

3.5

GEOLOGY

1

2 **3.5.1 Introduction**

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

12 **3.5.2 Environmental Setting**

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

19 **3.5.2.1 Regional Setting**

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

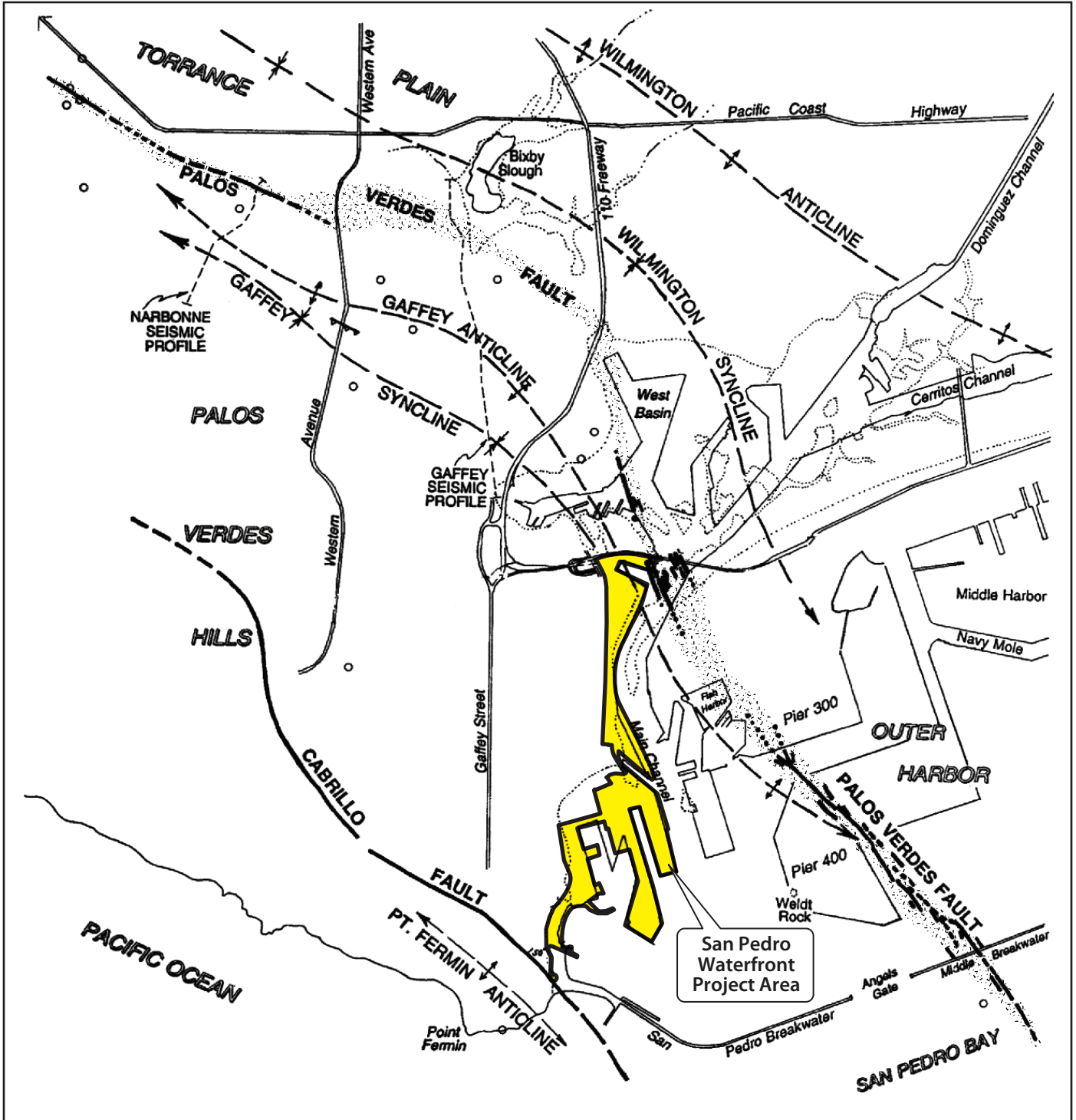
1 anticlines and the intervening Harbor-Wilmington syncline. The smaller Gaffey
2 anticline and syncline cross the northerly portion of the proposed project site and are
3 the result of deformation along the Palos Verdes Fault zone. The major faults in the
4 region that contribute to the seismic hazard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

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

24 **3.5.2.1.1 Seismicity and Major Faults**

25 An earthquake is classified by the magnitude of wave movement (related to the
26 amount of energy released), which traditionally has been quantified using the Richter
27 scale. This is a logarithmic scale, wherein each whole number increase in magnitude
28 represents a tenfold increase in the wave magnitude generated by an earthquake. A
29 magnitude 8.0 earthquake is not twice as large as a magnitude 4.0 earthquake; it is
30 10,000 times larger (i.e., 10^4 , or $10 \times 10 \times 10 \times 10$). Damage typically begins at
31 magnitude 5.0. One limitation of the Richter magnitude scale is that it has an upper
32 limit at which large earthquakes have about the same magnitude. As a result, the
33 moment magnitude scale, which does not have an upper limit magnitude, was
34 introduced in 1979, and is often used for earthquakes greater than magnitude 3.5.
35 Earthquakes of magnitude 6.0 to 6.9 are typically classified as moderate; those
36 between magnitude 7.0 and 7.9 are classified as major; and those of magnitude 8.0 or
37 greater are classified as great.

38 Southern California is recognized as one of the most seismically active areas in the
39 United States. The region has been subjected to at least 50 earthquakes of magnitude
40 6.0 or greater since 1796. Ground motion in the region is generally the result of
41 sudden movements of large blocks of the earth's crust along faults. Great
42 earthquakes, like the 1857 San Andreas Fault earthquake, are quite rare in southern
43 California. Earthquakes of magnitude 7.8 or greater occur at the rate of about two or
44 three per 1,000 years, corresponding to a 6 to 9 percent probability in 30 years.



EXPLANATION

	Fault		Shoreline from 1893-1894 Survey
	Anticline		Road
	Syncline		Oil Well
	Seismic Profile		N

SCALE IN FEET
0 5000

Source: Earth Mechanics, Inc. 2006.

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

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

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

<i>Fault Name</i>	<i>Place</i>	<i>Date</i>	<i>Moment Magnitude</i>
Palos Verdes		*	*
San Pedro Basin		*	*
Santa Monica-Raymond		*	*
San Andreas	Fort Tejon Kern County	1857 1952	7.9† 7.3
Newport-Inglewood	Long Beach	1933	6.4
San Fernando/Sierra Madre-Cucamonga	San Fernando Sierra Madre	1971 1991	6.6 5.6
Whittier-Elsinore	Whittier Narrows	1987	5.9
Camp Rock/Emerson	Landers	1992	7.3
Blind thrust fault beneath Northridge	Northridge	1994	6.7
Note: *No known earthquakes within the last 200 years. †Approximate magnitude Source: USGS 2007			

6
 7 Seismic analyses generally include discussions of maximum credible and maximum
 8 probable earthquakes. A maximum credible earthquake (MCE) is the largest event a
 9 fault is believed to be capable of generating. The probability of occurrence is not
 10 considered in this characterization. The maximum probable earthquake (MPE) is an
 11 earthquake having a 10 percent probability of being exceeded in 50 years, which
 12 corresponds to a return interval of approximately 475 years. In addition, LAHD uses
 13 a combination of probabilistic and deterministic seismic hazard assessment for
 14 seismic design. Probabilistic hazard assessments are required to define two-level
 15 design events, including the Operational Level Earthquake (OLE), which is the peak
 16 horizontal firm ground acceleration with a 50 percent probability of exceedance in 50
 17 years, and the Contingency Level Earthquake (CLE), which is the peak ground
 18 acceleration with a 10 percent probability of exceedance in 50 years.

