3.5

GEOLOGY

3.5.1 Introduction

This section presents the geologic conditions for the proposed Project area and analyzes: (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 backland areas.

3.5.2 Environmental Setting

3.5.2.1 Regional Setting

The proposed Project is located near sea level on Holocene alluvial outwash materials, Pleistocene terrace deposits, and Pleistocene Palos Verdes Sand, within the southwestern structural block of the Los Angeles Basin Province (Bryant 1987; Kennedy 1975; Yerkes et al. 1965). The southwestern structural block, one of four such blocks underlying the Los Angeles Basin, is marked by a northwest-southeast trending fault system (Yerkes et al. 1965) (Figure 3.5-1).

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 Richter magnitude (M) represents a tenfold increase in the wave magnitude generated by an earthquake. A Richter magnitude 8.0 earthquake is not twice as large as a M4.0 earthquake; it is 10,000 times larger (i.e., 10^4, or 10 x 10 x 10 x 10). Damage typically begins at M5.0.

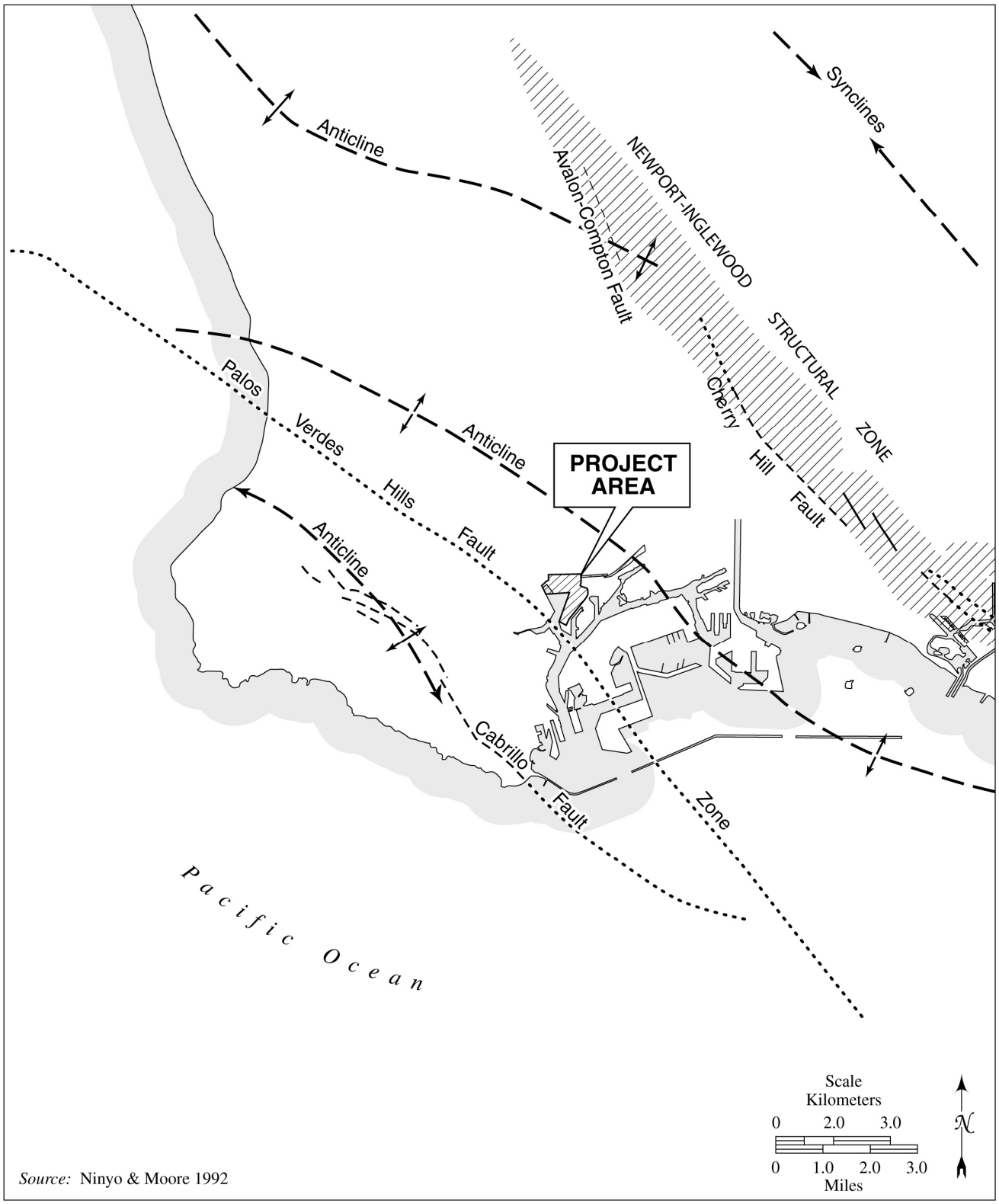

Figure 3.5-1. Local Faults and Geologic Structures – West Los Angeles Basin

Earthquakes of M6.0 to 6.9 are classified as moderate; those between 7.0 and 7.9 are classified as major; and those of 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 52 major earthquakes, of magnitude 6 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 (see Table 3.5-1), 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. 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).

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 the largest earthquake to have occurred on a given fault within the last 200 years, or is an earthquake that ruptures 10 percent of the total length of the fault. In addition, the Port of Los Angeles (Port) 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 cross the Los Angeles Harbor in the vicinity of the West Basin portion of the Port (Figure 3.5-1 - Palos Verdes). Although well constrained in the channel areas of the Harbor, such as at the intersection of the West Basin and the Southwest Slip, the onshore location of the fault zone in the West Basin area is not well defined. However, current data depicted in Figure 3.5-1 suggest the fault most likely crosses north-northwest across Berths 121-132 and immediately southwest of Berths 136-147. Recent studies indicate that the MCE for the Palos Verdes Fault is Richter magnitude 7.25, with a recurrence interval of 900 years and peak ground accelerations in the Port area of 0.28g and 0.52g, for the OLE and CLE, respectively (EMI 2001, McNeilan et al. 1996).

Numerous other active faults and fault zones are located within the general region, such as the Newport-Inglewood, San Pedro, Whittier-Elsinore, Santa Monica, Hollywood, 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 3.5-1. Known Earthquakes with Richter Magnitude Greater than 5.5 in the Los Angeles Basin Area

Fault Name	*Date*	*Richter Magnitude*
Palos Verdes Fault	*	*
San Pedro Basin Fault	*	*
Santa Monica-Raymond Fault	1855	6.0
San Andreas Fault	1857 1952	8.2 7.7
Newport-Inglewood Fault	1933	6.3
San Jacinto Fault	1968	6.4
San Fernando/Sierra Madre-Cucamonga Fault	1971 1991	6.4 6.0
Whittier-Elsinore Fault Zone	1987	5.9
Camp Rock/Emerson Fault	1992	7.4
Blind thrust fault beneath Northridge	1994	6.6
Note: * No known earthquakes within the last 200 years.		
Source: Ninyo & Moore (1992); U.S. Geological Survey/Caltech (1992, 1994).		

Table 3.5-2. Hazardous Faults and Bedrock Accelerations — Los Angeles Basin Area

Fault Name	*Distance in Miles*	*Richter Magnitude (Ziony 1985)*	*Maximum Credible Earthquake Magnitude (Greensfelder 1974)*	*Duration in seconds (Bolt 1973)*
Palos Verdes Fault	<1	6.4-6.6	7.25*	26
Newport-Inglewood Structural Zone	5	6.5-6.7	7	26
San Pedro Basin Fault	15	6.3-6.6	no data	18
Whittier-Elsinore Fault Zone	22	6.4-6.7	7.5	16
Santa Monica-Raymond Fault	23	6.2-6.6	7.5	15
San Fernando-Cucamonga Fault	31	6.4-6.5	6.5	14
San Jacinto Fault	57	6.4-7.0	7.5	22
San Andreas Fault	53	7.2-8.1	8.25	28
Source: Ninyo & Moore (1992), *EMI (2001)				

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, which has generated earthquakes of magnitudes ranging from 4.7 to 6.3 Richter scale (LAHD 1991a). Large events could occur on more distant faults in the general area, but because of the greater distance from the site, 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 the West Basin, 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 groundshaking 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 depths as shallow as 2 to 6 feet beneath the site. These conditions are conducive to liquefaction.

Some authors (Tinsley and Youd 1985; Toppozada et al. 1988; Davis et al. 1982) 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 proposed Project site is identified as an area susceptible to liquefaction in the City of Los Angeles General Plan, Safety Element because of the presence of recent alluvial deposits and groundwater less than 30 feet below ground surface (City of Los Angeles 1996). Other authors (e.g., Pyke 1990) indicate that the overall probability of widespread liquefaction of uncompacted hydraulic fills and major damage in the Port is judged to be relatively low. However, even minor damage resulting from liquefaction can be very significant in terms of loss of functionality and repair costs (Pyke 1990).

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 sets off transoceanic waves with wavelengths of up to 125 miles (200 km) 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-ft (1.8-m) rise of water in a few minutes were observed in the West Basin. The maximum water level fluctuations recorded by gauges were 5.0 ft (1.5 m) at Port Berth 60 (near Pilot Station) and 5.8 ft (1.8 m) 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 ft (2 m) and 8 ft (2.4m) above mean lower low water (MLLW), at 100-year intervals, and between 10 ft (3 m) and 11 ft (3.4 m), 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 runup estimates by Houston (1980) were used for the tsunami analysis contained in the Deep Draft Navigation Improvements EIR/EIS in September 1992 (USACE and LAHD 1992).

However, more recent studies (e.g., Synolakis et al. 1997; Borrero et al. 2001; Borrero et al. 2005a) 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 nearshore facilities. For example, one of the largest such features, the Catalina Fault, lies directly underneath Catalina Island, located only 22 miles (35 km) from the Port. Simulations of tsunamis generated by uplift on this fault suggest waves in the Port in excess of 12 ft (3.7 m), with an arrival time within 20 minutes (Legg et al. 2003; Borrero et al. 2005b). 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 ft (10 m), claiming more than 2,500 lives. In a study modeling potential tsunami generation by local offshore earthquakes, Legg et al. (2004), considers 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 approximately 7,500 year old. In contrast, the recurrence of 3 to 20 ft (1 to 6 m) 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 ft (2.4 m) and 15.0 ft (4.6 m) above mean sea level (MSL), at 100- and 500-year intervals, respectively, as a part of their Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS) (CSLC 2004). 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 the 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, see Appendix J). The 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. This model indicates that a reasonable maximum source for future tsunami events at the proposed Project site would either be a magnitude 7 earthquake on the Santa Catalina Fault or a submarine landslide along the nearby Palos Verdes Peninsula.

The Port Complex model predicts tsunami wave heights of 1.3 to 5.3 ft (0.4 to 1.6 m) above MSL at the proposed Project site. The areas of highest anticipated water levels are the northwest section of West Basin (Berths 134 and 135), where maximum water levels of 4.6 to 5.3 ft (1.4 to 1.6 m) above MSL could occur. The area of lowest anticipated tsunami-induced water levels, under this scenario, is the southeast portion of West Basin (Berths 145 to 147), where water levels of 1.3 to 2.0 ft (0.4 to 0.6 m) above MSL is possible.

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.

The proposed Project area experienced maximum cumulative subsidence of approximately 1.6 feet (0.5 m), from 1928 to 1970 (Allen 1973). 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).

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. 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 northern portion of the proposed Project site, in the vicinity of the proposed Harry Bridges Boulevard Landscaped Area, is located within the Wilmington Oil Field, 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 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). Numerous oil wells were formerly present on the proposed Project site. All of these wells have been abandoned in accordance with California Division of Oil and Gas and Geothermal Resources specifications.

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, 2001b). Local grading ordinances establish detailed procedures for excavation and earthwork required during construction in backland 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 2002b). Most local jurisdictions rely on the 1997 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. The 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 California Code of Regulations, Title 24, Part 2, Marine Oil Terminals, Chapter 31F. These standards apply to all existing marine oil terminals in California and include criterion 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. Public Resources Code, 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: Mineral Resource Zone (MRZ)-1, areas of no mineral resource significance; MRZ-2, areas of identified mineral resource significance; MRZ-3, areas of undetermined mineral resource significance; and MRZ-4, areas of unknown mineral resource significance.

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.

3.5.4.1.1 CEQA Baseline

Section 15125 of the CEQA Guidelines requires EIRs to include a description of the physical environmental conditions in the vicinity of a project that exist at the time of the NOP. These environmental conditions would normally constitute the baseline physical conditions by which the CEQA lead agency determines whether an impact is significant. For purposes of this Draft EIS/EIR, the CEQA Baseline for determining the significance of potential impacts under CEQA is December 2003. CEQA Baseline conditions are described in Table 2-2 of Section 2.4.

The CEQA Baseline represents the setting at a fixed point in time, with no project growth over time, and differs from the "No Project" Alternative (discussed in Section 2.5.1) in that the No Project Alternative addresses what is likely to happen at the site over time, starting from the baseline conditions. The No Project Alternative allows for growth at the proposed Project site that would occur without any required additional approvals.

3.5.4.1.2 No Federal Action/NEPA Baseline

For purposes of this Draft EIS/EIR, the evaluation of significance under NEPA is defined by comparing the proposed Project or other alternative to the No Federal Action scenario. The No Federal Action/NEPA Baseline condition for determining significance of impacts coincides with the "No Federal Action" condition, which is defined by examining the full range of construction and operational activities the applicant could implement and is likely to implement absent permits from the USACE. Therefore, the No Federal Action/NEPA Baseline would not include any dredging, filling of the Northwest Slip, wharf construction or upgrades, or crane replacement. The No Federal Action/NEPA Baseline would include construction and operation of all upland elements (existing lands) for backlands or other purposes. The upland elements are assumed to include:

- Adding 57 acres or existing land for backland area and an on-dock rail yard;
- Constructing a 500-space parking lot for union workers;
- Demolishing the existing administration building and constructing a new LEED certified administration building and other terminal buildings;

- Adding new lighting and replacing existing lighting, fencing, paving, and utilities on the backlands;
- Relocating the Pier A rail yard and constructing the new on-dock rail yard;
- Widening and realigning Harry Bridges Boulevard; and
- Developing the Harry Bridges Buffer Area.

