# 3.5 Geology and Soils

This section describes geologic, seismic, and soil conditions in the proposed Project area and analyzes environmental impacts related to these issues that could result from the Project. The following discussion addresses existing environmental conditions in the marine and terrestrial portions of the proposed Project, identifies and analyzes environmental impacts, and recommends measures to reduce or avoid adverse impacts. In addition, laws and regulations relevant to geological and seismic hazards are described. In some cases, compliance with these existing laws and regulations would serve to reduce or avoid certain impacts that might otherwise occur with the implementation of the Project. Impacts related to fault rupture and soils incapable of supporting wastewater disposal systems would not occur and are not addressed in this analysis (see the Initial Study in Appendix A).

## 3.5.1 Environmental Setting

### 3.5.1.1 Regional Geology

#### Terrestrial

Hermosa Beach lies within the southwest block of the Los Angeles Basin. It is bounded on the southwest by the Palos Verdes Fault and on the northeast by the Newport-Inglewood Fault. The southwestern block of the basin is the exposed portion of a much larger geographic area, most of which is located under the Pacific Ocean. Most of the block is a low plain that extends from Santa Monica in the northwest to Long Beach in the southeast. The Palos Verdes Hills are the most prominent topographic feature of the block; a line of elongated low hills and mesas (underlain by the Newport-Inglewood Fault Zone) extends from northwest to southeast along the inland margin of the plain. (Yerkes et al., 1965.)

The Los Angeles Basin is located within the Peninsular Ranges physiographic province. The physiographic basin of coastal Southern California is an alluviated lowland, also referred to as the “coastal plain.” The basin is bounded on the north by the Santa Monica Mountains and by the Elysian, Repetto, and Puente hills on the east. It is bounded to the southeast by the Santa Ana Mountains and San Joaquin Hills. The alluviated low land surface slopes gently south towards the ocean, but it is interrupted by the Coyote Hills on the northeast, and by mesas to the south and west that extend from Newport Bay northwest to Beverly Hills. The Palos Verdes peninsula is located at the basin’s southwest extremity (Yerkes et al., 1965). The proposed Project is located approximately one mile to the northwest of the Torrance Oil Field (California Department of Conservation, 2014).

#### Marine

The proposed marine cable routes cross Santa Monica Bay and several offshore basins, ridges, and escarpments on the California Borderland before reaching the edge of the outer continental shelf. The shallow Santa Monica shelf and continental slope are deeply carved by three submarine canyons: the Dume, Santa Monica, and Redondo. A low-angle continental slope on the northwest portion of Santa Monica Canyon gives way abruptly across the canyon to the San Pedro Escarpment, and farther southeast lie the high-relief Palos Verdes Hills. The escarpment continues to the southeast and is a relatively steep section of the continental margin. Under Santa Monica Bay, a subsurface basement ridge made up of Catalina Schist extends northwest–southeast beneath the continental shelf and slope. This ridge separates the onshore Los Angeles sedimentary basin from deep-water basins of the California Continental Borderland (Fisher et al., 2003). Figures 3.5-1 (Offshore Geologic Features) and 3.5-2 (Offshore Geologic Features Detail: Santa Monica Bay) illustrate the proposed Project alignment relative to these features.

Deformation has created tight folding of rocks under the shelf south of Santa Monica Canyon. The folding extends eastward nearly to the location of the Palos Verdes Fault. Rocks are deformed into numerous short-wavelength folds and underlie most of the continental shelf between the Santa Monica and Redondo canyons.

## 3.5.1.2 Seismicity and Major Faults

### Faults

There are no active faults within the proposed Project footprint or within 1 mile (1.6 kilometers) of the terrestrial portions of the Project. The closest known active faults are the Palos Verdes Fault Zone, approximately 2.5 miles (4 kilometers) south of the 25th Street beach landing site, and the Newport-Inglewood Fault Zone, approximately 8 miles (13 kilometers) northeast of the Neptune Avenue landing site.

The Palos Verdes Fault is considered an active fault with slip rates of approximately 0.04 to 0.20 inch (1 to 5 millimeters) per year and a maximum credible earthquake magnitude of 7.3 (City of Rancho Palos Verdes, 2011). The width of the zone of potential surface ruptures is variable and estimated to range from approximately 1,640 feet (500 meters) to as narrow as about 246 feet (75 meters). No known earthquakes have occurred along the Palos Verdes Fault in the past 200 years.

The Newport-Inglewood Fault has been the source of several earthquakes in the last 70 years, with magnitudes ranging from 4.7 to 6.4 on the Richter scale. The largest of these was the 1933 Long Beach quake, a magnitude 6.4 quake that caused surface fault rupture. The vertical fault strikes northwest–southeast and is a right-lateral strike slip fault with a minor reverse component. The fault separates the Southwestern Block from the Central Plain of the Los Angeles Basin. This fault is considered an active fault with slip rates of approximately 0.04 to 0.06 inch (1.0 to 1.5 millimeters) per year and a maximum credible earthquake magnitude of 7.1 (City of Rancho Palos Verdes, 2011). Therefore, the Newport-Inglewood Fault has the highest probability of impacting the proposed Project.