19 **3.5.2.1.2 Faults**

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

1 suggests that segments of the fault may cross beneath Berths 94 and 95. Recent
 2 studies indicate that the Palos Verdes Fault zone is capable of producing an
 3 earthquake of moment magnitude 6.7 to 7.2, and peak ground accelerations in the
 4 Port area of 0.23g¹ and 0.52g for the OLE and CLE, respectively (Earth Mechanics,
 5 Inc. 2006).

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

14 **Table 3.5-2.** Major Regional Faults

<i>Fault</i>		<i>Maximum Moment Magnitude</i>	<i>Fault Type</i>	<i>Slip Rate (mm/yr)</i>	<i>Source Type</i>	<i>Approximate Distance from Site in Miles (kilometers)</i>
Palos Verdes		7.3	SS	3	B	0 (0)
Newport-Inglewood		7.1	SS	1	B	6.7 (10.8)
Whittier-Elsinore		6.8	SS	2.5	A	22.0 (35.5)
Malibu- Santa Monica- Raymond Fault Zone	Santa Monica	6.6	DS	1	B	27.7 (36.7)
	Hollywood	6.4	DS	1	B	24.2 (39.0)
	Malibu Coast	6.7	DS	0.3	B	24.3 (39.2)
	Raymond	6.5	DS	1.5	B	25.8 (41.6)
Cucamonga		6.9	DS	5	A	40.7 (65.6)
San Jacinto		6.7	SS	12	A	55.7 (89.9)
San Andreas		7.4	SS	30	A	53.7 (86.7)
Notes: DS – Dip Slip NT – Normal-Thrust RO – Reverse-Oblique SS – Strike Slip Source: CDMG 1998						

15
 16 Numerous active faults located off site are capable of generating earthquakes in the
 17 proposed project area (Tables 3.5-1 and 3.5-2). Most noteworthy, due to its
 18 proximity to the site, is the Newport-Inglewood Fault zone, which was the source of
 19 the 1933 Long Beach magnitude 6.4 earthquake. Large events could occur on more
 20 distant faults in the general area, but because of the greater distance from the site,

¹g=acceleration due to gravity.

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

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

9 **3.5.2.1.3 Liquefaction**

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

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

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

33 **3.5.2.1.4 Tsunamis**

34 Tsunamis are gravity waves of long wavelength generated by a sudden disturbance in
35 a body of water. Typically, oceanic tsunamis are the result of sudden vertical
36 movement along a fault rupture in the ocean floor, submarine landslides or
37 subsidence, or volcanic eruption, where the sudden displacement of water may set off
38 transoceanic waves with wavelengths of up to 125 miles (200 kilometers) and with
39 periods generally from 5 to 60 minutes. The trough of the tsunami wave arrives first

1 leading to the classic retreat of water from the shore as the ocean level drops. This is
2 followed by the arrival of the crest of the wave which can run up on the shore in the
3 form of bores or surges in shallow water or simple rising and lowering of the water
4 level in relatively deeper water such as in harbor areas.

5 Tsunamis are a relatively common natural hazard, although most of the events are
6 small in amplitude and not particularly damaging. However, in the event of a large
7 submarine earthquake or landslide, coastal flooding may be caused by either run-up
8 of broken tsunamis in the form of bores and surges or by relatively dynamic flood
9 waves. In the process of bore/surge-type run-up, the onshore flow (up to tens of feet
10 per second) can cause tremendous dynamic loads on the structures onshore in the
11 form of impact forces and drag forces, in addition to hydrostatic loading. The
12 subsequent drawdown of the water after run-up exerts the often crippling opposite
13 drags on the structures and washes loose/broken properties and debris to sea; the
14 floating debris brought back on the next onshore flow have been found to be a
15 significant cause of extensive damage after successive run-up and drawdown. As has
16 been shown historically, the potential loss of human life in the process can be great if
17 such events occur in populated areas.

18 Abrupt sea level changes associated with tsunamis in the past have reportedly caused
19 damage to moored vessels within the outer portions of the Los Angeles Harbor. The
20 Chilean earthquake of May 1960, for example, caused local damages of over \$1
21 million and harbor closure. One person drowned at Cabrillo Beach and one was
22 injured. Small craft moorings in the harbor area, especially in the Cerritos Channel,
23 where a seiche occurred, were seriously damaged. Hundreds of small boats broke
24 loose from their moorings, 40 sank, and about 200 were damaged. Gasoline from
25 damaged boats caused a major spill in the harbor waters and created a fire hazard.
26 Currents of up to 8 knots and a 6-foot (1.8-meter) rise of water in a few minutes were
27 observed in the West Basin. The maximum water level fluctuations recorded by
28 gauges were 5.0 feet (1.5 meters) at Port Berth 60 (near Pilot Station) and 5.8 feet
29 (1.8 meters) in Long Beach Harbor (National Geophysical Data Center 1993).

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

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

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

5 In addition, landslide-derived tsunamis are now perceived as a viable local tsunami
6 hazard. Such tsunamis can potentially be more dangerous, due to the lack of warning
7 for such an event. This mechanism is illustrated by an earthquake in 1998, centered
8 onshore Papua-New Guinea, which appears to have created an offshore landslide that
9 caused tsunami inundation heights in excess of 33 feet (10 meters), claiming more
10 than 2,500 lives. In a study modeling potential tsunami generation by local offshore
11 earthquakes, Legg et al. (2004) consider the relative risk of tsunamis from a large
12 catastrophic submarine landslide (likely generated by a seismic event) in offshore
13 southern California versus fault-generated tsunamis. The occurrence of a large
14 submarine landslide appears quite rare by comparison with the tectonic faulting
15 events. Although many submarine landslides have been mapped off the southern
16 California shore, few appear to be of the scale necessary to generate a catastrophic
17 tsunami. Of two large landslides that appear to be of this magnitude, Legg et al.
18 (2004) indicated that one landslide is over 100,000 years old, and the other landslide
19 is approximately 7,500 years old. In contrast, the recurrence of 3-to-20-foot (1-to-6-
20 meter) fault movements on offshore faults would be several hundred to several
21 thousand years. Consequently, the study concludes that the most likely direct cause
22 of most of the local tsunamis in southern California is tectonic movement during
23 large offshore earthquakes.

24 Based on these recent studies (e.g., Synolakis et al. 1997; Borrero et al. 2001), the
25 California State Lands Commission (CSLC) has developed tsunami run-up
26 projections for the Ports of Los Angeles and Long Beach of 8.0 feet (2.4 meters) and
27 15.0 feet (4.6 meters) above mean sea level (MSL), at 100- and 500-year intervals,
28 respectively, as a part of its Marine Oil Terminal Engineering and Maintenance
29 Standards (MOTEMS) (CSLC 2005). However, these projections do not incorporate
30 consideration of the localized landfill configurations, bathymetric features, and the
31 interaction of the diffraction, reflection, and refraction of the tsunami wave
32 propagation within the Los Angeles/Long Beach Port Complex in its predictions of
33 tsunami wave heights.