Unlike the CEQA Baseline, which is defined by conditions at a point in time, the No Federal Action/NEPA Baseline is not bound by statute to a "flat" or "no growth" scenario; therefore, the USACE may project increases in operations over the life of a project to properly analyze the No Federal Action/NEPA Baseline condition. Normally, any ultimate permit decision would focus on direct impacts to the aquatic environment, as well as indirect and cumulative impacts in the uplands determined to be within the scope of federal control and responsibility. Significance of the proposed Project or alternative is defined by comparing the proposed Project or alternative to the No Federal Action/NEPA Baseline (i.e., the increment). The No Federal Action/NEPA Baseline conditions are described in Table 2-2 of Section 2.4.

The No Federal Action/NEPA Baseline also differs from the "No Project" Alternative, where the Port would take no further action to construct and develop additional backlands (other than the 176 acres that currently exist). Under this alternative, no construction impacts would occur. However, forecasted increases in cargo throughput would still occur as greater operational efficiencies are made.

3.5.4.2 Thresholds of Significance

The following significance criteria are based on the Los Angeles CEQA Thresholds (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. Geologic impacts are therefore considered significant only if the proposed Project would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from:

GEO-1 Fault rupture, seismic ground shaking, liquefaction, or other seismically induced ground failure;

GEO-2 Tsunamis or seiches;

GEO-3 Land subsidence/settlement;

GEO-4 Expansive soils;

GEO-5 Landslides, mudflows; or

GEO-6 Unstable soil conditions from excavation, grading, or fill.

In addition, a project would normally have a significant impact on landform alteration or mineral resources if:

GEO-7 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, hillslopes, canyons, ravines, rock outcrops, water bodies, streambeds, and wetlands.

GEO-8 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.

See section 3.13 (Water Quality) for significance criteria related to erosion.

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:

- The Port will design and construct backland 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 backland 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 Uniform Building Code, which classifies almost all of coastal California (including the Project site) within Seismic Zone 4, on a scale of 1 to 4, with 4 being most severe. The Project engineers shall review the Project plans for compliance with the appropriate standards in the building codes.
- The Port will design and construct wharf improvements in accordance with MOTEMS and LAHD standards, to minimize impacts associated with seismically induced geohazards. Such construction shall 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 maximum temporary slope gradient, will be incorporated into the design. A licensed geologist or engineer will monitor construction to verify that construction occurs in concurrence with proposed Project design.

3.5.4.3.1 Proposed Project

3.5.4.3.1.1 Construction Impacts

Seismicity

Impact GEO-1a: 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 that would expose people and structures to substantial risk during the construction period (through 2025).

There would be a minor increase in the exposure of people and property to seismic hazards relating to current and future baseline conditions. The proposed Project area lies in the vicinity of the Palos Verdes Fault Zone. Strands of the fault may pass beneath the perimeter and immediately west of the proposed Project area, in the vicinity of Berths 131/132 and 147 (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, ground acceleration, and 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 and alluvial fill is pervasive.

The Los Angeles Building Code, Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, regulates construction in backland 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, such as earthquakes. Necessary permits, plan checks, and inspections are also specified. The Los Angeles Municipal Code also incorporates structural seismic requirements of the California Uniform Building Code, 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 proposed Project engineers would review the proposed Project plans for compliance with the appropriate standards in the building codes.

With respect to existing wharfs, seismic upgrades would be completed, resulting in beneficial impacts. With respect to new wharf construction, it would be designed per the MOTEMS to protect against seismic hazards that could occur. These regulations have recently been drafted by the CSLC and adopted as State law. LAHD standards and specifications would be applied to the seismic design of the proposed Project.

Design objectives for both wharf and backland areas are for the proposed Project to maintain operation following an OLE and to survive without collapse and provide public safety following a CLE. At the lower-level OLE, structures are expected to suffer minor, nonstructural damage and resume operations immediately after an

earthquake. At the higher-level CLE, structural damage is permissible as long as public safety is not jeopardized.

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. In addition, 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.

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. Seismic upgrades would be completed on existing wharves, resulting in beneficial impacts. However, because construction of new wharves, buildings, and related infrastructure would occur over an extended period (through 2025), 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 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

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 remain significant and unavoidable.

NEPA Impact Determination

The proposed Project would include seismic upgrade of wharves, including construction of new concrete piles for seismic renovation, resulting in beneficial seismic related impacts. The proposed Project also would include the creation of a 10-acre (4.0-ha) fill, as well as construction of new wharves and dikes, which would be susceptible to

seismically induced ground shaking, fault rupture, and liquefaction. Therefore, beneficial impacts would be offset by adverse impacts.

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. Because construction would occur over an extended period (through 2025), 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 are significant and unavoidable under NEPA.

Mitigation Measures

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

Residual 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 remain significant and unavoidable.

Tsunami Runup

Impact GEO-2a: Construction on the proposed Project within the Port area would expose people and structures to substantial risk involving tsunamis or seiches.

Local or distant seismic activity and/or offshore landslides could result in the occurrence of tsunamis or seiches within the proposed Project area and vicinity. 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, the proposed Project would likely 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. These factors are considered for the proposed Project site, as described below.

The Port 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 ft (0 m) 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 mean sea level (MSL) in the Port is +2.8 ft (0.86 m) above MLLW (NOAA 2005). 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 Port. The recently developed 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. The Port MSL of +2.82 ft (0.86 m) must be considered in comparing projected tsunami run-up (i.e., amount of wharf overtopping and flooding) to proposed wharf height and topographic elevations, which are measured with respect to MLLW.

Generalized modeling completed by Borrero et al., (2005a) indicates that a large submarine landslide off the southern tip of the Palos Verdes Peninsula could result in 13 ft (4 m) of runup in the Port of Los Angeles and Port of Long Beach. Such runup may inundate the proposed Project site and potentially cause up to $36 billion direct, indirect, and induced losses in the Port areas.

Most recently and more definitively, a model has been developed specifically for the 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, see Appendix J). Based on this study, a reasonable worst-case scenario for generation of a tsunami or seiche in the San Pedro Bay Ports predicts tsunami wave heights of 1.3 to 5.3 ft (0.4 to 1.6 m) above MSL at the proposed Project site, under both earthquake and landslide scenarios. Incorporating the Port MSL of +2.82 ft (0.86 m), the model predicts tsunami wave heights of 4.1 to 8.1 ft (0.8 to 2.4 m) above MLLW at the proposed Project site. Because the proposed Project site elevation ranges from 10 to 15 ft (3.0 to 4.6 m) above MLLW, localized tsunami-induced flooding would not occur.

While the analysis above considers a reasonable worst-case seismic scenario based on a maximum seismic event, with respect to MSL, a theoretical maximum worst-

case wave action from a tsunami would result if the single highest tide predicted over the next 40 years at the San Pedro Bay Ports was present at the time of the seismic event. The single highest tide predicted over the next 40 years is 7.3 ft (2.2 m) above MLLW. This condition is expected to occur less than 1 percent of the time over this 40-year period. If that very rare condition were to coincide with a maximum tsunami event, the model predicts tsunami wave heights of 8.6 to 12.6 ft (2.6 to 3.8 m) above MLLW at the proposed Project site. Because the proposed Project site elevation ranges from 10 to 15 ft (3.0 to 4.5 m) above MLLW, localized tsunami-induced flooding up to 2.6 ft (0.8 m) is possible. To determine the extent of potential impacts due to tsunami-induced flooding, Port structural engineers have determined that Port reinforced concrete or steel structures designed to meet California earthquake protocols incorporated into MOTEMS would be expected to survive complete inundation in the event of a tsunami (personal communication, Yin, P., P.E., Senior Structural Engineer, Los Angeles Harbor Department 2006). However, substantial infrastructure damage and/or injury to personnel would occur as a result of complete site inundation.

Tsunami Probability

As previously discussed, there is a potential for tsunami-induced flooding under the theoretical maximum worst-case scenario. However, the likelihood of a large tsunami is very low during construction of the proposed Project.

The most likely worst-case tsunami scenario was based partially on a magnitude 7.6 earthquake on the offshore Santa Catalina Fault. The recurrence interval for a magnitude 7.5 earthquake along an offshore fault in the Southern California Continental Borderland 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 & 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. However, because the proposed Project elevation is located within 10 to 15 feet (3 to 4.6 m) above MLLW, there is a substantial risk of coastal flooding due to tsunamis and seiches. As a result, impacts during the construction phase would be significant and unavoidable under CEQA.

Mitigation Measures

GEO-1: Emergency Response Planning. The Terminal operator shall 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 shall 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 shall 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

Emergency planning and coordination between the Terminal operator and LAHD, as outlined in **Mitigation Measure GEO-1**, would contribute in reducing injuries to on-site personnel 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. Therefore, residual impacts would remain significant and unavoidable.

NEPA Impact Determination

The proposed Project would include seismic upgrade of wharves, including construction of new concrete piles, resulting in beneficial seismic related impacts. The proposed Project also would include the creation of a 10-acre (4.0-ha) fill, as well as the construction of new wharves and dikes, which would be susceptible to tsunamis and seiches. Therefore, beneficial impacts would be offset by adverse impacts. There is a substantial risk of coastal flooding of wharves and associated backland areas due to tsunamis and seiches. Because construction would occur over an extended period (through 2025), increased exposure of people and property during construction to seismically induced tsunamis or seiches from a major or great earthquake cannot be precluded. Impacts due to tsunamis and seiches are significant and unavoidable under NEPA.

Mitigation Measures

Mitigation Measure GEO-1 shall be applied to the NEPA project impact determination to reduce tsunami and seiche related impacts.

Residual Impacts

Emergency planning and coordination between the Terminal operator and the LAHD, as outlined in **Mitigation Measure GEO-1**, would contribute in reducing injuries to on-site personnel 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. Therefore, residual impacts would remain significant and unavoidable.

Subsidence/Settlement

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 subsidence/soil settlement.

Subsidence in the vicinity of the proposed Project, due to previous oil extraction in the Port area, has been mitigated and is not anticipated to adversely impact the proposed Project. However, in the absence of proper engineering, proposed structures could be cracked and warped as a result of saturated, unconsolidated/compressible sediments. However, during Project design, the Project engineer would evaluate the settlement potential in all 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 and Caltrans. Recommendations for soils subject to settlement typically include overexcavation 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 ensure that construction of the proposed Project would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

The settlement potential associated with creation of a 10-acre (4.0-ha) fill in the Northwest Slip would similarly be evaluated through a site-specific geotechnical investigation, which includes sampling of sediments to be placed as fill, as well as sampling of the substrate (harbor bottom sediments) on which the fill would be placed. Laboratory analysis of samples would be conducted, under the supervision of a geotechnical engineer, to determine soil compressibility. 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 and Caltrans. Recommendations for sediments subject to settlement typically include placement of excess sediments above final anticipated grade in order to surcharge (or compress) the underlying, newly placed sediments. When geotechnical instrumentation indicates that sufficient compaction has been achieved in the area of newly-place fill, the overburden soil would then be removed and construction would commence. Such geotechnical engineering would substantially reduce the potential for soil settlement and would ensure that construction of the 10-acre (4.0-ha) fill would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

CEQA Impact Determination

Settlement impacts in backland areas would be less than significant under CEQA, as the 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 Caltrans, and would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

Mitigation Measures

As subsidence impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, resulting in no required mitigation, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

The federal portions of the proposed Project would be limited to wharf and in-water construction activities, including construction of new concrete piles for seismic renovation, the creation of a 10-acre (4.0 ha) fill, new wharf construction, and channel deepening. Settlement impacts associated with creation of the 10-acre (4.0 ha) fill would be less than significant under NEPA, with implementation standard geotechnical engineering, including incorporation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code and criteria established by LAHD and Caltrans, and would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

Mitigation Measures

As subsidence impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of standard geotechnical engineering, resulting in no required mitigation, the residual impacts would be less than significant under NEPA.

Expansive Soils

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 soil expansion.

Expansive soil may be present in the vicinity of the Berths 136-147 area and may be present in dredged or imported soils used for proposed Project grading. Expansive

soils beneath the proposed Project's foundations could result in cracking and distress of foundations. Existing structures built on these sediments could be cracked and warped by such settlement. However, during the proposed Project design phase, the proposed Project engineer would evaluate the expansion potential associated with on-site 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 overexcavation and replacement of expansive soils with sandy, non-expansive soils, which would allow for construction of a conventional slab-on-grade; construction of post-tensioning 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

Expansive soil impacts in backland areas would be less than significant under CEQA as the 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

As expansive soil impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code resulting in no required mitigation, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

The federal portions of the proposed Project would be limited to wharf and in-water construction activities, including construction of new concrete piles for seismic renovation, the creation of a 10-acre (4.0 ha) fill, new wharf construction, and channel deepening. Expansive soil may be present in dredged or imported soils used for filling the 10-acre (4.0-ha) Northwest Slip. Use of expansive soils beneath the proposed Project's foundations could result in cracking and distress of foundations. However, expansive soil impacts in backland areas would be less than significant under NEPA 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 and would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

Mitigation Measures

As expansive soil impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of standard geotechnical engineering and Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, less than significant residual impacts would occur under NEPA.

Landslides and Mudslides

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

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

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

As landslide and mudslide impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, no residual impacts would occur under CEQA.

NEPA 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 NEPA.

Mitigation Measures

As landslide and mudslide impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, no residual impacts would occur under NEPA.

Unstable Soil Conditions

Impact GEO-6a: Shallow groundwater, which would cause unstable collapsible soils, may be encountered during excavation, but would not expose people or structures to substantial risk.