### Liquefaction

When loosely packed soils in proximity to water (such as groundwater or ocean water) are subjected to seismic shaking, a process called liquefaction can occur. This phenomenon typically occurs in loose, saturated sediments of primarily sandy composition with ground accelerations over 0.2 g. When this occurs, the sediments involved have a total or substantial loss of shear strength, and they behave more like a liquid or semi-viscous substance. This can cause ground settlement, foundation failures, and the buoyant rise of buried structures. When soil liquefies, loss of bearing strength may occur beneath a structure, possibly causing the building to settle or tilt.

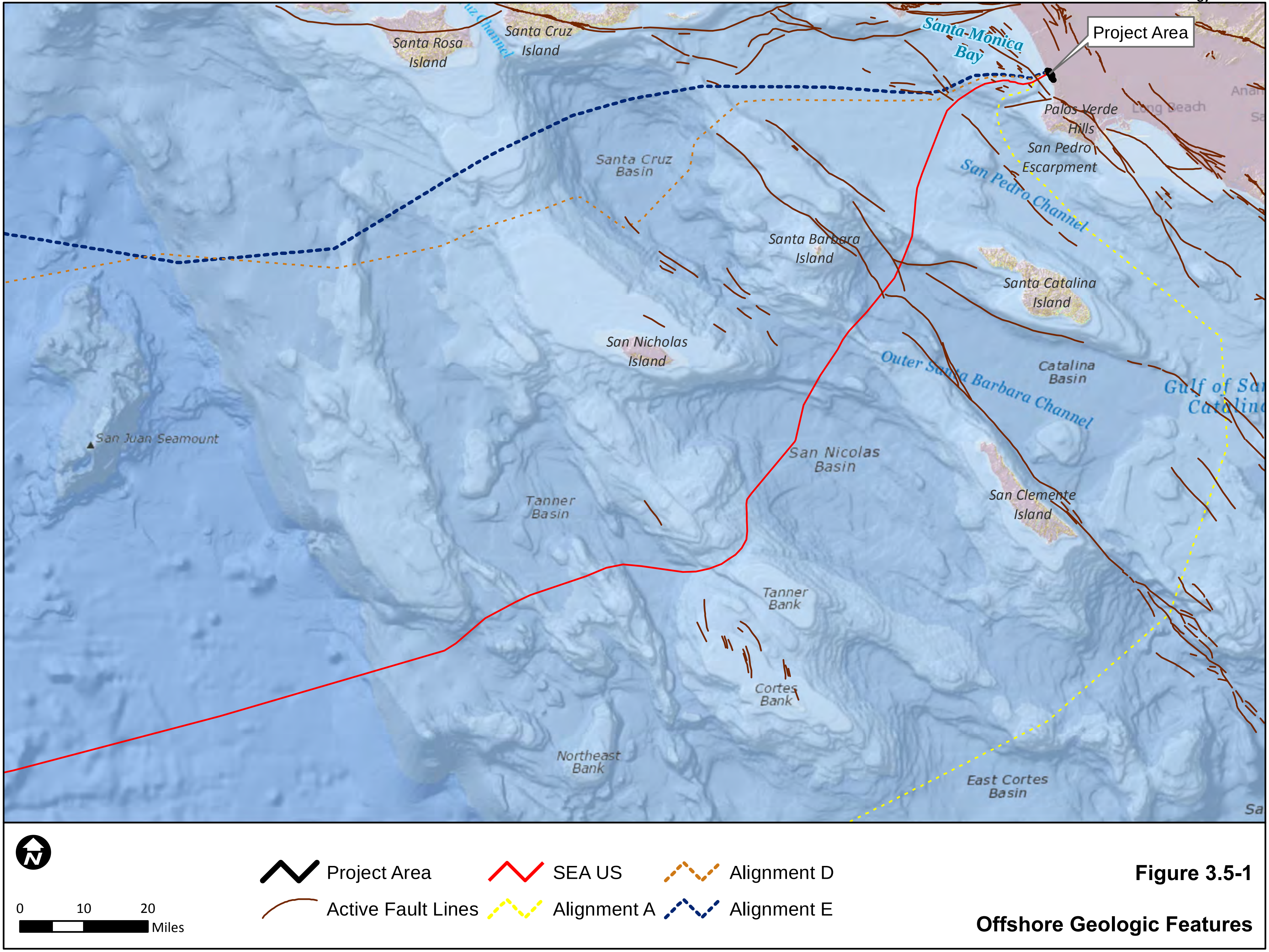
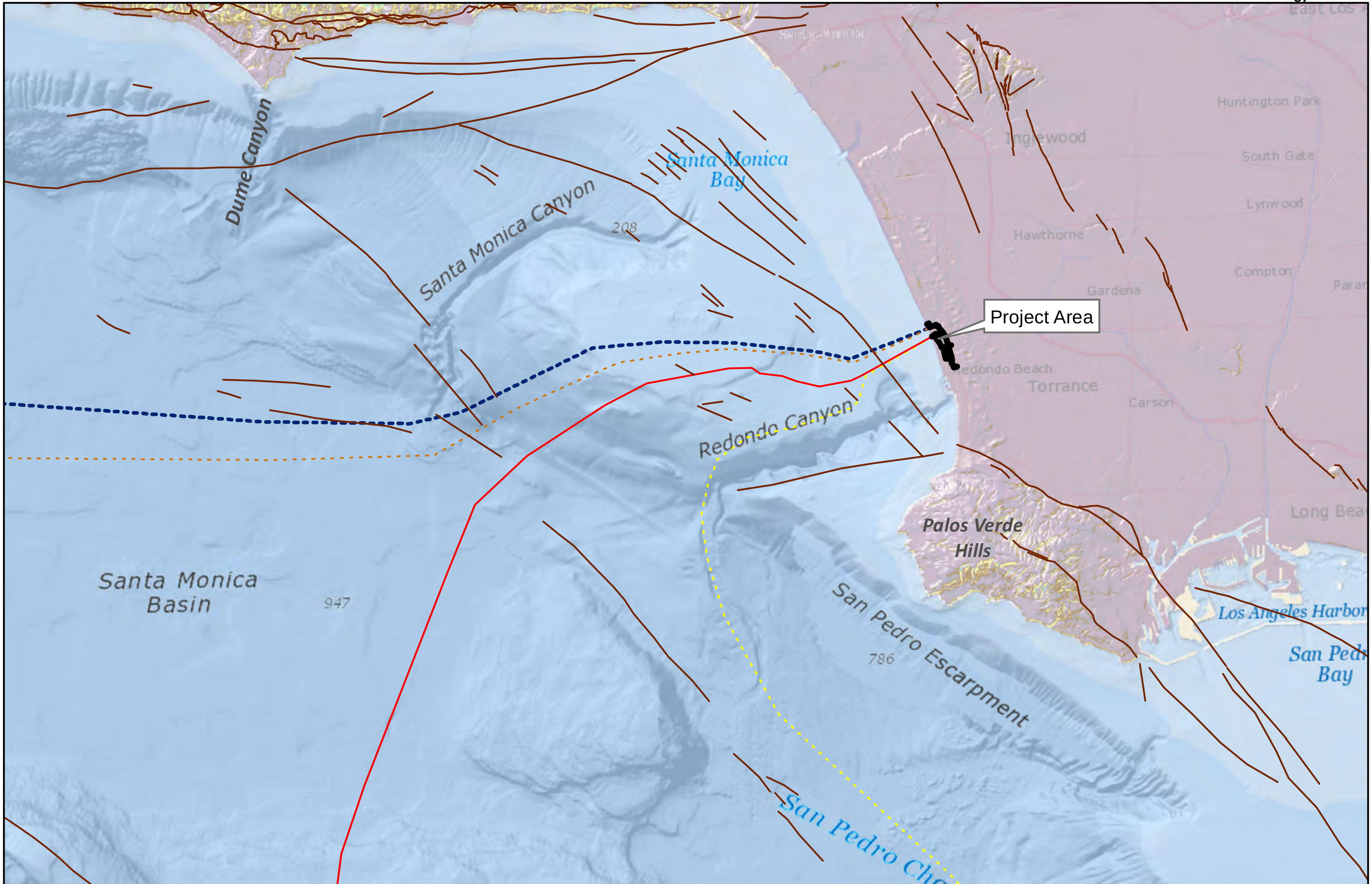



