3.5

GEOLOGY

3.5.1 Introduction

This section presents the existing geologic conditions for the proposed project area and applicable regulations related to geologic hazards, and evaluates: 1) seismic hazards including surface rupture, ground shaking, liquefaction, subsidence, tsunamis, and seiches; 2) other geologic issues, including potentially unstable soils and slopes; and 3) mineral resources. This evaluation is based on published reports and the general geologic setting as indicators of potential geologic hazards. The proposed Project would be exposed to significant and unavoidable seismic- and tsunami-related impacts as a result of numerous active faults in southern California, as well as the relatively low elevation of Port berths and upland areas.

3.5.2 Environmental Setting

The description of the environmental setting presented in this section, which is used to represent the baseline physical conditions, is from geologic maps and literature that are primarily dated pre-2006, and are dated back as much as 20 years. However, geologic conditions do not change significantly over a time span of up to 20 years; therefore, the use of these materials to represent the baseline conditions by which the significant potential impacts are evaluated is appropriate for the this analysis.

3.5.2.1 Regional Setting

The proposed project site is located near sea level in the coastal area of the Los Angeles Basin, a low-lying plain that rises inland to the Santa Monica Mountains to the north, the Repetto and Puente Hills to the northeast, the Santa Ana Mountains to the east, and the San Joaquin Hills to the southeast. The basin is bordered on the west by the Pacific Ocean and the Palos Verdes Hills. The geologic structure of the West Los Angeles Basin is characterized by several northwest trending folds and faults. The major folds in the area include the Wilmington and Palos Verdes

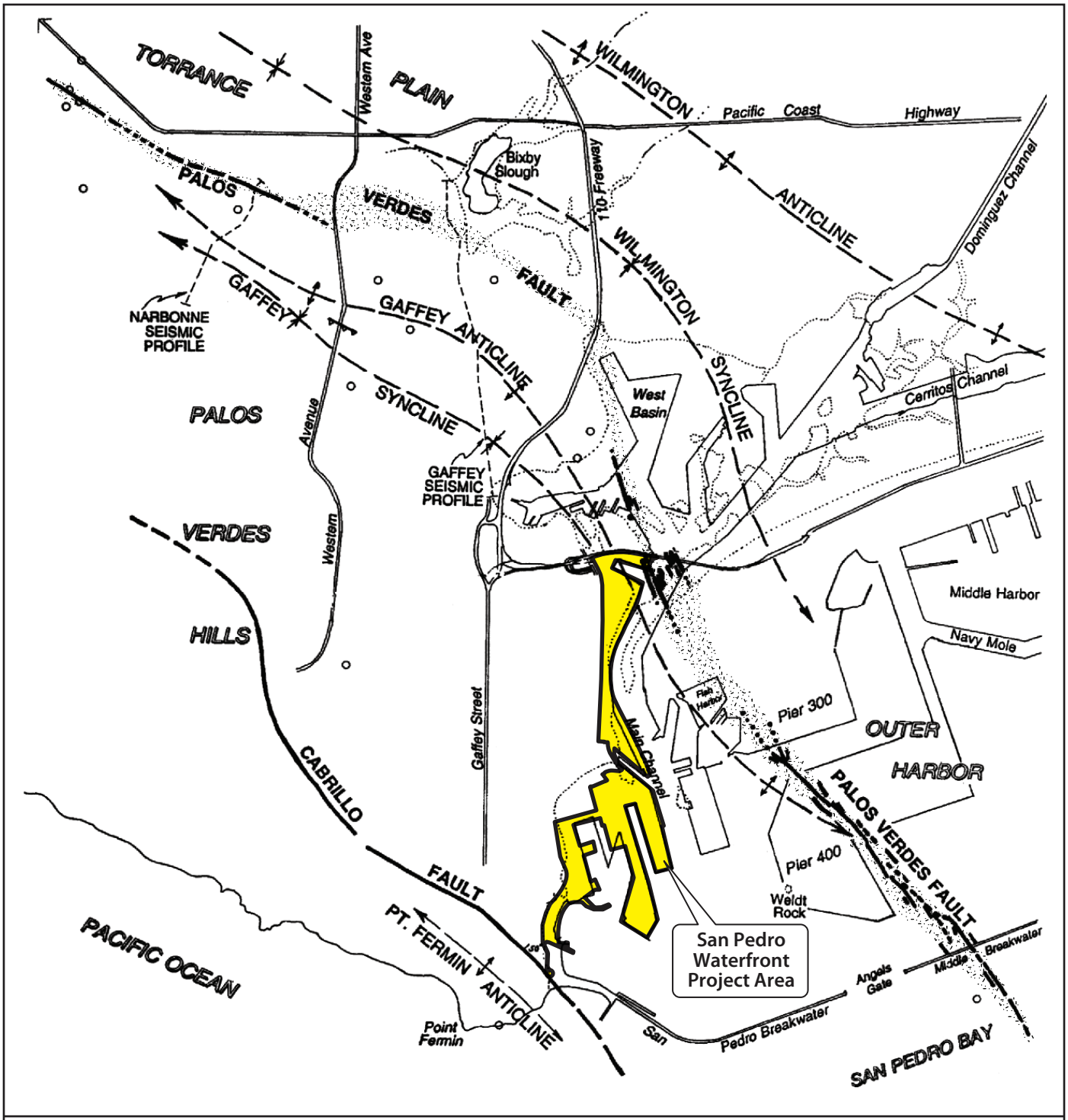
anticlines and the intervening Harbor-Wilmington syncline. The smaller Gaffey anticline and syncline cross the northerly portion of the proposed project site and are the result of deformation along the Palos Verdes Fault zone. The major faults in the region that contribute to the seismic hazard at the proposed project site include the Palos Verdes Fault zone, which crosses the northerly portion of the project site in the vicinity of the Vincent Thomas Bridge, and the more distant Newport-Inglewood Fault zone, located approximately 7 miles northeast of the project site. The Cabrillo Fault, located just south of the federal breakwater, may be a branch of the Palos Verdes Fault zone, but not much is known about its seismic activity. However, even a small earthquake on this fault could cause damage due to its close proximity to the proposed project site. Figure 3.5-1 presents the faults and geologic structure in the area of the proposed project site.

Surficial geology of the Los Angeles Harbor is characterized by Holocene-age, near shore, marine and non-marine deposits, including beach, estuary, tidal flat, lagoon, shallow-water bay sediments, and shoreline terrace deposits. Dredging and filling operations have modified these native sediments to create extensive land masses of dredged fill material that supports numerous harbor facilities. Consequently, most of the harbor facilities at the proposed project site have been constructed on dredged fill material. Both the fill and the native sediments overlie older late-Pleistocene age deposits. These older deposits are exposed in the bluffs that border the westerly side of the proposed project site and include the San Pedro Sand comprised primarily of sand and pebbly gravel and the San Timms Point Silt consisting largely of siltstone (Dibblee 1999).

3.5.2.1.1 Seismicity and Major Faults

An earthquake is classified by the magnitude of wave movement (related to the amount of energy released), which traditionally has been quantified using the Richter scale. This is a logarithmic scale, wherein each whole number increase in magnitude represents a tenfold increase in the wave magnitude generated by an earthquake. A magnitude 8.0 earthquake is not twice as large as a magnitude 4.0 earthquake; it is 10,000 times larger (i.e., 10^4, or 10 x 10 x 10 x 10). Damage typically begins at magnitude 5.0. One limitation of the Richter magnitude scale is that it has an upper limit at which large earthquakes have about the same magnitude. As a result, the moment magnitude scale, which does not have an upper limit magnitude, was introduced in 1979, and is often used for earthquakes greater than magnitude 3.5. Earthquakes of magnitude 6.0 to 6.9 are typically classified as moderate; those between magnitude 7.0 and 7.9 are classified as major; and those of magnitude 8.0 or greater are classified as great.

Southern California is recognized as one of the most seismically active areas in the United States. The region has been subjected to at least 50 earthquakes of magnitude 6.0 or greater since 1796. Ground motion in the region is generally the result of sudden movements of large blocks of the earth's crust along faults. Great earthquakes, like the 1857 San Andreas Fault earthquake, are quite rare in southern California. Earthquakes of magnitude 7.8 or greater occur at the rate of about two or three per 1,000 years, corresponding to a 6 to 9 percent probability in 30 years.



Source: Earth Mechanics, Inc. 2006.

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Figure 3.5-1
San Pedro Waterfront—
Local Faults and Geologic Structure

However, the probability of a magnitude 7.0 or greater earthquake in southern California before 2024 is 85 percent (Working Group on California Earthquake Probabilities 1995). Table 3.5-1 lists selected earthquakes that have caused damage in the Los Angeles Basin.

Table 3.5-1. Earthquakes in the Los Angeles Basin Area

Fault Name	*Place*	*Date*	*Moment Magnitude*
Palos Verdes		*	*
San Pedro Basin		*	*
Santa Monica-Raymond		*	*
San Andreas	Fort Tejon Kern County	1857 1952	7.9† 7.3
Newport-Inglewood	Long Beach	1933	6.4
San Fernando/Sierra Madre-Cucamonga	San Fernando Sierra Madre	1971 1991	6.6 5.6
Whittier-Elsinore	Whittier Narrows	1987	5.9
Camp Rock/Emerson	Landers	1992	7.3
Blind thrust fault beneath Northridge	Northridge	1994	6.7

Note:
*No known earthquakes within the last 200 years.
†Approximate magnitude

Source: USGS 2007

Seismic analyses generally include discussions of maximum credible and maximum probable earthquakes. A maximum credible earthquake (MCE) is the largest event a fault is believed to be capable of generating. The probability of occurrence is not considered in this characterization. The maximum probable earthquake (MPE) is an earthquake having a 10 percent probability of being exceeded in 50 years, which corresponds to a return interval of approximately 475 years. In addition, LAHD uses a combination of probabilistic and deterministic seismic hazard assessment for seismic design. Probabilistic hazard assessments are required to define two-level design events, including the Operational Level Earthquake (OLE), which is the peak horizontal firm ground acceleration with a 50 percent probability of exceedance in 50 years, and the Contingency Level Earthquake (CLE), which is the peak ground acceleration with a 10 percent probability of exceedance in 50 years.

3.5.2.1.2 Faults

Segments of the active Palos Verdes Fault zone cross the Los Angeles Harbor in the vicinity of the northerly proposed project site. Current data depicted in Figure 3.5-1

suggests that segments of the fault may cross beneath Berths 94 and 95. Recent studies indicate that the Palos Verdes Fault zone is capable of producing an earthquake of moment magnitude 6.7 to 7.2, and peak ground accelerations in the Port area of 0.23g[1] and 0.52g for the OLE and CLE, respectively (Earth Mechanics, Inc. 2006).

Numerous other active faults and fault zones are located within the general region, such as the Newport-Inglewood, Whittier-Elsinore, Santa Monica, Hollywood, Malibu Coast, Raymond, San Fernando, Sierra Madre, Cucamonga, San Jacinto, and San Andreas Faults. Table 3.5-2 presents potentially hazardous faults and anticipated earthquake magnitudes in the Los Angeles Basin area. Active faults, such as those noted above, are typical of southern California. Therefore, it is reasonable to expect a strong ground motion seismic event during the lifetime of any proposed project in the region.

Table 3.5-2. Major Regional Faults

Fault		*Maximum Moment Magnitude*	*Fault Type*	*Slip Rate (mm/yr)*	*Source Type*	*Approximate Distance from Site in Miles (kilometers)*
Palos Verdes		7.3	SS	3	B	0 (0)
Newport-Inglewood		7.1	SS	1	B	6.7 (10.8)
Whittier-Elsinore		6.8	SS	2.5	A	22.0 (35.5)
Malibu-Santa Monica-Raymond Fault Zone	Santa Monica	6.6	DS	1	B	27.7 (36.7)
	Hollywood	6.4	DS	1	B	24.2 (39.0)
	Malibu Coast	6.7	DS	0.3	B	24.3 (39.2)
	Raymond	6.5	DS	1.5	B	25.8 (41.6)
Cucamonga		6.9	DS	5	A	40.7 (65.6)
San Jacinto		6.7	SS	12	A	55.7 (89.9)
San Andreas		7.4	SS	30	A	53.7 (86.7)

Notes:
DS – Dip Slip
NT – Normal-Thrust
RO – Reverse-Oblique
SS – Strike Slip
Source: CDMG 1998

Numerous active faults located off site are capable of generating earthquakes in the proposed project area (Tables 3.5-1 and 3.5-2). Most noteworthy, due to its proximity to the site, is the Newport-Inglewood Fault zone, which was the source of the 1933 Long Beach magnitude 6.4 earthquake. Large events could occur on more distant faults in the general area, but because of the greater distance from the site,

[1] g=acceleration due to gravity.

earthquakes generated on these faults may be considered less significant with respect to ground accelerations.

In 1974, the California Division of Mines and Geology (CDMG) was designated by the Alquist-Priolo Act to delineate those faults deemed active and likely to rupture the ground surface. No faults within the area of the Port are currently zoned under the Alquist-Priolo Act; however, there is evidence that the Palos Verdes Fault, which lies beneath Berths 94 and 95, may be active and ground rupture cannot be ruled out (Fischer et al. 1987; McNeilan et al. 1996).

3.5.2.1.3 Liquefaction

Liquefaction is defined as the transformation of a granular material from a solid state into a liquefied state as a consequence of increased pore pressure, which results in the loss of grain-to-grain contact. Seismic ground shaking is capable of providing the mechanism for liquefaction, usually in fine-grained, loose to medium dense, saturated sands and silts. The effects of liquefaction may be excessive if total and/or differential settlement of structures occurs on liquefiable soils.

Natural drainages at Port berths have been backfilled with undocumented fill materials. Dredged materials from the harbor area were spread across lower Wilmington from 1905 until 1910 or 1911 (Ludwig 1927). In addition, the natural alluvial deposits below the site generally are unconsolidated, soft, and saturated. Groundwater is present at shallow depths beneath the site. These conditions are conducive to liquefaction.

Some authors (Tinsley and Youd 1985) have indicated that the liquefaction potential in the harbor area during a major earthquake on either the San Andreas or Newport-Inglewood Fault is high. The Seismic Hazard Maps published by the State of California (CDMG 1999) and the City of Los Angeles General Plan, Safety Element (City of Los Angeles 1996) identify the site to be in an area susceptible to liquefaction because of the nature of the soils (recent alluvial deposits and undocumented fill) and groundwater less than 30 feet below the ground surface (Figure 3.5-2). The site is located approximately ¼ mile southeast of an area of historical liquefaction resulting from the 1933 Long Beach earthquake. Extended duration of ground shaking could result in liquefaction and settlement of saturated subsurface materials.

3.5.2.1.4 Tsunamis

Tsunamis are gravity waves of long wavelength generated by a sudden disturbance in a body of water. Typically, oceanic tsunamis are the result of sudden vertical movement along a fault rupture in the ocean floor, submarine landslides or subsidence, or volcanic eruption, where the sudden displacement of water may set 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 classic 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.

Tsunamis are a relatively common natural hazard, although most of the events are small in amplitude and not particularly damaging. However, in the event of a large submarine earthquake or landslide, coastal flooding may be caused by either run-up of broken tsunamis in the form of bores and surges or by relatively dynamic flood waves. In the process of bore/surge-type run-up, the onshore flow (up to tens of feet per second) 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 drawdown 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 have been found to be a significant cause of extensive damage after successive run-up and drawdown. As has been shown historically, the potential loss of human life in the process can be great if such events occur in populated areas.

Abrupt sea level changes associated with tsunamis in the past have reportedly caused damage to moored vessels within the outer portions of the Los Angeles Harbor. The Chilean earthquake of May 1960, for example, caused local damages of over $1 million and harbor closure. One person drowned at Cabrillo Beach and one was injured. Small craft moorings in the harbor area, especially in the Cerritos Channel, where a seiche occurred, were seriously damaged. Hundreds of small boats broke loose from their moorings, 40 sank, and about 200 were damaged. Gasoline from damaged boats caused a major spill in the harbor waters and created a fire hazard. Currents of up to 8 knots and a 6-foot (1.8-meter) rise of water in a few minutes were observed in the West Basin. The maximum water level fluctuations recorded by gauges were 5.0 feet (1.5 meters) at Port Berth 60 (near Pilot Station) and 5.8 feet (1.8 meters) in Long Beach Harbor (National Geophysical Data Center 1993).

Until recently, projected tsunami run-ups along the western U.S. were based on farfield events, such as submarine earthquakes or landslides occurring at great distances from the U.S., as described above for the Chilean earthquake of May 1960. Based on such distant sources, tsunami-generated wave heights of between 6.5 feet (2 meters) and 8 feet (2.4 meters) above mean lower low water (MLLW), at 100-year intervals, and between 10 feet (3 meters) and 11 feet (3.4 meters), at 500-year intervals, were projected, including the effects of astronomical tides (Houston 1980). MLLW is the benchmark from which infrastructure (e.g., wharf and berth heights) is measured in the Port. These run-up estimates by Houston (1980) were used for the tsunami analysis contained in the Deep Draft Navigation Improvements EIR/EIS in September 1992 (USACE 1992; LAHD 1991).

However, more recent studies (e.g., Synolakis et al. 1997; Borrero et al. 2001; Borrero et al. 2005) have projected larger tsunami run-ups based on near-field events, such as earthquakes or submarine landslides occurring in proximity to the California coastline. Offshore faults present a larger local tsunami hazard than previously thought, posing a direct threat to near shore facilities. For example, one of the largest such features, the Catalina Fault, lies directly underneath Catalina Island, located

only 22 miles (35 kilometers) from the Port. Simulations of tsunamis generated by uplift on this fault suggest waves in the Port in excess of 12 feet (3.7 meters), with an arrival time within 20 minutes (Legg et al. 2004; Borrero et al. 2005). These simulations were based on rare events, representing worst-case scenarios.

