designed and sited for the earthquake-induced ground failure conditions present at the program area, they could fail and cause damage to or collapse of the turbine towers or collection system. This damage or collapse could cause harm to personnel or property in the immediate area.

The program area is known to be susceptible to earthquake-induced landsliding and the southwestern portion of the program area is in a state-designated earthquake-induced landslide hazard zone (Figure 3.6-4). In addition, although the potential for liquefaction is likely low because of the depth to groundwater and the age of the geologic units in the program area, the risk of lateral spread and differential settlement is unknown. The potential damage and harm that could result from landsliding, lateral spread, or differential settlement would be a significant impact.

Both the State of California and Alameda County have stringent building safety requirements, and all construction would have to comply with the CBSC. However, this may not address all seismic-related ground failure issues. If the turbine foundation and power collection system design and construction were not based on rigorous, detailed, site-specific geotechnical investigation, the foundation or collection system could fail as a result of landsliding, lateral spread, or differential settlement and cause damage to or collapse of the turbine or collection system.

This impact would be significant, but implementation of Mitigation Measure GEO-1 would reduce this impact to a less-than-significant level.

Mitigation Measure GEO-1: Conduct site-specific geotechnical investigation and implement design recommendations in subsequent geotechnical report

Impact GEO-3a-2: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, as a result of seismic-related ground failure, including landsliding and liquefaction—program Alternative 2: 450 MW (less than significant with mitigation)

Construction of turbines or power collection systems in areas with potential to experience seismic-related ground failure, such as landsliding, liquefaction, lateral spread, and differential settlement, could expose people or structures to potential substantial adverse effects. If turbine foundations or power collection systems were not properly designed and sited for the earthquake-induced ground failure conditions present at the program area, they could fail and cause damage to or collapse of the turbine towers or collection system. This damage or collapse could cause harm to personnel or property in the immediate area.

The program area is known to be susceptible to earthquake-induced landsliding and the southwestern portion of the program area is in a state-designated earthquake-induced landslide hazard zone (Figure 3.6-4). In addition, although the potential for liquefaction is likely low because of the depth to groundwater and the age of the geologic units in the program area, the risk of lateral

spread and differential settlement is unknown. The potential damage and harm that could result from landsliding, lateral spread, or differential settlement would be a significant impact.

Both the State of California and Alameda County have stringent building safety requirements, and all construction would have to comply with the CBSC. However, this may not address all seismic-related ground failure issues. If the turbine foundation and power collection system design and construction were not based on rigorous, detailed, site-specific geotechnical investigation, the foundation or collection system could fail as a result of landsliding, lateral spread, or differential settlement and cause damage to or collapse of the turbine or collection system.

This impact would be significant, but implementation of Mitigation Measure GEO-1 would reduce this impact to a less-than-significant level.

Mitigation Measure GEO-1: Conduct site-specific geotechnical investigation and implement design recommendations in subsequent geotechnical report

Impact GEO-3b: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, as a result of seismic-related ground failure, including landsliding and liquefaction—Golden Hills Project (less than significant with mitigation)

Construction of turbines or power collection systems in areas with potential to experience seismic-related ground failure, such as landsliding, liquefaction, lateral spread, and differential settlement, could expose people or structures to potential substantial adverse effects. If turbine foundations or power collection systems were not properly designed and sited for the earthquake-induced ground failure conditions present at the project area, they could fail and cause damage to or collapse of the turbine towers or collection system. This damage or collapse could cause harm to personnel or property in the immediate area.

The southwestern portion of the Golden Hills project area is in a state-designated earthquake-induced landslide hazard zone and the remaining area is in an area known to be susceptible to landsliding (Figure 3.6-4). In addition, although the potential for liquefaction is likely low because of the depth to groundwater and the age of the geologic units in the program area, the risk of lateral spread and differential settlement is unknown. The potential damage and harm that could result from landsliding, lateral spread, or differential settlement would be a significant impact.