**Figure 3.5-1**

**Offshore Geologic Features**




0 2.5 5 Miles

- Project Area
- Active Fault Lines
- SEA US
- Alignment A
- Alignment D
- Alignment E

**Figure 3.5-2**
**Offshore Geologic Features Detail: Santa Monica Bay**

The beach areas located along the coasts near Hermosa Beach have liquefaction potential, and both the north and south cable routes cross this liquefaction zone heading seaward (California Department of Conservation Division of Mines and Geology, 1998). The U.S. Department of Agriculture Natural Resources Conservation Service has not completed a soil survey for this area. A significant portion of the shoreline of Southern California has been dredged, filled, or reshaped for the development of marinas, harbors, jetties, and other developments (E&E, 2001). Consequently, the beach sands in these areas, including Hermosa Beach, have been compacted and reworked. The exact composition of soils east of the coast is unknown, and therefore liquefaction propensity cannot be determined at this time.

### Tsunamis

Tsunamis are large ocean waves caused by significant seismic events. Tsunamis, like tides, produce waves of water that move inland, but in the case of tsunami the inland movement of water is much greater and lasts for a longer period than normal tides. Typically, oceanic tsunamis are the result of sudden vertical movement along a fault rupture in the ocean floor, submarine landslides, subsidence, or volcanic eruption, where the sudden displacement of water sets off transoceanic waves with wavelengths of up to 125 miles (200 kilometers) and with periods generally from 5 to 60 minutes. The trough of the tsunami wave arrives first, leading to the retreat of water from the shore as the ocean level drops. This is followed by the arrival of the crest of the wave, which can run up on the shore in the form of bores or surges in shallow water or simple rising and lowering of the water level in relatively deeper water such as in harbor areas. According to the General Plan of the City of Los Angeles, Safety Element, hazardous tsunamis along the Los Angeles coast are rare, but major storms at sea also can generate heavy waves. These waves have caused considerable damage to properties and beaches along the ocean perimeter in the past.