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

1 (7.0 meters) above MSL for the landslide scenario. The highest anticipated water
2 levels from the landslide scenario would occur in the Outer Harbor area. The model
3 results suggest that tsunami-induced flooding could occur in the proposed project
4 area under both the earthquake and landslide scenarios, particularly in the area of the
5 West Channel where deck elevations are the lowest. Additionally, the modeled
6 landslide scenario could result in localized overtopping of the existing deck in the
7 proposed project area.

8 The modeled worst-case tsunami scenario was based partially on a moment
9 magnitude 7.6 earthquake on the offshore Catalina Fault. The recurrence interval for
10 a magnitude 7.5 earthquake along an offshore fault in southern California is about
11 10,000 years. Similarly, the recurrence interval of a magnitude 7.0 earthquake is
12 about 5,000 years and the recurrence interval of a magnitude 6.0 earthquake is about
13 500 years. However, there is no certainty that any of these earthquake events would
14 result in a tsunami, since only about 10 percent of earthquakes worldwide result in a
15 tsunami. In addition, available evidence indicates that tsunamigenic landslides would
16 be extremely infrequent and occur less often than large earthquakes. This suggests
17 recurrence intervals for such landslide events would be longer than the 10,000-year
18 recurrence interval estimated for a magnitude 7.5 earthquake (Moffatt and Nichol
19 2007).

20 **3.5.2.1.5 Seiches**

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

30 **3.5.2.1.6 Subsidence**

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

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

1 Harbor. By 1962, subsidence had spread over a wide area and reached approximately
2 26 feet in the area of Terminal Island (Parks 1999). Today, water injection continues
3 to be maintained at rates greater than the total volume of produced substances, including
4 oil, gas, and water, to prevent further reservoir compaction and subsidence (City of Long
5 Beach 2006). Subsidence near the proposed Project, due to previous oil extraction in
6 the Port area, has been mitigated and is not anticipated to affect adversely the proposed
7 Project.

8 **3.5.2.1.7 Landslides**

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

25 **3.5.2.1.8 Expansive Soils**

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

31 **3.5.2.1.9 Mineral Resources**

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

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

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

9 **3.5.3 Applicable Regulations**

10 **3.5.3.1 Geologic Hazards**

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

24 The MOTEMS were approved by the California Building Standards Commission on
25 January 19, 2005 and are codified as part of CCR, Title 24, Part 2, Marine Oil
26 Terminals, Chapter 31F. These standards apply to all existing marine oil terminals in
27 California and include criteria for inspection, structural analysis and design, mooring
28 and berthing, geotechnical considerations, fire, piping, and mechanical and electrical
29 systems. MOTEMS became effective on January 6, 2006 (CSLC 2005). The process
30 of developing the MOTEMS has produced parallel guidelines and recommended
31 provisions. The Seismic Design Guidelines for Port Structures, published in 2001 by
32 the Port International Navigation Association (PIANC) uses text virtually identical to
33 that found in the MOTEMS. The language for the PIANC and the MOTEMS is
34 derived from the Naval Facilities Engineering Service Center Technical Report (TR-
35 2103-SHR), Seismic Criteria for California Marine Oil Terminals (CSLC 2004).

36 **3.5.3.2 Mineral Resources**

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

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

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

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

31 **3.5.4 Impacts and Mitigation Measures**

32 **3.5.4.1 Methodology**

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

3.5.4.2 Thresholds of Significance

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

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

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

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

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

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

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

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

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

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

3.5.4.3 Impacts and Mitigation Measures

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

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

3.5.4.3.1 Proposed Project

Construction Impacts

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

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

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

12 **CEQA Impact Determination**

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

26 Mitigation Measures

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

29 Residual Impacts

30 Impacts would be significant and unavoidable.

31 **NEPA Impact Determination**

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

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

4 Mitigation Measures

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

7 Residual Impacts

8 Impacts would be significant and unavoidable.

9 **Impact GEO-2a: Construction of the proposed Project would** 10 **result in substantial damage to structures or infrastructure,** 11 **or expose people to substantial risk involving tsunamis or** 12 **seiches.**

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

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

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

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

9 The Los Angeles/Long Beach Port Complex study identified the lowest deck
10 elevations throughout the Port using various sources of data. The deck elevations
11 that are the lowest within the proposed project area are those surrounding the West
12 Channel and in the Cabrillo Marina. These elevations are based on an aerial survey
13 performed in February 1999 and information from the LAHD. The lowest deck
14 elevation in the area immediately surrounding the West Channel is approximately 4.9
15 feet (1.5 meters) above MSL. The adjacent buildings within the West Channel area
16 are set back from the waterfront and are at a slightly higher elevation of
17 approximately 7.2 feet (2.19 meters) above MSL. The lowest deck elevations within
18 the East Channel and Main Channel are approximately 11.2 feet (3.41 meters) and
19 12.2 feet (3.71 meters) above MSL, respectively.

20 The Los Angeles/Long Beach Port Complex model indicates that a reasonable
21 maximum source for future tsunami events at the proposed project site would either
22 be a moment magnitude 7.6 earthquake on the Catalina Fault or a submerged
23 landslide along the nearby Palos Verdes Peninsula. The model predicts maximum
24 tsunami wave heights in the Port area of approximately 5.2 feet (1.6 meters) to 6.6
25 feet (2.0 meters) above MSL for the earthquake scenario and approximately 7.2 feet
26 (2.2 meters) to 23.0 feet (7.0 meters) above MSL for the landslide scenario. The
27 highest anticipated water levels from the landslide scenario would occur in the Outer
28 Harbor area. Based on the lowest deck elevations presented above, tsunami-induced
29 flooding could occur in the proposed project area under both the earthquake and
30 landslide scenarios, particularly in the area of the West Channel where deck
31 elevations are the lowest. Additionally, the modeled landslide scenario could result
32 in localized overtopping of the existing deck in the proposed project area.

33 The modeled worst-case tsunami scenario was based partially on a magnitude 7.6
34 earthquake on the offshore Catalina Fault. The recurrence interval for a magnitude
35 7.5 earthquake along an offshore fault in southern California is about 10,000 years.
36 Similarly, the recurrence interval of a magnitude 7.0 earthquake is about 5,000 years
37 and the recurrence interval of a magnitude 6.0 earthquake is about 500 years.
38 However, there is no certainty that any of these earthquake events would result in a
39 tsunami, since only about 10 percent of earthquakes worldwide result in a tsunami.
40 In addition, available evidence indicates that tsunamigenic landslides would be
41 extremely infrequent and occur less often than large earthquakes. This suggests
42 recurrence intervals for such landslide events would be longer than the 10,000-year
43 recurrence interval estimated for a magnitude 7.5 earthquake (Moffatt and Nichol
44 2007).