Both the State of California and Alameda County have stringent building safety requirements, and all construction would have to comply with the CBSC. However, this may not address all seismic-related ground failure issues. If the turbine foundation and power collection system design and construction were not based on rigorous, detailed, site-specific geotechnical investigation, the foundation or collection system could fail as a result of landsliding, lateral spread, or differential settlement and cause damage to or collapse of the turbine or collection system.

This impact would be significant, but implementation of Mitigation Measure GEO-1 would reduce this impact to a less-than-significant level.

Mitigation Measure GEO-1: Conduct site-specific geotechnical investigation and implement design recommendations in subsequent geotechnical report

Impact GEO-3c: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, as a result of seismic-related ground failure, including landsliding and liquefaction—Patterson Pass Project (less than significant with mitigation)

Construction of turbines or power collection systems in areas with potential to experience seismic-related ground failure, such as landsliding, liquefaction, lateral spread, and differential settlement, could expose people or structures to potential substantial adverse effects. If turbine foundations or power collection systems were not properly designed and sited for the earthquake-induced ground failure conditions present at the project area, they could fail and cause damage to or collapse of the turbine towers or collection system. This damage or collapse could cause harm to personnel or property in the immediate area.

The Patterson Pass project area is in an area known to be susceptible to landsliding. In addition, although the potential for liquefaction is likely low because of the depth to groundwater and the age of the geologic units in the program area, the risk of lateral spread and differential settlement is unknown. The potential damage and harm that could result from landsliding, lateral spread, or differential settlement would be a significant impact.

Both the State of California and Alameda County have stringent building safety requirements, and all construction would have to comply with the CBSC. However, this may not address all seismic-related ground failure issues. If the turbine foundation and power collection system design and construction were not based on rigorous, detailed, site-specific geotechnical investigation, the foundation or collection system could fail as a result of landsliding, lateral spread, or differential settlement and cause damage to or collapse of the turbine or collection system.

This impact would be significant, but implementation of Mitigation Measure GEO-1 would reduce this impact to a less-than-significant level.

Mitigation Measure GEO-1: Conduct site-specific geotechnical investigation and implement design recommendations in subsequent geotechnical report

Impact GEO-4a-1: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, as a result of landsliding—program Alternative 1: 417 MW (less than significant with mitigation)

In addition to the seismic-related ground failure described in Impact GEO-3a-1 and GEO-3a-2, construction of turbines or power collection systems in areas with potential to experience nonseismic-related landsliding caused by heavy precipitation could also expose people or structures to potential substantial adverse effects. If turbine foundations or power collection systems were not properly designed and sited for the landsliding conditions present at the program area, they could fail and cause damage to or collapse of the turbine towers or collection system. This damage or collapse could cause harm to personnel or property in the immediate area.

The program area is in steep, hilly terrain in an area known to be susceptible to landsliding. The potential damage and harm that could result from landsliding would be a significant impact.

Both the State of California and Alameda County have stringent building safety requirements, and all construction would have to comply with the CBSC. However, this may not address all seismic-related landsliding issues. If the turbine foundation and power collection system design and construction were not based on rigorous, detailed, site-specific geotechnical investigation, the foundation or

collection system could fail as a result of landsliding and cause damage to or collapse of the turbine or collection system.

This impact would be significant, but implementation of Mitigation Measure GEO-1 would reduce this impact to a less-than-significant level.

Mitigation Measure GEO-1: Conduct site-specific geotechnical investigation and implement design recommendations in subsequent geotechnical report

Impact GEO-4a-2: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, as a result of landsliding—program Alternative 2: 450 MW (less than significant with mitigation)

In addition to the seismic-related ground failure described in Impact GEO-3a-1 and GEO-3a-2, construction of turbines or power collection systems in areas with potential to experience nonseismic-related landsliding caused by heavy precipitation could also expose people or structures to potential substantial adverse effects. If turbine foundations or power collection systems were not properly designed and sited for the landsliding conditions present at the program area, they could fail and cause damage to or collapse of the turbine towers or collection system. This damage or collapse could cause harm to personnel or property in the immediate area.