Tsunamis are a relatively common natural hazard, although most of the events are small in amplitude and not particularly damaging. However, run-up of broken tsunamis in the form of bores and surges or by relatively dynamic flood waves may cause coastal flooding in the event of a large submarine earthquake or landslide. In the process of bore/surge-type run-up, the onshore flow can cause tremendous dynamic loads on the structures onshore in the form of impact forces and drag forces, in addition to hydrostatic loading. The subsequent draw-down of the water after run-up exerts the often crippling opposite drags on the structures and washes loose/broken properties and debris to sea; the floating debris brought back on the next onshore flow has been found to be a significant cause of extensive damage after successive run-up and draw-down. The potential loss of human life in this process can be great if such events occur in populated areas.

In the area along the Pacific route, there is high seismic activity along the Pacific plate boundaries and there is a history of Pacific-wide tsunamis occurring every 10 to 20 years. Therefore, there is potential for a tsunami to occur during the lifetime of the cable (E&E, 2001).

## 3.5.1.3 Soils and Surficial Sediments

The United States Department of Agriculture has not completed a soil survey for this area; thus, information on subsurface soil conditions in the Project area is limited. According to the Seismic Hazard Zone Report for the Redondo Beach 7.5-minute quadrangle (California Department of Conservation Division of Mines and Geology, 1998), Holocene deposits located in the upper northeast area of the quadrangle (including parts of Hermosa Beach, Manhattan Beach, Redondo Beach, and Torrance) consist of three surficial units that crop out in bands parallel to the coast and undifferentiated alluvium along some of the stream channels. In the west, closest to the Project area, there is a narrow band of modern marine beach deposits, consisting of sand. The beach deposits extend from the northern boundary of the quadrangle, southward to Malaga Cove, and in Lunada Bay, east of Long Point and in Abalone Cove.

## Slope Stability

Landslides are movements of relatively large landmasses, either as nearly intact bedrock blocks or as jumbled mixes of bedrock blocks, fragments, debris, and soil. Landslides are common throughout Southern California's mountain ranges, particularly near major fault zones where the rock has been weakened by fracturing, shearing, and crushing. Landslides may occur due to seismic shaking, local climatic conditions, or human-made modifications to the slide mass. Ocean wave action, undercutting of slopes during construction, improper compaction, or over saturation can also trigger landslides. Immediate dangers from landslides include destruction of property and possible fatalities from rocks, mud, and water sliding downhill or downstream. Other dangers include broken electrical, water, gas, or sewage lines.

Given the proximity of the marine routes to active fault zones and submarine slopes, the potential for underwater landslides exists. Earthquakes can move loose sediments during seismic events and thus threaten the integrity of Project components. The terrestrial components of the proposed Project are not located near any slopes or features subject to landslides.

## Erosion

Erosion is a condition that could significantly and adversely affect development on any site. Structures located above or below actively eroding natural slopes or manufactured slopes would be susceptible to the effects of erosion. In addition, development could exacerbate erosion conditions if it exposes soils and adds additional water to the soil from irrigation and runoff from new impervious surfaces.

## Unstable and Expansive Soils

Compressible soils are fine-grained soils (silts and clays) that are susceptible to decreasing in volume (that is, they will compress) when weight is placed on them. Settlement of compressible silts and clays is referred to as consolidation, and occurs when groundwater is squeezed from soil pores by added surface loads such as fills or building foundations. The amount and rate of settlement can vary greatly, depending upon a number of factors, including natural moisture and density, the thickness of the compressible layer, the amount of fill placed over the compressible material, and the ability of pore water to escape from soil pores via drainage paths such as sand lenses and soil fissures.

Fine-grained soils (silts and clays) may contain variable amounts of expansive minerals. These minerals can undergo significant volume changes as a result of changes in moisture content; that is, they expand when they get wet and shrink as they dry out. This expansive behavior can damage structural foundations and potentially rigid and inflexible pipelines. Fine-grained sediments with high clay content would be most susceptible to potential expansive soil impacts.

To accommodate the development of marinas, harbors, jetties, etc., a significant portion of the shoreline of Southern California has been dredged, filled, or reshaped. Consequently, the beach sands in developed areas, including portions of Hermosa Beach, have been modified and reworked. However, the beach and areas offshore have remained largely unaffected, and susceptible to natural processes of wetting and drying. The beach and areas offshore are largely composed of sand rather than silts and clays and, therefore, do not experience expansion and contraction. The exact make-up of the soils east of the coast is unknown and, therefore, expansive or unstable characteristics cannot be determined at this time.

## 3.5.2 Regulatory Setting

### 3.5.2.1 Federal

There are no federal regulations relating to geology and soils pertinent to the proposed Project.

### 3.5.2.2 State

#### Seismic Hazards Mapping Act of 1990

The Seismic Hazards Mapping Act of 1990 (PRC Chapter 7.8, Section 2690–2699.6) addresses earthquake hazards other than surface fault rupture, including liquefaction and seismically induced landslides. Through it, California establishes city, county, and State agency responsibilities for identifying and mapping seismic hazard zones and mitigating seismic hazards to protect public health and safety. The act requires the California Department of Conservation, Division of Mines and Geology, to map seismic hazards and establishes specific criteria for project approval that apply within seismic hazard zones, including the requirement for a geological technical report.