Natural alluvial and estuarine deposits, as well as artificial fill consisting of dredged deposits or imported soils, may be encountered during excavations for utility pipeline relocation or for construction of retaining walls, manholes, and other structures. Groundwater is locally present at depths as shallow as 12 feet (4 m). Excavations may locally be completed to this depth, such as for underground utility construction or vehicle maintenance pits. Materials near and below the shallow groundwater table would be relatively fluid, requiring implementation of standard engineering practices regarding saturated, collapsible soils, such as dredging, dewatering wells, and other special handling procedures to facilitate excavation. For example, dewatering wells would locally increase the depth to groundwater, thus reducing the potential for collapsible soils. Various types of temporary shoring would also be used to stabilize excavations with saturated, collapsible soils. Such engineering practices would be implemented where necessary.

See section 3.6 (Groundwater and Soils) regarding potential soil and/or groundwater contamination in construction excavations.

CEQA Impact Determination

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

Mitigation Measures

As impacts associated with collapsible soils would be less than significant, no mitigation measures are required.

Residual Impacts

Due to implementation of standard engineering practices regarding saturated, collapsible soils resulting in no required mitigation, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

The federal portion of the proposed Project would be limited to wharf and in-water construction activities, including construction of new concrete piles for seismic

renovation, the creation of a 10-acre (4.0 ha) fill, new wharf construction, and channel deepening. Due to implementation of standard engineering practices regarding saturated, collapsible soils, people and structures would not be exposed to substantial adverse effects from the proposed Project and impacts associated with shallow groundwater would be less than significant under NEPA.

Mitigation Measures

As impacts associated with collapsible soils would be less than significant, no mitigation measures are required.

Residual Impacts

With implementation of standard engineering practices regarding saturated, collapsible soils, there would be less than significant residual impacts under NEPA.

Prominent Geologic and Topographic Features

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.

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

As impacts due to removal of prominent geologic or topographic features would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, no residual impacts would occur under CEQA.

NEPA 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 NEPA.

Mitigation Measures

As impacts related to removal of prominent geologic or topographic features would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, no residual impacts would occur under NEPA.

Mineral Resources

Impact GEO-8a: Although the northern portion of the proposed Project site is underlain by the Wilmington Oil Field, 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. However, with respect to petroleum resources, the northern portion of the proposed Project site is located within the Wilmington Oil Field.

CEQA Impact Determination

Proposed Project construction would preclude oil and gas drilling from within proposed Project boundaries; however, petroleum reserves beneath the site could be accessed from remote locations, using directional (or slant) drilling techniques. Therefore, 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

As impacts associated with mineral resources would be less than significant, no mitigation measures are required.

Residual Impacts

With no mitigation required, the residual impacts are less than significant under CEQA.

NEPA Impact Determination

In-water construction would preclude oil and gas drilling from within proposed Project boundaries; however, petroleum reserves beneath the site could be accessed from remote locations, using directional (or slant) drilling techniques. Therefore, 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 and less than significant mineral resource impacts would occur under NEPA.

Mitigation Measures

As impacts associated with mineral resources would be less than significant, no mitigation measures are required.

Residual Impacts

With no mitigation required, the residual impacts would be less than significant under NEPA.

3.5.4.3.1.2 Operations Impacts

Seismicity

Impact GEO-1b: 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 that would expose people and structures to substantial risk during the operations period (through 2038).

There would be a minor increase in the exposure of people and property to seismic hazards relating to current and future baseline conditions. The proposed Project area lies in the vicinity of the Palos Verdes Fault Zone. Strands of the fault may pass beneath the perimeter and immediately west of the proposed Project area, in the vicinity of Berths 131/132 and 147 (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, ground acceleration, and 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 and alluvial fill is pervasive.

As discussed with respect to existing wharfs, seismic upgrades would benefit structures and infrastructure at the proposed Project 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. 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 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

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 remain significant and unavoidable.

NEPA Impact Determination

The federal portions of the proposed Project would include seismic upgrade of existing wharves including construction of new concrete piles, resulting in beneficial seismic related impacts. The proposed Project also would include the creation of a 10-acre (4.0-ha) fill and the construction of new wharves and dikes, which would be susceptible to seismically induced ground shaking, fault rupture, and liquefaction during operations. Therefore, beneficial impacts would be offset by adverse impacts.

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. 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 are significant and unavoidable under NEPA.

Mitigation Measures

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

Residual 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 remain significant and unavoidable.

Tsunamis and Seiches

Impact GEO-2b: Proposed Project operations within the Port area would expose people and structures to substantial risk involving tsunamis or seiches. Local or distant seismic activity and/or offshore landslides could result in the occurrence of tsunamis or seiches within the proposed Project area and vicinity.

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 the proposed Project elevation is located within 10 to 15 feet (3 to 4.6 m) above MLLW, there is a substantial risk of coastal flooding in the event of a tsunami and seiche.

For on-site 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 and cargo/containers would be subject to some risk of exposure. Although initial tsunami induced run-up would potentially cause substantial injury and damage to infrastructure and cargo, 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 tanker 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 tanker vessel destined for the proposed Project berths (or any berth in the Port for that matter) would be under its own power and have one or more tugs in attendance. Under this circumstance, the vessel would likely be able to maneuver to avoid damage as it would with any ocean wave. 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 Port Complex.

Port engineers have indicated that currents moving over 5 meters per second (m/s) could potentially render a ship out of control (personal communication, Captain James Morgan 2006). 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 Port in excess of 5 m/s. Highest anticipated current speeds of 2 m/s would occur in the vicinity of Pier 400 and the entrance to the main channel. Currents in the vicinity of the Vincent Thomas Bridge (approximately ¼ mile south of the proposed Project area) would be approximately 0.9 m/s (Moffatt and Nichol (2007).

A tanker 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 vessel 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 that 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 was to strike while a vessel was secured at a berth.

Under the second scenario, a vessel set adrift in the Port area could have more serious consequences from the potential of collision, including a potential hull breach and possible fuel spill. This scenario is examined in section 3.7, Hazards and Hazardous Materials.

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. However, because the proposed Project elevation is located within 10 to 15 feet (3 to 4.6 m) above MLLW, there is a substantial risk of coastal flooding due to tsunamis and seiches. As described above, impacts from the theoretical maximum worst-case wave action would be significant and unavoidable for the site under CEQA.

Mitigation Measures

Mitigation Measure GEO-1 shall be applied to the CEQA project impact determination to reduce tsunami and seiche related impacts.

Residual Impacts

Emergency planning and coordination between the Terminal operator and LAHD, as outlined in **Mitigation Measure GEO-1**, would contribute in reducing injuries to on-site personnel 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. Therefore, residual impacts would remain significant and unavoidable.

NEPA Impact Determination

There is a substantial risk of coastal flooding of wharves and associated backland areas due to tsunamis and seiches. The federal portions of the proposed project would result in new wharf construction, channel deepening and a 10-acre (4 ha) increase in backlands, which contribute to increased operational area and activities. Because operations would occur over an extended period (through at least 2038), increased exposure of people and property during operations to seismically induced tsunamis or seiches from a major or great earthquake cannot be precluded. As described above, impacts from the theoretical maximum worst-case wave action would be significant and unavoidable for the site under NEPA.

Mitigation Measures

Mitigation Measure GEO-1 shall be applied to the NEPA project impact determination to reduce tsunami and seiche related impacts.

Residual Impacts

Emergency planning and coordination between the Terminal operator and the LAHD, as outlined in **Mitigation Measure GEO-1**, would contribute in reducing injuries to on-site personnel 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. Therefore, residual impacts would remain significant and unavoidable.

Subsidence/Settlement

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 subsidence/soil 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 is not anticipated to 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. However, during the proposed Project design phase, the proposed Project engineer would evaluate the settlement potential in all areas where structures are proposed. The settlement potential would be evaluated during the construction phase, as discussed for **Impact GEO-3a,** to reduce the potential for soil settlement.

CEQA Impact Determination

Settlement impacts in backland areas would be less than significant under CEQA, as the 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 Caltrans, and would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

Mitigation Measures

As subsidence impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, resulting in no required mitigation, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

New wharf construction, channel deepening, and the proposed 10-acre (4-ha) fill that would increase backlands that contribute to additional operational area and activities are proposed under this alternative. 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 and Caltrans.

Mitigation Measures

As settlement/subsidence impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of standard geotechnical engineering, resulting in no required mitigation, the residual impacts would be less than significant under NEPA.

Expansive Soils

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 soil expansion.

As described in **Impact GEO-4a**, expansive soil may be present in the vicinity of the Berths 136-147 area and may be present in dredged or imported soils used for proposed Project grading. Use of expansive soils beneath proposed Project foundations could result in cracking and distress of foundations during proposed Project operations. However, during the design phase, the proposed Project engineer would evaluate the expansion potential associated with on-site soils, as described in **Impact GEO-4a**, to reduce the potential for soil expansion and damage to overlying structures.

CEQA Impact Determination

Expansive soil impacts in backland areas would be less than significant under CEQA as the 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.

Mitigation Measures

As expansive soil impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, the residual impacts would be less than significant under CEQA, in conjunction with criteria established by LAHD.

NEPA Impact Determination

The federal portions of the proposed Project would be limited to wharf and in-water construction activities. Expansive soil may be present in dredged or imported soils used for filling the 10-acre (4.0-ha) Northwest Slip. Use of expansive soils beneath the proposed Project's foundations could result in cracking and distress of foundations. However, expansive soil impacts in backland areas 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

As expansive soil impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of standard geotechnical engineering and Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, there would be less than significant residual impacts under NEPA.

Landslides and Mudslides

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

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

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

As landslide and mudslide impacts would not occur, no mitigation measures are necessary under CEQA.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA 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 NEPA.

Mitigation Measures

As landslide and mudslide impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Unstable Soil Conditions

Impact GEO-6b: Collapsible soils would have no impact on proposed Project operations and would not expose people or structures to substantial risk.

No excavations would be completed as a part of proposed Project operations; therefore, onsite soils would not be subject to collapse or caving.

CEQA Impact Determination

Excavations would not be completed as a part of proposed Project operations; therefore, impacts associated with collapsible soils would not occur under CEQA.

Mitigation Measures

As impacts associated with collapsible soils would not occur, no mitigation measures are required.

Residual Impacts

With no mitigation required, there would be no residual impacts associated with collapsible soils under CEQA.

NEPA Impact Determination

The federal portions of the proposed Project would be limited to wharf and in-water construction activities including construction of new concrete piles for seismic renovation, the creation of a 10-acre (4.0 ha) fill, new wharf construction, and channel deepening. Backland excavations would not be completed as a part of proposed Project operations; therefore, impacts associated with collapsible soils would not occur under NEPA.

Mitigation Measures

As impacts associated with collapsible soils would not occur, no mitigation measures are required under NEPA.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Prominent Geologic and Topographic Features

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

As impacts due to removal of prominent geologic or topographic features would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA 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 NEPA.

Mitigation Measures

As impacts related to removal of prominent geologic or topographic features would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Mineral Resources

Impact GEO-8b: Although the northern portion of the proposed Project site is underlain by the Wilmington Oil Field, operation 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. However, with respect to petroleum resources, the northern portion of the proposed Project site is located within the Wilmington Oil Field.

CEQA Impact Determination

Proposed Project operations would preclude oil and gas drilling from within proposed Project boundaries; however, petroleum reserves beneath the site could be accessed from remote locations, using directional (or slant) drilling techniques. Therefore, 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

As impacts associated with mineral resources would be less than significant, no mitigation measures are required.

Residual Impacts

With no mitigation required, the residual impacts are less than significant under CEQA.

NEPA Impact Determination

Operations from the NEPA project components would preclude oil and gas drilling from within the proposed Project's boundaries; however, petroleum reserves beneath the site could be accessed from remote locations, using directional (or slant) drilling

techniques. Therefore, 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 and less than significant mineral resource impacts would occur under NEPA.

Mitigation Measures

As impacts associated with mineral resources would be less than significant, no mitigation measures are required.

Residual Impacts

With no mitigation required, the residual impacts would be less than significant under NEPA.

3.5.4.3.2 Alternatives

3.5.4.3.2.1 Alternative 1 – No Project Alternative

3.5.4.3.2.1.1 Construction Impacts

Seismicity

Impact GEO-1a: Seismic activity along the Palos Verdes Fault Zone, or other regional faults, would not expose people and structures to substantial risk.

Under the No Project Alternative (Alternative 1), no development would occur within the proposed Project area. Earthquake-related hazards at the proposed Project site are the same under the No Project Alternative 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 the No Project alternative involves no construction, impacts due to seismically induced ground failure would not occur under CEQA.

Mitigation Measures

No mitigation measures are required.

Residual Impacts

Residual impacts would not occur.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, construction related impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur.

Tsunamis and Seiches

Impact GEO-2a: Tsunamis and seiches would not expose people and structures to substantial risk.

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 the No Project Alternative 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 the No Project alternative involves no construction, impacts due to tsunamis and seiches would not occur under CEQA.

Mitigation Measures

No mitigation measures are required.

Residual Impacts

Residual impacts would not occur.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, construction related impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur.

Subsidence/Settlement

Impact GEO-3a: Subsidence/settlement would not expose people and structures to substantial risk.

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 the No Project alternative involves no construction, impacts due to subsidence/settlement would not occur under CEQA.

Mitigation Measures

No mitigation measures are required.

Residual Impacts

Residual impacts would not occur.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, construction related impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur.

Expansive Soils

Impact GEO-4a: Expansive soil would not expose people and structures to substantial risk.

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 the No Project alternative involves no construction, impacts due to expansive soils would not occur under CEQA.

Mitigation Measures

No mitigation measures are required.

Residual Impacts

Residual impacts would not occur.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, construction related impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur.

Landslides and Mudslides

Impact GEO-5a: Landslides and mudslides would not expose people and structures to substantial risk.