In addition, landslide-derived tsunamis are now perceived as a viable local tsunami hazard. Such tsunamis can potentially be more dangerous, due to the lack of warning for such an event. This mechanism is illustrated by an earthquake in 1998, centered onshore Papua-New Guinea, which appears to have created an offshore landslide that caused tsunami inundation heights in excess of 33 feet (10 meters), claiming more than 2,500 lives. In a study modeling potential tsunami generation by local offshore earthquakes, Legg et al. (2004) consider the relative risk of tsunamis from a large catastrophic submarine landslide (likely generated by a seismic event) in offshore southern California versus fault-generated tsunamis. The occurrence of a large submarine landslide appears quite rare by comparison with the tectonic faulting events. Although many submarine landslides have been mapped off the southern California shore, few appear to be of the scale necessary to generate a catastrophic tsunami. Of two large landslides that appear to be of this magnitude, Legg et al. (2004) indicated that one landslide is over 100,000 years old, and the other landslide is approximately 7,500 years old. In contrast, the recurrence of 3-to-20-foot (1-to-6-meter) fault movements on offshore faults would be several hundred to several thousand years. Consequently, the study concludes that the most likely direct cause of most of the local tsunamis in southern California is tectonic movement during large offshore earthquakes.

Based on these recent studies (e.g., Synolakis et al. 1997; Borrero et al. 2001), the California State Lands Commission (CSLC) has developed tsunami run-up projections for the Ports of Los Angeles and Long Beach of 8.0 feet (2.4 meters) and 15.0 feet (4.6 meters) above mean sea level (MSL), at 100- and 500-year intervals, respectively, as a part of its Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS) (CSLC 2005). However, these projections do not incorporate consideration of the localized landfill configurations, bathymetric features, and the interaction of the diffraction, reflection, and refraction of the tsunami wave propagation within the Los Angeles/Long Beach Port Complex in its predictions of tsunami wave heights.

Most recently, a model has been developed specifically for Los Angeles/Long Beach Port Complex that incorporates consideration of the localized landfill configurations, bathymetric features, and the interaction of the diffraction, reflection, and refraction of tsunami wave propagation in the predictions of tsunami wave heights (Moffatt and Nichol 2007). The Los Angeles/Long Beach Port Complex model uses a methodology similar to the above studies to generate a tsunami wave from several different potential sources, including local earthquakes, remote earthquakes, and local submarine landslides. The model predicts that a reasonable maximum source for future tsunami events at the proposed project site would either be a moment magnitude 7.6 earthquake on the Catalina Fault or a submerged landslide along the nearby Palos Verdes Peninsula. The model predicts maximum tsunami wave heights in the Port area of approximately 5.2 feet (1.6 meters) to 6.6 feet (2.0 meters) above MSL for the earthquake scenario and approximately 7.2 feet (2.2 meters) to 23.0 feet

(7.0 meters) above MSL for the landslide scenario. The highest anticipated water levels from the landslide scenario would occur in the Outer Harbor area. The model results suggest that tsunami-induced flooding could occur in the proposed project area under both the earthquake and landslide scenarios, particularly in the area of the West Channel where deck elevations are the lowest. Additionally, the modeled landslide scenario could result in localized overtopping of the existing deck in the proposed project area.

The modeled worst-case tsunami scenario was based partially on a moment magnitude 7.6 earthquake on the offshore Catalina Fault. The recurrence interval for a magnitude 7.5 earthquake along an offshore fault in southern California is about 10,000 years. Similarly, the recurrence interval of a magnitude 7.0 earthquake is about 5,000 years and the recurrence interval of a magnitude 6.0 earthquake is about 500 years. However, there is no certainty that any of these earthquake events would result in a tsunami, since only about 10 percent of earthquakes worldwide result in a tsunami. In addition, available evidence indicates that tsunamigenic landslides would be extremely infrequent and occur less often than large earthquakes. This suggests recurrence intervals for such landslide events would be longer than the 10,000-year recurrence interval estimated for a magnitude 7.5 earthquake (Moffatt and Nichol 2007).

3.5.2.1.5 Seiches

Seiches are seismically induced water waves that surge back and forth in an enclosed basin and may be expected in the harbor as a result of earthquakes. Any significant wave front could cause damage to seawalls and docks, and could breach sea walls at the proposed project site. Modern shoreline protection techniques are designed to resist seiche damage. The Los Angeles/Long Beach Port Complex model referred to above considered impacts from tsunamis and seiches. In each case, impacts from a tsunami were equal to or more severe than those from a seiche. As a result, the impact discussion below refers primarily to tsunamis as this will be considered the worst case of potential impacts.

3.5.2.1.6 Subsidence

Subsidence is the phenomenon where the soils and other earth materials underlying the site settle or compress, resulting in a lower ground surface elevation. Fill and native materials on site can be water saturated, and a net decrease in the pore pressure and contained water will allow the soil grains to pack closer together. This closer grain packing results in less volume and the lowering of the ground surface.

Subsidence in the Los Angeles-Long Beach harbor area was first observed in 1928. It has affected the majority of the harbor area. Based on extensive studies by the City of Long Beach and the California Division of Oil and Gas and Geothermal Resources, it has been determined that most of the subsidence was the result of oil and gas production from the Wilmington Oil Field following its discovery in 1936. By 1941, subsidence of approximately 1.3 feet was noted in the area of Long Beach

Harbor. By 1962, subsidence had spread over a wide area and reached approximately 26 feet in the area of Terminal Island (Parks 1999). Today, water injection continues to be maintained at rates greater than the total volume of produced substances, including oil, gas, and water, to prevent further reservoir compaction and subsidence (City of Long Beach 2006). Subsidence near the proposed Project, due to previous oil extraction in the Port area, has been mitigated and is not anticipated to affect adversely the proposed Project.

3.5.2.1.7 Landslides

Generally, a landslide is defined as the downward and outward movement of loosened rock or earth down a hillside or slope. Landslides can occur either very suddenly or slowly, and frequently accompany other natural hazards such as earthquakes, floods, or wildfires. Most landslides are single events, but more than a third are associated with heavy rains or the melting of winter snows. Landslides can also be triggered by ocean wave action or induced by the undercutting of slopes during construction, improper artificial compaction, or saturation from sprinkler systems or broken water pipes. In areas on hillsides where the ground cover has been destroyed, landslides are probable because there is nothing to hold the soil. 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, and sewage lines. With the exception of the Ports O'Call bluff area, and along Shoshonean Road where slope stabilization efforts have recently been completed or are ongoing, the proposed project site is relatively flat and paved, and no known or probable bedrock landslide areas have been identified (City of Los Angeles 1996).

3.5.2.1.8 Expansive Soils

Expansive soils generally result from specific clay minerals that expand when saturated and shrink in volume when dry. These expansive clay minerals are common in the geologic units in the adjacent Palos Verdes Peninsula. Clay minerals in geologic units at the proposed project area could be expansive, and previously imported fill soils could be expansive as well.

3.5.2.1.9 Mineral Resources

The proposed project site is located to the southwest of the Wilmington Oil Field. The Wilmington Oil Field is a broad, asymmetric anticline broken by a series of transverse normal faults that have created seven major oil-producing zones, from which production began in 1936 (Mayuga 1970). The field is approximately 11 miles long and 3 miles wide, covering approximately 13,500 acres. The southwesterly edge of the field crosses the Los Angeles Harbor to the north of the Vincent Thomas Bridge. The Wilmington Oil Field produced 84.4 million barrels of oil from January 1998 through October 2002, making it the 6th largest producing oil

field in the state (California Department of Conservation 2002; CDMG 1999). The proposed Project is not within an active oil field and no oil production or exploration occurs within the proposed project area.

The proposed project site is located primarily on dredged fill material. According to the CDMG, the proposed project site is located in a Mineral Resource Zone (MRZ) area classified as MRZ-1, which is defined as an area where adequate information indicates that no significant mineral deposits (i.e., aggregate deposits) are present or where it is judged that little likelihood exists for their presence (CDMG 1987).

3.5.3 Applicable Regulations

3.5.3.1 Geologic Hazards

Geologic resources and geotechnical hazards in the proposed project vicinity are governed primarily by the City of Los Angeles. The Conservation and Safety Elements of the City of Los Angeles General Plan contain policies for the protection of geologic features and avoidance of geologic hazards (City of Los Angeles 1996). Local grading ordinances establish detailed procedures for excavation and earthwork required during construction in upland areas. In addition, City of Los Angeles building codes and building design standards for the Port establish requirements for construction of aboveground structures (City of Los Angeles 2002). Most local jurisdictions rely on the California Uniform Building Code (UBC) as a basis of seismic design. However, with respect to wharf construction, LAHD standards and specifications would be applied to the design of the proposed Project. LAHD must comply with regulations of the Alquist-Priolo Act, which regulates development near active faults to mitigate the hazard of a surface fault rupture.

The MOTEMS were approved by the California Building Standards Commission on January 19, 2005 and are codified as part of CCR, Title 24, Part 2, Marine Oil Terminals, Chapter 31F. These standards apply to all existing marine oil terminals in California and include criteria for inspection, structural analysis and design, mooring and berthing, geotechnical considerations, fire, piping, and mechanical and electrical systems. MOTEMS became effective on January 6, 2006 (CSLC 2005). The process of developing the MOTEMS has produced parallel guidelines and recommended provisions. The Seismic Design Guidelines for Port Structures, published in 2001 by the Port International Navigation Association (PIANC) uses text virtually identical to that found in the MOTEMS. The language for the PIANC and the MOTEMS is derived from the Naval Facilities Engineering Service Center Technical Report (TR-2103-SHR), Seismic Criteria for California Marine Oil Terminals (CSLC 2004).

3.5.3.2 Mineral Resources

Excavations and construction in the immediate vicinity of abandoned oil wells is regulated in accordance with standards and procedures as set forth by the California Department of Conservation Division of Oil, Gas, and Geothermal Resources

(DOGGR). If any structure is to be located over or in proximity to a previously abandoned well, the well may require re-abandonment. PRC Section 3208.1, authorizes the State Oil and Gas Supervisor to order re-abandonment of any previously abandoned well when construction of any structure over or in proximity to the well could result in a hazard.

The Surface Mining and Reclamation Act of 1975 (SMARA) was enacted to promote conservation of the State's mineral resources and to ensure adequate reclamation of lands once they have been mined. Among other provisions, SMARA requires the State Geologist to classify land in California for mineral resource potential. The four categories include: MRZ-1, areas of no mineral resource significance; MRZ-2, areas of identified mineral resource significance; MRZ-3, areas containing potential but presently unproven resources; and MRZ-4, areas where available information is inadequate for assignment to any other MRZ zone.

The distinction between these categories is important for land use considerations. The presence of known mineral resources, which are of regional significance and possibly unique to that particular area, could potentially result in non-approval or changes to a given project if it were determined that those mineral resources would no longer be available for extraction and consumptive use. To be considered significant for the purpose of mineral land classification, a mineral deposit, or a group of mineral deposits that can be mined as a unit, must meet marketability and threshold value criteria adopted by the California State Mining and Geology Board. The criteria vary for different minerals depending on the following: 1) whether the minerals are strategic or non-strategic, 2) the uniqueness or rarity of the minerals, and 3) the commodity-type category (metallic minerals, industrial minerals, or construction materials) of the minerals. The State Geologist submits the mineral land classification report to the State Mining and Geology Board, which transmits the information to appropriate local governments that maintain jurisdictional authority in mining, reclamation, and related land use activities. Local governments are required to incorporate the report and maps into their general plans and consider the information when making land use decisions.

3.5.4 Impacts and Mitigation Measures

3.5.4.1 Methodology

Geological impacts have been evaluated in two ways: 1) impacts of the proposed Project on the local geologic environment, and 2) impacts of geohazards on components of the proposed Project that may result in substantial damage to structures or infrastructure or expose people to substantial risk of injury. Impacts would be considered significant if the proposed Project meets any of the significance criteria listed in Section 3.5.4.2.

3.5.4.2 Thresholds of Significance

The following significance criteria are based on the *Los Angeles CEQA Thresholds Guide* (City of Los Angeles 2006) and are the basis for determining the significance of impacts associated with geology resulting from development of the proposed Project.

Geologic hazard impacts are considered significant if the proposed Project causes or accelerates hazards that would result in substantial damage to structures or infrastructure, or exposes people to substantial risk of injury. Because the region is considered to be geologically active, most projects are exposed to some risk from geologic hazards, such as earthquakes. The following factors are used to determine significance for geologic impacts.

GEO-1: A project would have a significant impact if it would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury, from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.

GEO-2: A project would have a significant impact if it would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury, from tsunamis or seiches.

GEO-3: A project would have a significant impact if it would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury, from land subsidence/settlement.

GEO-4: A project would have a significant impact if it would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury, from expansive soils.

GEO-5: A project would have a significant impact if it would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury, from landslides or mudflows.

GEO-6: A project would have a significant impact if it would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury, from unstable soil conditions from excavation, grading, or fill.

GEO-7: A project would have a significant impact if one or more distinct and prominent geologic or topographic features would be destroyed, permanently covered, or materially and adversely modified. Such features may include, but not be limited to, hilltops, ridges, hill slopes, canyons, ravines, rock outcrops, water bodies, streambeds, and wetlands.

GEO-8: A project would have a significant impact if it resulted in the permanent loss of availability of a known mineral resource of regional, state, or local significance that would be of future value to the region and the residents of the state.

3.5.4.3 Impacts and Mitigation Measures

The assessment of impacts is based on regulatory controls and on the assumptions that the proposed Project and all alternatives would include the following:

- LAHD or authorized developers within the proposed project area will design and construct upland improvements in accordance with Los Angeles Building Code, Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, to minimize impacts associated with seismically induced geohazards. Sections 91.000 through 91.7016 of the Los Angeles Municipal Code regulate construction in upland areas of the Port. These building codes and criteria provide requirements for construction, grading, excavations, use of fill, and foundation work, including type of materials, design, procedures, etc. These codes are intended to limit the probability of occurrence and the severity of consequences from geological hazards. Necessary permits, plan checks, and inspections are also specified. The Los Angeles Municipal Code also incorporates structural seismic requirements of the California UBC, which classifies almost all of coastal California (including the proposed project site) within Seismic Zone 4, on a scale of 1 to 4, with 4 being most severe. The Project engineers will review the proposed project plans for compliance with the appropriate standards in the building codes.
- LAHD will design and construct new harbors and wharf improvements in accordance with MOTEMS and LAHD standards, to minimize impacts associated with seismically induced geohazards. Such construction will include, but not be limited to, completion of site-specific geotechnical investigations regarding construction and foundation engineering. Measures pertaining to temporary construction conditions, such as protecting adjacent structures and temporary slope stability, will be incorporated into the design. A licensed geologist or engineer will monitor construction to check that construction occurs in concurrence with proposed project design.

3.5.4.3.1 Proposed Project

Construction Impacts

Impact GEO-1a: Construction of the proposed Project would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.

There would be a minor increase in the exposure of people and property to seismic hazards during construction relating to baseline conditions. The proposed project area lies near the Palos Verdes Fault zone. Strands of the fault may pass beneath the northerly portion of the proposed project area, in the vicinity of Berths 94 and 95 (Figure 3.5-1). Strong-to-intense ground shaking, surface rupture, and liquefaction

could occur in these areas due to the location of the fault beneath the proposed project area and the presence of water-saturated hydraulic fill. Projects in construction phases are especially susceptible to earthquake damage due to temporary conditions, such as temporary slopes and unfinished structures, which are typically not in a condition to withstand intense ground shaking. Strong ground shaking would potentially cause damage to unfinished structures resulting in injury or fatality to construction workers. With the exception of ground rupture, similar seismic impacts could occur due to earthquakes on other regional faults. Earthquake-related hazards, such as fault rupture, liquefaction, and seismic ground shaking cannot be avoided in the Los Angeles region and in particular in the harbor area where the Palos Verdes Fault is present and hydraulic fill and alluvial deposits underlie the site.

CEQA Impact Determination

As discussed above, seismic activity along the Palos Verdes Fault zone, or other regional faults, would potentially produce fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure. Seismic hazards are common to the Los Angeles region and are not increased by the proposed Project. However, because the proposed project area is potentially underlain by strands of the active Palos Verdes Fault and liquefaction-prone hydraulic fill, there is a substantial risk of seismic impacts. Design and construction in accordance with applicable laws and regulations pertaining to seismically induced ground movement would minimize structural damage in the event of an earthquake. However, increased exposure of people and property during construction to seismic hazards from a major or great earthquake cannot be precluded even with incorporation of modern construction engineering and safety standards. Therefore, impacts due to seismically induced ground failure would be significant and unavoidable under CEQA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

The federal portions of the proposed Project would include the development of three new harbors involving water cuts, two new cruise terminals and berths in the Outer Harbor, new pier and wharf construction, and upgrading existing piers and wharves. Because the proposed project area is potentially underlain by strands of the active Palos Verdes Fault and liquefaction-prone hydraulic fill, there is a substantial risk of seismic impacts. The proposed waterfront development would be susceptible to fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure. Design and construction in accordance with applicable laws and regulations pertaining to seismically induced ground movement would minimize structural damage in the event of an earthquake. However, increased exposure of people and property during construction to seismic hazards from a major or great earthquake

cannot be precluded even with incorporation of modern construction engineering and safety standards. Therefore, impacts due to seismically induced ground failure would be significant and unavoidable under NEPA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-2a: Construction of the proposed Project would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.