CEQA Impact Determination

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

Mitigation Measures

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

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

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

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

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

12 Mitigation Measures

13 Implement Mitigation Measure MM GEO-1.

14 Residual Impacts

15 Impacts would be significant and unavoidable.

16 **Impact GEO-3a: Construction of the proposed Project would** 17 **not result in substantial damage to structures or** 18 **infrastructure, or expose people to substantial risk of injury** 19 **from land subsidence/settlement.**

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

27 The settlement potential of existing onshore soils would be evaluated through a site-
28 specific geotechnical investigation, which includes subsurface soil sampling,
29 laboratory analysis of samples collected to determine soil compressibility, and an
30 evaluation of the laboratory testing results by a geotechnical engineer.
31 Recommendations of the engineer would be incorporated into the design specifications
32 for the proposed Project, consistent with City design guidelines, including Sections
33 91.000 through 91.7016 of the Los Angeles Municipal Code, in conjunction with
34 criteria established by LAHD. Recommendations for soils subject to settlement
35 typically include over excavation and recompaction of compressible soils, which
36 would allow for construction of a conventional slab-on-grade; or alternatively,
37 installation of concrete or steel foundation piles through the settlement prone soils to
38 a depth of competent soils. Such geotechnical engineering would substantially
39 reduce the potential for soil settlement and would allow for construction of the
40 proposed Project that would not result in substantial damage to structures or
41 infrastructure, or expose people to substantial risk of injury.

1 **CEQA Impact Determination**

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

8 Mitigation Measures

9 No mitigation is required.

10 Residual Impacts

11 Impacts would be less than significant.

12 **NEPA Impact Determination**

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

22 Mitigation Measures

23 No mitigation is required.

24 Residual Impacts

25 Impacts would be less than significant.

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

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

1 a site-specific geotechnical investigation, which includes subsurface soil sampling,
2 laboratory analysis of samples collected to determine soil expansion potential, and an
3 evaluation of the laboratory testing results by a geotechnical engineer.

4 Recommendations of the engineer would be incorporated into the design
5 specifications for the proposed Project, consistent with City design guidelines,
6 including Sections 91.000 through 91.7016 of the Los Angeles Municipal Code, in
7 conjunction with criteria established by LAHD. Recommendations for soils subject
8 to expansion typically include over excavation and replacement of expansive soils
9 with sandy, non-expansive soils, which would allow for construction of a
10 conventional slab-on-grade; construction of post-tensioned concrete slabs, which can
11 accommodate movement of underlying expansive soils; or alternatively, installation
12 of concrete or steel foundation piles through the expansion prone soils, to a depth of
13 non-expansive soils. Such geotechnical engineering would substantially reduce the
14 potential for soil expansion and damage to overlying structures.

15 **CEQA Impact Determination**

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

23 Mitigation Measures

24 No mitigation is required.

25 Residual Impacts

26 Impacts would be less than significant.

27 **NEPA Impact Determination**

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

1 Mitigation Measures

2 No mitigation is required.

3 Residual Impacts

4 Impacts would be less than significant.

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

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

24 **CEQA Impact Determination**

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

27 Mitigation Measures

28 No mitigation is required.

29 Residual Impacts

30 No impacts would occur.

31 **NEPA Impact Determination**

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

1 Mitigation Measures

2 No mitigation is required.

3 Residual Impacts

4 No impacts would occur.

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

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

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

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

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

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

5 **CEQA Impact Determination**

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

10 Mitigation Measures

11 No mitigation is required.

12 Residual Impacts

13 Impacts would be less than significant.

14 **NEPA Impact Determination**

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

23 Mitigation Measures

24 No mitigation is required.

25 Residual Impacts

26 Impacts would be less than significant.

27 **Impact GEO-7a: Construction of the proposed Project would** 28 **not result in one or more distinct and prominent geologic or** 29 **topographic features being destroyed, permanently covered,** 30 **or materially and adversely modified.**

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

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

3 **CEQA Impact Determination**

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

7 Mitigation Measures

8 No mitigation is required.

9 Residual Impacts

10 No impacts would occur.

11 **NEPA Impact Determination**

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

13 Mitigation Measures

14 No mitigation is required.

15 Residual Impacts

16 No impacts would occur.

17 **Impact GEO-8a: Construction of the proposed Project would** 18 **not result in the permanent loss of availability of any mineral** 19 **resource of regional, statewide, or local significance.**

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

1 **CEQA Impact Determination**

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

5 Mitigation Measures

6 No mitigation is required.

7 Residual Impacts

8 Impacts would be less than significant.

9 **NEPA Impact Determination**

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

12 Mitigation Measures

13 No mitigation is required.

14 Residual Impacts

15 Impacts would be less than significant.

16 **Operations Impacts**

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

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

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

8 **CEQA Impact Determination**

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

22 Mitigation Measures

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

25 Residual Impacts

26 Impacts would be significant and unavoidable.

27 **NEPA Impact Determination**

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

33 Mitigation Measures

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

36 Residual Impacts

37 Impacts would be significant and unavoidable.

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

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

14 For onsite personnel, the risk of tsunami or seiches is a part of any ocean-shore
15 interface and hence personnel working at the proposed project berths cannot avoid
16 some risk of exposure. Similarly, berth infrastructure would be subject to some risk
17 of exposure. Although initial tsunami-induced run-up would potentially cause
18 substantial injury and damage to infrastructure, the drawdown of the water after run-
19 up exerts the often crippling opposite drags on the persons and structures and washes
20 loose/broken properties and debris to sea. The floating debris brought back on the
21 next onshore flow has been found to be a significant cause of extensive damage after
22 successive run-up and drawdown. Similarly, for cruise ships and other water vessels,
23 the risk of tsunami or seiches is a part of any ocean-shore interface and hence vessels
24 in transit or at berth cannot avoid some risk of exposure. A vessel destined for the
25 proposed project berths (or any berth in the Port for that matter) would be under its
26 own power. Under this circumstance, the vessel would likely be able to maneuver to
27 avoid damage. The exposure of a tsunami or seiche to a vessel in transit to or from
28 the proposed project berth, and the associated risk, is no different than for any other
29 vessel entering the Los Angeles/Long Beach Port Complex.

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

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

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

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

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

17 **CEQA Impact Determination**

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

37 **Mitigation Measures**

38 Implement Mitigation Measure MM GEO-1.

39 **Residual Impacts**

40 Impacts would be significant and unavoidable.

NEPA Impact Determination

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

Mitigation Measures

Implement Mitigation Measure MM GEO-1.

Residual Impacts

Impacts would be significant and unavoidable.

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

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

CEQA Impact Determination

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

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

3 Mitigation Measures

4 No mitigation is required.

5 Residual Impacts

6 Impacts would be less than significant.

7 **NEPA Impact Determination**

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

16 Mitigation Measures

17 No mitigation is required.

18 Residual Impacts

19 Impacts would be less than significant.

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

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

32 **CEQA Impact Determination**

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

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

5 Mitigation Measures

6 No mitigation is required.

7 Residual Impacts

8 Impacts would be less than significant.

9 **NEPA Impact Determination**

10 The federal portions of the proposed Project would include wharf and in-water
11 construction activities, including water cuts for three new harbors, new pier and
12 wharf construction, and upgrading existing wharves, as well as two new cruise
13 terminals and berths in the Outer Harbor. Expansive soil impacts in the waterfront
14 area would be less than significant under NEPA, as the proposed Project would be
15 designed and constructed in compliance with the recommendations of the
16 geotechnical engineer, consistent with implementation of Sections 91.000 through
17 91.7016 of the Los Angeles Municipal Code, and in conjunction with criteria
18 established by LAHD, and would not result in substantial damage to structures or
19 infrastructure, or expose people to substantial risk of injury.