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 the No Project alternative involves no construction, impacts due to landslides and mudslides would not occur under CEQA.

Mitigation Measures

No mitigation measures are required.

Residual Impacts

Residual impacts would not occur.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, construction related impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur.

Unstable Soil Conditions

Impact GEO-6a: Unstable soil conditions would not expose people and structures to substantial risk.

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 the No Project alternative involves no construction, impacts due to unstable soil conditions would not occur under CEQA.

Mitigation Measures

No mitigation measures are required.

Residual Impacts

Residual impacts would not occur.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, construction related impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur.

Prominent Geologic and Topographic Features

Impact GEO-7a: The No Project Alternative 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 the No Project alternative involves no construction, impacts associated with potential removal of prominent geologic or topographic features would not occur under CEQA.

Mitigation Measures

No mitigation measures are required.

Residual Impacts

Residual impacts would not occur.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, construction related impacts under NEPA are not applicable.

Mitigation Measures

No mitigation measures are required.

Residual Impacts

Due to No Federal Action, mitigation is not applicable. Residual impacts would not occur.

Mineral Resources

Impact GEO-8a: The No Project Alternative 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 the No Project alternative involves 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 measures are required.

Residual Impacts

Residual impacts would not occur.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, construction related impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur.

3.5.4.3.2.1.2 Operation Impacts

Seismicity

Impact GEO-1b: 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 that would expose people and structures to substantial risk.

Earthquake-related hazards at the project site are the same under the No Project Alternative as those described above for the proposed Project. Under this alternative, no development would occur within the Project area. There would be no seismic retrofits to the wharf structures, resulting in no beneficial impacts, as described for the proposed Project. Cargo ships that currently berth and load/unload at the terminal would continue to do so and operations are projected to increase over the CEQA baseline (See Tables 2-2 and 2-4). This alternative would result in a maximum container terminal of 176 acres with a maximum throughput of 1,697,000 TEUs (907,487 containers) per year. Approximately 250 vessel calls per year would be expected by 2025. 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, 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 No Project Alternative. 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 due to seismically induced ground failure under this Alternative would be significant and unavoidable, which is the same as the proposed Project.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, operations related impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur.

Tsunamis and Seiches

Impact GEO-2b: Operations under the No Project Alternative within the Port area would expose people and structures to substantial risk involving tsunamis or seiches. Local or distant seismic activity and/or offshore landslides could result in the occurrence of tsunamis or seiches in the West Basin area.

Risks of seismically induced tsunamis and seiches are typical for the entire California coastline and would not be increased by the No Project Alternative. As this alternative would result in a maximum container terminal of 176 acres with a maximum throughput of 1,697,000 TEUs (907,487 containers) per year and approximately 250 vessel calls by 2025, 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 ground failure.

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 the West Basin elevation is located within 10 to 15 feet (3 to 4.6 m) above MLLW, there is a substantial risk of coastal flooding due to tsunamis and seiches.

The risk to tanker vessels would be the same under the No Project Alternative 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

The No Project alternative would continue to expose people and property to flooding from tsunamis and seiches. Therefore, impacts due to tsunamis and seiches are significant and unavoidable under CEQA.

Mitigation Measures

Mitigation measures are not applicable to Alternative 1 during No Project operations, as this alternative would not involve approval of new uses at Berths 136-147.

Residual Impacts

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

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, operations related impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur.

Subsidence/Settlement

Impact GEO-3b: Operations under the No Project Alternative would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from subsidence/soil settlement.

As discussed for **Impact GEO-3a**, subsidence in the vicinity of West Basin, 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 the No Project Alternative, 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 West Basin, 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

As subsidence impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts, as there would be no new construction under this alternative.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, operations related impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Expansive Soils

Impact GEO-4b: Operations under the No Project Alternative would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from soil expansion.

Because construction would not occur in association with the No Project Alternative, impacts related to cracking and warping of structures during operations as a result of expansive soils would not occur.

CEQA Impact Determination

Due to a lack of new construction, soil expansion impacts would not occur during operations under this alternative.

Mitigation Measures

As expansive soil impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts, as there would be no new construction under this alternative.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, operations related impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Landslides and Mudslides

Impact GEO-5b: Operations under the No Project Alternative would not result in 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

As landslide and mudslide impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, operations related impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Unstable Soil Conditions

Impact GEO-6b: Collapsible soils would have no impact on operations under the No Project Alternative and would not expose people or structures to substantial risk.

No excavations would be completed as a part of operations under the No Project Alternative; therefore, onsite soils would not be subject to collapse or caving.

CEQA Impact Determination

As excavations would not be completed as a part of operations under the No Project Alternative, impacts associated with collapsible soils would not occur under CEQA.

Mitigation Measures

As impacts associated with collapsible soils would not occur, no mitigation measures are required.

Residual Impacts

With no mitigation required, there would be no residual impacts associated with collapsible soils under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, operations related impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Prominent Geologic and Topographic Features

Impact GEO-7b: Operations under the No Project Alternative 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 West Basin area is relatively flat and paved, with no prominent geologic or topographic features, operations under the No Project 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

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

As impacts due to removal of prominent geologic or topographic features would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, operations related impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur.

Mineral Resources

Impact GEO-8b: Although the northern portion of the site is underlain by the Wilmington Oil Field, operations of the No Project Alternative 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 West Basin 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. However, with respect to petroleum resources, the northern portion of the site is located within the Wilmington Oil Field.

CEQA Impact Determination

Operation of the No Project Alternative would preclude oil and gas drilling from within the proposed Project boundaries; however, petroleum reserves beneath the site could be accessed from remote locations, using directional (or slant) drilling techniques. Therefore, the No Project Alternative 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 are less than significant under CEQA.

Mitigation Measures

As mineral resources impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, residual impacts would be less than significant.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, operations related impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

3.5.4.3.2.2 Alternative 2 – Reduced Project: proposed Project without the 10-Acre Fill

3.5.4.3.2.2.1 Construction Impacts

Seismicity

Impact GEO-1a: 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 that would expose people and structures to substantial risk during the construction period (through 2015).

CEQA Impact Determination

Seismic impacts for the Reduced Project Alternative (Alternative 2) would be similar but less than those described for the proposed Project, because the 10-acre (4.0 ha) fill and 400-foot (122 m) Berth 136 wharf extension would not occur, thus resulting in less infrastructure susceptible to seismically induced ground failure. In all other respects, **Impact GEO-1a** would be the same as the proposed Project. As with 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. Seismic hazards are common to the Los Angeles region and are not increased by this alternative. 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. Seismic upgrades would be completed on existing wharves, resulting in beneficial impacts. However, because construction of new wharves, buildings, and related infrastructure would occur over an extended period (through 2015), 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 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

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 remain significant and unavoidable.

NEPA Impact Determination

With respect to the No Federal Action/NEPA Baseline, in-water construction impacts would be similar but less than those described for the proposed Project because the 10-acre (4.0 ha) fill and 400-foot (122 m) Berth 136 wharf extension would not occur, thus resulting in less infrastructure susceptible to seismically induced ground failure. Alternative 2 would include seismic upgrades of existing wharves, resulting in beneficial seismic related impacts. Alternative 2 also would include the construction of new wharves and dikes, which would be susceptible to seismically induced ground shaking, fault rupture, and liquefaction. Therefore, beneficial impacts would be offset by adverse impacts.

Seismic hazards are common to the Los Angeles region and are not increased by Alternative 2. However, because the West Basin 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. Because construction would occur over an extended period (through 2015), 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 are significant and unavoidable under NEPA.

Mitigation Measures

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

Residual 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 remain significant and unavoidable.

Tsunami Runup

Impact GEO-2a: Alternative 2 construction within the Port area would expose people and structures to substantial risk involving tsunamis or seiches. Local or distant seismic activity and/or offshore landslides could result in the occurrence of tsunamis or seiches within West Basin and vicinity.

CEQA Impact Determination

Tsunami/seiche impacts would be similar but less than those described for the proposed Project, because the 10-acre (4.0 ha) fill and 400-foot (122 m) Berth 136 wharf extension would not occur, thus resulting in less infrastructure susceptible to inundation. In all other respects, **Impact GEO-2a** would be the same as the proposed Project. Therefore, impacts during the construction phase of Alternative 2 would be significant and unavoidable under CEQA.

Mitigation Measures

Mitigation Measure GEO-1 shall be applied to the CEQA project impact determination to reduce tsunami and seiche related impacts. Residual Impacts

Emergency planning and coordination between the Terminal operator and LAHD, as outlined in **Mitigation Measure GEO-1**, would contribute in reducing injuries to on-site personnel 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. Therefore, residual impacts would remain significant and unavoidable.

NEPA Impact Determination

With respect to the No Federal Action/NEPA Baseline, in-water construction impacts would be similar but less than those described for the proposed Project, because the 10-acre (4.0 ha) fill and 400-foot (122 m) Berth 136 wharf extension would not occur, thus resulting in less infrastructure susceptible to inundation. In all other respects, **Impact GEO-2a** would be the same as the proposed Project. Therefore, impacts during the construction phase of Alternative 2 due to tsunamis and seiches would be significant and unavoidable under NEPA.

Mitigation Measures

Mitigation Measure GEO-1 shall be applied to the NEPA project impact determination to reduce tsunami and seiche related impacts.

Residual Impacts

Emergency planning and coordination between the Terminal operator and the LAHD, as outlined in **Mitigation Measure GEO-1**, would contribute in reducing injuries to on-site personnel 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. Therefore, residual impacts would remain significant and unavoidable.

Subsidence/Settlement

Impact GEO-3a: Alternative 2 construction 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

Construction impacts would be similar but less than those described for the proposed Project, because the 10-acre (4.0-ha) fill would not occur, thus resulting in less area susceptible to subsidence/settlement. In all other respects, **Impact GEO-3a** would be the same as the proposed Project. Impacts in backland areas would be less than significant under CEQA as Alternative 2 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 Caltrans, and would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

Mitigation Measures

As subsidence impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code resulting in no required mitigation, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

The federal portion of Alternative 2 would be limited to wharf renovation and channel deepening activities. Because subsidence/settlement impacts relate primarily to proposed backland improvements and Alternative 2 does not include the 10-acre (4-ha) fill, no impacts would occur under NEPA.

Mitigation Measures

As no subsidence impacts would occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Expansive Soils

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

CEQA Impact Determination

Construction impacts would be similar but less than those described for the proposed Project, because the 10-acre (4.0-ha) fill would not occur, thus resulting in less area susceptible to expansive soils. In all other respects, **Impact GEO-4a** would be the same as the proposed Project. Expansive soil impacts in backland areas would be less than significant under CEQA as Alternative 2 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.

Mitigation Measures

As expansive soil impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, resulting in no required mitigation, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

The federal portion of Alternative 2 would be limited to wharf renovation and channel deepening activities. Because expansive soil impacts relate primarily to proposed backland improvements and Alternative 2 does not include the 10-acre (4-ha) fill, no impacts would occur under NEPA.

Mitigation Measures

As expansive soil impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Landslides and Mudslides

Impact GEO-5a: Alternative 2 construction would not result in or expose people or property to a substantial risk of landslides or mudslides.

CEQA Impact Determination

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

Mitigation Measures

As landslide and mudslide impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

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

Mitigation Measures

As landslide and mudslide impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Unstable Soil Conditions

Impact GEO-6a: Shallow groundwater, which would cause unstable collapsible soils, may be encountered during excavations, but would not expose people or structures to substantial risk.

CEQA Impact Determination

Construction impacts would be similar but less than those described for the proposed Project, because the 10-acre (4.0 ha) fill and 400-foot (122 m) Berth 136 wharf extension would not occur, thus resulting in less area susceptible to unstable soil conditions. In all other respects, **Impact GEO-6a** would be the same as the proposed Project. Impacts associated with shallow groundwater would be less than significant under CEQA due to implementation of standard engineering practices regarding saturated, collapsible soils.

Mitigation Measures

As impacts associated with collapsible soils would be less than significant, no mitigation measures are required.

Residual Impacts

The residual impacts would be less than significant under CEQA.

NEPA Impact Determination

The federal portion of Alternative 2 would be limited to wharf renovation and channel deepening activities. Because collapsible soil impacts relate primarily to proposed backland improvements and Alternative 2 does not include the 10-acre (4-ha) fill, no impacts would occur under NEPA.

Mitigation Measures

As impacts associated with collapsible soils would not occur, no mitigation measures are required.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Prominent Geologic and Topographic Features

Impact GEO-7a: Alternative 2 construction 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 the topography in the vicinity of the Alternative 2 site is flat and does not contain prominent geologic or topographic features, no impacts would occur under CEQA.

Mitigation Measures

As impacts due to removal of prominent geologic or topographic features would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

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

Mitigation Measures

As impacts related to removal of prominent geologic or topographic features would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Mineral Resources

Impact GEO-8a: Although the northern portion of West Basin is underlain by the Wilmington Oil Field, Alternative 2 site construction 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 Alternative 2 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. However, with respect to petroleum resources, the northern portion of the Alternative 2 site is located within the Wilmington Oil Field.

CEQA Impact Determination

Alternative 2 construction would preclude oil and gas drilling from within Alternative 2 boundaries; however, petroleum reserves beneath the site could be accessed from remote locations, using directional (or slant) drilling techniques. Therefore, 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. Mineral resource impacts are less than significant under CEQA.

Mitigation Measures

As impacts associated with mineral resources would be less than significant, no mitigation measures are required.

Residual Impacts

With no mitigation required, the residual impacts are less than significant under CEQA.

NEPA Impact Determination

The federal portion of Alternative 2 would be limited to wharf renovation and channel deepening activities, which would preclude oil and gas drilling from within site boundaries. However, petroleum reserves beneath the site could be accessed from remote locations, using directional (or slant) drilling techniques. Therefore, Alternative 2 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, and less than significant mineral resource impacts would occur under NEPA.