#### California Building Code

CCR Title 24 (California Building Code) applies to all applications for building permits. The California Building Code (also called the California Building Standards Code) has incorporated the International Building Code, which was first enacted by the International Conference of Building Officials in 1927 and which has been updated approximately every three years since. The current version of the California Building Code (2013) became effective on January 1, 2014.

Local agencies must ensure that development in their jurisdictions comply with guidelines contained in the California Building Code. Cities and counties can, however, adopt building standards beyond those provided in the code.

### 3.5.2.3 Local

#### County of Los Angeles Building Code

The 2014 County of Los Angeles Building Code, as amended, came into effect January 1, 2014, with Title 26, Building Code, adopting the 2013 California Building Code (24 CCR 2). The County of Los Angeles Building Code addresses issues related to site grading; cut-and-fill slope design; soil expansion; geotechnical investigations before and during construction; slope stability; allowable bearing pressures and settlement below footings; effects of adjacent slopes on foundations, retaining walls, and basement walls; shoring of adjacent properties; and potential primary and secondary seismic effects. The County of Los Angeles Department of Public Works Building and Safety Division is responsible for implementing the provisions of the Building Code. The County's primary seismic regulatory document is the Safety Element of the Los Angeles County General Plan, dated December 1990.

### City of Hermosa Beach Building Code

The California Building Code 2013 Edition (Part 2 of Title 24 of the California Code of Regulations), including Appendices F, G, and J, and not including Appendixes A, B, C, D, E, H, I, and K, has been adopted by the City of Hermosa Beach. This Code comprises the Building Code of the City of Hermosa Beach. Whenever the word "jurisdiction" appears in the Code, it means and refers to the City of Hermosa Beach. Whenever the term "building official" appears in the Code, it means and refers to the Director of Community Development of the City of Hermosa Beach or his or her designee.

### City of Hermosa General Plan

The City of Hermosa Beach General Plan discusses conservation of coastal resources and the geological considerations that apply to these resources in Section 3. The Seismic Safety Element section discusses different problem areas, which seismic safety elements must be addressed and also provides recommendations in Section 11.

# 3.5.3 Impact Analysis

## 3.5.3.1 Methodology/Approach

The following impact analysis is a project-level analysis that evaluates the effects of geologic and soils hazards that would result should the proposed Project be implemented. Based upon the existing conditions described above, the impact analysis assesses the direct and indirect impacts related to geologic and soils hazards and determines whether the proposed Project would exceed any significance threshold listed below. Mitigation measures are recommended as needed to avoid or minimize significant impacts.

## 3.5.3.2 Significance Thresholds

An impact related to geology or soils would be considered significant if the proposed Project would:

- Disturb unique geologic features or geologic features of unusual scientific value for study or interpretation.
- Trigger or accelerate geologic processes, such as landslides and/or substantial sediment erosion during construction.
- Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the Project, and potentially result in on- or off-site erosion, landslides, subsidence, liquefaction, or collapse.
- Cause any post-construction alteration of bathymetry that could cause a hazard to navigation or measurable change in wave shoaling or breaking characteristics.
- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: (1) strong seismic ground shaking; (2) tsunamis; (3) seismic-related ground failure, including liquefaction; or (4) landslides.
- Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property.

### 3.5.3.3 Impacts and Mitigation Measures

The impact discussions below address each of the significance thresholds listed above in Section 3.5.3.2.

#### Disturbance of Unique Geologic Features

The terrestrial portion of the proposed Project would be entirely within roadways, greenbelts, and sandy beach areas subject to routine disturbance and, therefore, the terrestrial portion of the Project would have no impact on unique geologic features.

***Impact GEO-1: Marine construction could disturb unique geologic features.***

Geologic features present in Santa Monica Bay are characterized by the shallow Santa Monica shelf and continental slopes deeply carved by three submarine canyons: Dume, Santa Monica, and Redondo. The seafloor of the Santa Monica Shelf consists of sands and gravels, clayey sand, and sandy clay. During marine construction activities, disturbances to the seafloor are expected to be local and short-term, with the re-suspended sediments settling onto the seafloor shortly after the disturbance. The proposed cable routes were selected to avoid the geologically active canyons. Marine construction would occur under the sand in the form of directional bores; beyond this, cable will be buried 3 to 4 feet (1 to 1.2 meters) beneath the seafloor up to a water depth of 3,037 feet (1,200 meters). Cables would be less than 2 inches (5 centimeters) in diameter. Unburied cable occurring either temporarily during construction or in water depths greater than 3,037 feet (1,200 meters) would not disturb geologic features in Santa Monica Bay. The shallow depth of buried cable, small cable diameter, and temporary nature of construction activities would result in minimal effects on the Santa Monica Shelf and other geologic features in the marine portion of the proposed Project. Impacts would not be significant (Class III).