Due to the historic occurrence of earthquakes and tsunamis along the Pacific Rim, placement of any development on or near the shore in southern California, including the proposed project site, would always involve some measure of risk of impacts from a tsunami or seiche. Although relatively rare, should a large tsunami or seiche occur, it would be expected to cause some amount of damage and possibly injuries to most on or near-shore locations. As a result, this is considered by LAHD as the average, or normal condition for most on- and near-shore locations in southern California. Therefore, a proposed project tsunami or seiche related impact would be one that would exceed this normal condition and cause substantial damage and/or substantial injuries. For reasons explained below, under a theoretical maximum worst-case scenario, construction of the proposed Project would expose people or property to substantial damage or substantial injuries in the event of a tsunami or seiche. Therefore, impacts would be significant.

Since tsunamis and seiches are derived from wave action, the risk of damage or injuries from these events at any particular location is lessened if the location is high enough above sea level, far enough inland, or protected by manmade structures such as dikes or concrete walls. The height of a given site above sea level is either the result of an artificial structure (e.g., a dock or wall), topography (e.g., a hill or slope), or both, and a key variable related to the height of a site location relative to sea level is the behavior of tides. During high tide, for instance, the distance between the site and sea level is less. During low tide, the distance is greater. How high a site must be located above sea level to avoid substantial wave action during a tsunami or seiche depends upon the height of the tide at the time of the event and the height of the potential tsunami or seiche wave.

The harbor is subject to diurnal tides, meaning two high tides and two low tides during a 24-hour day. The average of the lowest water level during low tide periods each day is typically set as a benchmark of 0 feet and is defined as Mean Lower Low Water level (MLLW). For purposes of this discussion, all proposed project structures

and land surfaces are expressed as height above (or below) MLLW. The MSL in the harbor is +2.82 feet above MLLW (NOAA 2007). This height reflects the arithmetic mean of hourly heights observed over the National Tidal Datum Epoch (19 years) and therefore, reflects the mean of both high and low tides in the harbor. The recently developed Los Angeles/Long Beach Port Complex model described in Section 3.5.2 above predicts tsunami wave heights with respect to MSL, rather than MLLW, and therefore, can be considered a reasonable average condition under which a tsunami might occur. (Moffatt and Nichol 2007.)

The Los Angeles/Long Beach Port Complex study identified the lowest deck elevations throughout the Port using various sources of data. The deck elevations that are the lowest within the proposed project area are those surrounding the West Channel and in the Cabrillo Marina. These elevations are based on an aerial survey performed in February 1999 and information from the LAHD. The lowest deck elevation in the area immediately surrounding the West Channel is approximately 4.9 feet (1.5 meters) above MSL. The adjacent buildings within the West Channel area are set back from the waterfront and are at a slightly higher elevation of approximately 7.2 feet (2.19 meters) above MSL. The lowest deck elevations within the East Channel and Main Channel are approximately 11.2 feet (3.41 meters) and 12.2 feet (3.71 meters) above MSL, respectively.

The Los Angeles/Long Beach Port Complex model indicates that a reasonable maximum source for future tsunami events at the proposed project site would either be a moment magnitude 7.6 earthquake on the Catalina Fault or a submerged landslide along the nearby Palos Verdes Peninsula. The model predicts maximum tsunami wave heights in the Port area of approximately 5.2 feet (1.6 meters) to 6.6 feet (2.0 meters) above MSL for the earthquake scenario and approximately 7.2 feet (2.2 meters) to 23.0 feet (7.0 meters) above MSL for the landslide scenario. The highest anticipated water levels from the landslide scenario would occur in the Outer Harbor area. Based on the lowest deck elevations presented above, tsunami-induced flooding could occur in the proposed project area under both the earthquake and landslide scenarios, particularly in the area of the West Channel where deck elevations are the lowest. Additionally, the modeled landslide scenario could result in localized overtopping of the existing deck in the proposed project area.

The modeled worst-case tsunami scenario was based partially on a magnitude 7.6 earthquake on the offshore Catalina Fault. The recurrence interval for a magnitude 7.5 earthquake along an offshore fault in southern California is about 10,000 years. Similarly, the recurrence interval of a magnitude 7.0 earthquake is about 5,000 years and the recurrence interval of a magnitude 6.0 earthquake is about 500 years. However, there is no certainty that any of these earthquake events would result in a tsunami, since only about 10 percent of earthquakes worldwide result in a tsunami. In addition, available evidence indicates that tsunamigenic landslides would be extremely infrequent and occur less often than large earthquakes. This suggests recurrence intervals for such landslide events would be longer than the 10,000-year recurrence interval estimated for a magnitude 7.5 earthquake (Moffatt and Nichol 2007).

CEQA Impact Determination

Designing new facilities based on existing building codes may not prevent substantial damage to structures from coastal flooding. In addition, projects in construction phases are especially susceptible to damage due to temporary conditions, such as unfinished structures, which are typically not in a condition to withstand coastal flooding. Impacts due to tsunamis and seiches are typical for the entire California coastline and would not be increased by construction of the proposed Project. Emergency planning and coordination between the existing and future Port tenants and LAHD, as outlined in Mitigation Measure MM GEO-1, would contribute to reducing onsite injuries during a tsunami. However, even with incorporation of emergency planning and construction in accordance with current City and State regulations, substantial damage and/or injury would occur in the event of a tsunami or seiche. Because portions of the proposed project site are at elevations lower than the predicted tsunami wave heights, there is a substantial risk of coastal flooding due to tsunamis and seiches. Raising the elevation of the site or constructing a wall along the perimeter of the site of sufficient height to mitigate the potentially damaging effects of tsunami would be the only way to mitigate potential impacts. However, elevating the approximately 400 acres within the site or building a wall around the entire perimeter of the proposed project area would be cost-prohibitive and would significantly impact existing infrastructure requiring extensive modification of existing improvements. Mitigating the tsunami risk would not be feasible. As a result, impacts during the construction phase of the proposed Project would be significant and unavoidable under CEQA.

Mitigation Measures

MM GEO-1. Emergency response planning. The tenants within the proposed project area will work with Port engineers and LAHD police to develop tsunami response training and procedures to assure that construction and operations personnel will be prepared to act in the event of a large seismic event. Such procedures will include immediate evacuation requirements in the event that a large seismic event is felt at the proposed project site, as part of overall emergency response planning for this proposed Project.

Such procedures will be included in any bid specifications for construction or operations personnel, with a copy of such bid specifications to be provided to LAHD, including a completed copy of its operations emergency response plan prior to commencement of construction activities and/or operations.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

The proposed Project would include the construction of three new harbors, two new cruise terminals and berths in the Outer Harbor, new piers and wharves, as well as upgrading existing wharves, which would be susceptible to tsunamis and seiches.

There is a substantial risk of coastal flooding of wharves and associated upland areas due to tsunamis and seiches. Because construction would occur over an extended period, increased exposure of people and property during construction to seismically induced tsunamis or seiches from a major or great earthquake cannot be precluded. Emergency planning and coordination between the existing and future Port tenants and the LAHD, as outlined in Mitigation Measure MM GEO-1, would contribute to reducing onsite injuries during a tsunami. However, even with incorporation of emergency planning and construction in accordance with current City and State regulations, substantial damage and injury would occur in the event of a tsunami or seiche. Impacts due to tsunamis and seiches would be significant and unavoidable under NEPA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-3a: Construction of the proposed Project would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.

Subsidence in the vicinity of the proposed Project, due to previous oil extraction in the Port area, has been mitigated through water injection and is not anticipated to adversely impact the proposed Project (City of Long Beach 2006). However, in the absence of proper engineering, proposed structures could be cracked and warped as a result of saturated, unconsolidated/compressible sediments. During proposed project design, a geotechnical engineer would evaluate the settlement potential in areas where structures are proposed.

The settlement potential of existing onshore soils would be evaluated through a site-specific geotechnical investigation, which includes subsurface soil sampling, laboratory analysis of samples collected to determine soil compressibility, and an evaluation of the laboratory testing results by a geotechnical engineer. Recommendations of the engineer would be incorporated into the design specifications for the proposed Project, consistent with City design guidelines, including Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, in conjunction with criteria established by LAHD. Recommendations for soils subject to settlement typically include over excavation and recompaction of compressible soils, which would allow for construction of a conventional slab-on-grade; or alternatively, installation of concrete or steel foundation piles through the settlement prone soils to a depth of competent soils. Such geotechnical engineering would substantially reduce the potential for soil settlement and would allow for construction of the proposed Project that would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

CEQA Impact Determination

The proposed Project would be designed and constructed in compliance with the recommendations of the geotechnical engineer, consistent with Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, and in conjunction with criteria established by LAHD, and would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury. Therefore, settlement impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

The federal portions of the proposed Project would include wharf and in-water construction activities, including water cuts for three new harbors, new pier and wharf construction, and upgrading existing piers and wharves, as well as two new cruise terminals and berths in the Outer Harbor. Settlement impacts associated with these construction activities would be less than significant under NEPA, with implementation of standard geotechnical engineering practices, including incorporation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code and criteria established by LAHD, and would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-4a: Construction of the proposed Project would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.

Expansive soil may be present in the proposed project area and may be present in dredged or imported soils used for proposed project grading. Expansive soils beneath the proposed project's foundations, pavement, or behind retaining structures could result in cracking and distress of these structures. However, during the proposed project design phase, a geotechnical engineer would evaluate the expansion potential associated with onsite soils. The soil expansion potential would be evaluated through

a site-specific geotechnical investigation, which includes subsurface soil sampling, laboratory analysis of samples collected to determine soil expansion potential, and an evaluation of the laboratory testing results by a geotechnical engineer. Recommendations of the engineer would be incorporated into the design specifications for the proposed Project, consistent with City design guidelines, including Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, in conjunction with criteria established by LAHD. Recommendations for soils subject to expansion typically include over excavation and replacement of expansive soils with sandy, non-expansive soils, which would allow for construction of a conventional slab-on-grade; construction of post-tensioned concrete slabs, which can accommodate movement of underlying expansive soils; or alternatively, installation of concrete or steel foundation piles through the expansion prone soils, to a depth of non-expansive soils. Such geotechnical engineering would substantially reduce the potential for soil expansion and damage to overlying structures.

CEQA Impact Determination

The proposed Project would be designed and constructed in compliance with the recommendations of the geotechnical engineer, consistent with implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, and in conjunction with criteria established by LAHD, and would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury. Therefore, expansive soil impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

The federal portions of the proposed Project would include wharf and in-water construction activities, including water cuts for three new harbors, new pier and wharf construction, and upgrading existing piers and wharves, as well as construction of two new cruise terminals and berths in the Outer Harbor. Expansive soil may be present in the material excavated from the water cuts or imported soils used for fill during construction. Use of expansive soils beneath the proposed project's foundations, pavement, or backfill behind retaining structures could result in cracking and distress of these structures. However, expansive soil impacts in the waterfront areas would be less than significant under NEPA with implementation of standard geotechnical engineering practices and Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, in conjunction with criteria established by LAHD, and would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury. Therefore, expansive soil impacts in the waterfront areas would be less than significant under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-5a: Construction of the proposed Project would not result in substantial damage to structures or infrastructure, or expose people to a substantial risk of landslides or mudslides.

Numerous ancient and recent landslides have occurred within the southerly portion of the Palos Verdes Hills, including the large Portuguese Bend landslide complex. This area is approximately 5 miles to the west of the proposed project site. The topography of the proposed project site is flat with no significant slopes nearby; therefore, the risk associated with landslides or mudflows is considered low. A relatively small slope is located along the westerly border of the proposed project site. The slope ranges from 0 to approximately 20 feet in height and is vegetated and maintained. Harbor Boulevard extends along the top of the slope. Due to the relatively small size of the slope, the potential for a deep-seated landslide or mudflow to occur on this slope is considered low. In addition, the proposed project site and vicinity is not located in an area susceptible to earthquake-induced landslides (CDMG 1999). The proposed multi-level parking structure along the bluffs at the westerly border of the proposed project site would involve construction adjacent to an existing slope. The impacts associated with this construction are discussed in Impact GEO-6a.

CEQA Impact Determination

As the topography in the vicinity of the proposed project site is flat and not subject to landslides or mudflows, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-6a: Construction of the proposed Project would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of unstable soil conditions from excavation, grading, or fill.

Natural alluvial deposits, as well as fill consisting of dredged deposits or imported soils, may be encountered during excavations for utility pipeline relocation or for construction of foundations, retaining walls, manholes, and other structures. Groundwater is present at depths of approximately 12 feet or shallower. Materials near and below the groundwater table would be relatively fluid and unstable, requiring implementation of standard engineering practices such as dewatering wells, installation of sheet piling, and other special handling procedures to facilitate excavation. For example, dewatering wells would lower the groundwater level, thus reducing the potential for unstable soils. Various types of temporary shoring would also be used to stabilize excavations.

The proposed multi-level parking structure along the bluffs at the westerly border of the project site would involve construction adjacent to an existing slope. A site-specific geotechnical evaluation would be performed during the design phase of the parking structure and would include recommendations to maintain stability of the slope during construction. Such recommendations may include installation of temporary shoring walls or retaining structures and installation of ground instrumentation, such as inclinometers to monitor ground movement during construction. Such engineering practices would be implemented where necessary.

The proposed water cuts for the three new harbors would involve excavation and dredging operations. Some of these operations would be located near to existing structures, including the Maritime Museum Ferry Building. Standard engineering practices would be implemented to substantially reduce the potential for damage to these existing structures during the excavation operations. Such engineering practices may include installation of sheet piling at the perimeter of the excavation, underpinning the foundations of the structures so that the foundation support extends below the level of the excavation, and implementation of ground instrumentation such as inclinometers to monitor lateral deformation of the ground adjacent to the excavation.

Granular material, if encountered during excavation or dredging, may be suitable for reuse as fill during construction. Excess excavation or dredged material could be used at other nearby construction sites, if suitable, or transported to an appropriate

disposal facility. Contaminated material, if encountered, would be evaluated by an environmental professional. Handling of contaminated soil, including disposal at an appropriate facility, would be performed under the direction of the environmental professional.

CEQA Impact Determination

Due to implementation of standard engineering practices regarding unstable soils, people and structures would not be exposed to substantial adverse effects from the proposed Project, and impacts associated with unstable soil would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

The federal portion of the proposed Project would include wharf and in-water construction activities, including construction of new water-cuts for three new harbors, new pier and wharf construction, and upgrading existing piers and wharves, as well as construction of two new cruise terminals and berths in the Outer Harbor. Due to implementation of standard engineering practices mentioned above, people and structures would not be exposed to substantial adverse effects from the proposed Project, and impacts associated with unstable soils would be less than significant under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-7a: Construction of the proposed Project would not result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.

Since the proposed project area is relatively flat and paved, with no prominent geologic or topographic features, proposed project construction would not result in any distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified. The bluffs along Harbor

Boulevard are currently covered with landscaping. The proposed Project would not result in the covering of any distinct or prominent geologic features.

CEQA Impact Determination

As the topography in the vicinity of the proposed project site is flat and does not contain prominent geologic or topographic features, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-8a: Construction of the proposed Project would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.

With respect to aggregate potential, the proposed project site is located in MRZ-1, which is defined as an area where adequate information indicates that no significant mineral deposits are present or where it is judged that little likelihood exists for their presence. Therefore, the proposed Project would not result in the permanent loss of availability of aggregate mineral resources. Non-contaminated coarse-grained granular material, if encountered during excavation or dredging, may be suitable for reuse as fill during construction. With respect to petroleum resources, the proposed project site is not located within the Wilmington Oil Field, which is a large oil-producing field in the state. The southwesterly edge of the field is located to the northeast of the site on the north side of the Vincent Thomas Bridge.

CEQA Impact Determination

The proposed Project would not result in the permanent loss of availability of a known mineral resource that would be of future value to the region and the residents of the state. Mineral resource impacts would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

Impacts would be less than significant, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Operations Impacts

Impact GEO-1b: Operation of the proposed Project would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.

There would be an increase in the exposure of people and property to seismic hazards relating to baseline conditions. The proposed project area lies in the vicinity of the Palos Verdes Fault zone. Strands of the fault may pass beneath the proposed project area near Berths 94 and 95 (Figure 3.5-1). Strong-to-intense ground shaking, surface rupture, and liquefaction could occur in these areas due to the location of the fault beneath the proposed project area and the presence of water-saturated hydraulic fill. With the exception of ground rupture, similar seismic impacts could occur due to earthquakes on other regional faults. Earthquake-related hazards, such as liquefaction, ground rupture, and seismic ground shaking cannot be avoided in the Los Angeles region and in particular in the harbor area where the Palos Verdes Fault is present and dredged fill and alluvial deposits underlie the site.

However, as discovered during the 1971 San Fernando earthquake and the 1994 Northridge earthquake, existing building codes are often inadequate to completely protect engineered structures from hazards associated with liquefaction, ground rupture, and large ground accelerations. Consequently, designing new facilities based on existing building codes may not prevent significant damage to structures from a major or great earthquake on the underlying Palos Verdes Fault or any other regional fault.