Mitigation Measures

As impacts associated with mineral resources would be less than significant, no mitigation measures are required.

Residual Impacts

With no mitigation required, the residual impacts would be less than significant under NEPA.

3.5.4.3.2.2.2 Operations Impacts

Seismicity

Impact GEO-1b: 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 that would expose people and structures to substantial risk during the operations period (through 2038).

CEQA Impact Determination

Seismic impacts would be similar but less than those described for the proposed Project, because the 10-acre (4.0 ha) fill and 400-foot (122 m) Berth 136 wharf extension would not occur, thus resulting in less infrastructure susceptible to seismically induced ground failure. In all other respects, **Impact GEO-1b** would be the same as the proposed Project. As with 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. Seismic hazards are common

to the Los Angeles region and are not increased by the Alternative 2. However, because the Alternative 2 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. 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 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

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 remain significant and unavoidable.

NEPA Impact Determination

Construction impacts would be similar but less than those described for the proposed Project because the 10-acre (4.0-ha) fill and 400-foot (122 m) Berth 136 wharf extension would not occur, thus resulting in less infrastructure susceptible to seismically induced ground failure. In all other respects, **Impact GEO-1b** would be the same as the proposed Project. The federal portion of Alternative 2 would include seismic upgrades of existing wharves, resulting in beneficial seismic related impacts. Alternative 2 would also include the construction of new wharves and dikes, which would be susceptible to seismically induced ground shaking, fault rupture, and liquefaction. Therefore, beneficial impacts would be offset by adverse impacts.

Seismic hazards are common to the Los Angeles region and are not increased by Alternative 2. However, because the Alternative 2 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. 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 are significant and unavoidable under NEPA.

Mitigation Measures

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

Residual 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 remain significant and unavoidable.

Tsunamis and Seiches

Impact GEO-2b: Alternative 2 operations within the Port area would expose people and structures to substantial risk involving tsunamis or seiches. Local or distant seismic activity and/or offshore landslides could result in the occurrence of tsunamis or seiches within the Alternative 2 area and vicinity.

CEQA Impact Determination

Tsunami/seiche impacts would be similar but less than those described for the proposed Project, because the 10-acre (4.0-ha) fill and 400-foot (122 m) Berth 136 wharf extension would not occur, thus resulting in less infrastructure susceptible to inundation. In all other respects, **Impact GEO-2b** would be the same as the proposed Project. Therefore, impacts during the operations phase of Alternative 2 would be significant and unavoidable under CEQA.

Mitigation Measures

Mitigation Measure GEO-1 shall be applied to the CEQA project impact determination to reduce tsunami and seiche related impacts.

Residual Impacts

Emergency planning and coordination between the Terminal operator and LAHD, as outlined in **Mitigation Measure GEO-1**, would contribute in reducing injuries to on-site personnel 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. Therefore, residual impacts would remain significant and unavoidable.

NEPA Impact Determination

Operation impacts would be similar but less than those described for the proposed Project, because the 10-acre (4.0-ha) fill and 400-foot (122 m) Berth 136 wharf extension would not occur, thus resulting in less infrastructure susceptible to inundation. In all other respects, **Impact GEO-1b** would be the same as the proposed Project. Therefore, impacts due to tsunami and seiches during the operations phase are significant and unavoidable under NEPA.

Mitigation Measures

Mitigation Measure GEO-1 shall be applied to the NEPA project impact determination to reduce tsunami and seiche related impacts.

Residual Impacts

Emergency planning and coordination between the Terminal operator and the LAHD, as outlined in **Mitigation Measure GEO-1**, would contribute in reducing injuries to on-site personnel 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. Therefore, residual impacts would remain significant and unavoidable.

Subsidence/Settlement

Impact GEO-3b: Alternative 2 operation 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

Subsidence/settlement impacts during operations would be similar but less than those described for the proposed Project, because the 10-acre (4.0 ha) fill would not occur, thus resulting in less area susceptible to settlement. In all other respects, **Impact GEO-3b** would be the same as the proposed Project. Settlement impacts in backland areas would be less than significant under CEQA, as Alternative 2 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 Caltrans, and would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

Mitigation Measures

As subsidence impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

The federal portion of Alternative 2 would be limited to wharf renovation and dredging activities. Because subsidence/settlement impacts relate primarily to proposed backland improvements and Alternative 2 does not include the 10-acre (4-ha) fill, no impacts would occur under NEPA.

Mitigation Measures

As no subsidence impacts would occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Expansive Soils

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

CEQA Impact Determination

Operations impacts would be similar but less than those described for the proposed Project, because the 10-acre (4.0-ha) fill would not occur, thus resulting in less area susceptible to soil expansion. In all other respects, **Impact GEO-4b** would be the same as the proposed Project. Expansive soil impacts in backland areas would be less than significant under CEQA, as Alternative 2 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.

Mitigation Measures

As expansive soil impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

The federal portions of Alternative 2 would be limited to wharf renovation and channel deepening activities. Because expansive soil impacts relate primarily to proposed backland improvements, and Alternative 2 does not include the 10-acre (4 ha) fill, no impacts would occur under NEPA.

Mitigation Measures

As expansive soil impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Landslides and Mudslides

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

CEQA Impact Determination

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

Mitigation Measures

As landslide and mudslide impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

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

Mitigation Measures

As landslide and mudslide impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Unstable Soil Conditions

Impact GEO-6b: Collapsible soils would have no impact on Alternative 2 operations and would not expose people or structures to substantial risk.

CEQA Impact Determination

As excavations would not be completed as a part of Alternative 2 operations, impacts associated with collapsible soils would not occur under CEQA.

Mitigation Measures

As impacts associated with collapsible soils would not occur, no mitigation measures are required.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

Because collapsible soil impacts relate primarily to proposed backland improvements and Alternative 2 does not include the 10-acre (4-ha) fill, no impacts would occur under NEPA.

Mitigation Measures

As impacts associated with collapsible soils would not occur, no mitigation measures are required.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Prominent Geologic and Topographic Features

Impact GEO-7b: Alternative 2 operations 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 the topography in the vicinity of the Alternative 2 site is flat and does not contain prominent geologic or topographic features, no impacts would occur under CEQA.

Mitigation Measures

As impacts due to removal of prominent geologic or topographic features would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

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

Mitigation Measures

As impacts related to removal of prominent geologic or topographic features would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Mineral Resources

Impact GEO-8b: Although the northern portion of the Alternative 2 site is underlain by the Wilmington Oil Field, Alternative 2 operations 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 Alternative 2 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. However, with respect to petroleum resources, the northern portion of the Alternative 2 site is located within the Wilmington Oil Field.

CEQA Impact Determination

Alternative 2 operations would preclude oil and gas drilling from within Alternative 2 boundaries; however, petroleum reserves beneath the site could be accessed from remote locations, using directional (or slant) drilling techniques. Therefore, 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. Mineral resource impacts are less than significant under CEQA.

Mitigation Measures

As impacts associated with mineral resources would be less than significant, no mitigation measures are required.

Residual Impacts

With no mitigation required, the residual impacts are less than significant under CEQA.

NEPA Impact Determination

Wharf renovation/construction and dredging activities would preclude oil and gas drilling from within Alternative 2 boundaries. However, petroleum reserves beneath the site could be accessed from remote locations, using directional (or slant) drilling techniques. Therefore, Alternative 2 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 and less than significant mineral resource impacts would occur under NEPA.

Mitigation Measures

As impacts associated with mineral resources would be less than significant, no mitigation measures are required.

Residual Impacts

With no mitigation required, the residual impacts would be less than significant under NEPA.

3.5.4.3.2.3 Alternative 3 – Reduced Wharf

3.5.4.3.2.3.1 Construction Impacts

Seismicity

Impact GEO-1a: 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 that would expose people and structures to substantial risk during the construction period (through 2015).

CEQA Impact Determination

Construction impacts of the Reduced Wharf Alternative (Alternative 3) would be similar but less than those identified for the proposed Project because the 400-foot Berth 136 wharf extension and 705-foot wharf at Berths 145-147 would not be constructed and the 10-acre (4.0 ha) Northwest Slip would not be filled, thus resulting in less infrastructure susceptible to seismically induced ground failure. In all other respects, **Impact GEO-1a** would be the same as the proposed Project. As with 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. Seismic hazards are common to the Los Angeles region and are not increased by this alternative. 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. Seismic upgrades would be completed on existing wharves, resulting in beneficial impacts. However, because construction of buildings and related infrastructure would occur over an extended period (through 2015), 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 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

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 remain significant and unavoidable.

NEPA Impact Determination

As the Reduced Wharf Alternative would only include minimal in-water construction activities (i.e., deepening navigation channels and wharf seismic improvements), potential impacts would be similar to, but less severe than those described for the proposed Project under the NEPA analysis. Seismic hazards are common to the Los Angeles region and are not increased by Alternative 3. Seismic upgrade of existing wharves would result in beneficial seismic related impacts. However, because the West Basin 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. Because construction would occur over an extended period (through 2015), 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 are significant and unavoidable under NEPA.

Mitigation Measures

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

Residual 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 remain significant and unavoidable.

Tsunami Runup

Impact GEO-2a: Alternative 3 construction within the Port area would expose people and structures to substantial risk involving tsunamis or seiches. Local or distant seismic activity and/or offshore landslides could result in the occurrence of tsunamis or seiches within West Basin and vicinity.

CEQA Impact Determination

Construction impacts of this alternative would be similar but less than those identified for the proposed Project because the 400-foot Berth 136 wharf extension and 705-foot wharf at Berths 145-147 would not be constructed and the 10-acre (4.0-ha) Northwest Slip would not be filled, thus resulting in less infrastructure susceptible to inundation. In all other respects, **Impact GEO-2a** would be the same as the proposed Project. Therefore, impacts during the construction phase would be significant and unavoidable under CEQA.

Mitigation Measures

Mitigation Measure GEO-1 shall be applied to the CEQA project impact determination to reduce tsunami and seiche related impacts.

Residual Impacts

Emergency planning and coordination between the Terminal operator and LAHD, as outlined in **Mitigation Measure GEO-1**, would contribute in reducing injuries to on-site personnel 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. Therefore, residual impacts would remain significant and unavoidable.

NEPA Impact Determination

As the Reduced Wharf Alternative would only include minimal in-water construction activities (i.e., deepening navigation channels and wharf seismic improvements), potential impacts would be similar to, but less than those described for the proposed Project under the NEPA analysis. In all other respects, **Impact GEO-2a** would be the same as the proposed Project. Therefore, impacts due to tsunamis and seiches during the construction phase would be significant and unavoidable under NEPA.

Mitigation Measures

Mitigation Measure GEO-1 shall be applied to the NEPA project impact determination to reduce tsunami and seiche related impacts.

Residual Impacts

Emergency planning and coordination between the Terminal operator and the LAHD, as outlined in **Mitigation Measure GEO-1**, would contribute in reducing injuries to on-site personnel 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. Therefore, residual impacts would remain significant and unavoidable.

Subsidence/Settlement

Impact GEO-3a: Alternative 3 construction 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

Construction impacts of this alternative would be similar but less than those identified for the proposed Project because the 10-acre (4.0-ha) Northwest Slip would not be filled, thus resulting in less area susceptible to subsidence/settlement. In all other respects, **Impact GEO-3a** would be the same as the proposed Project. Impacts in backland areas would be less than significant under CEQA, as Alternative 3 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 Caltrans, and would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

Mitigation Measures

As subsidence impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

The federal portions of Alternative 3 construction would be limited to wharf renovation and dredging activities. Because subsidence/settlement impacts relate primarily to proposed backland improvements and Alternative 3 does not include the 10-acre (4-ha) fill, no impacts would occur under NEPA.

Mitigation Measures

As no subsidence impacts would occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Expansive Soils

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

CEQA Impact Determination

Construction impacts of this alternative would be similar but less than those identified for the proposed Project, as the 10-acre (4.0-ha) Northwest Slip would not be filled, thus resulting in less area susceptible to expansive soils. In all other respects, **Impact GEO-4a** would be the same as the proposed Project. Expansive soil impacts in backland areas would be less than significant under CEQA as Alternative 3 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.

Mitigation Measures

As expansive soil impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

The federal portions of Alternative 3 construction would be limited to wharf and in-water activities, including new concrete piles for seismic renovation and channel deepening. Because expansive soil impacts relate primarily to proposed backland improvements and Alternative 3 does not include the 10-acre (4-ha) fill, no impacts would occur under NEPA.

Mitigation Measures

As expansive soil impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Landslides and Mudslides

Impact GEO-5a: Alternative 3 construction would not result in or expose people or property to a substantial risk of landslides or mudslides.

CEQA Impact Determination

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

Mitigation Measures

As landslide and mudslide impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

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

Mitigation Measures

As landslide and mudslide impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Unstable Soil Conditions

Impact GEO-6a: Shallow groundwater, which would cause unstable collapsible soils, may be encountered during excavations, but would not expose people or structures to substantial risk.

CEQA Impact Determination

Construction impacts of this alternative would be similar but less than those identified for the proposed Project because the 400-foot Berth 136 wharf extension and 705-foot wharf at Berths 145-147 would not be constructed and the 10-acre (4.0 ha) Northwest Slip would not be filled, thus resulting in less infrastructure susceptible to unstable soil conditions. In all other respects, **Impact GEO-6a** would be the same as the proposed Project. Therefore, impacts associated with shallow groundwater would be less than significant under CEQA due to implementation of standard engineering practices regarding saturated, collapsible soils.

Mitigation Measures

As impacts associated with collapsible soils would be less than significant, no mitigation measures are required.

Residual Impacts

With no mitigation required, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

The federal portions of Alternative 3 construction would be limited to wharf and in-water construction activities including new concrete piles for seismic renovation and channel deepening. Because collapsible soil impacts relate primarily to proposed backland improvements and Alternative 3 does not include the 10-acre (4-ha) fill, no impacts would occur under NEPA.