The program area is in steep, hilly terrain in an area known to be susceptible to landsliding. The potential damage and harm that could result from landsliding would be a significant impact.

Both the State of California and Alameda County have stringent building safety requirements, and all construction would have to comply with the CBSC. However, this may not address all seismic-related landsliding issues. If the turbine foundation and power collection system design and construction were not based on rigorous, detailed, site-specific geotechnical investigation, the foundation or collection system could fail as a result of landsliding and cause damage to or collapse of the turbine or collection system.

This impact would be significant, but implementation of Mitigation Measure GEO-1 would reduce this impact to a less-than-significant level.

Mitigation Measure GEO-1: Conduct site-specific geotechnical investigation and implement design recommendations in subsequent geotechnical report

Impact GEO-4b: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, as a result of landsliding—Golden Hills Project (less than significant with mitigation)

In addition to the seismic-related ground failure described in impact GEO-3b, construction of turbines or power collection systems in areas with potential to experience nonseismic-related landsliding caused by heavy precipitation could also expose people or structures to potential substantial adverse effects. If turbine foundations or power collection systems were not properly designed and sited for the landsliding conditions present at the project area, they could fail and cause damage to or collapse of the turbine towers or collection system. This damage or collapse could cause harm to personnel or property in the immediate area.

The program area, including the Golden Hills project area, is in steep, hilly terrain in an area known to be susceptible to landsliding. The potential damage and harm that could result from landsliding would be a significant impact.

Both the State of California and Alameda County have stringent building safety requirements, and all construction would have to comply with the CBSC. However, this may not address all seismic-related landsliding issues. If the turbine foundation and power collection system design and construction were not based on rigorous, detailed, site-specific geotechnical investigation, the foundation or collection system could fail as a result of landsliding and cause damage to or collapse of the turbine or collection system.

This impact would be significant, but implementation of Mitigation Measure GEO-1 would reduce this impact to a less-than-significant level.

Mitigation Measure GEO-1: Conduct site-specific geotechnical investigation and implement design recommendations in subsequent geotechnical report

Impact GEO-4c: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death as a result of landsliding—Patterson Pass Project (less than significant with mitigation)

In addition to the seismic-related ground failure described in impact GEO-3c, construction of turbines or power collection systems in areas with potential to experience nonseismic-related landsliding caused by heavy precipitation could also expose people or structures to potential substantial adverse effects. If turbine foundations or power collection systems were not properly designed and sited for the landsliding conditions present at the project area, they could fail and cause damage to or collapse of the turbine towers or collection system. This damage or collapse could cause harm to personnel or property in the immediate area.

The program area, including the Patterson Pass project area, is in steep, hilly terrain in an area known to be susceptible to landsliding. The potential damage and harm that could result from landsliding would be a significant impact.

Both the State of California and Alameda County have stringent building safety requirements, and all construction would have to comply with the CBSC. However, this may not address all seismic-related landsliding issues. If the turbine foundation and power collection system design and construction were not based on rigorous, detailed, site-specific geotechnical investigation, the foundation or collection system could fail as a result of landsliding and cause damage to or collapse of the turbine or collection system.

This impact would be significant, but implementation of Mitigation Measure GEO-1 would reduce this impact to a less-than-significant level.

Mitigation Measure GEO-1: Conduct site-specific geotechnical investigation and implement design recommendations in subsequent geotechnical report

Impact GEO-5a-1: Result in substantial soil erosion or the loss of topsoil—program Alternative 1: 417 MW (less than significant)

Ground-disturbing earthwork associated with construction of the proposed program may increase soil erosion rates. These activities, which include excavation, grading, trenching, compaction, and

road widening, would cause surface disturbance and vegetation removal during turbine foundation construction and power collection system and communication lines installation and, to a lesser extent, during preparation and decommissioning of the staging areas. As a result, soil would be exposed to rain and wind, potentially causing accelerated erosion, thereby resulting in significant impacts. In addition, if decommissioned sites were left unvegetated, the bare ground could be exposed to accelerated erosion.