CEQA Impact Determination

As discussed above, seismic activity along the Palos Verdes Fault zone, or other regional faults, could produce fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure. Seismic hazards are common to the Los Angeles region and are not increased by the proposed Project. However, because the proposed project area is potentially underlain by strands of the active Palos Verdes Fault and liquefaction-prone hydraulic fill, there is a substantial risk of seismic impacts. Design and construction in accordance with applicable laws and regulations pertaining to seismically induced ground movement would minimize structural damage in the event of an earthquake. However, increased exposure of people and property during operations to seismic hazards from a major or great earthquake cannot be precluded even with incorporation of modern construction engineering and safety standards. Therefore, impacts due to seismically induced ground failure would be significant and unavoidable under CEQA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

The federal portions of the proposed Project would include the development of three new harbors involving water cuts, two new cruise terminals and berths in the Outer Harbor, new pier and wharf construction, and upgrading existing piers and wharves. Impacts due to seismically induced ground failure would be significant and unavoidable, as discussed for the CEQA impact determination.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-2b: Operation of the proposed Project would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.

The discussion of Impact GEO-2a, above, sets forth the probability and anticipated magnitude of a tsunami at the proposed project site. As discussed for Impact GEO-2a, designing new facilities based on existing building codes may not prevent substantial damage to structures from coastal flooding. Impacts due to seismically induced tsunamis and seiches are typical for the entire California coastline and would not be increased by operation of the proposed Project. However, because portions of the proposed project site are at elevations lower than the predicted tsunami wave heights, there is a substantial risk of coastal flooding in the event of a tsunami and seiche.

For onsite personnel, the risk of tsunami or seiches is a part of any ocean-shore interface and hence personnel working at the proposed project berths cannot avoid some risk of exposure. Similarly, berth infrastructure would be subject to some risk of exposure. Although initial tsunami-induced run-up would potentially cause substantial injury and damage to infrastructure, the drawdown of the water after run-up exerts the often crippling opposite drags on the persons and 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 drawdown. Similarly, for cruise ships and other water vessels, the risk of tsunami or seiches is a part of any ocean-shore interface and hence vessels in transit or at berth cannot avoid some risk of exposure. A vessel destined for the proposed project berths (or any berth in the Port for that matter) would be under its own power. Under this circumstance, the vessel would likely be able to maneuver to avoid damage. The exposure of a tsunami or seiche to a vessel in transit to or from the proposed project berth, and the associated risk, is no different than for any other vessel entering the Los Angeles/Long Beach Port Complex.

Port engineers have indicated that currents moving over 5 meters per second (m/s) could potentially render a ship out of control (Morgan pers. comm.). Modeling indicates that tsunami related currents created as a result of a large earthquake on the Santa Catalina Fault or submarine landslide off the coast of the nearby Palos Verdes Peninsula would not create currents in the harbor in excess of 5 m/s. Highest anticipated current speeds of 2 m/s would occur in the vicinity of the entrance to the Main Channel. Currents in the vicinity of the Vincent Thomas Bridge (northerly edge of the proposed project area) would be approximately 0.9 m/s (Moffatt and Nichol 2007).

A vessel docked at one of the proposed project berths would be subject to the rising and falling of the water levels and the accompanying currents during a tsunami or seiche. Two scenarios could arise. Either the vessel would stay secured to the berth and ride out the tsunami or the motion during a tsunami would cause the mooring lines of the vessel to break free and the ship would be set adrift. In the first scenario, the energy of the tsunami wave would be transmitted through the vessel that is

moored at berth and into the wharf. Forces transmitted through the vessel would be transferred to the fendering system of the wharf and then to the wharf structure.

The existing wharf fendering systems are designed with the assumption that, under a normal docking scenario, a berthing vessel will contact only one fender. For such scenarios, each fender is designed to absorb the berthing energy of the entire vessel. During a tsunami occurrence, the wave is assumed to move the vessel against more than one of the existing fenders, so that the vessel would be contacting a minimum of four to five fenders, often simultaneously. In such cases, the forces experienced by each fender during a tsunami are often less than the standard docking forces for which the fendering system is designed, because more than one fender would absorb these forces at the same time. Therefore, substantial damage is not expected to the vessel or the wharf in the event that a tsunami were to strike while a vessel was secured at a berth.

Under the second scenario, a vessel set adrift in the harbor could have more serious consequences from the potential of collision, including a potential hull breach and possible fuel spill.

CEQA Impact Determination

Designing new facilities based on existing building codes may not prevent substantial damage to structures from coastal flooding. Impacts due to seismically induced tsunamis and seiches are typical for the entire California coastline and would not be increased by construction of the proposed Project. Emergency planning and coordination between the Terminal operator and LAHD, as outlined in Mitigation Measure MM GEO-1, would contribute to reducing onsite injuries during a tsunami. However, even with incorporation of emergency planning and construction in accordance with current City and State regulations, substantial damage and/or injury could occur in the event of a tsunami or seiche. Because portions of the proposed project site are at elevations lower than the predicted tsunami wave heights, there is a substantial risk of coastal flooding due to tsunamis and seiches. Raising the elevation of the site or constructing a wall along the perimeter of the site of sufficient height to mitigate the potentially damaging effects of tsunami would be the only way to mitigate potential impacts. However, elevating the approximately 400 acres within the site or building a wall around the entire perimeter of the proposed project area would be cost-prohibitive and would significantly impact existing infrastructure requiring extensive modification of existing improvements. Mitigation of the tsunami risk would not be feasible. As described above, impacts from the worst-case wave action would be significant and unavoidable for the site under CEQA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

There is a substantial risk of coastal flooding of wharves and associated upland areas due to tsunamis and seiches. The federal portions of the proposed Project would include the development of three new harbors involving water cuts, two new cruise terminals and berths in the Outer Harbor, new pier and wharf construction, and upgrading existing piers and wharves. The waterfront development would contribute to increased operational area and activities. Because operations would occur over an extended period, increased exposure of people and property during operations to seismically induced tsunamis or seiches from a major or great earthquake cannot be precluded. Emergency planning and coordination between the Terminal operator and the LAHD, as outlined in Mitigation Measure MM GEO-1, would contribute to reducing onsite injuries during a tsunami. However, even with incorporation of emergency planning and construction in accordance with current City and State regulations, substantial damage and injury could occur in the event of a tsunami or seiche. As described above, impacts from the worst-case wave action would be significant and unavoidable for the site under NEPA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-3b: Operation of the proposed Project would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.

As discussed for Impact GEO-3a, subsidence in the proposed project vicinity due to previous oil extraction in the Port area has been mitigated and would not adversely impact the proposed Project. However, in the absence of proper engineering, proposed structures could be cracked and warped during proposed project operations as a result of saturated, unconsolidated/compressible sediments. During the proposed project design phases, a geotechnical engineer would evaluate the settlement potential in areas where structures are proposed, as discussed for Impact GEO-3a, to reduce the potential for soil settlement.

CEQA Impact Determination

The proposed Project would be designed and constructed in compliance with the recommendations of a geotechnical engineer, consistent with implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, and in conjunction with criteria established by LAHD, and would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

Therefore, settlement impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

New pier and wharf construction, two new cruise terminals and berths in the Outer Harbor, and the proposed three new harbors involving water cuts would contribute to additional operational area and activities. Settlement impacts associated with these actions would be less than significant under NEPA, as these activities would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury with implementation of standard geotechnical engineering and Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, in conjunction with criteria established by LAHD.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-4b: Operation of the proposed Project would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.

As described in Impact GEO-4a, expansive soil may be present in the proposed project area and may be present in dredged or imported soils used for proposed project grading. Use of expansive soils beneath proposed project foundations, pavement, or behind retaining structures could result in cracking and distress of these structures during the proposed project operations. However, during the design phase, the proposed project geotechnical engineer would evaluate the expansion potential associated with onsite soils, as described in Impact GEO-4a, to reduce the potential for soil expansion and damage to overlying structures.

CEQA Impact Determination

The proposed Project would be designed and constructed in compliance with the recommendations of the geotechnical engineer, consistent with Sections 91.000

through 91.7016 of the Los Angeles Municipal Code, and in conjunction with criteria established by LAHD, and would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury. Therefore, expansive soil impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

The federal portions of the proposed Project would include wharf and in-water construction activities, including water cuts for three new harbors, new pier and wharf construction, and upgrading existing wharves, as well as two new cruise terminals and berths in the Outer Harbor. Expansive soil impacts in the waterfront area would be less than significant under NEPA, as the proposed Project would be designed and constructed in compliance with the recommendations of the geotechnical engineer, consistent with implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, and in conjunction with criteria established by LAHD, and would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-5b: Operation of the proposed Project would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.

Risk of landslides or mudslides in the proposed project area is described in Impact GEO-5a for the proposed Project.

CEQA Impact Determination

As the topography in the vicinity of the proposed project site is flat and not subject to landslides or mudflows, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-6b: Operation of the proposed Project would not result in substantial damage to structures or infrastructure, or expose people or structures to substantial risk of unstable soil conditions from excavation, grading, or fill.

CEQA Impact Determination

Excavations would not be performed as a part of proposed project operations; therefore, impacts associated with unstable soils would not occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

The federal portions of the proposed Project would include wharf and in-water construction activities including construction of new water cuts for three new harbors, construction of new piers and wharfs, and upgrading existing piers and wharfs, as well as two new cruise terminals and berths in the Outer Harbor. Excavations would not be performed as a part of proposed project operations; therefore, impacts associated with unstable soils would not occur under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-7b: Operation of the proposed Project would not result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.

Since the proposed project area is relatively flat and paved, with no prominent geologic or topographic features, proposed project operations would not result in any distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.

CEQA Impact Determination

As the topography in the vicinity of the proposed project site is flat and does not contain prominent geologic or topographic features, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-8b: Operation of the proposed Project would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.

See impact discussion for the proposed Project under GEO-8a.

CEQA Impact Determination

The proposed project operations would not result in the permanent loss of availability of a known mineral resource that would be of future value to the region and the residents of the state. Therefore, mineral resource impacts would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

Impacts would be less than significant, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

3.5.4.3.2 Alternative 1—Alternative Development Scenario 1

Construction Impacts

Impact GEO-1a: Construction of Alternative 1 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.

CEQA Impact Determination

Seismic impacts for Alternative 1 would be similar to those described for the proposed Project because the resulting infrastructure susceptible to seismically induced ground failure would not be substantially different from the proposed Project. However, this alternative may slightly reduce impacts related to increased damage to structures or exposure of people to risk since this alternative would only include one Outer Harbor cruise terminal and berth. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-1a would be the same as for the proposed Project. Impacts due to seismically induced ground failure would be significant and unavoidable under CEQA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

With respect to the federal portions of Alternative 1, the waterfront construction impacts would be similar to those described for the proposed Project because the resulting infrastructure susceptible to seismically induced ground failure would not be substantially different from that of the proposed Project. However, this alternative may slightly reduce impacts related to increased damage to structures or exposure of people to risk since this alternative would only include one Outer Harbor cruise terminal and berth. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-1a would be the same as for the proposed Project. Construction of new piers and wharves, and the three new harbors would be susceptible to seismically induced ground shaking, fault rupture, and liquefaction. Impacts due to seismically induced ground failure would be significant and unavoidable.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-2a: Construction of Alternative 1 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.

CEQA Impact Determination

Tsunami/seiche impacts would be similar to those described for the proposed Project because the resulting infrastructure susceptible to inundation would not be substantially different from that of the proposed Project. However, this alternative may slightly reduce impacts related to increased damage to structures or exposure of people to risk since this alternative would only include one Outer Harbor cruise terminal and berth. This slight change from the proposed Project would not change the impact conclusions, and, therefore, Impact GEO-2a would be the same as for the proposed Project. Impacts during the construction phase of Alternative 1 would be significant and unavoidable under CEQA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

With respect to the federal portions of Alternative 1, the construction impacts would be similar to those described for the proposed Project because the resulting infrastructure susceptible to inundation would not be substantially different from that of the proposed Project. However, this alternative may slightly reduce impacts related to increased damage to structures or exposure of people to risk since this alternative would only include one Outer Harbor cruise terminal and berth. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-2a would be the same as for the proposed Project. Impacts during the construction phase of Alternative 1 due to tsunamis and seiches would be significant and unavoidable under NEPA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-3a: Construction of Alternative 1 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.

CEQA Impact Determination

Construction impacts would be similar to those described for the proposed Project because the resulting infrastructure susceptible to subsidence/settlement would not be substantially different from that of the proposed Project. However, this alternative may slightly reduce impacts related to increased damage to structures or exposure of people to risk since this alternative would only include one Outer Harbor cruise terminal and berth. This slight change from the proposed Project would not change the impact conclusions, and, therefore, Impact GEO-3a would be the same as for the proposed Project. Impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

With respect to the federal portions of Alternative 1, the construction impacts would be similar to those described for the proposed Project because the resulting infrastructure susceptible to subsidence/settlement would not be substantially different from that of the proposed Project. However, this alternative may slightly reduce impacts related to increased damage to structures or exposure of people to risk since this alternative would only include one Outer Harbor cruise terminal and berth. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-3a would be the same as for the proposed Project. Subsidence/settlement associated with construction activities along the waterfront would be less than significant under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-4a: Construction of Alternative 1 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.

CEQA Impact Determination

Construction impacts would be similar to those described for the proposed Project because the infrastructure susceptible to expansive soils would be not be substantially different from that of the proposed Project. However, this alternative may slightly reduce impacts related to increased damage to structures or exposure of people to risk since this alternative would only include one Outer Harbor cruise terminal and berth. This slight change from the proposed Project would not change the impact conclusions, and, therefore, Impact GEO-4a would be the same as for the proposed Project. Expansive soil impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

With respect to the federal portions of Alternative 1, the construction impacts would be similar to those described for the proposed Project because the resulting infrastructure susceptible to expansive soils would not be substantially different from that of the proposed Project. However, this alternative may slightly reduce impacts related to increased damage to structures or exposure of people to risk since this alternative would only include one Outer Harbor cruise terminal and berth. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-4a would be the same as for the proposed Project. Expansive soils associated with construction activities along the waterfront would be less than significant under NEPA.

Mitigation Measures

No mitigation is required

Residual Impacts

Impacts would be less than significant.

Impact GEO-5a: Construction of Alternative 1 would not result in substantial damage to structure or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 1 site is flat and not subject to landslides or mudflows. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-6a: Construction of Alternative 1 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of unstable soil conditions from excavation, grading, or fill.

CEQA Impact Determination

Construction impacts would be similar to those described for the proposed Project because the infrastructure susceptible to unstable soils would not be substantially different from that of the proposed Project. However, this alternative may slightly reduce impacts related to increased damage to structures or exposure of people to risk

since this alternative would only include one Outer Harbor cruise terminal and berth. This slight change from the proposed Project would not change the impact conclusions, and, therefore, Impact GEO-6a would be the same as for the proposed Project. Impacts associated with unstable soils would be less than significant.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

With respect to the federal portions of Alternative 1, the construction impacts would be similar to those described for the proposed Project because the resulting infrastructure susceptible to unstable soils would not be substantially different from that of the proposed Project. However, this alternative may slightly reduce impacts related to increased damage to structures or exposure of people to risk since this alternative would only include one Outer Harbor cruise terminal and berth. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-6a would be the same as for the proposed Project. The impacts associated with unstable soils would be less than significant under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-7a: Construction of Alternative 1 would not result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 1 site is flat and does not contain prominent geologic or topographic features. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-8a: Construction of Alternative 1 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.

CEQA Impact Determination

As with the proposed Project, Alternative 1 would not result in the permanent loss of availability of a known mineral resource of regional, state, or local significance that would be of future value to the region and the residents of the state. Therefore, mineral resource impacts would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

Impacts would be less than significant, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Operations Impacts

Impact GEO-1b: Operation of Alternative 1 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.

CEQA Impact Determination

Seismic impacts for Alternative 1 would be similar to those described for the proposed Project because the resulting infrastructure susceptible to seismically induced ground failure would not be substantially different from that of the proposed Project. However, this alternative may slightly reduce impacts related to increased damage to structures or exposure of people to risk since this alternative would only include one Outer Harbor cruise terminal and berth. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-1b would be the same as for the proposed Project. Impacts due to seismically induced ground failure would be significant and unavoidable under CEQA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

Seismic impacts for the federal portion of Alternative 1 would be similar to those described for the proposed Project because the resulting infrastructure susceptible to seismically induced ground failure would not be substantially different from that of the proposed Project. However, this alternative may slightly reduce impacts related to increased damage to structures or exposure of people to risk since this alternative would only include one Outer Harbor cruise terminal and berth. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-1b would be the same as for the proposed Project. Therefore, impacts due to seismically induced ground failure would be significant and unavoidable under NEPA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-2b: Operation of Alternative 1 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.

CEQA Impact Determination

Tsunami/seiche impacts would be similar to those described for the proposed Project because the resulting infrastructure susceptible to inundation would not be substantially different from that of the proposed Project. However, this alternative may slightly reduce impacts related to increased damage to structures or exposure of people to risk since this alternative would only include one Outer Harbor cruise terminal and berth. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-2b would be the same as for the proposed Project. Impacts during the operations phase of Alternative 1 would be significant and unavoidable under CEQA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

Operation impacts would be similar to those described for the proposed Project because the resulting infrastructure susceptible to inundation would not be substantially different from that of the proposed Project. However, this alternative may slightly reduce impacts related to increased damage to structures or exposure of people to risk since this alternative would only include one Outer Harbor cruise terminal and berth. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-2b would be the same as for the proposed Project. The impacts due to tsunami and seiches during the operations phase would be significant and unavoidable under NEPA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-3b: Operation of Alternative 1 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/ settlement.