Mitigation Measures

As impacts associated with collapsible soils would not occur, no mitigation measures are required.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Prominent Geologic and Topographic Features

Impact GEO-7a: Alternative 3 construction 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 the topography in the vicinity of the Alternative 3 site is flat and does not contain prominent geologic or topographic features, no impacts would occur under CEQA.

Mitigation Measures

As impacts due to removal of prominent geologic or topographic features would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

As the topography in the vicinity of the Alternative 3 project site is flat and does not contain prominent geologic or topographic features, no impacts would occur under NEPA.

Mitigation Measures

As impacts related to removal of prominent geologic or topographic features would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Mineral Resources

Impact GEO-8a: Although the northern portion of West Basin is underlain by the Wilmington Oil Field, Alternative 3 site construction 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 Alternative 3 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. However, with respect to petroleum resources, the northern portion of the Alternative 3 site is located within the Wilmington Oil Field.

CEQA Impact Determination

Alternative 3 construction would preclude oil and gas drilling from within project boundaries; however, petroleum reserves beneath the site could be accessed from remote locations, using directional (or slant) drilling techniques. Therefore, Alternative 3 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 are less than significant under CEQA.

Mitigation Measures

As impacts associated with mineral resources would be less than significant, no mitigation measures are required.

Residual Impacts

With no mitigation required, the residual impacts are less than significant under CEQA.

NEPA Impact Determination

In-water construction for wharf renovation and channel deepening would preclude oil and gas drilling from within Alternative 3 site boundaries; however, petroleum reserves beneath the site could be accessed from remote locations using directional (or slant) drilling techniques. Therefore, Alternative 3 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 and less than significant mineral resource impacts would occur under NEPA.

Mitigation Measures

As impacts associated with mineral resources would be less than significant, no mitigation measures are required.

Residual Impacts

With no mitigation required, the residual impacts are less than significant under NEPA.

3.5.4.3.2.3.2 Operations Impacts

Seismicity

Impact GEO-1b: 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 that would expose people and structures to substantial risk during the operations period (through 2038).

CEQA Impact Determination

Operations impacts of this alternative would be similar but less than those identified for the proposed Project because the 400-foot Berth 136 wharf extension and 705-foot wharf at Berths 145-147 would not be constructed and the 10-acre (4.0 ha) Northwest Slip would not be filled, thus resulting in less infrastructure susceptible to seismically induced ground failure. In all other respects, **Impact GEO-1b** would be the same as the proposed Project. As with 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. Seismic hazards are common to the Los Angeles region and are not increased by Alternative 3. However, because the Alternative 3 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. 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 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

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 remain significant and unavoidable.

NEPA Impact Determination

As the federal portions of the Reduced Wharf Alternative would only include minimal in-water construction activities (i.e., deepening navigation channels and wharf seismic improvements), potential operations impacts would be similar to, but less severe than those described for the proposed Project under the NEPA analysis. In all other respects, **Impact GEO-1b** would be the same as the proposed Project. Seismic upgrade of existing wharves would result in beneficial seismic related impacts. Seismic hazards are common to the Los Angeles region and are not increased by Alternative 3. However, because the Alternative 3 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. 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 are significant and unavoidable under NEPA.

Mitigation Measures

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

Residual 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 remain significant and unavoidable.

Tsunamis and Seiches

Impact GEO-2b: Alternative 3 operations within the Port area would expose people and structures to substantial risk involving tsunamis or seiches. Local or distant seismic activity and/or offshore landslides could result in the occurrence of tsunamis or seiches within the Alternative 3 area and vicinity.

CEQA Impact Determination

Impacts as a result of operations of this alternative would be similar but less than those identified for the proposed Project because the 400-foot Berth 136 wharf extension and 705-foot wharf at Berths 145-147 would not be constructed and the 10-

acre (4.0 ha) Northwest Slip would not be filled, thus resulting in less infrastructure susceptible to inundation. In all other respects, **Impact GEO-2b** would be the same as the proposed Project. Therefore, impacts during the operations phase of Alternative 3 would be significant and unavoidable under CEQA.

Mitigation Measures

Mitigation Measure GEO-1 shall be applied to the CEQA project impact determination to reduce tsunami and seiche related impacts.

Residual Impacts

Emergency planning and coordination between the Terminal operator and LAHD, as outlined in **Mitigation Measure GEO-1**, would contribute in reducing injuries to on-site personnel 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. Therefore, residual impacts would remain significant and unavoidable.

NEPA Impact Determination

As the federal portions of the Reduced Wharf Alternative would only include minimal in-water construction activities (i.e., deepening navigation channels and wharf seismic improvements) and not the 10-acre (4-ha) fill, potential operations impacts would be similar to, but less severe than those described for the proposed Project under the NEPA analysis. In all other respects, **Impact GEO-2b** would be the same as the proposed Project. Therefore, impacts during the operations phase due to tsunamis and seiches would be significant and unavoidable under NEPA.

Mitigation Measures

Mitigation Measure GEO-1 shall be applied to the NEPA project impact determination to reduce tsunami and seiche related impacts.

Residual Impacts

Emergency planning and coordination between the Terminal operator and the LAHD, as outlined in **Mitigation Measure GEO-1**, would contribute in reducing injuries to on-site personnel 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. Therefore, residual impacts would remain significant and unavoidable.

Subsidence/Settlement

Impact GEO-3b: Alternative 3 operations 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 but less than those identified for the proposed Project because the 10-acre (4.0 ha) Northwest Slip would not be filled, thus resulting in less area susceptible to settlement. In all other respects, **Impact GEO-3b** would be the same as the proposed Project. Settlement impacts in backland areas would be less than significant under CEQA as Alternative 3 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 Caltrans, and would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

Mitigation Measures

As subsidence impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

The federal portions of Alternative 3 would be limited to wharf renovation and channel deepening activities. Because subsidence/settlement impacts relate primarily to proposed backland improvements and Alternative 3 does not include the 10-acre (4-ha) fill, no impacts would occur under NEPA.

Mitigation Measures

As no subsidence impacts would occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Expansive Soils

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

CEQA Impact Determination

Operations impacts of this alternative would be similar but less than those identified for the proposed Project because the 10-acre (4.0-ha) Northwest Slip would not be filled, thus resulting in less area susceptible to soil expansion. In all other respects, **Impact GEO-4b** would be the same as the proposed Project. Expansive soil impacts in backland

areas would be less than significant under CEQA, as Alternative 3 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.

Mitigation Measures

As expansive soil impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

The federal portions of Alternative 3 would be limited to wharf renovation and channel deepening activities. Because expansive soil impacts relate primarily to proposed backland improvements and Alternative 3 does not include the 10-acre (4-ha) fill, no impacts would occur under NEPA.

Mitigation Measures

As expansive soil impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, there would be no residual impacts under NEPA.

Landslides and Mudslides

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

CEQA Impact Determination

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

Mitigation Measures

As landslide and mudslide impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

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

Mitigation Measures

As landslide and mudslide impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Unstable Soil Conditions

Impact GEO-6b: Collapsible soils would have no impact on Alternative 3 operations and would not expose people or structures to substantial risk.

CEQA Impact Determination

As excavations would not be completed as a part of Alternative 3 operations, impacts associated with collapsible soils would not occur under CEQA.

Mitigation Measures

As impacts associated with collapsible soils would not occur, no mitigation measures are required.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

The federal portions of Alternative 3 would be limited to wharf renovation and channel deepening activities. Because collapsible soil impacts relate primarily to proposed backland improvements and Alternative 3 does not include the 10-acre (4-ha) fill, no impacts would occur under NEPA.

Mitigation Measures

As impacts associated with collapsible soils would not occur, no mitigation measures are required.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Prominent Geologic and Topographic Features

Impact GEO-7b: Alternative 3 operations 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 the topography in the vicinity of the Alternative 3 site is flat and does not contain prominent geologic or topographic features, no impacts would occur under CEQA.

Mitigation Measures

As impacts due to removal of prominent geologic or topographic features would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

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

Mitigation Measures

As impacts related to removal of prominent geologic or topographic features would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under NEPA.

Mineral Resources

Impact GEO-8b: Although the northern portion of the Alternative 3 site is underlain by the Wilmington Oil Field, operations 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 Alternative 3 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. However, with respect to petroleum resources, the northern portion of the Alternative 3 site is located within the Wilmington Oil Field.

CEQA Impact Determination

Alternative 3 operations would preclude oil and gas drilling from within site boundaries; however, petroleum reserves beneath the site could be accessed from remote locations, using directional (or slant) drilling techniques. Therefore, 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. Mineral resource impacts are less than significant under CEQA.

Mitigation Measures

As impacts associated with mineral resources would be less than significant, no mitigation measures are required.

Residual Impacts

With no mitigation required, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

The federal portions of Alternative 3 would be limited to wharf renovation and channel deepening activities, which would preclude oil and gas drilling from within the project boundaries. However, petroleum reserves beneath the site could be accessed from remote locations, using directional (or slant) drilling techniques. Therefore, Alternative 3 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 and less than significant mineral resource impacts would occur under NEPA.

Mitigation Measures

As impacts associated with mineral resources would be less than significant, no mitigation measures are required.

Residual Impacts

With no mitigation required, the residual impacts would be less than significant.

3.5.4.3.2.4 Alternative 4 – Omni Terminal

3.5.4.3.2.4.1 Construction Impacts

Seismicity

Impact GEO-1a: 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 that would expose people and structures to substantial risk during the construction period (through 2015).

CEQA Impact Determination

Seismic impacts of the Omni Terminal Alternative (Alternative 4) would be similar but less than those identified for the proposed Project, as no new rail yard, 10-acre (4-ha) fill, wharf construction, and associated dredging would occur, thus resulting in less infrastructure susceptible to seismically induced ground failure. In all other respects, **Impact GEO-1a** would be the same as the proposed Project. As for 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. Seismic hazards are common to the Los Angeles region and are not increased by this alternative. 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. Because new construction of buildings and related infrastructure would occur over an extended period (through 2015), 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 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

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 remain significant and unavoidable.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Tsunamis and Seiches

Impact GEO-2a: Alternative 4 construction within the Port area would expose people and structures to substantial risk involving tsunamis or seiches. Local or distant seismic activity and/or offshore landslides could result in the occurrence of tsunamis or seiches within West Basin and vicinity.

CEQA Impact Determination

Under this alternative, no new rail yard, 10-acre (4-ha) fill, wharf construction and associated dredging would occur, thus resulting in less infrastructure that is susceptible to inundation from tsunamis/seiches. In all other respects, **Impact GEO-2a** would be the same as the proposed Project. Therefore, impacts during the construction phase would be significant and unavoidable under CEQA.

Mitigation Measures

Mitigation Measure GEO-1 shall be applied to the CEQA project impact determination to reduce tsunami and seiche related impacts.

Residual Impacts

Emergency planning and coordination between the Terminal operator and LAHD, as outlined in **Mitigation Measure GEO-1**, would contribute in reducing injuries to on-site personnel 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. Therefore, residual impacts would remain significant and unavoidable.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Subsidence/Settlement

Impact GEO-3a: Alternative 4 construction 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

Under this alternative, no 10-acre (4-ha) fill or new rail yard construction would occur, thus resulting in less infrastructure that is susceptible to subsidence/settlement. In all other respects, **Impact GEO-3a** would be the same as the proposed Project. Impacts in backland areas would be less than significant under CEQA as Alternative 4 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 Caltrans, and would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

Mitigation Measures

As subsidence impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Expansive Soils

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

CEQA Impact Determination

Under this alternative no new rail yard construction or 10-acre (4-ha) fill would occur, thus resulting in less infrastructure that is susceptible to expansive soils. In all other respects, **Impact GEO-4a** would be the same as the proposed Project. Expansive soil impacts in backland areas would be less than significant under CEQA as Alternative 4 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.

Mitigation Measures

As expansive soil impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Landslides and Mudslides

Impact GEO-5a: Alternative 4 construction would not result in or expose people or property to a substantial risk of landslides or mudslides.

CEQA Impact Determination

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

Mitigation Measures

As landslide and mudslide impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Unstable Soil Conditions

Impact GEO-6a: Shallow groundwater, which would cause unstable collapsible soils, may be encountered during excavations, but would not expose people or structures to substantial risk.

See section 3.6 (Groundwater and Soils) regarding potential soil and/or groundwater contamination in construction excavations.

CEQA Impact Determination

Under this alternative, no new rail yard construction and 10-acre (4-ha) fill would occur, thus resulting in less infrastructure that is susceptible to unstable soil conditions. In all other respects, **Impact GEO-6a** would be the same as the proposed Project. Therefore, impacts associated with shallow groundwater would be less than

significant under CEQA due to implementation of standard engineering practices regarding saturated, collapsible soils.

Mitigation Measures

As impacts associated with collapsible soils would be less than significant, no mitigation measures are required.

Residual Impacts

With no mitigation required, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur.

Prominent Geologic and Topographic Features

Impact GEO-7a: Alternative 4 construction 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 the topography in the vicinity of the Alternative 4 site is flat and does not contain prominent geologic or topographic features, no impacts would occur under CEQA.

Mitigation Measures

As impacts due to removal of prominent geologic or topographic features would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Mineral Resources

Impact GEO-8a: Although the northern portion of West Basin is underlain by the Wilmington Oil Field, Alternative 4 site construction 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 Alternative 4 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. However, with respect to petroleum resources, the northern portion of the Alternative 4 site is located within the Wilmington Oil Field.

CEQA Impact Determination

Construction would preclude oil and gas drilling from within Alternative 4 boundaries; however, petroleum reserves beneath the site could be accessed from remote locations, using directional (or slant) drilling techniques. Therefore, 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. Mineral resource impacts are less than significant under CEQA.

Mitigation Measures

As impacts associated with mineral resources would be less than significant, no mitigation measures are required.