20 Mitigation Measures

21 No mitigation is required.

22 Residual Impacts

23 Impacts would be less than significant.

24 **Impact GEO-5b: Operation of the proposed Project would** 25 **not result in substantial damage to structures or** 26 **infrastructure, or expose people or property to a substantial** 27 **risk of landslides or mudslides.**

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

30 **CEQA Impact Determination**

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

1 Mitigation Measures

2 No mitigation is required.

3 Residual Impacts

4 No impacts would occur.

5 **NEPA Impact Determination**

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

7 Mitigation Measures

8 No mitigation is required.

9 Residual Impacts

10 No impacts would occur.

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

16 **CEQA Impact Determination**

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

19 Mitigation Measures

20 No mitigation is required.

21 Residual Impacts

22 No impacts would occur.

23 **NEPA Impact Determination**

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

1 Mitigation Measures

2 No mitigation is required.

3 Residual Impacts

4 No impacts would occur.

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

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

13 **CEQA Impact Determination**

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

17 Mitigation Measures

18 No mitigation is required.

19 Residual Impacts

20 No impacts would occur.

21 **NEPA Impact Determination**

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

23 Mitigation Measures

24 No mitigation is required.

25 Residual Impacts

26 No impacts would occur.

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

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

5 **CEQA Impact Determination**

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

10 Mitigation Measures

11 No mitigation is required.

12 Residual Impacts

13 Impacts would be less than significant.

14 **NEPA Impact Determination**

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

17 Mitigation Measures

18 No mitigation is required.

19 Residual Impacts

20 Impacts would be less than significant.

3.5.4.3.2 Alternative 1—Alternative Development Scenario 1

Construction Impacts

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

CEQA Impact Determination

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

Mitigation Measures

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

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

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

1 Mitigation Measures

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

4 Residual Impacts

5 Impacts would be significant and unavoidable.

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

9 **CEQA Impact Determination**

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

19 Mitigation Measures

20 Implement Mitigation Measure MM GEO-1.

21 Residual Impacts

22 Impacts would be significant and unavoidable.

23 **NEPA Impact Determination**

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

1 Mitigation Measures

2 Implement Mitigation Measure MM GEO-1.

3 Residual Impacts

4 Impacts would be significant and unavoidable.

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

9 **CEQA Impact Determination**

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

18 Mitigation Measures

19 No mitigation is required.

20 Residual Impacts

21 Impacts would be less than significant.

22 **NEPA Impact Determination**

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

33 Mitigation Measures

34 No mitigation is required.

1 Residual Impacts

2 Impacts would be less than significant.

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

7 **CEQA Impact Determination**

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

17 Mitigation Measures

18 No mitigation is required.

19 Residual Impacts

20 Impacts would be less than significant.

21 **NEPA Impact Determination**

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

32 Mitigation Measures

33 No mitigation is required

1 Residual Impacts

2 Impacts would be less than significant.

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

7 **CEQA Impact Determination**

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

11 Mitigation Measures

12 No mitigation is required

13 Residual Impacts

14 No impacts would occur.

15 **NEPA Impact Determination**

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

17 Mitigation Measures

18 No mitigation is required.

19 Residual Impacts

20 No impacts would occur.

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

25 **CEQA Impact Determination**

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

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

5 Mitigation Measures

6 No mitigation is required.

7 Residual Impacts

8 Impacts would be less than significant.

9 **NEPA Impact Determination**

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

19 Mitigation Measures

20 No mitigation is required.

21 Residual Impacts

22 Impacts would be less than significant.

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

27 **CEQA Impact Determination**

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

31 Mitigation Measures

32 No mitigation is required

1 Residual Impacts

2 No impacts would occur.

3 **NEPA Impact Determination**

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

5 Mitigation Measures

6 No mitigation is required.

7 Residual Impacts

8 No impacts would occur.

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

12 **CEQA Impact Determination**

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

17 Mitigation Measures

18 No mitigation is required.

19 Residual Impacts

20 Impacts would be less than significant.

21 **NEPA Impact Determination**

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

24 Mitigation Measures

25 No mitigation is required.

26 Residual Impacts

27 Impacts would be less than significant.

1 **Operations Impacts**

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

7 **CEQA Impact Determination**

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

17 Mitigation Measures

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

20 Residual Impacts

21 Impacts would be significant and unavoidable.

22 **NEPA Impact Determination**

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

33 Mitigation Measures

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

1 Residual Impacts

2 Impacts would be significant and unavoidable.

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

6 **CEQA Impact Determination**

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

16 Mitigation Measures

17 Implement Mitigation Measure MM GEO-1.

18 Residual Impacts

19 Impacts would be significant and unavoidable.

20 **NEPA Impact Determination**

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

30 Mitigation Measures

31 Implement Mitigation Measure MM GEO-1.

32 Residual Impacts

33 Impacts would be significant and unavoidable.

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

5 **CEQA Impact Determination**

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

15 Mitigation Measures

16 No mitigation is required.

17 Residual Impacts

18 Impacts would be less than significant.

19 **NEPA Impact Determination**

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

30 Mitigation Measures

31 No mitigation is required.

32 Residual Impacts

33 Impacts would be less than significant.

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

5 **CEQA Impact Determination**

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

15 Mitigation Measures

16 No mitigation is required.

17 Residual Impacts

18 Impacts would be less than significant.

19 **NEPA Impact Determination**

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

29 Mitigation Measures

30 No mitigation is required.

31 Residual Impacts

32 Impacts would be less than significant.

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

5 **CEQA Impact Determination**

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

9 Mitigation Measures

10 No mitigation is required.

11 Residual Impacts

12 No impacts would occur.

13 **NEPA Impact Determination**

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

15 Mitigation Measures

16 No mitigation is required.

17 Residual Impacts

18 No impacts would occur.

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

23 **CEQA Impact Determination**

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

27 Mitigation Measures

28 No mitigation is required

1 Residual Impacts

2 No impacts would occur.

3 **NEPA Impact Determination**

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

5 Mitigation Measures

6 No mitigation is required.

7 Residual Impacts

8 No impacts would occur.

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