Most soils in the program area are covered by grasses. Most unvegetated areas are associated with roads.

To address construction-related erosion, an approved SWPPP, as required by the applicable Regional Water Board, is required when a project involves 1 acre or more of disturbance. A SWPPP specifies BMPs that would prevent construction pollutants from contacting stormwater with the intent of keeping all products of erosion from moving offsite into receiving waters. Compliance with the federal and local erosion-related regulations applicable to the proposed program (i.e., the SWPPP that is developed for the site and the requirements of the county's Stormwater Quality Management Plan) would ensure that the construction activities do not result in significant erosion and that impacts would be reduced to a less-than-significant level.

To address erosion of decommissioned sites, as described in Chapter 2, *Program Description*, decommissioned sites will be regraded and seeded to preproject conditions (unless leaving certain roadways or footings is deemed to be more protective of natural resources than removal). The project applicants will develop a reclamation plan in coordination with the County, USFWS, and CDFW. The reclamation plan will be completed and approved by the County 6 months in advance of project decommissioning. Compliance with the reclamation plan would ensure that decommissioned sites do not result in significant erosion and that impacts would be reduced to a less-than-significant level.

Impact GEO-5a-2: Result in substantial soil erosion or the loss of topsoil—program Alternative 2: 450 MW (less than significant)

Ground-disturbing earthwork associated with construction of the proposed program may increase soil erosion rates. These activities, which include excavation, grading, trenching, compaction, and road widening, would cause surface disturbance and vegetation removal during turbine foundation construction and power collection system and communication lines installation and, to a lesser extent, during preparation and decommissioning of the staging areas. As a result, soil would be exposed to rain and wind, potentially causing accelerated erosion, thereby resulting in significant impacts.

Most soils in the program area are covered by grasses. Most unvegetated areas are associated with roads.

An approved SWPPP, as required by the applicable Regional Water Board, is required when a project involves 1 acre or more of disturbance. A SWPPP specifies BMPs that would prevent construction pollutants from contacting stormwater with the intent of keeping all products of erosion from moving offsite into receiving waters. Compliance with the federal and local erosion-related regulations applicable to the proposed program (i.e., the SWPPP that is developed for the site and the requirements of the county's Stormwater Quality Management Plan) would ensure that the construction activities do not result in significant erosion and that impacts would be reduced to a less-than-significant level.

To address erosion of decommissioned sites, as described in Chapter 2, *Program Description*, decommissioned sites will be regraded and seeded to preproject conditions (unless leaving certain roadways or footings is deemed to be more protective of natural resources than removal). The project applicants will develop a reclamation plan in coordination with the County, USFWS, and CDFW. The reclamation plan will be completed and approved by the County 6 months in advance of project decommissioning. Compliance with the reclamation plan would ensure that decommissioned sites do not result in significant erosion and that impacts would be reduced to a less-than-significant level.

Impact GEO-5b: Result in substantial soil erosion or the loss of topsoil—Golden Hills Project (less than significant)

Ground-disturbing earthwork associated with construction of the proposed project may increase soil erosion rates. These activities, which include excavation, grading, trenching, compaction, and road widening, would cause surface disturbance and vegetation removal during turbine foundation construction and power collection system and communication lines installation and, to a lesser extent, during preparation and decommissioning of the staging areas. As a result, soil would be exposed to rain and wind, potentially causing accelerated erosion, thereby resulting in significant impacts.

Most soils in the project area are covered by grasses. Most unvegetated areas are associated with roads.