Residual Impacts

With no mitigation required, the residual impacts are less than significant under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

3.5.4.3.2.4.2 Operations Impacts

Seismicity

Impact GEO-1b: 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 that would expose people and structures to substantial risk during the operations period (through 2038).

CEQA Impact Determination

Under this alternative, no new wharf construction and associated dredging would occur, thus resulting in less infrastructure that is susceptible to seismically induced ground failure during operations. In all other respects, **Impact GEO-1b** would be the same as the proposed Project. As with 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. Seismic hazards are common to the Los Angeles region and are not increased by Alternative 4. 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. 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 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

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 remain significant and unavoidable.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Tsunamis and Seiches

Impact GEO-2b: Alternative 4 operations within the Port area would expose people and structures to substantial risk involving tsunamis or seiches. Local or distant seismic activity and/or offshore landslides could result in the occurrence of tsunamis or seiches within the project area and vicinity.

CEQA Impact Determination

Under this alternative, no new wharf or rail yard construction and associated dredging or 10-acre (4-ha) fill would occur, thus resulting in less infrastructure that is susceptible to inundation during operations. In all other respects, **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

Mitigation Measure GEO-1 shall be applied to the CEQA project impact determination to reduce tsunami and seiche related impacts.

Residual Impacts

Emergency planning and coordination between the Terminal operator and LAHD, as outlined in **Mitigation Measure GEO-1**, would contribute in reducing injuries to on-site personnel 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. Therefore, residual impacts would remain significant and unavoidable.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Subsidence/Settlement

Impact GEO-3b: Alternative 4 operations 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

Under this alternative, no new rail yard construction or 10-acre fill would occur, thus resulting in less infrastructure that is susceptible to subsidence/settlement during operations. n all other respects, **Impact GEO-3b** would be the same as the proposed Project. Settlement impacts in backland areas would be less than significant under CEQA, as Alternative 4 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 Caltrans, and would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

Mitigation Measures

As subsidence impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Expansive Soils

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

CEQA Impact Determination

Under this alternative, no new rail yard construction or 10-acre (4-ha) fill would occur, thus resulting in less infrastructure that is susceptible to soil expansion during operations. In all other respects, **Impact GEO-4b** would be the same as the proposed Project. Expansive soil impacts in backland areas would be less than significant under CEQA, as Alternative 4 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.

Mitigation Measures

As expansive soil impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Landslides and Mudslides

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

CEQA Impact Determination

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

Mitigation Measures

As landslide and mudslide impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Unstable Soil Conditions

Impact GEO-6b: Collapsible soils would have no impact on Alternative 4 operations and would not expose people or structures to substantial risk.

CEQA Impact Determination

As excavations would not be completed as a part of Alternative 4 operations, impacts associated with collapsible soils would not occur under CEQA.

Mitigation Measures

As impacts associated with collapsible soils would not occur, no mitigation measures are required.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Prominent Geologic and Topographic Features

Impact GEO-7b: Alternative 4 operations 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 the topography in the vicinity of the Alternative 4 site is flat and does not contain prominent geologic or topographic features, no impacts would occur under CEQA.

Mitigation Measures

As impacts due to removal of prominent geologic or topographic features would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Mineral Resources

Impact GEO-8b: Although the northern portion of the Alternative 4 site is underlain by the Wilmington Oil Field, operations 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 Alternative 4 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. However, with respect to petroleum resources, the northern portion of the Alternative 4 site is located within the Wilmington Oil Field.

CEQA Impact Determination

Alternative 4 operations would preclude oil and gas drilling from within site boundaries; however, petroleum reserves beneath the site could be accessed from remote locations, using directional (or slant) drilling techniques. Therefore, 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. Mineral resource impacts are less than significant under CEQA.

Mitigation Measures

As impacts associated with mineral resources would be less than significant, no mitigation measures are required.

Residual Impacts

With no mitigation required, the residual impacts are less than significant under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

3.5.4.3.2.5 Alternative 5 – Landside Terminal Improvements

3.5.4.3.2.5.1 Construction Impacts

Seismicity

Impact GEO-1a: 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 that would expose people and structures to substantial risk during the construction period (through 2015).

CEQA Impact Determination

Under the Landside Terminal Improvements Alternative (Alternative 5), no new wharf construction, associated dredging, or 10-acre (4-ha) fill would occur, thus resulting in less infrastructure susceptible to seismically induced ground failure. In all other respects, **Impact GEO-1a** would be the same as the proposed Project. As with 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. Seismic hazards are common to the Los Angeles region and are not increased by this alternative. 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. Seismic upgrades would be completed on existing wharves, resulting in beneficial impacts. However, because construction of new wharves, buildings, and related infrastructure would occur over an extended period (through 2015), 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 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

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 remain significant and unavoidable.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Tsunamis and Seiches

Impact GEO-2a: Alternative 5 construction within the Port area would expose people and structures to substantial risk involving tsunamis or seiches. Local or distant seismic activity and/or offshore landslides could result in the occurrence of tsunamis or seiches within West Basin and vicinity.

CEQA Impact Determination

Under this alternative, no new wharf construction and associated dredging would occur, thus resulting in less infrastructure that is susceptible to inundation from tsunamis/seiches. In all other respects, **Impact GEO-2a** would be the same as the proposed Project. Therefore, impacts during the construction phase would be significant and unavoidable under CEQA.

Mitigation Measures

Mitigation Measure GEO-1 shall be applied to the CEQA impact determination to reduce tsunami and seiche related impacts.

Residual Impacts

Emergency planning and coordination between the Terminal operator and LAHD, as outlined in **Mitigation Measure GEO-1**, would contribute in reducing injuries to on-site personnel 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. Therefore, residual impacts would remain significant and unavoidable.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Subsidence/Settlement

Impact GEO-3a: Alternative 5 construction 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

Under this alternative, 10-acre (4-ha) fill would not occur, thus resulting in less area that is susceptible to subsidence/settlement. In all other respects, **Impact GEO-3a** would be the same as the proposed Project. Impacts in backland areas would be less than significant under CEQA as Alternative 5 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 Caltrans, and would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

Mitigation Measures

As subsidence impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Expansive Soils

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

CEQA Impact Determination

Under this alternative, the 10-acre (4-ha) fill would not occur, thus resulting in less area that is susceptible to expansive soils. In all other respects, **Impact GEO-4a** would be the same as the proposed Project. Expansive soil impacts in backland areas would be less than significant under CEQA, as Alternative 5 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.

Mitigation Measures

As expansive soil impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Landslides and Mudslides

Impact GEO-5a: Alternative 5 construction would not result in or expose people or property to a substantial risk of landslides or mudslides.

CEQA Impact Determination

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

Mitigation Measures

As landslide and mudslide impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Unstable Soil Conditions

Impact GEO-6a: Shallow groundwater, which would cause unstable collapsible soils, may be encountered during excavations, but would not expose people or structures to substantial risk.

CEQA Impact Determination

Under this alternative, the 10-acre (4-ha) fill would not occur, thus resulting in less area that is susceptible to unstable soil conditions. In all other respects, **Impact GEO-6a** would be the same as the proposed Project. Therefore, impacts associated with shallow groundwater would be less than significant under CEQA due to implementation of standard engineering practices regarding saturated, collapsible soils.

Mitigation Measures

As impacts associated with collapsible soils would be less than significant, no mitigation measures are required.

Residual Impacts

With no mitigation required, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Prominent Geologic and Topographic Features

Impact GEO-7a: Alternative 5 construction 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 the topography in the vicinity of the Alternative 5 site is flat and does not contain prominent geologic or topographic features, no impacts would occur under CEQA.

Mitigation Measures

As impacts due to removal of prominent geologic or topographic features would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Mineral Resources

Impact GEO-8a: Although the northern portion of West Basin is underlain by the Wilmington Oil Field, Alternative 5 site construction 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 Alternative 5 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. However, with respect to petroleum resources, the northern portion of the Alternative 5 site is located within the Wilmington Oil Field.

CEQA Impact Determination

Construction would preclude oil and gas drilling from within Alternative 5 boundaries; however, petroleum reserves beneath the site could be accessed from remote locations, using directional (or slant) drilling techniques. Therefore, 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. Mineral resource impacts are less than significant under CEQA.

Mitigation Measures

As impacts associated with mineral resources would be less than significant, no mitigation measures are required.

Residual Impacts

With no mitigation required, the residual impacts are less than significant under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

3.5.4.3.2.5.2 Operations Impacts

Seismicity

Impact GEO-2b: 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 that would expose people and structures to substantial risk during the operations period (through 2038).

CEQA Impact Determination

Under this alternative, no new wharf construction, associated dredging, or 10-acre (4-ha) fill would occur, thus resulting in less infrastructure that is susceptible to seismically induced ground failure during operations. In all other respects, **Impact GEO-2b** would be the same as the proposed Project. As with 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. Seismic hazards are common to the Los Angeles region and are not increased by Alternative 5. 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. 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 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

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 remain significant and unavoidable.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Tsunamis and Seiches

Impact GEO-2b: Alternative 5 operations within the Port area would expose people and structures to substantial risk involving tsunamis or seiches. Local or distant seismic activity and/or offshore landslides could result in the occurrence of tsunamis or seiches within the project area and vicinity.

CEQA Impact Determination

Tsunami/seiche impacts would similar but less than those described for the proposed Project because no new wharf construction and associated dredging or 10-acre (4-ha) fill would occur, thus resulting in less infrastructure susceptible to inundation. In all other respects, **Impact GEO-2b** would be the same as the proposed Project. Therefore, impacts during the operations phase would be significant and unavoidable under CEQA.

Mitigation Measures

Mitigation Measure GEO-1 shall be applied to the CEQA project impact determination to reduce tsunami and seiche related impacts.

Residual Impacts

Emergency planning and coordination between the Terminal operator and LAHD, as outlined in **Mitigation Measure GEO-1**, would contribute in reducing injuries to on-site personnel 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. Therefore, residual impacts would remain significant and unavoidable.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Subsidence/Settlement

Impact GEO-3b: Alternative 5 operations 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

Under this alternative the 10-acre (4-ha) fill would not occur, thus resulting in less area that is susceptible to subsidence/settlement during operations. In all other respects, **Impact GEO-3b** would be the same as the proposed Project. Settlement impacts in backland areas would be less than significant under CEQA as Alternative 5 would be designed and constructed in compliance with the recommendations of the geotechnical engineers, 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 Caltrans, and would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

Mitigation Measures

As subsidence/settlement impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Expansive Soils

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

CEQA Impact Determination

Under this alternative the 10-acre (4-ha) fill would not occur, thus resulting in less area that is susceptible to soil expansion during operations. In all other respects, **Impact GEO-4b** would be the same as the proposed Project. Expansive soil impacts in backland areas would be less than significant under CEQA as Alternative 5 would be designed and constructed in compliance with the recommendations of the geotechnical engineers, 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.

Mitigation Measures

As expansive soil impacts would be less than significant, no mitigation measures are necessary.

Residual Impacts

With implementation of Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, the residual impacts would be less than significant under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Landslides and Mudslides

Impact GEO-5b: Alternative 5 operations would not result in or expose people or property to a substantial risk of landslides or mudslides.

CEQA Impact Determination

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

Mitigation Measures

As landslide and mudslide impacts would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Unstable Soil Conditions

Impact GEO-6b: Collapsible soils would have no impact on Alternative 5 operations and would not expose people or structures to substantial risk.

CEQA Impact Determination

As excavations would not be completed as a part of Alternative 5 operations, impacts associated with collapsible soils would not occur under CEQA.

Mitigation Measures

As impacts associated with collapsible soils would not occur, no mitigation measures are required.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Prominent Geologic and Topographic Features

Impact GEO-7b: Alternative 5 operations 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 the topography in the vicinity of the Alternative 5 site is flat and does not contain prominent geologic or topographic features, no impacts would occur under CEQA.

Mitigation Measures

As impacts due to removal of prominent geologic or topographic features would not occur, no mitigation measures are necessary.

Residual Impacts

With no mitigation required, there would be no residual impacts under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

Mineral Resources

Impact GEO-8b: Although the northern portion of the Alternative 5 site is underlain by the Wilmington Oil Field, operations 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 Alternative 5 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. However, with respect to petroleum resources, the northern portion of the Alternative 5 site is located within the Wilmington Oil Field.

CEQA Impact Determination

Alternative 5 operations would preclude oil and gas drilling from within site boundaries; however, petroleum reserves beneath the site could be accessed from remote locations, using directional (or slant) drilling techniques. Therefore, Alternative 5 would not result in the permanent loss of availability of a known mineral resource of future value to the region and the residents of the state. Mineral resource impacts are less than significant under CEQA.

Mitigation Measures

As impacts associated with mineral resources would be less than significant, no mitigation measures are required.

Residual Impacts

With no mitigation required, the residual impacts are less than significant under CEQA.

NEPA Impact Determination

Under this alternative, no development would occur within the in-water area (i.e., no dredging, filling of the Northwest Slip, or new wharf construction). Therefore, impacts under NEPA are not applicable.

Mitigation Measures

Due to No Federal Action, mitigation is not applicable. No mitigation measures are required.