13 **CEQA Impact Determination**

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

17 Mitigation Measures

18 No mitigation is required.

19 Residual Impacts

20 No impacts would occur.

21 **NEPA Impact Determination**

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

23 Mitigation Measures

24 No mitigation is required.

25 Residual Impacts

26 No impacts would occur.

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

4 **CEQA Impact Determination**

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

9 Mitigation Measures

10 No mitigation is required.

11 Residual Impacts

12 Impacts would be less than significant.

13 **NEPA Impact Determination**

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

16 Mitigation Measures

17 No mitigation is required.

18 Residual Impacts

19 Impacts would be less than significant.

20 **3.5.4.3.3 Alternative 2—Alternative Development Scenario 2**

21 **Construction Impacts**

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

27 **CEQA Impact Determination**

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

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

10 Mitigation Measures

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

13 Residual Impacts

14 Impacts would be significant and unavoidable.

15 **NEPA Impact Determination**

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

29 Mitigation Measures

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

32 Residual Impacts

33 Impacts would be significant and unavoidable.

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

5 **CEQA Impact Determination**

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

16 Mitigation Measures

17 Implement Mitigation Measure MM GEO-1.

18 Residual Impacts

19 Impacts would be significant and unavoidable.

20 **NEPA Impact Determination**

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

32 Mitigation Measures

33 Implement Mitigation Measure MM GEO-1.

34 Residual Impacts

35 Impacts would be significant and unavoidable.

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

5 **CEQA Impact Determination**

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

16 Mitigation Measures

17 No mitigation is required.

18 Residual Impacts

19 Impacts would be less than significant.

20 **NEPA Impact Determination**

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

32 Mitigation Measures

33 No mitigation is required.

34 Residual Impacts

35 Impacts would be less than significant.

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

5 **CEQA Impact Determination**

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

16 Mitigation Measures

17 No mitigation is required.

18 Residual Impacts

19 Impacts would be less than significant.

20 **NEPA Impact Determination**

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

32 Mitigation Measures

33 No mitigation is required.

34 Residual Impacts

35 Impacts would be less than significant.

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

5 **CEQA Impact Determination**

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

9 Mitigation Measures

10 No mitigation is required.

11 Residual Impacts

12 No impacts would occur.

13 **NEPA Impact Determination**

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

15 Mitigation Measures

16 No mitigation is required.

17 Residual Impacts

18 No impacts would occur.

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

23 **CEQA Impact Determination**

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

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

3 Mitigation Measures

4 No mitigation is required.

5 Residual Impacts

6 Impacts would be less than significant.

7 **NEPA Impact Determination**

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

18 Mitigation Measures

19 No mitigation is required.

20 Residual Impacts

21 Impacts would be less than significant.

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

26 **CEQA Impact Determination**

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

30 Mitigation Measures

31 No mitigation is required.

1 Residual Impacts

2 No impacts would occur.

3 **NEPA Impact Determination**

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

5 Mitigation Measures

6 No mitigation is required.

7 Residual Impacts

8 No impacts would occur.

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

12 **CEQA Impact Determination**

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

17 Mitigation Measures

18 No mitigation is required.

19 Residual Impacts

20 Impacts would be less than significant.

21 **NEPA Impact Determination**

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

24 Mitigation Measures

25 No mitigation is required

26 Residual Impacts

27 Impacts would be less than significant.

1 **Operations Impacts**

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

7 **CEQA Impact Determination**

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

18 Mitigation Measures

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

21 Residual Impacts

22 Impacts would be significant and unavoidable.

23 **NEPA Impact Determination**

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

1 Mitigation Measures

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

4 Residual Impacts

5 Impacts would be significant and unavoidable.

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

9 **CEQA Impact Determination**

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

20 Mitigation Measures

21 Implement Mitigation Measure MM GEO-1.

22 Residual Impacts

23 Impacts would be significant and unavoidable.

24 **NEPA Impact Determination**

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

1 Mitigation Measures

2 Implement Mitigation Measure MM GEO-1.

3 Residual Impacts

4 Impacts would be significant and unavoidable.

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

9 **CEQA Impact Determination**

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

20 Mitigation Measures

21 No mitigation is required.

22 Residual Impacts

23 Impacts would be less than significant.

24 **NEPA Impact Determination**

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

1 Mitigation Measures

2 No mitigation is required.

3 Residual Impacts

4 Impacts would be less than significant.

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

9 **CEQA Impact Determination**

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

19 Mitigation Measures

20 No mitigation is required.

21 Residual Impacts

22 Impacts would be less than significant.

23 **NEPA Impact Determination**

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

1 Mitigation Measures

2 No mitigation is required.

3 Residual Impacts

4 Impacts would be less than significant.

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

9 **CEQA Impact Determination**

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

13 Mitigation Measures

14 No mitigation is required.

15 Residual Impacts

16 No impacts would occur.

17 **NEPA Impact Determination**

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

19 Mitigation Measures

20 No mitigation is required.

21 Residual Impacts

22 No impacts would occur.

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

5 **CEQA Impact Determination**

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

9 Mitigation Measures

10 No mitigation is required.

11 Residual Impacts

12 Impacts would not occur.

13 **NEPA Impact Determination**

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

15 Mitigation Measures

16 No mitigation is required.

17 Residual Impacts

18 No impacts would occur.

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

23 **CEQA Impact Determination**

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

27 Mitigation Measures

28 No mitigation is required.

1 Residual Impacts

2 No impacts would occur.

3 **NEPA Impact Determination**

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

5 Mitigation Measures

6 No mitigation is required.

7 Residual Impacts

8 No impacts would occur.

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

12 **CEQA Impact Determination**

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

17 Mitigation Measures

18 No mitigation is required.

19 Residual Impacts

20 Impacts would be less than significant.

21 **NEPA Impact Determination**

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

24 Mitigation Measures

25 No mitigation is required.

26 Residual Impacts

27 Impacts would be less than significant.

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

Construction Impacts

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

CEQA Impact Determination

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

Mitigation Measures

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

Residual Impacts

Impacts would be significant and unavoidable.