CEQA Impact Determination

Subsidence/settlement impacts during operations would be similar to those described for the proposed Project because the resulting infrastructure susceptible to subsidence/settlement would not be substantially different from that of the proposed Project. However, this alternative may slightly reduce impacts related to increased damage to structures or exposure of people to risk since this alternative would only include one Outer Harbor cruise terminal and berth. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-3b would be the same as for the proposed Project. Subsidence/settlement impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

Subsidence/settlement impacts during operations for the federal portion of Alternative 1 would be similar to those described for the proposed Project because the resulting infrastructure for the new waterfront development would not be substantially different from that of the proposed Project. However, this alternative may slightly reduce impacts related to increased damage to structures or exposure of people to risk since this alternative would only include one Outer Harbor cruise terminal and berth. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-3b would be the same as for the proposed Project. Subsidence/settlement impacts associated with the new waterfront development would be less than significant under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-4b: Operation of Alternative 1 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.

CEQA Impact Determination

Operations impacts would be similar to those described for the proposed Project because the resulting infrastructure susceptible to expansive soils would not be substantially different from that of the proposed Project. However, this alternative may slightly reduce impacts related to increased damage to structures or exposure of people to risk since this alternative would only include one Outer Harbor cruise terminal berth. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-4b would be the same as for the proposed Project. Expansive soil impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

The operations impacts for the federal portion of Alternative 1 would be similar to those described for the proposed Project because the resulting infrastructure susceptible to expansive soils would not be substantially different from that of the proposed Project. However, this alternative may slightly reduce impacts related to increased damage to structures or exposure of people to risk since this alternative would only include one Outer Harbor cruise terminal and berth. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-4b would be the same as for the proposed Project. Expansive soil impacts in the waterfront areas would be less than significant under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-5b: Operation of Alternative 1 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 1 site is flat and not subject to landslides or mudflows. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-6b: Operation of Alternative 1 would not result in substantial damage to structures or infrastructure, or expose people or structures to substantial risk of unstable soil conditions from excavation, grading, or fill.

CEQA Impact Determination

As with the proposed Project, excavations would not be performed as a part of Alternative 1 operations. Therefore, impacts associated with unstable soils would not occur under CEQA.

Mitigation Measures

No mitigation is required

Residual Impacts

No impacts would occur.

NEPA Impact Determination

Impacts would not occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-7b: Operation of Alternative 1 would not result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 1 site is flat and does not contain prominent geologic or topographic features. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-8b: Operation of Alternative 1 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.

CEQA Impact Determination

As with the proposed Project, Alternative 1 would not result in the permanent loss of availability of a known mineral resource of regional, state, or local significance that would be of future value to the region and the residents of the state. Therefore, mineral resource impacts would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

Impacts would be less than significant, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

3.5.4.3.3 Alternative 2—Alternative Development Scenario 2

Construction Impacts

Impact GEO-1a: Construction of Alternative 2 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.

CEQA Impact Determination

Seismic impacts for Alternative 2 would be similar to those described for the proposed Project because the resulting infrastructure susceptible to seismically

induced ground failure would not be substantially different from the proposed Project. However, this alternative would involve construction of a parking structure for the Outer Harbor cruise terminals. The impacts of the Outer Harbor cruise parking structure would essentially be the same as those covered under the proposed Project for the Inner Harbor cruise terminal parking structure. This slight change from the proposed Project would not change the impact conclusions and therefore, Impact GEO-1a would be the same as for the proposed Project. Impacts due to seismically induced ground failure would be significant and unavoidable under CEQA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

With respect to the federal portions of Alternative 2, the construction impacts would be similar to those described for the proposed Project because the resulting infrastructure susceptible to seismically induced ground failure would not be substantially different from that of the proposed Project. However, this alternative involves construction of a parking structure for the Outer Harbor cruise terminals. The impacts of the Outer Harbor cruise parking structure would essentially be the same as those covered under the proposed Project for the Inner Harbor cruise terminal parking structure. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-1a would be the same as for the proposed Project. Construction of new piers and wharves, and the three new harbors would be susceptible to seismically induced ground shaking, fault rupture, and liquefaction. Therefore, impacts due to seismically induced ground failure would be significant and unavoidable under NEPA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-2a: Construction of Alternative 2 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.

CEQA Impact Determination

Tsunami/seiche impacts would be similar to those described for the proposed Project because the resulting infrastructure susceptible to inundation would not be substantially different from that of the proposed Project. However, this alternative involves construction of a parking structure for the Outer Harbor cruise terminals. The impacts of the Outer Harbor cruise parking structure would essentially be the same as those covered under the proposed Project for the Inner Harbor cruise terminal parking structure. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-2a would be the same as for the proposed Project. Impacts during the construction phase of Alternative 2 would be significant and unavoidable under CEQA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

With respect to the federal portions of Alternative 2, the construction impacts would be similar to those described for the proposed Project because the resulting infrastructure susceptible to inundation would not be substantially different from that of the proposed Project. However, this alternative involves construction of a parking structure for the Outer Harbor cruise terminals. The impacts of the Outer Harbor cruise parking structure would essentially be the same as those covered under the proposed Project for the Inner Harbor cruise terminal parking structure. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-2a would be the same as for the proposed Project. Construction of new piers and wharves, and the water cuts for the three new harbors would be susceptible to seismically induced tsunamis and seiches.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-3a: Construction of Alternative 2 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/ settlement.

CEQA Impact Determination

Construction impacts would be similar to those described for the proposed Project because the resulting infrastructure susceptible to subsidence/settlement would not be substantially different from that of the proposed Project. However, this alternative involves construction of a parking structure for the Outer Harbor cruise terminals. The impacts of the Outer Harbor cruise parking structure would essentially be the same as those covered under the proposed Project for the Inner Harbor cruise terminal parking structure. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-3a would be the same as for the proposed Project. Settlement impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

With respect to the federal portions of Alternative 2, the construction impacts would be similar to those described for the proposed Project because the resulting infrastructure susceptible to subsidence/settlement would not be substantially different from that of the proposed Project. However, this alternative involves construction of a parking structure for the Outer Harbor cruise terminals. The impacts of the Outer Harbor cruise parking structure would essentially be the same as those covered under the proposed Project for the Inner Harbor cruise terminal parking structure. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-3a would be the same as for the proposed Project. Subsidence/settlement associated with construction activities along the waterfront would be less than significant under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-4a: Construction of Alternative 2 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.

CEQA Impact Determination

Construction impacts would be similar to those described for the proposed Project because the infrastructure susceptible to expansive soils would not be substantially different from that of the proposed Project. However, this alternative involves construction of a parking structure for the Outer Harbor cruise terminals. The impacts of the Outer Harbor cruise parking structure would essentially be the same as those covered under the proposed Project for the Inner Harbor cruise terminal parking structure. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-4a would be the same as for the proposed Project. Expansive soil impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

With respect to the federal portions of Alternative 2, the construction impacts would be similar to those described for the proposed Project because the resulting infrastructure susceptible to expansive soils would not be substantially different from that of the proposed Project. However, this alternative involves construction of a parking structure for the Outer Harbor cruise terminals. The impacts of the Outer Harbor cruise parking structure would essentially be the same as those covered under the proposed Project for the Inner Harbor cruise terminal parking structure. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-4a would be the same as for the proposed Project. Expansive soils associated with construction activities of waterfront development would be less than significant under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-5a: Construction of Alternative 2 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 2 site is flat and not subject to landslides or mudflows. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-6a: Construction of Alternative 2 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of unstable soil conditions from excavation, grading, or fill.

CEQA Impact Determination

Construction impacts for Alternative 2 would be similar to those described for the proposed Project because the resulting infrastructure susceptible to unstable soils would not be substantially different from that of the proposed Project. However, this alternative involves construction of a parking structure for the Outer Harbor cruise terminals. The impacts of the Outer Harbor cruise parking structure would essentially be the same as those covered under the proposed Project for the Inner Harbor cruise terminal parking structure. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-6a

would be the same as for the proposed Project. Impacts associated with unstable soils would be less than significant.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

With respect to the federal portions of Alternative 2, the waterfront impacts would be similar to those described for the proposed Project because the resulting infrastructure susceptible to unstable soils would not be substantially different from that of the proposed Project. However, this alternative involves construction of a parking structure for the Outer Harbor cruise terminals. The impacts of the Outer Harbor cruise parking structure would essentially be the same as those covered under the proposed Project for the Inner Harbor cruise terminal parking structure. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-6a would be the same as for the proposed Project. Impacts associated with unstable soils would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-7a: Construction of Alternative 2 would not result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 2 site is flat and does not contain prominent geologic or topographic features. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-8a: Construction of Alternative 2 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.

CEQA Impact Determination

As with the proposed Project, Alternative 2 would not result in the permanent loss of availability of a known mineral resource of regional, state, or local significance that would be of future value to the region and the residents of the state. Therefore, mineral resource impacts would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

Impacts would be less than significant, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required

Residual Impacts

Impacts would be less than significant.

Operations Impacts

Impact GEO-1b: Operation of Alternative 2 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.

CEQA Impact Determination

Seismic impacts for the Alternative 2 would be similar to those described for the proposed Project because the resulting infrastructure susceptible to seismically induced ground failure would not be substantially different from that of the proposed Project. However, this alternative involves operation of a parking structure for the Outer Harbor cruise terminals. The impacts of the Outer Harbor cruise parking structure would essentially be the same as those covered under the proposed Project for the Inner Harbor cruise terminal parking structure. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-1b would be the same as for the proposed Project. Impacts due to seismically induced ground failure would be significant and unavoidable under CEQA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

Seismic impacts for the federal portion of Alternative 2 would be similar to those described for the proposed Project because the resulting infrastructure susceptible to seismically induced ground failure would not be substantially different from that of the proposed Project. However, this alternative involves operation of a parking structure for the Outer Harbor cruise terminals. The impacts of the Outer Harbor cruise parking structure would essentially be the same as those covered under the proposed Project for the Inner Harbor cruise terminal parking structure. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-1b would be the same as for the proposed Project. The federal portion of Alternative 2 would include the construction of new piers and wharves, and three new harbors, which would be susceptible to seismically induced ground shaking, fault rupture, and liquefaction. Impacts due to seismically induced ground failure would be significant and unavoidable under NEPA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-2b: Operation of Alternative 2 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.

CEQA Impact Determination

Tsunami/seiche impacts would be similar to those described for the proposed Project because the infrastructure susceptible to inundation would not be substantially different from that of the proposed Project. However, this alternative involves operation of a parking structure for the Outer Harbor cruise terminals. The impacts of the Outer Harbor cruise parking structure would essentially be the same as those covered under the proposed Project for the Inner Harbor cruise terminal parking structure. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-2b would be the same as for the proposed Project. Impacts during the operations phase of Alternative 2 would be significant and unavoidable under CEQA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

Operation impacts would be similar to those described for the proposed Project because the infrastructure susceptible to inundation would be substantially the same as the proposed Project. However, this alternative involves operation of a parking structure for the Outer Harbor cruise terminals. The impacts of the Outer Harbor cruise parking structure would essentially be the same as those covered under the proposed Project for the Inner Harbor cruise terminal parking structure. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-2b would be the same as for the proposed Project. The impacts due to tsunami and seiches during the operations phase would be significant and unavoidable under NEPA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-3b: Operation of Alternative 2 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/ settlement.

CEQA Impact Determination

Subsidence/settlement impacts during operations would be similar to those described for the proposed Project because the infrastructure susceptible to subsidence/settlement would not be substantially different from that of the proposed Project. However, this alternative involves operation of a parking structure for the Outer Harbor cruise terminals. The impacts of the Outer Harbor cruise parking structure would essentially be the same as those covered under the proposed Project for the Inner Harbor cruise terminal parking structure. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-3b would be the same as for the proposed Project. Subsidence/settlement impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

Subsidence/settlement impacts during operations for the federal portion of Alternative 2 would be similar to those described for the proposed Project because the infrastructure for the new waterfront development would not be substantially different from that of the proposed Project. However, this alternative involves operation of a parking structure for the Outer Harbor cruise terminals. The impacts of the Outer Harbor cruise parking structure would essentially be the same as those covered under the proposed Project for the Inner Harbor cruise terminal parking structure. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-3b would be the same as for the proposed Project. Subsidence/settlement impacts associated with the new waterfront development would be less than significant under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-4b: Operation of Alternative 2 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.

CEQA Impact Determination

Operations impacts would be similar to those described for the proposed Project because the infrastructure would not be substantially different from that of the proposed Project. However, this alternative involves operation of a parking structure for the Outer Harbor cruise terminals. The impacts of the Outer Harbor cruise parking structure would essentially be the same as those covered under the proposed Project for the Inner Harbor cruise terminal parking structure. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-4b would be the same as for the proposed Project. Expansive soil impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

The operations impacts for the federal portion of Alternative 2 would be similar to those described for the proposed Project because the infrastructure would not be substantially different from that of the proposed Project. However, this alternative involves operation of a parking structure for the Outer Harbor cruise terminals. The impacts of the Outer Harbor cruise parking structure would essentially be the same as those covered under the proposed Project for the Inner Harbor cruise terminal parking structure. This slight change from the proposed Project would not change the impact conclusions, and therefore, Impact GEO-4b would be the same as for the proposed Project. Therefore, expansive soil impacts in the waterfront areas would be less than significant under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-5b: Operation of Alternative 2 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 2 site is flat and not subject to landslides or mudflows. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-6b: Operation of Alternative 2 would not result in substantial damage to structures or infrastructure, or expose people or structures to substantial risk of unstable soil conditions from excavation, grading, or fill.

CEQA Impact Determination

As with the proposed Project, excavations would not be performed as a part of Alternative 2 operations. Therefore, impacts associated with unstable soils would not occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would not occur.

NEPA Impact Determination

Impacts would not occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-7b: Operation of Alternative 2 would not result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 2 site is flat and does not contain prominent geologic or topographic features. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

Impacts would not occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-8b: Operation of Alternative 2 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.

CEQA Impact Determination

As with the proposed Project, Alternative 2 would not result in the permanent loss of availability of a known mineral resource of regional, state, or local significance that would be of future value to the region and the residents of the state. Therefore, mineral resource impacts would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

Impacts would be less than significant, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

3.5.4.3.4 Alternative 3—Alternative Development Scenario 3 (Reduced Project)

Construction Impacts

Impact GEO-1a: Construction of Alternative 3 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.

CEQA Impact Determination

Seismic impacts for the Alternative 3 would be similar but less than those described for the proposed Project because the resulting infrastructure susceptible to seismically induced ground failure would be reduced when compared to the proposed Project. Under this alternative, only one Outer Harbor terminal would be developed, redevelopment of the Ports O'Call would be reduced, and the parking structure adjacent to the bluff site would not be constructed. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-1a would be the same as for the proposed Project. Therefore, impacts due to seismically induced ground failure would be significant and unavoidable under CEQA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

With respect to the federal portions of Alternative 3, the construction impacts would be similar but less than those described for the proposed Project because only one Outer Harbor cruise berth would be constructed compared to the proposed Project. This change from the proposed Project would not change the impact determination conclusions, and Impact GEO-1a would be the same as for the proposed Project. Construction of new piers and wharves, the new Outer Harbor cruise terminal, and the water cuts for the three new harbors would be susceptible to seismically induced ground shaking, fault rupture, and liquefaction. Impacts due to seismically induced ground failure would be significant and unavoidable under NEPA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-2a: Construction of Alternative 3 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.

CEQA Impact Determination

Tsunami/seiche impacts would be similar but less than those described for the proposed Project because the resulting infrastructure would be reduced under Alternative 3. Under this alternative, only one Outer Harbor terminal would be developed, redevelopment of the Ports O'Call would be reduced, and the parking structure adjacent to the bluff site would not be constructed. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact determination conclusions, and Impact GEO-2a would be the same as for the proposed Project. Impacts during the construction phase of Alternative 3 would be significant and unavoidable under CEQA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

With respect to the federal portions of Alternative 3, the construction impacts would be similar but less than those described for the proposed Project because only one Outer Harbor cruise berth would be constructed. This change from the proposed Project would not change the impact conclusions, and Impact GEO-2a would be the same as for the proposed Project. Construction of new piers and wharves, and the water cuts for the three new harbors would be susceptible to seismically induced tsunamis and seiches. The impacts during the construction phase of Alternative 3 due to tsunamis and seiches would be significant and unavoidable under NEPA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-3a: Construction of Alternative 3 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/ settlement.

CEQA Impact Determination

Construction impacts would be similar but less than those described for the proposed Project because the resulting infrastructure would be reduced compared to the proposed Project. Under this alternative, only one Outer Harbor terminal would be developed, redevelopment of the Ports O'Call would be reduced, and the parking structure adjacent to the bluff site would not be constructed. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-3a would be the same as for the proposed Project. Therefore, impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

With respect to the federal portions of Alternative 3, the construction impacts would be similar but less than those described for the proposed Project because only one Outer Harbor terminal would be developed. This change from the proposed Project would not change the impact determination conclusions, and Impact GEO-3a would be the same as for the proposed Project. Therefore, settlement associated with construction activities along the waterfront would be less than significant under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-4a: Construction of Alternative 3 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.

CEQA Impact Determination

Construction impacts would be similar but less than those described for the proposed Project because the resulting infrastructure would be reduced when compared to the proposed Project. Under this alternative, only one Outer Harbor terminal would be developed, redevelopment of the Ports O'Call would be reduced, and the parking structure adjacent to the bluff site would not be constructed. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-4a would be the same as for the proposed Project. Therefore, expansive soil impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

With respect to the federal portions of Alternative 3, construction impacts would be similar but less than those described for the proposed Project because only one Outer Harbor terminal would be developed. This change from the proposed Project would not change the impact conclusions, and Impact GEO-4a would be the same as for the proposed Project. Therefore, expansive soils associated with construction activities along the waterfront would be less than significant under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-5a: Construction of Alternative 3 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 3 site is flat and not subject to landslides or mudflows. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-6a: Construction of Alternative 3 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of unstable soil conditions from excavation, grading, or fill.