An approved SWPPP, as required by the applicable Regional Water Board, is required when a project involves 1 acre or more of disturbance. A SWPPP specifies BMPs that would prevent construction pollutants from contacting stormwater with the intent of keeping all products of erosion from moving offsite into receiving waters. Compliance with the federal and local erosion-related regulations applicable to the proposed program (i.e., the SWPPP that is developed for the site and the requirements of the county's Stormwater Quality Management Plan) would ensure that the construction activities do not result in significant erosion and that impacts would be reduced to a less-than-significant level.

To address erosion of decommissioned sites, as described in Chapter 2, *Program Description*, decommissioned sites will be regraded and seeded to preproject conditions (unless leaving certain roadways or footings is deemed to be more protective of natural resources than removal). The project applicants will develop a reclamation plan in coordination with the County, USFWS, and CDFW. The reclamation plan will be completed and approved by the County 6 months in advance of project decommissioning. Compliance with the reclamation plan would ensure that decommissioned sites do not result in significant erosion and that impacts would be reduced to a less-than-significant level.

Impact GEO-5c: Result in substantial soil erosion or the loss of topsoil—Patterson Pass Project (less than significant)

Ground-disturbing earthwork associated with construction of the proposed project may increase soil erosion rates. These activities, which include excavation, grading, trenching, compaction, and road widening, would cause surface disturbance and vegetation removal during turbine foundation construction and power collection system and communication lines installation and, to a lesser extent, during preparation and decommissioning of the staging areas. As a result, soil would be

exposed to rain and wind, potentially causing accelerated erosion, thereby resulting in significant impacts.

Most soils in the project area are covered by grasses. Most unvegetated areas are associated with roads.

An approved SWPPP, as required by the applicable Regional Water Board, is required when a project involves 1 acre or more of disturbance. A SWPPP specifies BMPs that would prevent construction pollutants from contacting stormwater with the intent of keeping all products of erosion from moving offsite into receiving waters. Compliance with the federal and local erosion-related regulations applicable to the proposed program (i.e., the SWPPP that is developed for the site and the requirements of the county's Stormwater Quality Management Plan) would ensure that the construction activities do not result in significant erosion and that impacts would be reduced to a less-than-significant level.

To address erosion of decommissioned sites, as described in Chapter 2, *Program Description*, decommissioned sites will be regraded and seeded to preproject conditions (unless leaving certain roadways or footings is deemed to be more protective of natural resources than removal). The project applicants will develop a reclamation plan in coordination with the County, USFWS, and CDFW. The reclamation plan will be completed and approved by the County 6 months in advance of project decommissioning. Compliance with the reclamation plan would ensure that decommissioned sites do not result in significant erosion and that impacts would be reduced to a less-than-significant level.

Impact GEO-6a-1: Be located on expansive soil, creating substantial risks to life or property—program Alternative 1: 417 MW (less than significant with mitigation)

Turbine foundations built on expansive soils would be subject to the expansion and contraction of these soils, which could cause damage to structures if the subsoil, drainage, and foundation are not properly engineered. The metrological tower and underground systems would be subject to the same expansion and contraction.

Expansive soils occur in much of the program area, particularly in the Fontana-Diablo-Altamont soil association. However, soil sampling and treatment procedures are addressed by state and local building codes. Compliance with these codes and implementation of Mitigation Measure GEO-1 would ensure that this is a less-than-significant impact.

Mitigation Measure GEO-1: Conduct site-specific geotechnical investigation and implement design recommendations in subsequent geotechnical report

Impact GEO-6a-2: Be located on expansive soil, creating substantial risks to life or property—program Alternative 2: 450 MW (less than significant with mitigation)

Turbine foundations built on expansive soils would be subject to the expansion and contraction of these soils, which could cause damage to structures if the subsoil, drainage, and foundation are not properly engineered. The metrological tower and underground systems would be subject to the same expansion and contraction.

Expansive soils occur in much of the program area, particularly in the Fontana-Diablo-Altamont soil association. However, soil sampling and treatment procedures are addressed by state and local

building codes. Compliance with these codes and implementation of Mitigation Measure GEO-1 would ensure that this is a less-than-significant impact.