NEPA Impact Determination

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

1 Mitigation Measures

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

4 Residual Impacts

5 Impacts would be significant and unavoidable.

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

10 **CEQA Impact Determination**

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

21 Mitigation Measures

22 Implement Mitigation Measure MM GEO-1.

23 Residual Impacts

24 Impacts would be significant and unavoidable.

25 **NEPA Impact Determination**

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

1 Mitigation Measures

2 Implement Mitigation Measure MM GEO-1.

3 Residual Impacts

4 Impacts would be significant and unavoidable.

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

9 **CEQA Impact Determination**

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

20 Mitigation Measures

21 No mitigation is required.

22 Residual Impacts

23 Impacts would be less than significant.

24 **NEPA Impact Determination**

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

32 Mitigation Measures

33 No mitigation is required.

1 Residual Impacts

2 Impacts would be less than significant.

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

7 **CEQA Impact Determination**

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

18 Mitigation Measures

19 No mitigation is required

20 Residual Impacts

21 Impacts would be less than significant.

22 **NEPA Impact Determination**

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

29 Mitigation Measures

30 No mitigation is required.

31 Residual Impacts

32 Impacts would be less than significant.

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

5 **CEQA Impact Determination**

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

9 Mitigation Measures

10 No mitigation is required

11 Residual Impacts

12 No impacts would occur.

13 **NEPA Impact Determination**

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

15 Mitigation Measures

16 No mitigation is required.

17 Residual Impacts

18 No impacts would occur.

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

23 **CEQA Impact Determination**

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

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

3 Mitigation Measures

4 No mitigation is required.

5 Residual Impacts

6 Impacts would be less than significant.

7 **NEPA Impact Determination**

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

14 Mitigation Measures

15 No mitigation is required.

16 Residual Impacts

17 Impacts would be less than significant.

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

22 **CEQA Impact Determination**

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

26 Mitigation Measures

27 No mitigation is required.

28 Residual Impacts

29 No impacts would occur.

1 **NEPA Impact Determination**

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

3 Mitigation Measures

4 No mitigation is required.

5 Residual Impacts

6 No impacts would occur.

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

10 **CEQA Impact Determination**

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

15 Mitigation Measures

16 No mitigation is required.

17 Residual Impacts

18 Impacts would be less than significant.

19 **NEPA Impact Determination**

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

22 Mitigation Measures

23 No mitigation is required.

24 Residual Impacts

25 Impacts would be less than significant.

1 **Operations Impacts**

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

7 **CEQA Impact Determination**

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

18 Mitigation Measures

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

21 Residual Impacts

22 Impacts would be significant and unavoidable.

23 **NEPA Impact Determination**

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

33 Mitigation Measures

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

1 Residual Impacts

2 Impacts would be significant and unavoidable.

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

6 **CEQA Impact Determination**

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

17 Mitigation Measures

18 Implement Mitigation Measure MM GEO-1.

19 Residual Impacts

20 Impacts would be significant and unavoidable.

21 **NEPA Impact Determination**

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

28 Mitigation Measures

29 Implement Mitigation Measure MM GEO-1.

30 Residual Impacts

31 Impacts would be significant and unavoidable.

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

5 **CEQA Impact Determination**

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

16 Mitigation Measures

17 No mitigation is required.

18 Residual Impacts

19 Impacts would be less than significant.

20 **NEPA Impact Determination**

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

28 Mitigation Measures

29 No mitigation is required.

30 Residual Impacts

31 Impacts would be less than significant.

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

5 **CEQA Impact Determination**

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

16 Mitigation Measures

17 No mitigation is required.

18 Residual Impacts

19 Impacts would be less than significant.

20 **NEPA Impact Determination**

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

27 Mitigation Measures

28 No mitigation is required.

29 Residual Impacts

30 Impacts would be less than significant.

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

5 **CEQA Impact Determination**

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

9 Mitigation Measures

10 No mitigation is required.

11 Residual Impacts

12 No impacts would occur.

13 **NEPA Impact Determination**

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

15 Mitigation Measures

16 No mitigation is required.

17 Residual Impacts

18 No impacts would occur.

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

23 **CEQA Impact Determination**

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

27 Mitigation Measures

28 No mitigation is required.

1 Residual Impacts

2 No impacts would occur.

3 **NEPA Impact Determination**

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

5 Mitigation Measures

6 No mitigation is required.

7 Residual Impacts

8 No impacts would occur.

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

13 **CEQA Impact Determination**

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

17 Mitigation Measures

18 No mitigation is required.

19 Residual Impacts

20 No impacts would occur.

21 **NEPA Impact Determination**

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

23 Mitigation Measures

24 No mitigation is required.

25 Residual Impacts

26 No impacts would occur.

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

4 **CEQA Impact Determination**

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

9 Mitigation Measures

10 No mitigation is required.

11 Residual Impacts

12 Impacts would be less than significant.

13 **NEPA Impact Determination**

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

15 Mitigation Measures

16 No mitigation is required.

17 Residual Impacts

18 Impacts would be less than significant.

19 **3.5.4.3.5 Alternative 4—Alternative Development Scenario 4**

20 **Construction Impacts**

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

26 **CEQA Impact Determination**

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

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

7 Mitigation Measures

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

10 Residual Impacts

11 Impacts would be significant and unavoidable.

12 **NEPA Impact Determination**

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

23 Mitigation Measures

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

26 Residual Impacts

27 Impacts would be significant and unavoidable.

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

32 **CEQA Impact Determination**

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

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

7 Mitigation Measures

8 Implement Mitigation Measure MM GEO-1.

9 Residual Impacts

10 Impacts would be significant and unavoidable.

11 **NEPA Impact Determination**

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

20 Mitigation Measures

21 Implement Mitigation Measure MM GEO-1.

22 Residual Impacts

23 Impacts would be significant and unavoidable.

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

28 **CEQA Impact Determination**

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

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

5 Mitigation Measures

6 No mitigation is required.

7 Residual Impacts

8 Impacts would be less than significant

9 **NEPA Impact Determination**

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

21 Mitigation Measures

22 No mitigation is required.

23 Residual Impacts

24 Impacts would be less than significant.

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

29 **CEQA Impact Determination**

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

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

5 Mitigation Measures

6 No mitigation is required.

7 Residual Impacts

8 Impacts would be less than significant

9 **NEPA Impact Determination**

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

21 Mitigation Measures

22 No mitigation is required.

23 Residual Impacts

24 Impacts would be less than significant.

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

29 **CEQA Impact Determination**

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

1 Mitigation Measures

2 No mitigation is required.

3 Residual Impacts

4 No impacts would occur.

5 **NEPA Impact Determination**

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

7 Mitigation Measures

8 No mitigation is required.

9 Residual Impacts

10 No impacts would occur.

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

15 **CEQA Impact Determination**

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

27 Mitigation Measures

28 No mitigation is required.

29 Residual Impacts

30 Impacts would be less than significant.

1 **NEPA Impact Determination**

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

11 Mitigation Measures

12 No mitigation is required

13 Residual Impacts

14 Impacts would be less than significant.

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

19 **CEQA Impact Determination**

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

23 Mitigation Measures

24 No mitigation is required.

25 Residual Impacts

26 No impacts would occur.

27 **NEPA Impact Determination**

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

29 Mitigation Measures

30 No mitigation is required.

1 Residual Impacts

2 No impacts would occur.

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

6 **CEQA Impact Determination**

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

11 Mitigation Measures

12 No mitigation is required.

13 Residual Impacts

14 Impacts would be less than significant.

15 **NEPA Impact Determination**

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

17 Mitigation Measures

18 No mitigation is required

19 Residual Impacts

20 Impacts would be less than significant.

1 **Operations Impacts**

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

7 **CEQA Impact Determination**

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

17 Mitigation Measures

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

20 Residual Impacts

21 Impacts would be significant and unavoidable.

22 **NEPA Impact Determination**

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

31 Mitigation Measures

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

34 Residual Impacts

35 Impacts would be significant and unavoidable.

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

4 **CEQA Impact Determination**

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

14 Mitigation Measures

15 Implement Mitigation Measure MM GEO-1.

16 Residual Impacts

17 Impacts would be significant and unavoidable.

18 **NEPA Impact Determination**

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

27 Mitigation Measures

28 Implement Mitigation Measure MM GEO-1.

29 Residual Impacts

30 Impacts would be significant and unavoidable.

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

5 **CEQA Impact Determination**

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

17 Mitigation Measures

18 No mitigation is required.

19 Residual Impacts

20 Impacts would be less than significant

21 **NEPA Impact Determination**

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

33 Mitigation Measures

34 No mitigation is required.

35 Residual Impacts

36 Impacts would be less than significant.

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

5 **CEQA Impact Determination**

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

16 Mitigation Measures

17 No mitigation is required

18 Residual Impacts

19 Impacts would be less than significant

20 **NEPA Impact Determination**

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

32 Mitigation Measures

33 No mitigation is required.

34 Residual Impacts

35 Impacts would be less than significant.

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

5 **CEQA Impact Determination**

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

9 Mitigation Measures

10 No mitigation is required.

11 Residual Impacts

12 No impacts would occur.

13 **NEPA Impact Determination**

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

15 Mitigation Measures

16 No mitigation is required.

17 Residual Impacts

18 No impacts would occur.

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

23 **CEQA Impact Determination**

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

27 Mitigation Measures

28 No mitigation is required.

1 Residual Impacts

2 No impacts would occur.

3 **NEPA Impact Determination**

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

5 Mitigation Measures

6 No mitigation is required.

7 Residual Impacts

8 No impacts would occur.

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

13 **CEQA Impact Determination**

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

17 Mitigation Measures

18 No mitigation is required.

19 Residual Impacts

20 No impacts would occur.

21 **NEPA Impact Determination**

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

23 Mitigation Measures

24 No mitigation is required.

25 Residual Impacts

26 No impacts would occur.

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

4 **CEQA Impact Determination**

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

9 Mitigation Measures

10 No mitigation is required.

11 Residual Impacts

12 Impacts would be less than significant.

13 **NEPA Impact Determination**

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

16 Mitigation Measures

17 No mitigation is required.

18 Residual Impacts

19 Impacts would be less than significant.

20 **3.5.4.3.6 Alternative 5—No-Federal-Action Alternative**

21 **Construction Impacts**

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

27 **CEQA Impact Determination**

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

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

9 Mitigation Measures

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

12 Residual Impacts

13 Impacts would be significant and unavoidable.

14 **NEPA Impact Determination**

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

17 Mitigation Measures

18 No mitigation is required.

19 Residual Impacts

20 No impacts would occur.

21 **Impact GEO-2a: Construction of Alternative 5 would result** 22 **in substantial damage to structures or infrastructure, or** 23 **expose people to substantial risk involving tsunamis or** 24 **seiches.**