CEQA Impact Determination

Construction impacts would be similar but less than those described for the proposed Project because the resulting infrastructure would be reduced when compared to the proposed Project. Under this alternative, only one Outer Harbor terminal would be developed, redevelopment of the Ports O'Call would be reduced, and the parking structure adjacent to the bluff site would not be constructed. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-6a would be the same as

for the proposed Project. Expansive soil impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

With respect to the federal portions of Alternative 3, the construction impacts would be similar but less than those described for the proposed Project because only one Outer Harbor terminal would be developed. This change from the proposed Project would not change the impact conclusions, and Impact GEO-6a would be the same as for the proposed Project. The impacts associated with unstable soils would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-7a: Construction of Alternative 3 would not result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 3 site is flat and does not contain prominent geologic or topographic features. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-8a: Construction of Alternative 3 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.

CEQA Impact Determination

As with the proposed Project, Alternative 3 would not result in the permanent loss of availability of a known mineral resource of regional, state, or local significance that would be of future value to the region and the residents of the state. Therefore, mineral resource impacts would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

Impacts would be less than significant, as discussed under the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Operations Impacts

Impact GEO-1b: Operation of Alternative 3 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.

CEQA Impact Determination

Seismic impacts for the Alternative 3 would be similar but less than those described for the proposed Project because the resulting infrastructure would be reduced when compared to the proposed Project. Under this alternative, only one Outer Harbor terminal would be developed, redevelopment of the Ports O'Call would be reduced, and the parking structure adjacent to the bluff site would not be constructed. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-1b would be the same as for the proposed Project. Therefore, impacts due to seismically induced ground failure would be significant and unavoidable under CEQA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance associated with seismically induced ground failure.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

Seismic impacts for the federal portion of Alternative 3 would be similar but less than those described for the proposed Project because only one Outer Harbor terminal would be developed. This change from the proposed Project would not change the impact conclusions, and Impact GEO-1b would be the same as for the proposed Project. The federal portion of Alternative 3 would include the construction of new piers and wharves, and three new harbors, which would be susceptible to seismically induced ground shaking, fault rupture, and liquefaction. Therefore, impacts due to seismically induced ground failure would be significant and unavoidable under NEPA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-2b: Operation of Alternative 3 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.

CEQA Impact Determination

Tsunami/seiche impacts would be similar but less than those described for the proposed Project because the resulting infrastructure would be reduced when compared to the proposed Project. Under this alternative, only one Outer Harbor terminal would be developed, redevelopment of the Ports O'Call would be reduced, and the parking structure adjacent to the bluff site would not be constructed. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-2b would be the same as for the proposed Project. Therefore, impacts during the operations phase of Alternative 3 would be significant and unavoidable under CEQA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

Operation impacts would be similar but less than those described for the proposed Project because only one Outer Harbor terminal would be developed. This change from the proposed Project would not change the impact conclusions, and Impact GEO-2b would be the same as for the proposed Project. Therefore, impacts due to tsunami and seiches during the operations phase would be significant and unavoidable under NEPA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-3b: Operation of Alternative 3 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/ settlement.

CEQA Impact Determination

Subsidence/settlement impacts during operations would be similar but less than those described for the proposed Project because the resulting infrastructure would be reduced when compared to the proposed Project. Under this alternative, only one Outer Harbor terminal would be developed, redevelopment of the Ports O'Call would be reduced, and the parking structure adjacent to the bluff site would not be constructed. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-3b would be the same as for the proposed Project. Settlement impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

Subsidence/settlement impacts during operations for the federal portion of Alternative 3 would be similar but less than those described for the proposed Project because only one Outer Harbor terminal would be developed. This change from the proposed Project would not change the impact conclusions, and Impact GEO-3b would be the same as for the proposed Project. Therefore, settlement impacts associated with the new waterfront construction would be less than significant under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-4b: Operation of Alternative 3 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.

CEQA Impact Determination

Operations impacts would be similar but less than those described for the proposed Project because the resulting infrastructure would be reduced when compared to the proposed Project. Under this alternative, only one Outer Harbor terminal would be developed, redevelopment of the Ports O'Call would be reduced, and the parking structure adjacent to the bluff site would not be constructed. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-4b would be the same as for the proposed Project. Therefore, expansive soil impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

The operations impacts for the federal portion of Alternative 3 would be similar but less than those described for the proposed Project because only one Outer Harbor terminal would be developed. This change from the proposed Project would not change the impact conclusions, and Impact GEO-4b would be the same as for the proposed Project. Therefore, expansive soil impacts in the waterfront areas would be less than significant under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-5b: Operation of Alternative 3 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 3 site is flat and not subject to landslides or mudflows. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as described for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-6b: Operation of Alternative 3 would not result in substantial damage to structures or infrastructure, or expose people or structures to substantial risk of unstable soil conditions from excavation, grading, or fill.

CEQA Impact Determination

As with the proposed Project, excavations would not be performed as a part of Alternative 3 operations. Therefore, impacts associated with unstable soils would not occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as described for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-7b: Operation of Alternative 3 would not result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 3 site is flat and does not contain prominent geologic or topographic features. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as described for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-8b: Operation of Alternative 3 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.

CEQA Impact Determination

As with the proposed Project, Alternative 3 would not result in the permanent loss of availability of a known mineral resource of regional, state, or local significance that would be of future value to the region and the residents of the state. Therefore, mineral resource impacts would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

No impacts would occur, as described for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

3.5.4.3.5 Alternative 4—Alternative Development Scenario 4

Construction Impacts

Impact GEO-1a: Construction of Alternative 4 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.

CEQA Impact Determination

Construction impacts for Alternative 4 would be similar but less than those described for the proposed Project because the North Harbor would not be constructed and the two cruise berths in the Outer Harbor would not be developed, thus reducing the

infrastructure susceptible to seismically induced ground failure. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-1a would be the same as for the proposed Project. Therefore, impacts due to seismically induced ground failure would be significant and unavoidable under CEQA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

With respect to the federal portions of Alternative 4, the construction impacts would be similar but less than those described for the proposed Project because the North Harbor would not be constructed and the two cruise berths in the Outer Harbor would not be developed, thus reducing the waterfront infrastructure susceptible to seismically induced ground failure. This change from the proposed Project would not change the impact conclusions, and Impact GEO-1a would be the same as for the proposed Project. Construction of new piers and wharves, and the Downtown Harbor, and 7th Street Harbor would be susceptible to seismically induced ground shaking, fault rupture, and liquefaction. Impacts due to seismically induced ground failure would be significant and unavoidable under NEPA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-2a: Construction of Alternative 4 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.

CEQA Impact Determination

Tsunami/seiche impacts would be similar but less than those described for the proposed Project because the North Harbor would not be constructed and the two cruise berths in the Outer Harbor would not be developed, thus reducing the

infrastructure susceptible to inundation. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-2a would be the same as for the proposed Project. The impacts during the construction phase of Alternative 4 would be significant and unavoidable under CEQA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

With respect to the federal portions of Alternative 4, the construction impacts would be similar but less than those described for the proposed Project because the North Harbor would not be constructed and the two cruise berths in the Outer Harbor would not be developed, thus reducing the waterfront infrastructure susceptible to inundation. This change from the proposed Project would not change the impact conclusions, and Impact GEO-2a would be the same as for the proposed Project. Therefore, impacts due to tsunamis and seiches during the construction phase would be significant and unavoidable under NEPA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-3a: Construction of Alternative 4 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/ settlement.

CEQA Impact Determination

Construction impacts of this alternative would be similar to those described for the proposed Project because the resulting infrastructure susceptible to subsidence/settlement would not be substantially different from that of the proposed Project. Under this alternative, the North Harbor would not be constructed and the two cruise berths in the Outer Harbor would not be developed, thus reducing the infrastructure susceptible to land subsidence and settlement. The reduced infrastructure for this alternative would result in fewer people in the project area and

fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-3a would be the same as for the proposed Project. Impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant

NEPA Impact Determination

With respect to the federal portions of Alternative 4, the construction impacts would be similar to those described for the proposed Project because the resulting infrastructure as it relates to settlement would not be substantially different from that of the proposed Project. Under this alternative the North Harbor would not be constructed and the two cruise berths in the Outer Harbor would not be developed, thus reducing the infrastructure susceptible to subsidence. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-3a would be the same as for the proposed Project. Settlement associated with construction activities along the waterfront would be less than significant under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-4a: Construction of Alternative 4 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.

CEQA Impact Determination

Construction impacts of this alternative would be similar to those described for the proposed Project because the resulting infrastructure as it relates to expansive soils would not be substantially different from that of the proposed Project. Under this alternative, the North Harbor would not be constructed and the two cruise berths in the Outer Harbor would not be developed, thus reducing the infrastructure susceptible to soil expansion. The reduced infrastructure for this alternative would

result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-4a would be the same as for the proposed Project. Expansive soil impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant

NEPA Impact Determination

With respect to the federal portions of Alternative 4, the construction impacts would be similar to those described for the proposed Project because the resulting infrastructure as it relates to expansive soils would not be substantially different from that of the proposed Project. Under this alternative, the North Harbor would not be constructed and the two cruise berths in the Outer Harbor would not be developed, thus reducing the infrastructure susceptible to soil expansion. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-4a would be the same as for the proposed Project. Expansive soil associated with construction activities along the waterfront would be less than significant under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-5a: Construction of Alternative 4 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 4 site is flat and not subject to landslides or mudflows. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-6a: Construction of Alternative 4 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of unstable soil conditions from excavation, grading, or fill.

CEQA Impact Determination

Construction impacts of this alternative would be similar to those described for the proposed Project because the resulting infrastructure susceptible to unstable soil conditions in the upland areas would not be substantially different from that of the proposed Project. Under this alternative, the North Harbor would not be constructed and the two cruise berths in the Outer Harbor would not be developed, thus reducing the infrastructure susceptible to unstable soils. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-6a would be the same as for the proposed Project. The impacts associated with unstable soils would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

With respect to the federal portions of Alternative 4, the construction impacts would be similar but less than those described for the proposed Project because the North Harbor would not be excavated and the two cruise berths in the Outer Harbor would not be developed, thus reducing the infrastructure susceptible to unstable soils. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-6a would be the same as for the proposed Project. Impacts associated with unstable soils would be less than significant under CEQA.

Mitigation Measures

No mitigation is required

Residual Impacts

Impacts would be less than significant.

Impact GEO-7a: Construction of Alternative 4 would not result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 4 site is flat and does not contain prominent geologic or topographic features. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-8a: Construction of Alternative 4 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.

CEQA Impact Determination

As with the proposed Project, Alternative 4 would not result in the permanent loss of availability of a known mineral resource that would be of future value to the region and the residents of the state. Therefore, mineral resource impacts would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

Impacts would not occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required

Residual Impacts

Impacts would be less than significant.

Operations Impacts

Impact GEO-1b: Operation of Alternative 4 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.

CEQA Impact Determination

Operations impacts of this alternative would be similar but less than those described for the proposed Project because the North Harbor would not be constructed and the two cruise berths in the Outer Harbor would not be developed, thus reducing the infrastructure susceptible to seismically induced ground failure. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-1b would be the same as for the proposed Project. Therefore, impacts due to seismically induced ground failure would be significant and unavoidable under CEQA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance associated with seismically induced ground failure.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

As for the federal portions of Alternative 4, potential operations impacts would be similar to but less than those described for the proposed Project because the North Harbor would not be constructed and the two cruise berths in the Outer Harbor would not be developed, thus resulting in less infrastructure susceptible to seismically induced ground failure. This change from the proposed Project would not change the impact conclusions, and Impact GEO-1b would be the same as for the proposed Project. Impacts due to seismically induced ground failure would be significant and unavoidable under NEPA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-2b: Operation of Alternative 4 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.

CEQA Impact Determination

Impacts as a result of operations of this alternative would be similar but less than those described for the proposed Project because the North Harbor would not be constructed and the two cruise berths in the Outer Harbor would not be developed, thus resulting in less infrastructure susceptible to inundation. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-2b would be the same as for the proposed Project. Therefore, impacts during the operations phase of Alternative 4 would be significant and unavoidable under CEQA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

As for the federal portions of Alternative 4, potential operations impacts would be similar to but less than those described for the proposed Project because the North Harbor would not be constructed and the two cruise berths in the Outer Harbor would not be developed, thus resulting in less infrastructure susceptible to inundation. This change from the proposed Project would not change the impact conclusions, and Impact GEO-2b would be the same as for the proposed Project. Therefore, impacts during the operations phase due to tsunamis and seiches would be significant and unavoidable under NEPA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

Impact GEO-3b: Operation of Alternative 4 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from subsidence/soil settlement.

CEQA Impact Determination

Operations impacts of this alternative would be similar to those described for the proposed Project because the resulting infrastructure as it relates to settlement would not be substantially different from that of the proposed Project. Under this alternative, the North Harbor would not be constructed and the two cruise berths in the Outer Harbor would not be developed, thus reducing the infrastructure susceptible to land subsidence and settlement. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-3b would be the same as for the proposed Project. Settlement impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant

NEPA Impact Determination

As for the federal portions of Alternative 4, operations impacts would be similar to those described for the proposed Project because the resulting infrastructure as it relates to settlement would not be substantially different from that of the proposed Project. Under this alternative, the North Harbor would not be constructed and the two cruise berths in the Outer Harbor would not be developed, thus reducing the infrastructure susceptible to land subsidence and settlement. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-3b would be the same as for the proposed Project. Settlement impacts associated with the new waterfront construction would be less than significant under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-4b: Operation of Alternative 4 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.

CEQA Impact Determination

Operations impacts would be similar to those described for the proposed Project because the resulting infrastructure susceptible to expansive soils would not be substantially different from that of the proposed Project. Under this alternative, the North Harbor would not be constructed and the two cruise berths in the Outer Harbor would not be developed, thus reducing the infrastructure susceptible to soil expansion. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-4b would be the same as for the proposed Project. Expansive soil impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required

Residual Impacts

Impacts would be less than significant

NEPA Impact Determination

The operations impacts for the federal portion of Alternative 4 would be similar to those described for the proposed Project because the resulting infrastructure susceptible to expansive soils would not be substantially different from that of the proposed Project. Under this alternative, the North Harbor would not be constructed and the two cruise berths in the Outer Harbor would not be developed, thus reducing the infrastructure susceptible to soil expansion. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-4b would be the same as for the proposed Project. Expansive soil impacts in the waterfront areas would be less than significant under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

Impact GEO-5b: Operation of Alternative 4 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 4 site is flat and not subject to landslides or mudflows. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-6b: Operation of Alternative 4 would not result in substantial damage to structures or infrastructure, or expose people or structures to substantial risk of unstable soil conditions from excavation, grading, or fill.

CEQA Impact Determination

As with the proposed Project, excavations would not be performed as a part of Alternative 4 operations. Therefore, impacts associated with unstable soils would not occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-7b: Operation of Alternative 4 would not result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 4 site is flat and does not contain prominent geologic or topographic features. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

No impacts would occur, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-8b: Operation of Alternative 4 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.

CEQA Impact Determination

As with the proposed Project, Alternative 4 would not result in the permanent loss of availability of a known mineral resource of regional, state, or local significance that would be of future value to the region and the residents of the state. Therefore, mineral resource impacts would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

Impacts would be less than significant, as discussed for the CEQA impact determination.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

3.5.4.3.6 Alternative 5—No-Federal-Action Alternative

Construction Impacts

Impact GEO-1a: Construction of Alternative 5 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.

CEQA Impact Determination

Seismic impacts of Alternative 5 would be similar but less than those described for the proposed Project as harbor cuts, dredging activities, and construction of Outer

Harbor cruise terminals and berths, new wharves, piers, pilings, or promenades would not occur, thus resulting in less infrastructure susceptible to seismically induced ground failure. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-1a would be the same as for the proposed Project. Therefore, impacts due to seismically induced ground failure would be significant and unavoidable under CEQA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance associated with seismically induced ground failure.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

Because the No-Federal-Action Alternative is identical to the NEPA baseline, this alternative would have no impact under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-2a: Construction of Alternative 5 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.

CEQA Impact Determination

Under this alternative, harbor cuts, dredging activities, and construction of Outer Harbor cruise terminals and berths, new wharves, piers, pilings, or promenades would not occur, thus resulting in less infrastructure that is susceptible to inundation from tsunamis/seiches. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-2a would be the same as for the proposed Project. Therefore, impacts during the construction phase would be significant and unavoidable under CEQA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

Because the No-Federal-Action Alternative is identical to the NEPA baseline, this alternative would have no impact under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-3a: Construction of Alternative 5 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.

CEQA Impact Determination

Under this alternative, harbor cuts, dredging activities, and construction of Outer Harbor cruise terminals and berths, new wharves, piers, pilings, or promenades would not occur, thus resulting in less infrastructure that is susceptible to inundation from tsunamis/seiches. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-3a would be the same as for the proposed Project. Impacts in upland areas would be less than significant under CEQA

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

Because the No-Federal-Action Alternative is identical to the NEPA baseline, this alternative would have no impact under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-4a: Construction of Alternative 5 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.