Residual Impacts

Residual impacts would not occur

3.5.4.3.3 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*	*Residual Impacts after Mitigation*
		3.5 Geology		
Proposed Project	**GEO-1a:** 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 that would expose people and structures to substantial risk during the construction period (through 2025).	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact	No mitigation measures are available to reduce below significance No mitigation measures are available to reduce below significance	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact
	GEO-2a: Project construction within the Port area would expose people and structures to substantial risk involving tsunamis or seiches. Local or distant seismic activity and/or offshore landslides could result in the occurrence of tsunamis or seiches within the proposed Project area and vicinity.	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact	**GEO-1** (Emergency Response Planning) **GEO-1**	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact
	GEO-3a: Project construction would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from subsidence/soil settlement.	CEQA: Less than significant impact NEPA: Less than significant impact	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Less than significant impact
	GEO-4a: Project construction would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from soil expansion.	CEQA: Less than significant impact NEPA: Less than significant impact	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Less than significant impact
	GEO-5a: Project construction would not result in or expose people or property to a substantial risk of landslides or mudflows.	CEQA: No impact NEPA: No impact	Mitigation not required Mitigation not required	CEQA: No impact NEPA: No impact
	GEO-6a: Shallow groundwater, which would cause unstable collapsible soils, may be encountered during excavation, but would not expose people or structures to substantial risk.	CEQA: Less than significant impact NEPA: Less than significant impact	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Less than significant impact

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

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Residual Impacts after Mitigation*
3.5 Geology (continued)				
Proposed Project (continued)	**GEO-7a:** Project construction 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 NEPA: No impact	Mitigation not required Mitigation not required	CEQA: No impact NEPA: No impact
	GEO-8a: Although the northern portion of the proposed Project site is underlain by the Wilmington Oil Field, Project construction would not result in the permanent loss of availability of a known mineral resource of regional, statewide, or local significance.	CEQA: Less than significant impact NEPA: Less than significant impact	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Less than significant impact
	GEO-1b: 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 that would expose people and structures to substantial risk during the operations period (through 2038).	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact	No mitigation measures are available to reduce below significance No mitigation measures are available to reduce below significance	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact
	GEO-2b: Project operations within the Port area would expose people and structures to substantial risk involving tsunamis or seiches. Local or distant seismic activity and/or offshore landslides could result in the occurrence of tsunamis or seiches within the proposed Project area and vicinity.	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact	**GEO-1** **GEO-1**	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact
	GEO-3b: Project operation would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from subsidence/soil settlement.	CEQA: Less than significant impact NEPA: Less than significant impact	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Less than significant impact
	GEO-4b: Project operation would not result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury from soil expansion.	CEQA: Less than significant impact NEPA: Less than significant impact	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Less than significant impact

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

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Residual Impacts after Mitigation*
3.5 Geology (continued)				
Proposed Project (continued)	**GEO-5b:** Project operation would not result in or expose people or property to a substantial risk of landslides or mudflows.	CEQA: No impact NEPA: No impact	Mitigation not required Mitigation not required	CEQA: No impact NEPA: No impact
	GEO-6b: Collapsible soils would have less than significant impact on proposed Project operations and would not expose people or structures to substantial risk.	CEQA: No impact NEPA: No impact	Mitigation not required Mitigation not required	CEQA: No impact NEPA: No impact
	GEO-7b: Project operations 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 NEPA: No impact	Mitigation not required Mitigation not required	CEQA: No impact NEPA: No impact
	GEO-8b: Although the northern portion of the proposed Project site is underlain by the Wilmington Oil Field, Project operations would not result in the permanent loss of availability of a known mineral resource of regional, statewide, or local significance.	CEQA: Less than significant impact NEPA: Less than significant impact	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Less than significant impact
Alternative 1 (No Project)	No development would occur under Alternative 1, therefore there are no construction impacts under CEQA or NEPA for **GEO-1a, GEO-2a, GEO-3a, GEO-4a, GEO-5a, GEO-6a, GEO-7a** and **GEO-8a.**	CEQA: No impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: No impact NEPA: Not applicable
	GEO-1b	CEQA: **Significant** and unavoidable impact NEPA: Not applicable	No mitigation measures are available to reduce below significance Mitigation not required	CEQA: **Significant** and unavoidable impact NEPA: Not applicable
	GEO-2b	CEQA: **Significant** and unavoidable impact NEPA: Not applicable	No mitigation measures are available to reduce below significance Mitigation not required	CEQA: **Significant** and unavoidable impact NEPA: Not applicable
	GEO-3b	CEQA: No impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: No impact NEPA: Not applicable

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

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Residual Impacts after Mitigation*
3.5 Geology (continued)				
Alternative 1 (continued)	**GEO-4b**	CEQA: No impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: No impact NEPA: Not applicable
	GEO-5b	CEQA: No impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: No impact NEPA: Not applicable
	GEO-6b	CEQA: No impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: No impact NEPA: Not applicable
	GEO-7b	CEQA: No impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: No impact NEPA: Not applicable
	GEO-8b	CEQA: Less than significant impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Not applicable
Alternative 2	**GEO-1a**	CEQA: **Significant** and unavoidable impact NEPA**: Significant** and unavoidable impact	No mitigation measures are available to reduce below significance No mitigation measures are available to reduce below significance	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact
	GEO-2a	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact	**GEO-1** **GEO-1**	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact
	GEO-3a	CEQA: Less than significant impact NEPA: No impact	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: No impact
	GEO-4a	CEQA: Less than significant impact NEPA: No impact	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: No impact

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

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Residual Impacts after Mitigation*
3.5 Geology (continued)				
Alternative 2 (continued)	**GEO-5a**	CEQA: No impact NEPA: No impact	Mitigation not required Mitigation not required	CEQA: No impact NEPA: No impact
	GEO-6a	CEQA: Less than significant impact NEPA: No impact	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: No impact
	GEO-7a	CEQA: No impact NEPA: No impact	Mitigation not required Mitigation not required	CEQA: No impact NEPA: No impact
	GEO-8a	CEQA: Less than significant impact NEPA: Less than significant impact	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Less than significant impact
	GEO-1b	CEQA: **Significant** and unavoidable impact NEPA**: Significant** and unavoidable impact	No mitigation measures are available to reduce below significance No mitigation measures are available to reduce below significance	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact
	GEO-2b	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact	**GEO-1** **GEO-1**	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact
	GEO-3b	CEQA: Less than significant impact NEPA: No impact	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: No impact

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

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Residual Impacts after Mitigation*
3.5 Geology (continued)				
Alternative 2 (continued)	**GEO-4b**	CEQA: Less than significant impact NEPA: No impact	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: No impact
	GEO-5b	CEQA: No impact NEPA: No impact	Mitigation not required Mitigation not required	CEQA: No impact NEPA: No impact
	GEO-6b	CEQA: No impact NEPA: No impact	Mitigation not required Mitigation not required	CEQA: No impact NEPA: No impact
	GEO-7b	CEQA: No impact NEPA: No impact	Mitigation not required Mitigation not required	CEQA: No impact NEPA: No impact
	GEO-8b	CEQA: Less than significant impact NEPA: Less than significant impact	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Less than significant impact
Alternative 3	**GEO-1a**	CEQA: **Significant** and unavoidable impact NEPA**: Significant** and unavoidable impact	No mitigation measures are available to reduce below significance No mitigation measures are available to reduce below significance	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact
	GEO-2a	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact	**GEO-1** **GEO-1**	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact
	GEO-3a	CEQA: Less than significant impact NEPA: No impact	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: No impact

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

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Residual Impacts after Mitigation*
3.5 Geology (continued)				
Alternative 3 (continued)	**GEO-4a**	CEQA: Less than significant impact NEPA: No impact	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: No impact
	GEO-5a	CEQA: No impact NEPA: No impact	Mitigation not required Mitigation not required	CEQA: No impact NEPA: No impact
	GEO-6a	CEQA: Less than significant impact NEPA: No impact	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: No impact
	GEO-7a	CEQA: No impact NEPA: No impact	Mitigation not required Mitigation not required	CEQA: No impact NEPA: No impact
	GEO-8a	CEQA: Less than significant impact NEPA: Less than significant impact	Mitigation not required Mitigation not required	CEQA: Less than significant NEPA: Less than significant impact
	GEO-1b	CEQA: **Significant** and unavoidable impact NEPA**: Significant** and unavoidable impact	No mitigation measures are available to reduce below significance No mitigation measures are available to reduce below significance	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact
	GEO-2b	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact	**GEO-1** **GEO-1**	CEQA: **Significant** and unavoidable impact NEPA: **Significant** and unavoidable impact
	GEO-3b	CEQA: Less than significant impact NEPA: No impact	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: No impact

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

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Residual Impacts after Mitigation*
3.5 Geology (continued)				
Alternative 3 (continued)	**GEO-4b**	CEQA: Less than significant impact	Mitigation not required	CEQA: Less than significant impact
		NEPA: No impact	Mitigation not required	NEPA: No impact
	GEO-5b	CEQA: No impact	Mitigation not required	CEQA: No impact
		NEPA: No impact	Mitigation not required	NEPA: No impact
	GEO-6b	CEQA: No impact	Mitigation not required	CEQA: No impact
		NEPA: No impact	Mitigation not required	NEPA: No impact
	GEO-7b	CEQA: No impact	Mitigation not required	CEQA: No impact
		NEPA: No impact	Mitigation not required	NEPA: No impact
	GEO-8b	CEQA: Less than significant impact	Mitigation not required	CEQA: Less than significant impact
		NEPA: Less than significant impact	Mitigation not required	NEPA: Less than significant impact
Alternative 4	**GEO-1a**	CEQA: **Significant** and unavoidable impact	No mitigation measures are available to reduce below significance	CEQA: **Significant** and unavoidable impact
		NEPA: Not applicable	Mitigation not required	NEPA: Not applicable
	GEO-2a	CEQA: **Significant** and unavoidable impact	**GEO-1**	CEQA: **Significant** and unavoidable impact
		NEPA: Not applicable	Mitigation not required	NEPA: Not applicable
	GEO-3a	CEQA: Less than significant impact	Mitigation not required	CEQA: Less than significant impact
		NEPA: Not applicable	Mitigation not required	NEPA: Not applicable
	GEO-4a	CEQA: Less than significant impact	Mitigation not required	CEQA: Less than significant impact
		NEPA: Not applicable	Mitigation not required	NEPA: Not applicable

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

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Residual Impacts after Mitigation*
3.5 Geology (continued)				
Alternative 4 (continued)	**GEO-5a**	CEQA: No impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: No impact NEPA: Not applicable
	GEO-6a	CEQA: Less than significant impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Not applicable
	GEO-7a	CEQA: No impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: No impact NEPA: Not applicable
	GEO-8a	CEQA: Less than significant impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Not applicable
	GEO-1b	CEQA: **Significant** and unavoidable impact NEPA: Not applicable	No mitigation measures are available to reduce below significance Mitigation not required	CEQA: **Significant** and unavoidable impact NEPA: Not applicable
	GEO-2b	CEQA: **Significant** and unavoidable impact NEPA: Not applicable	**GEO-1** Mitigation not required	CEQA: **Significant** and unavoidable impact NEPA: Not applicable
	GEO-3b	CEQA: Less than significant impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Not applicable
	GEO-4b	CEQA: Less than significant impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Not applicable
	GEO-5b	CEQA: No impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: No impact NEPA: Not applicable
	GEO-6b	CEQA No impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: No impact NEPA: Not applicable

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

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Residual Impacts after Mitigation*
3.5 Geology (continued)				
Alternative 4 (continued)	**GEO-7b**	CEQA: No impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: No impact NEPA: Not applicable
	GEO-8b	CEQA: Less than significant impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Not applicable
Alternative 5	**GEO-1a**	CEQA: **Significant** and unavoidable impact NEPA: Not applicable	No mitigation measures are available to reduce below significance Mitigation not required	CEQA: **Significant** and unavoidable impact NEPA: Not applicable
	GEO-2a	CEQA: **Significant** and unavoidable impact NEPA: Not applicable	**GEO-1** Mitigation not required	CEQA: **Significant** and unavoidable impact NEPA: Not applicable
	GEO-3a	CEQA: Less than significant impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Not applicable
	GEO-4a	CEQA: Less than significant impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Not applicable
	GEO-5a	CEQA: No impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: No impact NEPA: Not applicable
	GEO-6a	CEQA: Less than significant impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Not applicable
	GEO-7a	CEQA: No impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: No impact NEPA: Not applicable
	GEO-8a	CEQA: Less than significant impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Not applicable

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

Alternative	*Environmental Impacts**	*Impact Determination*	*Mitigation Measures*	*Residual Impacts after Mitigation*
3.5 Geology (continued)				
Alternative 5 (continued)	**GEO-1b**	CEQA: **Significant** and unavoidable impact NEPA: Not applicable	No mitigation measures are available to reduce below significance Mitigation not required	CEQA: **Significant** and unavoidable impact NEPA: Not applicable
	GEO-2b	CEQA: **Significant** and unavoidable impact NEPA: Not applicable	**GEO-1** Mitigation not required	CEQA: **Significant** and unavoidable impact NEPA: Not applicable
	GEO-3b	CEQA: Less than significant impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Not applicable
	GEO-4b	CEQA: Less than significant impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Not applicable
	GEO-5b	CEQA: No impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: No impact NEPA: Not applicable
	GEO-6b	CEQA No impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: No impact NEPA: Not applicable
	GEO-7b	CEQA: No impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: No impact NEPA: Not applicable
	GEO-8b	CEQA: Less than significant impact NEPA: Not applicable	Mitigation not required Mitigation not required	CEQA: Less than significant impact NEPA: Not applicable

* Unless otherwise noted, all impact descriptions for each of the Alternatives are the same as those described for the Proposed Project.

3.5.4.4 Mitigation Monitoring

In instances where the **GEO-1** Emergency Response Planning Mitigation Measure is necessary, the Terminal operator shall 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.

GEO-2: Construction on the proposed Project within the Port area would expose people and structures to substantial risk involving tsunamis or seiches	
Mitigation Measure	**GEO-1: Emergency Response Planning**. The Terminal operator shall 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 shall 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 shall 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 shall 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	Significant after mitigation.

3.5.5 Significant Unavoidable Adverse 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 and operation to seismic hazards from a major or great earthquake cannot be precluded, even with incorporation of modern construction engineering and safety standards. Emergency planning and coordination between the Terminal operator and the LAHD, as outlined in **Mitigation Measure GEO-1**, would contribute in reducing injuries to on-site personnel 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. Therefore, potential impacts due to seismically induced ground failure or in the event of a tsunami or seiche would remain significant for the proposed Project and its alternatives.

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