#### Triggering or Accelerating Geologic Processes, such as Landslides or Erosion

***Impact GEO-2: Terrestrial construction could result in erosion.***

The terrestrial portion of the proposed Project would not be located near any features subject to landslides, and implementation of the proposed Project would not result in substantial soil erosion or the loss of topsoil. Construction activities have the potential to exacerbate erosion conditions by exposing soils during trenching and excavation of bore pits. However, best management practices (BMPs) would be employed during construction to minimize erosion discharge (see Section 3.8, *Water Resources*), such as erosion control measures to prevent sediments and pollutants from leaving the site. Trench and bore pit backfilling would begin immediately after the conduits are installed. Backfill material would be compacted to eliminate erosion and soil settlement in conformance with *2015 Greenbook: Specifications for Public Works Construction*, adopted by the City of Hermosa Beach in 2004. In unpaved areas, restoration would entail grading to restore original contours; installing erosion control devices at locations susceptible to erosion; and seeding, mulching, and fertilizing to return the site to preconstruction conditions. By implementing standard BMPs, impacts related to erosion would be avoided. Impacts would not be significant (Class III).

Upon retirement of the Project, the applicant anticipates that both the terrestrial cable systems would be abandoned in place, meaning they would not be removed (see Section 2.7, *Retirement, Abandonment, or Removal of the Cable Systems*). It is possible that the terrestrial cable would be pulled out of the buried conduit, leaving the conduit itself in place. Because neither option would involve excavation or ground disturbance, no erosion impacts would occur.

## Unstable Geologic Units or Soils

Unstable conditions are not expected to be encountered within the terrestrial portion of the Project, which is located within a fully improved area where soil conditions have been stabilized. In addition, the terrestrial portion of the Project is not located within any steeply sloped areas or known landslide areas (see Impact GEO-2). Possible unstable conditions that may be encountered along the marine portion of the Project are discussed below.

***Impact GEO-3: Marine construction associated with cable laying and directional boring could be located on a geologic unit or soil that is unstable or that would become unstable as a result of the Project.***

There may be locations along the proposed marine fiber-optic cable routes where the sea floor is unstable, such as steep areas where landslides and slumping are possible. Plowing and cable laying associated with the Project could potentially disturb an unstable area and trigger slope failure. However, the potential for this to occur is relatively low. Surficial slumping and land sliding is unlikely to occur because the plow would only be able operate in areas of soft sediment on low or moderate slopes. The plow would be pulled at a slow rate (approximately 1 knot or 1.2 miles per hour [1.9 kilometer per hour]) and would primarily trench straight up and down slopes, as opposed to traversing and potentially undercutting a slope. If any steep slopes are encountered, the plow would not be utilized as it cannot operate effectively in steep areas. In areas where plow burial is not feasible, the cable would be buried using post-lay burial methods including diver-assisted jet burial and ROV burial.

Because information regarding the exact composition of soils in the Project area is limited, and the precise alignments of the marine cable routes would be determined during final design, implementation of Mitigation Measure GEO-1 would require a geotechnical report to be prepared for the marine portion of the Project to identify unstable areas and avoid them where possible. In accordance with Mitigation Measure GEO-1, by either avoiding unstable areas or implementing appropriate engineering, impacts can be reduced to a less-than-significant level (Class II).

*Mitigation Measures*

GEO-1 **Avoid Unique Geological Features and Hazards.** Prior to construction, the applicant will conduct a geotechnical study evaluation of sea floor conditions and geologic hazards for the marine portion of the Project. Using this information, the applicant shall re-align the cable where feasible to avoid unstable areas or hazards.

The geotechnical study will be signed by a California-registered professional engineer and must contain bathymetry data, characterization of sub-surface sediments, grain size of sub-surface sediments, and photographs of the seabed at representative areas. The marine geotechnical survey will be conducted using an accurate electronic positioning system (accuracy of 3m or less), a magnetometer, and a side-scan sonar at a minimum. Survey intervals should be no less than 50 meters. The magnetometer should be sensitive to one gamma (nanotesla) or less, with noise levels of 3 gammas (nanoteslas) or less. Vessel speed should not exceed 4 knots. The side-scan sonar should have a resolution capability of 600 KhZ operating at 50m or less per channel. The applicant will use these studies to determine the appropriate engineering for the marine portions of the Project to minimize geotechnical hazard impacts.

## Alteration of Bathymetry

There are no expected Project activities that would result in an alteration of bathymetry (the measurement of depth of water in oceans) to such a scale that would result in a hazard to navigation or measurable change in wave shoaling or breaking characteristics. Marine construction would occur under the sand in the form of directional bores, beyond this cable would be buried 3 to 4 feet (1 to 1.2 meters) beneath the seafloor up to a water depth of 3,037 feet (1,200 meters). Cables would be less than 2 inches (5 centimeters) in diameter, unburied cable occurring either temporarily during construction and maintenance or in water depths greater than 3,037 feet (1,200 meters) would not alter bathymetry. The weight of the cable, where unburied, is expected to ensure that the cable would not shift or become positively buoyant to the point where a hazard could result. Following completion of the cable laying and submittal of the location of the as-installed cables to NOAA/USCG, there would be no long-term impediment to marine navigation. No impact on bathymetry resulting from the construction and operation of the proposed Project would occur.