CEQA Impact Determination

Under this alternative, harbor cuts, dredging activities, and construction of Outer Harbor cruise terminals and berths, new wharves, piers, pilings, or promenades would not occur, thus resulting in less infrastructure that is susceptible to inundation from tsunamis/seiches. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-4a would be the same as for the proposed Project. Therefore, expansive soil impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

Because the No-Federal-Action Alternative is identical to the NEPA baseline, this alternative would have no impact under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-5a: Construction of Alternative 5 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 5 site is flat and not subject to landslides or mudflows. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

Because the No-Federal-Action Alternative is identical to the NEPA baseline, this alternative would have no impact under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-6a: Construction of Alternative 5 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of unstable soil conditions from excavation, grading, or fill.

CEQA Impact Determination

Under this alternative, harbor cuts, dredging activities, and construction of Outer Harbor cruise terminals and berths, new wharves, piers, pilings, or promenades would not occur, thus resulting in less infrastructure that is susceptible to inundation from tsunamis/seiches. The reduced infrastructure for this alternative would result in

fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-6a would be the same as for the proposed Project. Therefore, impacts associated with unstable soil would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

Because the No-Federal-Action Alternative is identical to the NEPA baseline, this alternative would have no impact under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-7a: Construction of Alternative 5 would not result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 5 site is flat and does not contain prominent geologic or topographic features. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

Because the No-Federal-Action Alternative is identical to the NEPA baseline, this alternative would have no impact under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-8a: Construction of Alternative 5 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.

CEQA Impact Determination

As with the proposed Project, Alternative 5 would not result in the permanent loss of availability of a known mineral resource that would be of future value to the region and the residents of the state. Therefore, mineral resource impacts would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

Because the No-Federal-Action Alternative is identical to the NEPA baseline, this alternative would have no impact under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Operations Impacts

Impact GEO-1b: Operation of Alternative 5 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.

CEQA Impact Determination

Under this alternative, harbor cuts, dredging activities, and construction of Outer Harbor cruise terminals and berths, new wharves, piers, pilings, or promenades would not occur, thus resulting in less infrastructure that is susceptible to inundation from tsunamis/seiches. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-1b would be the same as for the proposed Project. Therefore, impacts due to seismically induced ground failure would be significant and unavoidable under CEQA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

Because the No-Federal-Action Alternative is identical to the NEPA baseline, this alternative would have no impact under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-2b: Operation of Alternative 5 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.

CEQA Impact Determination

Under this alternative, harbor cuts, dredging activities, and construction of Outer Harbor cruise terminals and berths, new wharves, piers, pilings, or promenades would not occur, thus resulting in less infrastructure that is susceptible to inundation from tsunamis/seiches. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-2b would be the same as for the proposed Project. Therefore, impacts during the operations phase would be significant and unavoidable under CEQA.

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

Because the No-Federal-Action Alternative is identical to the NEPA baseline, this alternative would have no impact under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-3b: Operation of Alternative 5 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.

CEQA Impact Determination

Under this alternative, harbor cuts, dredging activities, and construction of Outer Harbor cruise terminals and berths, new wharves, piers, pilings, or promenades would not occur, thus resulting in less infrastructure that is susceptible to inundation from tsunamis/seiches. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This

change from the proposed Project would not change the impact conclusions, and Impact GEO-3b would be the same as for the proposed Project. Therefore, settlement impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

Because the No-Federal-Action Alternative is identical to the NEPA baseline, this alternative would have no impact under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-4b: Operation of Alternative 5 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.

CEQA Impact Determination

Under this alternative, harbor cuts, dredging activities, and construction of Outer Harbor cruise terminals and berths, new wharves, piers, pilings, or promenades would not occur, thus resulting in less infrastructure that is susceptible to inundation from tsunamis/seiches. The reduced infrastructure for this alternative would result in fewer people in the project area and fewer people exposed to these hazards. This change from the proposed Project would not change the impact conclusions, and Impact GEO-4b would be the same as for the proposed Project. Expansive soil impacts in upland areas would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

Because the No-Federal-Action Alternative is identical to the NEPA baseline, this alternative would have no impact under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-5b: Operation of Alternative 5 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 5 site is flat and not subject to landslides or mudflows. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

Because the No-Federal-Action Alternative is identical to the NEPA baseline, this alternative would have no impact under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-6b: Operation of Alternative 5 would not result in substantial damage to structures or infrastructure, or expose people or structures to substantial risk of unstable soil conditions from excavation, grading, or fill.

CEQA Impact Determination

As with the proposed Project, excavations would not be performed as a part of Alternative 5 operations. Therefore, impacts associated with unstable soils would not occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

Because the No-Federal-Action Alternative is identical to the NEPA baseline, this alternative would have no impact under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-7b: Operation of Alternative 5 would not result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.

CEQA Impact Determination

As with the proposed Project, the topography in the vicinity of the Alternative 5 site is flat and does not contain prominent geologic or topographic features. Therefore, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

Because the No-Federal-Action Alternative is identical to the NEPA baseline, this alternative would have no impact under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

Impact GEO-8b: Operation of Alternative 5 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.

CEQA Impact Determination

As with the proposed Project, Alternative 5 would not result in the permanent loss of availability of a known mineral resource that would be of future value to the region and the residents of the state. Therefore, mineral resource impacts would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

Because the No-Federal-Action Alternative is identical to the NEPA baseline, this alternative would have no impact under NEPA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

3.5.4.3.7 Alternative 6—No-Project Alternative

Construction Impacts

Impact GEO-1a: Construction of Alternative 6 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.

Under Alternative 6, no new development would occur within the proposed project area. Earthquake-related hazards at the proposed project site are the same under Alternative 6 as those described above for the proposed Project. However, because no new developments would occur, this alternative would not result in, or expose people to, construction-related geologic impacts, including seismicity.

CEQA Impact Determination

As discussed with respect to the proposed Project, seismic activity along the Palos Verdes Fault zone, or other regional faults, could produce fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure. However, because Alternative 6 would involve no construction, impacts due to seismically induced ground failure would not occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

This alternative is not applicable to NEPA.

Mitigation Measures

Not applicable.

Residual Impacts

Not applicable.

Impact GEO-2a: Construction of Alternative 6 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.

Under this alternative, no development would occur within the proposed project area. Tsunami- and seiche-related hazards at the proposed project site are the same under Alternative 6 as those described above for the proposed Project. However, because no new developments would occur, this alternative would not result in, or expose people to, construction-related geologic impacts, including tsunamis and seiches.

CEQA Impact Determination

As discussed with respect to the proposed Project, the Port would potentially be subject to inundation by a large tsunami as a result of an offshore earthquake or landslide. However, because Alternative 6 would involve no construction, impacts due to tsunamis and seiches would not occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would not occur.

NEPA Impact Determination

This alternative is not applicable to NEPA.

Mitigation Measures

Not applicable.

Residual Impacts

Not applicable.

Impact GEO-3a: Construction of Alternative 6 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from subsidence/soil settlement.

Under this alternative, no development would occur within the proposed project area. Because no new developments would occur, this alternative would not result in, or expose people to, construction-related geologic impacts, including subsidence/settlement.

CEQA Impact Determination

Because Alternative 6 would involve no construction, impacts due to subsidence/settlement would not occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would not occur.

NEPA Impact Determination

This alternative is not applicable to NEPA.

Mitigation Measures

Not applicable.

Residual Impacts

Not applicable.

Impact GEO-4a: Construction of Alternative 6 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.

Under this alternative, no development would occur within the proposed project area. Because no new developments would occur, this alternative would not result in, or expose people to, construction-related geologic impacts, including expansive soils.

CEQA Impact Determination

Because Alternative 6 would involve no construction, impacts due to expansive soils would not occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would not occur.

NEPA Impact Determination

This alternative is not applicable to NEPA.

Mitigation Measures

Not applicable.

Residual Impacts

Not applicable.

Impact GEO-5a: Construction of Alternative 6 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.

Under this alternative, no development would occur within the proposed project area. Because no new developments would occur, this alternative would not result in, or expose people to, construction-related geologic impacts, including landslides and mudslides.

CEQA Impact Determination

Because Alternative 6 would involve no construction, impacts due to landslides and mudslides would not occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would not occur.

NEPA Impact Determination

This alternative is not applicable to NEPA.

Mitigation Measures

Not applicable.

Residual Impacts

Not applicable.

Impact GEO-6a: Construction of Alternative 6 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of unstable soil conditions from excavation, grading, or fill.

Under this alternative, no development would occur within the proposed project area. Because no new developments would occur, this alternative would not result in, or expose people to, construction-related geologic impacts, including unstable soil conditions.

CEQA Impact Determination

Because Alternative 6 would involve no construction, impacts due to unstable soil conditions would not occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would not occur.

NEPA Impact Determination

This alternative does not apply to NEPA.

Mitigation Measures

Not applicable.

Residual Impacts

Not applicable.

Impact GEO-7a: Construction of Alternative 6 would not result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.

Under this alternative, no development would occur within the proposed project area. Because no new developments would occur, this alternative would not result in any distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.

CEQA Impact Determination

Because Alternative 6 would involve no construction, impacts associated with potential removal of prominent geologic or topographic features would not occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would not occur.

NEPA Impact Determination

This alternative does not apply to NEPA.

Mitigation Measures

Not applicable.

Residual Impacts

Not applicable.

Impact GEO-8a: Construction of Alternative 6 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.

Under this alternative, no development would occur within the proposed project area. Because no new developments would occur, this alternative would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.

CEQA Impact Determination

Because Alternative 6 would involve no construction, impacts associated with potential loss of availability of any mineral resource of regional, statewide, or local significance would not occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would not occur.

NEPA Impact Determination

This alternative does not apply to NEPA.

Mitigation Measures

Not applicable.

Residual Impacts

Not applicable.

Operations Impacts

Impact GEO-1b: Operation of Alternative 6 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.

Earthquake-related hazards at the proposed project site are the same under Alternative 6 as those described above for the proposed Project. Under this alternative, no development would occur within the project area. Cruise ships that currently berth and load/unload at the project site would continue to do so and operations are projected to increase over the CEQA baseline. Therefore, this alternative would continue to expose people to substantial risks associated with the geologic environment, although impacts would be less than those described for the proposed Project, as less development and infrastructure would be susceptible to seismically induced ground failure.

CEQA Impact Determination

As discussed with respect to the proposed Project, seismic activity along the Palos Verdes Fault zone, or other regional faults, would produce fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure. Seismic hazards are common to the Los Angeles region and are not increased by Alternative 6. However, because the site is potentially underlain by strands of the active Palos Verdes Fault and liquefaction-prone hydraulic fill, there is a substantial risk of seismic impacts. Continued exposure of people and property during operations to seismic hazards from a major or great earthquake cannot be precluded, even with incorporation of modern construction engineering and safety standards. Therefore, impacts due to seismically induced ground failure are significant and unavoidable under CEQA.

Mitigation Measures

There are no mitigation measures available that would reduce impacts below significance associated with seismically induced ground failure.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

This alternative does not apply to NEPA.

Mitigation Measures

Not applicable.

Residual Impacts

Not applicable.

Impact GEO-2b: Operation of Alternative 6 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.

Risks of seismically induced tsunamis and seiches are typical for the entire California coastline and would not be increased by the Alternative 6. This alternative would continue to expose people to substantial risks associated with tsunamis and seiches. However, impacts would be less than those described for the proposed Project, as less development and infrastructure would be susceptible to seismically induced tsunamis and seiches.

As discussed for Impact GEO-2a for the proposed Project, existing buildings and infrastructure may be subject to substantial damage from coastal flooding as a result of a large tsunami or seiche. Because portions of the proposed project site are at elevations lower than the predicted tsunami wave heights, there is a substantial risk of coastal flooding due to tsunamis and seiches.

The risk to vessels would be the same under the Alternative 6 as that described above for the proposed Project. Additionally, for the same reasons described for the proposed Project, substantial damage is not expected to a vessel or the wharf in the event that a tsunami was to strike while a vessel was secured at a berth.

CEQA Impact Determination

Alternative 6 would continue to expose people and property to flooding from tsunamis and seiches. Therefore, impacts due to tsunamis and seiches would be significant and unavoidable under CEQA.

Mitigation Measures

As there are no applicable mitigation measures, impacts would remain significant under CEQA.

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

This alternative does not apply to NEPA.

Mitigation Measures

Not applicable.

Residual Impacts

Not applicable.

Impact GEO-3b: Operation of Alternative 6 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.

As discussed for Impact GEO-3a, subsidence in the vicinity of the proposed project area, due to previous oil extraction in the Port area, has been mitigated and is not anticipated to adversely impact the site. Because construction would not occur in association with Alternative 6, impacts related to cracking and warping of structures during operations as a result of saturated, unconsolidated/compressible sediments would not occur.

CEQA Impact Determination

As subsidence in the vicinity of the proposed project area, due to previous oil extraction in the Port area, has been mitigated and is not anticipated to adversely impact the site, impacts would be less than significant from past actions. There would be no additional soil settlement impacts during operations under CEQA, as there would be no new construction under this alternative.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

This alternative does not apply to NEPA.

Mitigation Measures

Not applicable.

Residual Impacts

Not applicable.

Impact GEO-4b: Operation of Alternative 6 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.

Because construction would not occur in association with Alternative 6, impacts related to cracking and warping of structures during operations as a result of expansive soils would not occur.

CEQA Impact Determination

Because no new construction would occur, soil expansion impacts would not occur during operations under this alternative.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

This alternative does not apply to NEPA.

Mitigation Measures

Not applicable.

Residual Impacts

Not applicable.

Impact GEO-5b: Operation of Alternative 6 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.

The topography in the vicinity of the site is flat and not subject to landslides or mudflows.

CEQA Impact Determination

As the topography in the vicinity of the site is flat and not subject to landslides or mudflows, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

This alternative does not apply to NEPA.

Mitigation Measures

Not applicable.

Residual Impacts

Not applicable.

Impact GEO-6b: Operation of Alternative 6 would not result in substantial damage to structures or infrastructure, or expose people or structures to substantial risk of unstable soil conditions from excavation, grading, or fill.

CEQA Impact Determination

As excavations would not be performed as a part of operations under Alternative 6, impacts associated with unstable soils would not occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

This alternative does not apply to NEPA.

Mitigation Measures

Not applicable.

Residual Impacts

Not applicable.

Impact GEO-7b: Operation of Alternative 6 would not result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.

Since the proposed project area is relatively flat and paved, with no prominent geologic or topographic features, operations under Alternative 6 would not result in any distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.

CEQA Impact Determination

As the topography in the vicinity of the site is flat and does not contain prominent geologic or topographic features, no impacts would occur under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

This alternative does not apply to NEPA.

Mitigation Measures

Not applicable.

Residual Impacts

Not applicable.

Impact GEO-8b: Operation of Alternative 6 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.

CEQA Impact Determination

Alternative 6 would not result in the permanent loss of availability of a known mineral resource of regional, state, or local significance that would be of future value to the region and the residents of the state. Mineral resource impacts would be less than significant under CEQA.

Mitigation Measures

No mitigation is required.

Residual Impacts

Impacts would be less than significant.

NEPA Impact Determination

This alternative does not apply to NEPA.

Mitigation Measures

Not applicable.

Residual Impacts

Not applicable.

3.5.4.3.8 Summary of Impact Determinations

The following Table 3.5-3 summarizes the CEQA and NEPA impact determinations of the proposed Project and its alternatives related to geology, as described in the detailed discussion in Sections 3.5.4.3.1 and 3.5.4.3.2. This table is meant to allow easy comparison between the potential impacts of the proposed Project and its alternatives with respect to this resource. Identified potential impacts may be based on Federal, State, or City of Los Angeles significance criteria, Port criteria, and the scientific judgment of the report preparers.

For each type of potential impact, the table describes the impact, notes the CEQA and NEPA impact determinations, describes any applicable mitigation measures, and notes the residual impacts (i.e.: the impact remaining after mitigation). All impacts, whether significant or not, are included in this table. Note that impact descriptions for each of the Alternatives are the same as for the proposed Project, unless otherwise noted.