Mitigation Measure GEO-1: Conduct site-specific geotechnical investigation and implement design recommendations in subsequent geotechnical report

Impact GEO-6b: Be located on expansive soil, creating substantial risks to life or property—Golden Hills Project (less than significant with mitigation)

Turbine foundations built on expansive soils would be subject to the expansion and contraction of these soils, which could cause damage to structures if the subsoil, drainage, and foundation are not properly engineered.

The Golden Hills project area is underlain by the Fontana-Diablo-Altamont soil association, which contains soils with high shrink-swell potential. However, soil sampling and treatment procedures are addressed by state and local building codes. Compliance with these codes and implementation of Mitigation Measure GEO-1 would ensure that this is a less-than-significant impact.

Mitigation Measure GEO-1: Conduct site-specific geotechnical investigation and implement design recommendations in subsequent geotechnical report

Impact GEO-6c: Be located on expansive soil, creating substantial risks to life or property—Patterson Pass Project (less than significant with mitigation)

Turbine foundations built on expansive soils would be subject to the expansion and contraction of these soils, which could cause damage to structures if the subsoil, drainage, and foundation are not properly engineered.

The Patterson Pass project area is underlain by the Fontana-Diablo-Altamont and the Carbona-Calla soil associations, which both contain soils with high shrink-swell potential. However, soil sampling and treatment procedures are addressed by state and local building codes. Compliance with these codes and implementation of Mitigation Measure GEO-1 would ensure that this is a less-than-significant impact.

Mitigation Measure GEO-1: Conduct site-specific geotechnical investigation and implement design recommendations in subsequent geotechnical report

Impact GEO-7a-1: Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature—program Alternative 1: 417 MW (less than significant with mitigation)

If fossils are present in the program area, they could be damaged by during earth-disturbing activities during construction activities, such as excavation for foundations, placement of fills, trenching for power collection systems, and grading for roads and staging areas. The more extensive and deeper the earth-disturbing activity, the greater the potential for damage to paleontological resources.

Because they are sedimentary rocks, geologic units with potential to contain paleontological resources include most units in the program area. In particular, the Neroly Formation and some units of the Great Valley Sequence are known to contain vertebrate fossils. Substantial damage to or

destruction of significant paleontological resources as defined by the Society of Vertebrate Paleontology (2010) would be a significant impact.

Because most geologic units in the program area are likely to be sensitive for paleontological resources, excavation in these units could damage paleontological resources.

This impact would be significant, but implementation of Mitigation Measures GEO-7a through GEO-7c would reduce this impact to a less-than-significant level.

Mitigation Measure GEO-7a: Retain a qualified professional paleontologist to monitor significant ground-disturbing activities

The applicant will retain a qualified professional paleontologist as defined by the SVP's *Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources* (2010) to monitor activities with the potential to disturb sensitive paleontological resources. Data gathered during detailed project design will be used to determine the activities that will require the presence of a monitor. In general, these activities include any ground-disturbing activities involving excavation deeper than 3 feet in areas with high potential to contain sensitive paleontological resources. Recovered fossils will be prepared so that they can be properly documented. Recovered fossils will then be curated at a facility that will properly house and label them, maintain the association between the fossils and field data about the fossils' provenance, and make the information available to the scientific community.

Mitigation Measure GEO-7b: Educate construction personnel in recognizing fossil material

The applicant will ensure that all construction personnel receive training provided by a qualified professional paleontologist experienced in teaching non-specialists to ensure that they can recognize fossil materials in the event any are discovered during construction.

Mitigation Measure GEO-7c: Stop work if substantial fossil remains are encountered during construction

If substantial fossil remains (particularly vertebrate remains) are discovered during earth disturbing activities, activities within 100 feet of the find will stop immediately until a state-registered professional geologist or qualified professional paleontologist can assess the nature and importance of the find and a qualified professional paleontologist can recommend appropriate treatment. Treatment may include preparation and recovery of fossil materials so that they can be housed in an appropriate museum or university collection and may also include preparation of a report for publication describing the finds. The applicant will be responsible for ensuring that recommendations regarding treatment and reporting are implemented.