The applicant anticipates that the marine cable would be retired in place when the Project is retired and taken out of service. In that case, no further alterations to bathymetry would occur. However, it is also possible that the Coastal Commission would require removal of the cable from State waters. If that occurs, ROVs and vessels would be used to remove the cable and transport it away for disposal. Similar to cable installation, this would require disturbance to the seafloor, but would have no substantial or lasting effects on bathymetry.

## Strong Seismic Ground Shaking

The Palos Verdes Fault is the closest fault to the Project site—approximately 2.5 miles (4 kilometers) south of the proposed 25th Street beach landing site location. The Newport-Inglewood Fault is approximately 8 miles (13 kilometers) northeast of the Neptune Avenue landing site and is considered the primary fault in the area. Additionally, Hermosa Beach is located in Seismic Zone 4, which is a designation previously used in the Uniform Building Code to denote the areas of the highest risk to earthquake ground motion (California Seismic Safety Commission, 2005). As a result, the Project area could be subject to future seismic shaking and strong ground motion resulting from seismic activity, and damage to Project components could occur. However, terrestrial Project components are minimal and would be buried in roadways and under recreational areas (Greenbelt and beach); therefore, Project components would not present a safety hazard to the public during strong seismic ground shaking.

The proposed Project is not expected to draw a substantial amount of people, either during construction activities or permanently, and the small number of personnel required for occasional routine maintenance of the PFE facilities would be on site temporarily. Moreover, no structures intended for frequent human occupation would be built, and thus potential risk to the occasional personnel visiting the site would be extremely limited. Finally, construction of the proposed Project would be subject to the 2013 California Building Code (CCR Title 24), which would reduce anticipated impacts related to the proximity of earthquake faults by requiring the Project to be built to withstand seismic ground shaking. As a result, no impacts would occur.

## Tsunamis

In the areas along the marine routes, there is high seismic activity along the Pacific plate boundaries. Therefore, there is a potential of a tsunami occurring during the lifetime of the Project. Tsunamis could threaten the integrity of the Project components, requiring repair, re-installation, or removal activities. However, the construction and operation of the proposed Project would not cause tsunamis and would not expose people or structures other than the proposed Project itself to additional risk of loss, injury or death involving a tsunami.

A tsunami likely would pose little hazard to the cable itself. The greatest danger to the cable would not be from the water motion of the tsunami, but rather from the effect of the earthquake-induced slumping or sediment movement. Because the marine portion of the cable would be buried beneath the bottom of the ocean floor and the terrestrial portion would be buried in streets and other public ROWs, the Project would not result in any increased risk to humans associated with tsunamis. Impacts due to damage of the cable as a result of seismic activity, resulting in repair or removal, would be temporary and localized, and would result in no greater impacts than those incurred by Project construction activities. Furthermore, all components would be subject to the 2013 California Building Code (CCR Title 24) and would be built according to appropriate seismic design standards. Therefore, the Project would not expose people or structures to potential substantial adverse effects from tsunamis.

## Seismic-Related Ground Failure, Including Liquefaction

***Impact GEO-4: The proposed cable alignment and marine construction associated with cable laying and directional boring could be susceptible to seismic-related ground failure.***

Implementation of the proposed Project would not expose people existing structures, or new structures to substantial adverse effects from seismic-related ground failure, including liquefaction. Therefore, the Project would not present a seismic-related hazard to humans. Any seismic-related hazards would only create risks for the Project’s own infrastructure. Liquefaction occurs when saturated, low-density, loose materials (e.g., sand or silty sand) are weakened and transformed from a solid to a near-liquid state as a result of increased pore water pressure. The increase in pressure is caused by strong ground motion from an earthquake. Liquefaction more often occurs in areas underlain by silts and fine sands and where shallow groundwater exists. A slight risk of cable displacement may occur if submarine liquefaction occurs, but the displacement would not pose an impact to humans or the environment.

The beach dune areas located along the coasts near Hermosa Beach have liquefaction potential. Either the Palos Verdes Fault or the Newport-Inglewood Fault could cause seismic shaking and strong ground motion at the proposed Project site and could potentially create ground settlement, and soil can undergo loss of bearing strength in these areas.

The proposed Project does not involve the construction of housing, places of employment, or facilities attracting visitors. Therefore, the Project would not draw a substantial amount of people to the area, either during construction activities or permanently, and the small number of personnel required for occasional routine maintenance of the PFE facilities would be on site temporarily. Thus, potential risk to the occasional personnel visiting the site would be extremely limited. Construction of the proposed Project would also be subject to the 2013 California Building Code (CCR Title 24).

Therefore, terrestrial Project components are not expected to be subject to substantial adverse effects from liquefaction or other seismic-related ground failure.

Because information as to the exact composition of the seafloor along the marine cable routes is limited, and the precise alignment of the cables would be determined during final design, Mitigation Measure GEO-1 would require a geotechnical report to be prepared for the marine portion of the Project to more precisely identify potential geotechnical hazards and reduce effects pertaining to ground failure. With implementation of this measure and by utilizing the results of the report to avoid and minimize risk to the proposed Project from ground failure, impacts would be reduced to a less-than-significant level (Class II).

*Mitigation Measures*

GEO-1 **Avoid Unique Geological Features and Hazards.** See above for the full text of this measure.