Table 3.5-3: Summary Matrix of Potential Impacts and Mitigation Measures for Geology Associated with the Proposed Project and Alternatives

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
3.5 Geology				
Proposed Project	**GEO-1a:** Construction of the proposed Project would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.	CEQA: Significant	No mitigation measures are available to reduce below significance.	CEQA: Significant and unavoidable
		NEPA: Significant	No mitigation measures are available to reduce below significance.	NEPA: Significant and unavoidable
	GEO-2a: Construction of the proposed Project would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.	CEQA: Significant	**MM GEO-1. Emergency response planning**. The tenants within the proposed project area will work with Port engineers and LAHD police to develop tsunami response training and procedures to assure that construction and operations personnel will be prepared to act in the event of a large seismic event. Such procedures will include immediate evacuation requirements in the event that a large seismic event is felt at the proposed project site, as part of overall emergency response planning for this proposed Project. Such procedures will be included in any bid specifications for construction or operations personnel, with a copy of such bid specifications to be provided to LAHD, including a completed copy of its operations emergency response plan prior to commencement of construction activities and/or operations.	CEQA: Significant and unavoidable

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
		NEPA: Significant	Implement Mitigation Measure MM GEO-1.	NEPA: Significant and unavoidable
	GEO-3a: Construction of the proposed Project would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-4a: Construction of the proposed Project would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-5a: Construction of the proposed Project would not result in substantial damage to structures or infrastructure, or expose people to a substantial risk of landslides or mudslides.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-6a: Construction of the proposed Project would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of unstable soil conditions from excavation, grading, or fill.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	GEO-7a: Construction of the proposed Project would not result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-8a: Construction of the proposed Project would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-1b: Operation of the proposed Project would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.	CEQA: Significant	No mitigation measures are available to reduce below significance.	CEQA: Significant and unavoidable
		NEPA: Significant	No mitigation measures are available to reduce below significance.	NEPA: Significant and unavoidable
	GEO-2b: Operation of the proposed Project would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.	CEQA: Significant	Implement Mitigation Measure MM GEO-1.	CEQA: Significant and unavoidable
		NEPA: Significant	Implement Mitigation Measure MM GEO-1.	NEPA: Significant and unavoidable

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	GEO-3b: Operation of the proposed Project would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-4b: Operation of the proposed Project would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-5b: Operation of the proposed Project would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-6b: Operation of the proposed Project would not result in substantial damage to structures or infrastructure, or expose people or structures to substantial risk of unstable soil conditions from excavation, grading, or fill.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	GEO-7b: Operation of the proposed Project would not result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-8b: Operation of the proposed Project would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
Alternative 1	**GEO-1a:** Construction of Alternative 1 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.	CEQA: Significant	No mitigation measures are available to reduce below significance.	CEQA: Significant and unavoidable
		NEPA: Significant	No mitigation measures are available to reduce below significance.	NEPA: Significant and unavoidable
	GEO-2a: Construction of Alternative 1 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.	CEQA: Significant	Implement Mitigation Measure MM GEO-1.	CEQA: Significant and unavoidable
		NEPA: Significant	Implement Mitigation Measure MM GEO-1.	NEPA: Significant and unavoidable

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	GEO-3a: Construction of Alternative 1 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-4a: Construction of Alternative 1 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-5a: Construction of Alternative 1 would not result in substantial damage to structures or infrastructure, or expose people to a substantial risk of landslides or mudslides.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-6a: Construction of Alternative 1 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of unstable soil conditions from excavation, grading, or fill.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-7a: Construction of Alternative 1 would not	CEQA: No impact	No mitigation is required.	CEQA: No impact

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.	NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-8a: Construction of Alternative 1 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-1b: Operation of Alternative 1 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.	CEQA: Significant	No mitigation measures are available to reduce below significance.	CEQA: Significant and unavoidable
		NEPA: Significant	No mitigation measures are available to reduce below significance.	NEPA: Significant and unavoidable
	GEO-2b: Operation of Alternative 1 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.	CEQA: Significant	Implement Mitigation Measure MM GEO-1.	CEQA: Significant and unavoidable
		NEPA: Significant	Implement Mitigation Measure MM GEO-1.	NEPA: Significant and unavoidable

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	GEO-3b: Operation of Alternative 1 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-4b: Operation of Alternative 1 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-5b: Operation of Alternative 1 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-6b: Operation of the Alternative 1 would not result in substantial damage to structures or infrastructure, or expose people or structures to substantial risk of unstable soil conditions from excavation, grading, or fill.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-7b: Operation of the	CEQA: No impact	No mitigation is required.	CEQA: No impact

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	Alternative 1 would not result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.	NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-8b: Operation of the Alternative 1 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
Alternative 2	**GEO-1a:** Construction of Alternative 2 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.	CEQA: Significant	No mitigation measures are available to reduce below significance.	CEQA: Significant and unavoidable
		NEPA: Significant	No mitigation measures are available to reduce below significance.	NEPA: Significant and unavoidable
	GEO-2a: Construction of Alternative 2 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.	CEQA: Significant	Implement Mitigation Measure MM GEO-1.	CEQA: Significant and unavoidable
		NEPA: Significant	Implement Mitigation Measure MM GEO-1.	NEPA: Significant and unavoidable
	GEO-3a: Construction of	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	Alternative 2 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.	NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-4a: Construction of Alternative 2 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-5a: Construction of Alternative 2 would not result in substantial damage to structures or infrastructure, or expose people to a substantial risk of landslides or mudslides.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-6a: Construction of Alternative 2 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of unstable soil conditions from excavation, grading, or fill.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-7a: Construction of Alternative 2 would not	CEQA: No impact	No mitigation is required.	CEQA: No impact

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.	NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-8a: Construction of Alternative 2 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-1b: Operation of Alternative 2 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.	CEQA: Significant	No mitigation measures are available to reduce below significance.	CEQA: Significant and unavoidable
		NEPA: Significant	No mitigation measures are available to reduce below significance.	NEPA: Significant and unavoidable
	GEO-2b: Operation of Alternative 2 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.	CEQA: Significant	Implement Mitigation Measure MM GEO-1.	CEQA: Significant and unavoidable
		NEPA: Significant	Implement Mitigation Measure MM GEO-1.	NEPA: Significant and unavoidable
	GEO-3b: Operation of Alternative 2 would not result in substantial	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.	NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-4b: Operation of Alternative 2 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-5b: Operation of Alternative 2 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-6b: Operation of the Alternative 2 would not result in substantial damage to structures or infrastructure, or expose people or structures to substantial risk of unstable soil conditions from excavation, grading, or fill.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-7b: Operation of the Alternative 2 would not	CEQA: No impact	No mitigation is required.	CEQA: No impact

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.	NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-8b: Operation of the Alternative 2 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
Alternative 3	**GEO-1a:** Construction of Alternative 3 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.	CEQA: Significant	No mitigation measures are available to reduce below significance.	CEQA: Significant and unavoidable
		NEPA: Significant	No mitigation measures are available to reduce below significance.	NEPA: Significant and unavoidable
	GEO-2a: Construction of Alternative 3 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.	CEQA: Significant	Implement Mitigation Measure MM GEO-1.	CEQA: Significant and unavoidable
		NEPA: Significant	Implement Mitigation Measure MM GEO-1.	NEPA: Significant and unavoidable
	GEO-3a: Construction of	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	Alternative 3 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.	NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-4a: Construction of Alternative 3 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-5a: Construction of Alternative 3 would not result in substantial damage to structures or infrastructure, or expose people to a substantial risk of landslides or mudslides.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-6a: Construction of Alternative 3 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of unstable soil conditions from excavation, grading, or fill.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-7a: Construction of Alternative 3 would not	CEQA: No impact	No mitigation is required.	CEQA: No impact

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.	NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-8a: Construction of Alternative 3 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-1b: Operation of Alternative 3 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.	CEQA: Significant	No mitigation measures are available to reduce below significance.	CEQA: Significant and unavoidable
		NEPA: Significant	No mitigation measures are available to reduce below significance.	NEPA: Significant and unavoidable
	GEO-2b: Operation of Alternative 3 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.	CEQA: Significant	Implement Mitigation Measure MM GEO-1.	CEQA: Significant and unavoidable
		NEPA: Significant	Implement Mitigation Measure MM GEO-1.	NEPA: Significant and unavoidable
	GEO-3b: Operation of Alternative 3 would not result in substantial	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.	NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-4b: Operation of Alternative 3 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-5b: Operation of Alternative 3 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-6b: Operation of the Alternative 3 would not result in substantial damage to structures or infrastructure, or expose people or structures to substantial risk of unstable soil conditions from excavation, grading, or fill.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-7b: Operation of the Alternative 3 would not	CEQA: No impact	No mitigation is required.	CEQA: No impact

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.	NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-8b: Operation of the Alternative 3 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
Alternative 4	**GEO-1a:** Construction of Alternative 4 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.	CEQA: Significant	No mitigation measures are available to reduce below significance.	CEQA: Significant and unavoidable
		NEPA: Significant	No mitigation measures are available to reduce below significance.	NEPA: Significant and unavoidable
	GEO-2a: Construction of Alternative 4 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.	CEQA: Significant	Implement Mitigation Measure MM GEO-1.	CEQA: Significant and unavoidable
		NEPA: Significant	Implement Mitigation Measure MM GEO-1.	NEPA: Significant and unavoidable
	GEO-3a: Construction of	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	Alternative 4 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.	NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-4a: Construction of Alternative 4 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-5a: Construction of Alternative 4 would not result in substantial damage to structures or infrastructure, or expose people to a substantial risk of landslides or mudslides.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-6a: Construction of Alternative 4 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of unstable soil conditions from excavation, grading, or fill.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-7a: Construction of Alternative 4 would not	CEQA: No impact	No mitigation is required.	CEQA: No impact

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.	NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-8a: Construction of Alternative 4 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-1b: Operation of Alternative 4 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.	CEQA: Significant	No mitigation measures are available to reduce below significance.	CEQA: Significant and unavoidable
		NEPA: Significant	No mitigation measures are available to reduce below significance.	NEPA: Significant and unavoidable
	GEO-2b: Operation of Alternative 4 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.	CEQA: Significant	Implement Mitigation Measure MM GEO-1.	CEQA: Significant and unavoidable
		NEPA: Significant	Implement Mitigation Measure MM GEO-1.	NEPA: Significant and unavoidable
	GEO-3b: Operation of Alternative 4 would not result in substantial	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.	NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-4b: Operation of Alternative 4 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
	GEO-5b: Operation of Alternative 4 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-6b: Operation of the Alternative 4 would not result in substantial damage to structures or infrastructure, or expose people or structures to substantial risk of unstable soil conditions from excavation, grading, or fill.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-7b: Operation of the Alternative 4 would not	CEQA: No impact	No mitigation is required.	CEQA: No impact

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.	NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-8b: Operation of the Alternative 4 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Less than significant	No mitigation is required.	NEPA: Less than significant
Alternative 5	**GEO-1a:** Construction of Alternative 5 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.	CEQA: Significant	No mitigation measures are available to reduce below significance.	CEQA: Significant and unavoidable
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-2a: Construction of Alternative 5 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.	CEQA: Significant	Implement Mitigation Measure MM GEO-1.	CEQA: Significant and unavoidable
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-3a: Construction of	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	Alternative 5 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.	NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-4a: Construction of Alternative 5 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-5a: Construction of Alternative 5 would not result in substantial damage to structures or infrastructure, or expose people to a substantial risk of landslides or mudslides.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-6a: Construction of Alternative 5 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of unstable soil conditions from excavation, grading, or fill.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-7a: Construction of Alternative 5 would not	CEQA: No impact	No mitigation is required.	CEQA: No impact

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.	NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-8a: Construction of Alternative 5 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-1b: Operation of Alternative 5 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.	CEQA: Significant	No mitigation measures are available to reduce below significance.	CEQA: Significant and unavoidable
		NEPA No impact	No mitigation is required.	NEPA: No impact
	GEO-2b: Operation of Alternative 5 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.	CEQA: Significant	Implement Mitigation Measure MM GEO-1.	CEQA: Significant and unavoidable
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-3b: Operation of Alternative 5 would not result in substantial	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.	NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-4b: Operation of Alternative 5 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-5b: Operation of Alternative 5 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-6b: Operation of the Alternative 5 would not result in substantial damage to structures or infrastructure, or expose people or structures to substantial risk of unstable soil conditions from excavation, grading, or fill.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-7b: Operation of the Alternative 5 would not	CEQA: No impact	No mitigation is required.	CEQA: No impact

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.	NEPA: No impact	No mitigation is required.	NEPA: No impact
	GEO-8b: Operation of the Alternative 5 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: No impact	No mitigation is required.	NEPA: No impact
Alternative 6	**GEO-1a:** Construction of Alternative 6 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: Not applicable[†]	Not applicable	NEPA: Not applicable
	GEO-2a: Construction of Alternative 6 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: Not applicable	Not applicable	NEPA: Not applicable
	GEO-3a: Construction of	CEQA: No impact	No mitigation is required.	CEQA: No impact

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	Alternative 6 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.	NEPA: Not applicable	Not applicable	NEPA: Not applicable
	GEO-4a: Construction of Alternative 6 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: Not applicable	Not applicable	NEPA: Not applicable
	GEO-5a: Construction of Alternative 6 would not result in substantial damage to structures or infrastructure, or expose people to a substantial risk of landslides or mudslides.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: Not applicable	Not applicable	NEPA: Not applicable
	GEO-6a: Construction of Alternative 6 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of unstable soil conditions from excavation, grading, or fill.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: Not applicable	Not applicable	NEPA: Not applicable
	GEO-7a: Construction of Alternative 6 would not	CEQA: No impact	No mitigation is required.	CEQA: No impact

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.	NEPA: Not applicable	Not applicable	NEPA: Not applicable
	GEO-8a: Construction of Alternative 6 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: Not applicable	Not applicable	NEPA: Not applicable
	GEO-1b: Operation of Alternative 6 would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure.	CEQA: Significant	No mitigation measures are available to reduce below significance.	CEQA: Significant and unavoidable
		NEPA Not applicable	Not applicable	NEPA: Not applicable
	GEO-2b: Operation of Alternative 6 would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches.	CEQA: Significant	No mitigation measures are applicable.	CEQA: Significant and unavoidable
		NEPA: Not applicable	Not applicable	NEPA: Not applicable
	GEO-3b: Operation of Alternative 6 would not result in substantial	CEQA: No impact	No mitigation is required.	CEQA: No impact

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	damage to structures or infrastructure, or expose people to substantial risk of injury from land subsidence/settlement.	NEPA: Not applicable	Not applicable	NEPA: Not applicable
	GEO-4b: Operation of Alternative 6 would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from expansive soils.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: Not applicable	Not applicable	NEPA: Not applicable
	GEO-5b: Operation of Alternative 6 would not result in substantial damage to structures or infrastructure, or expose people or property to a substantial risk of landslides or mudslides.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: Not applicable	Not applicable	NEPA: Not applicable
	GEO-6b: Operation of the Alternative 6 would not result in substantial damage to structures or infrastructure, or expose people or structures to substantial risk of unstable soil conditions from excavation, grading, or fill.	CEQA: No impact	No mitigation is required.	CEQA: No impact
		NEPA: Not applicable	Not applicable	NEPA: Not applicable
	GEO-7b: Operation of the Alternative 6 would not	CEQA: No impact	No mitigation is required.	CEQA: No impact

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Impacts after Mitigation*
	result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.	NEPA: Not applicable	Not applicable	NEPA: Not applicable
	GEO-8b: Operation of the Alternative 6 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Not applicable	Not applicable	NEPA: Not applicable

Notes:

* Impact descriptions for each of the alternatives are the same as for the proposed Project, unless otherwise noted.

† The term *not applicable* is used in cases where a particular impact is not identified as a CEQA- or NEPA-related issue in the threshold of significance criteria, or where there is no federal action requiring a NEPA determination of significance.

3.5.4.4 Mitigation Monitoring

Table 3.5-4. Mitigation Monitoring for Geology

GEO-2a: Construction of the proposed Project would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches. **GEO-2b:** Operation of the proposed Project would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches. *(Also applies to Impact GEO-2a for Alternatives 1–5.)*	
Mitigation Measure	**GEO-1: Emergency response planning**. The Terminal operator will work with Port engineers and Port police to develop tsunami response training and procedures to assure that construction and operations personnel will be prepared to act in the event of a large seismic event. Such procedures will include immediate evacuation requirements in the event that a large seismic event is felt at the proposed project site, as part of overall emergency response planning for this proposed Project.
Timing	Prior to construction and/or operation.
Methodology	Such procedures will be included in any bid specifications for construction or operations personnel, with a copy of such bid specifications to be provided to LAHD, including a completed copy of its operations emergency response plan prior to commencement of construction activities and/or operations. Such procedures will include immediate evacuation requirements in the event that a large seismic event is felt at the proposed project site, as part of overall emergency response planning for this proposed Project.
Responsible Parties	LAHD
Residual Impacts for Impact GEO-2a	Significant after mitigation.
GEO-2b: Operation of the proposed Project would result in substantial damage to structures or infrastructure, or expose people to substantial risk involving tsunamis or seiches. *(Also applies to Impact GEO-2b for Alternatives 1–5.)*	
Mitigation Measure	See Mitigation Measure MM GEO-1 above.
Residual Impacts for Impact GEO-2b	Significant after mitigation.

3.5.5 Significant Unavoidable Adverse Impacts

The proposed Project and Alternatives 1 through 5 would result in increased exposure of people and property to seismic hazards from a major or great earthquake during construction and operation. Seismic activity along the Palos Verdes Fault zone, or other regional faults, would potentially produce fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure. Seismic hazards are common to the Los Angeles region and are not increased by the proposed Project. However, because the proposed project area is potentially underlain by strands of the active Palos Verdes Fault and liquefaction-prone hydraulic fill, there is a substantial

risk of seismic impacts. Design and construction in accordance with applicable laws and regulations pertaining to seismically induced ground movement would minimize structural damage in the event of an earthquake. However, increased exposure of people and property during construction to seismic hazards from a major or great earthquake cannot be precluded even with incorporation of modern construction engineering and safety standards. Therefore, impacts due to seismically induced ground failure would be significant and unavoidable.

The proposed Project and Alternatives 1 through 5 would expose people and structures to tsunami and seiche hazards during construction and operations. Portions of the proposed project site are at elevations lower than the predicted tsunami wave heights, resulting in a substantial risk of coastal flooding due to tsunamis and seiches. Designing new facilities based on existing building codes may not prevent substantial damage to structures from coastal flooding. Impacts due to tsunamis and seiches are typical for the entire California coastline and would not be increased by construction or operation of the proposed Project. Emergency planning and coordination between the existing and future Port tenants and LAHD, as outlined in Mitigation Measure MM GEO-1, would contribute to reducing onsite injuries during a tsunami. However, even with incorporation of emergency planning and construction in accordance with current City and State regulations, substantial damage and/or injury would occur in the event of a tsunami or seiche. Raising the elevation of the site, or constructing a wall along the perimeter of the site of sufficient height to mitigate the potentially damaging effects of a tsunami, would be the only way to mitigate potential impacts. However, elevating the approximately 400 acres within the site or building a wall around the entire perimeter of the proposed project area would be cost-prohibitive and would significantly impact existing infrastructure requiring extensive modification of existing improvements. Mitigation of the tsunami risk would not be feasible. As a result, impacts due to tsunami would be significant and unavoidable.