Impact GEO-7a-2: Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature—program Alternative 2: 450 MW (less than significant with mitigation)

If fossils are present in the program area, they could be damaged by during earth-disturbing activities during construction activities, such as excavation for foundations, placement of fills, trenching for power collection systems, and grading for roads and staging areas. The more extensive

and deeper the earth-disturbing activity, the greater the potential for damage to paleontological resources.

Because they are sedimentary rocks, geologic units with potential to contain paleontological resources include most units in the program area. In particular, the Neroly Formation and some units of the Great Valley Sequence are known to contain vertebrate fossils. Substantial damage to or destruction of significant paleontological resources as defined by the Society of Vertebrate Paleontology (2010) would be a significant impact.

Because most geologic units in the program area are likely to be sensitive for paleontological resources, excavation in these units could damage paleontological resources.

This impact would be significant, but implementation of Mitigation Measures GEO-7a through GEO-7c would reduce this impact to a less-than-significant level.

Mitigation Measure GEO-7a: Retain a qualified professional paleontologist to monitor significant ground-disturbing activities

Mitigation Measure GEO-7b: Educate construction personnel in recognizing fossil material

Mitigation Measure GEO-7c: Stop work if substantial fossil remains are encountered during construction

Impact GEO-7b: Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature—Golden Hills Project (less than significant with mitigation)

If fossils are present in the project area, they could be damaged by during earth-disturbing activities during construction activities, such as excavation for foundations, placement of fills, trenching for power collection systems, and grading for roads and staging areas. The more extensive and deeper the earth-disturbing activity, the greater the potential for damage to paleontological resources.

Because they are sedimentary rocks, geologic units with potential to contain paleontological resources include most units in the program area. In particular, the Neroly Formation and some units of the Great Valley Sequence are known to contain vertebrate fossils. Substantial damage to or destruction of significant paleontological resources as defined by the SVP (2010) would be a significant impact.

Because most geologic units in the project area are likely to be sensitive for paleontological resources, excavation in these units could damage paleontological resources.

This impact would be significant, but implementation of Mitigation Measures GEO-7a through GEO-7c would reduce this impact to a less-than-significant level.

Mitigation Measure GEO-7a: Retain a qualified professional paleontologist to monitor significant ground-disturbing activities

Mitigation Measure GEO-7b: Educate construction personnel in recognizing fossil material

Mitigation Measure GEO-7c: Stop work if substantial fossil remains are encountered during construction

Impact GEO-7c: Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature—Patterson Pass Project (less than significant with mitigation)

If fossils are present in the project area, they could be damaged by during earth-disturbing activities during construction activities, such as excavation for foundations, placement of fills, trenching for power collection systems, and grading for roads and staging areas. The more extensive and deeper the earth-disturbing activity, the greater the potential for damage to paleontological resources.

Because they are sedimentary rocks, geologic units with potential to contain paleontological resources include most units in the program area. In particular, the Neroly Formation and some units of the Great Valley Sequence are known to contain vertebrate fossils. Substantial damage to or destruction of significant paleontological resources as defined by the SVP (2010) would be a significant impact.

Because most geologic units in the project area are likely to be sensitive for paleontological resources, excavation in these units could damage paleontological resources.

This impact would be significant, but implementation of Mitigation Measures GEO-7a through GEO-7c would reduce this impact to a less-than-significant level.

Mitigation Measure GEO-7a: Retain a qualified professional paleontologist to monitor significant ground-disturbing activities

Mitigation Measure GEO-7b: Educate construction personnel in recognizing fossil material

Mitigation Measure GEO-7c: Stop work if substantial fossil remains are encountered during construction

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