## Landslides

The terrestrial portion of the Project is not located in an area subject to landslide hazards; therefore, implementation of the Project would not expose people or structures to substantial adverse effects from seismic-related landslides.

The potential danger to a submarine cable in seismically active areas is not from the immediate surface rupture or ground-shaking caused by an earthquake, but from the effects that these actions can have on loose sediments found on slopes near the earthquake epicenter. Earthquakes can set these sediments in motion, causing debris flows that can be extremely dangerous to a cable. Because of the proximity of the routes to active fault zones, the potential for underwater landslides exists (E&E, 2001). The principal failure mechanism for rock and soil falls is the loss of cohesion or tensile strength of the near-surface material on a very steep slope. Routes were selected wherever feasible to avoid steep slopes. Additionally, the routes were selected to avoid the geologically active Santa Monica Canyon and Redondo Canyon. Where it is not feasible to avoid steep slopes, cable burial may not be possible and the cables would need to be laid directly along the slope, avoiding free spans. Impacts due to damage of the cable as a result of seismic activity, resulting in repair or removal, would be temporary and localized, and would result in no greater impacts than those associated with Project construction activities. Furthermore, all components would be subject to the 2013 California Building Code (CCR Title 24) and would be built according to appropriate seismic design standards.

## Expansive Soils

***Impact GEO-5: Expansive soils could damage terrestrial Project components.***

Changes in the water content of a highly expansive soil can result in severe distress for structures constructed on or against the soil. The majority of the proposed Project is located in the ocean; therefore, soils and sediments remain saturated. Without water content changes in the soils and sediments on the seafloor the cable is not expected to experience impacts from expansive soils.

The terrestrial portion of the proposed Project is generally underlain with soils consisting of sandy substrate, which typically have low expansion potential. The Project's terrestrial components include cable buried in underground conduits in public ROWs and PFE facilities. The PFE facilities would be located within existing structures, unmanned, and would occasionally be visited by a technician for routine maintenance and emergency repairs. Therefore, the Project would not expose people or structures to substantial risks from expansive soils. Impacts would not be significant (Class III).

## 3.5.3.4 Cumulative Effects

### Introduction

The marine segments of the cable systems are located in Santa Monica Bay between the MHW line and the outer limit of the Continental Shelf—that is, areas where seawater depth is no greater than approximately 5,904 feet (1,800 meters). Santa Monica Bay is a semi-enclosed shelf centrally located in the Southern California Bight.

The region surrounding Santa Monica Bay has been substantially altered in the last one hundred years and terrestrial areas have been developed. The development surrounding areas has subsequently altered the marine environment; existing impacts that have been identified are contaminated water and sediments within Santa Monica Bay associated with effluent from storm drains and Ballona Creek, the Palos Verdes shelf, and military explosives dumping areas. Submarine cables have also been installed in Santa Monica Bay. As stated above, marine construction will take place in Santa Monica Bay. All projects listed on the cumulative projects list in Table 3-1 are terrestrial and not considered within the water area of Santa Monica Bay as defined by the marine segments of the proposed Project.

### Project Contribution to Cumulative Impacts

The marine and submarine nature of these Project segments provide a distinct separation from the terrestrial projects listed in Table 3-1 and should not cause cumulative effects. Any disturbances to the seafloor during construction of the proposed Project would be temporary and localized. With the implementation of Mitigation Measure GEO-1 the low probability of disturbance of geologic features associated with marine construction equipment would be further reduced through avoidance of such features, facilitated by a detailed, site-specific geotechnical study. Therefore, no cumulative impacts should occur from the Project when considered together with other projects in the area.

## 3.5.3.5 Summary of Impacts, Mitigation Measures, and Significance Conclusions

Table 3.5-1, below, provides a summary of the Project's significant impacts (Class I or Class II) related to geology and soils. The table also indicates the mitigation measures proposed to reduce these significant impacts.

**Table 3.5-1. Summary of Geology and Soils Impacts, Mitigation Measures, and Significance Conclusions**

| Impact | Mitigation Measures | Significance Conclusion |
|---|---|---|
| Impact GEO-3: Marine construction associated with cable laying and directional boring could be located on a geologic unit or soil that is unstable or that would become unstable as a result of the Project. | GEO-1: Avoid Unique Geological Features and Hazards. | Class II |

**Table 3.5-1. Summary of Geology and Soils Impacts, Mitigation Measures, and Significance Conclusions**

| **Impact** | Mitigation Measures | Significance Conclusion |
|---|---|---|
| Impact GEO-4: The proposed cable alignment and marine construction associated with cable laying and directional boring could be susceptible to seismic-related ground failure. | GEO-1: Avoid Unique Geological Features and Hazards. | Class II |

**Class I:** **Significant impact; cannot be mitigated to a level that is not significant.** A Class I impact is a significant adverse effect that cannot be mitigated below a level of significance through the application of feasible mitigation measures. Class I impacts are significant and unavoidable.

**Class II:** **Significant impact; can be mitigated to a level that is not significant.** A Class II impact is a significant adverse effect that can be reduced to a less-than-significant level through the application of feasible mitigation measures presented in this EIR.