25 **CEQA Impact Determination**

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

1 Mitigation Measures

2 Implement Mitigation Measure MM GEO-1.

3 Residual Impacts

4 Impacts would be significant and unavoidable.

5 **NEPA Impact Determination**

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

8 Mitigation Measures

9 No mitigation is required.

10 Residual Impacts

11 No impacts would occur.

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

16 **CEQA Impact Determination**

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

25 Mitigation Measures

26 No mitigation is required.

27 Residual Impacts

28 Impacts would be less than significant.

1 **NEPA Impact Determination**

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

4 Mitigation Measures

5 No mitigation is required.

6 Residual Impacts

7 No impacts would occur.

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

12 **CEQA Impact Determination**

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

21 Mitigation Measures

22 No mitigation is required

23 Residual Impacts

24 Impacts would be less than significant.

25 **NEPA Impact Determination**

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

28 Mitigation Measures

29 No mitigation is required.

1 Residual Impacts

2 No impacts would occur.

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

7 **CEQA Impact Determination**

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

11 Mitigation Measures

12 No mitigation is required.

13 Residual Impacts

14 No impacts would occur.

15 **NEPA Impact Determination**

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

18 Mitigation Measures

19 No mitigation is required.

20 Residual Impacts

21 No impacts would occur.

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

26 **CEQA Impact Determination**

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

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

5 Mitigation Measures

6 No mitigation is required.

7 Residual Impacts

8 Impacts would be less than significant.

9 **NEPA Impact Determination**

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

12 Mitigation Measures

13 No mitigation is required.

14 Residual Impacts

15 No impacts would occur.

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

20 **CEQA Impact Determination**

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

24 Mitigation Measures

25 No mitigation is required.

26 Residual Impacts

27 No impacts would occur.

1 **NEPA Impact Determination**

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

4 Mitigation Measures

5 No mitigation is required.

6 Residual Impacts

7 No impacts would occur.

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

11 **CEQA Impact Determination**

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

16 Mitigation Measures

17 No mitigation is required.

18 Residual Impacts

19 Impacts would be less than significant.

20 **NEPA Impact Determination**

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

23 Mitigation Measures

24 No mitigation is required.

25 Residual Impacts

26 No impacts would occur.

1 **Operations Impacts**

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

7 **CEQA Impact Determination**

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

17 Mitigation Measures

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

20 Residual Impacts

21 Impacts would be significant and unavoidable.

22 **NEPA Impact Determination**

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

25 Mitigation Measures

26 No mitigation is required.

27 Residual Impacts

28 No impacts would occur.

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

4 **CEQA Impact Determination**

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

13 Mitigation Measures

14 Implement Mitigation Measure MM GEO-1.

15 Residual Impacts

16 Impacts would be significant and unavoidable.

17 **NEPA Impact Determination**

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

20 Mitigation Measures

21 No mitigation is required.

22 Residual Impacts

23 No impacts would occur.

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

28 **CEQA Impact Determination**

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

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

4 Mitigation Measures

5 No mitigation is required

6 Residual Impacts

7 Impacts would be less than significant.

8 **NEPA Impact Determination**

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

11 Mitigation Measures

12 No mitigation is required.

13 Residual Impacts

14 No impacts would occur.

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

19 **CEQA Impact Determination**

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

28 Mitigation Measures

29 No mitigation is required.

30 Residual Impacts

31 Impacts would be less than significant.

1 **NEPA Impact Determination**

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

4 Mitigation Measures

5 No mitigation is required.

6 Residual Impacts

7 No impacts would occur.

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

12 **CEQA Impact Determination**

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

16 Mitigation Measures

17 No mitigation is required.

18 Residual Impacts

19 No impacts would occur.

20 **NEPA Impact Determination**

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

23 Mitigation Measures

24 No mitigation is required.

25 Residual Impacts

26 No impacts would occur.

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

5 **CEQA Impact Determination**

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

9 Mitigation Measures

10 No mitigation is required.

11 Residual Impacts

12 No impacts would occur.

13 **NEPA Impact Determination**

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

16 Mitigation Measures

17 No mitigation is required.

18 Residual Impacts

19 No impacts would occur.

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

24 **CEQA Impact Determination**

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

28 Mitigation Measures

29 No mitigation is required.

1 Residual Impacts

2 No impacts would occur.

3 **NEPA Impact Determination**

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

6 Mitigation Measures

7 No mitigation is required.

8 Residual Impacts

9 No impacts would occur.

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

13 **CEQA Impact Determination**

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

18 Mitigation Measures

19 No mitigation is required.

20 Residual Impacts

21 Impacts would be less than significant.

22 **NEPA Impact Determination**

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

25 Mitigation Measures

26 No mitigation is required.

27 Residual Impacts

28 No impacts would occur.

3.5.4.3.7 Alternative 6—No-Project Alternative

Construction Impacts

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

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

CEQA Impact Determination

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

Mitigation Measures

No mitigation is required.

Residual Impacts

No impacts would occur.

NEPA Impact Determination

This alternative is not applicable to NEPA.

Mitigation Measures

Not applicable.

Residual Impacts

Not applicable.

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

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

10 **CEQA Impact Determination**

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

15 Mitigation Measures

16 No mitigation is required.

17 Residual Impacts

18 Impacts would not occur.

19 **NEPA Impact Determination**

20 This alternative is not applicable to NEPA.

21 Mitigation Measures

22 Not applicable.

23 Residual Impacts

24 Not applicable.

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

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

1 **CEQA Impact Determination**

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

4 Mitigation Measures

5 No mitigation is required.

6 Residual Impacts

7 Impacts would not occur.

8 **NEPA Impact Determination**

9 This alternative is not applicable to NEPA.

10 Mitigation Measures

11 Not applicable.

12 Residual Impacts

13 Not applicable.

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

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

21 **CEQA Impact Determination**

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

24 Mitigation Measures

25 No mitigation is required.

26 Residual Impacts

27 Impacts would not occur.

1 **NEPA Impact Determination**

2 This alternative is not applicable to NEPA.

3 Mitigation Measures

4 Not applicable.

5 Residual Impacts

6 Not applicable.

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

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

15 **CEQA Impact Determination**

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

18 Mitigation Measures

19 No mitigation is required.

20 Residual Impacts

21 Impacts would not occur.

22 **NEPA Impact Determination**

23 This alternative is not applicable to NEPA.

24 Mitigation Measures

25 Not applicable.

26 Residual Impacts

27 Not applicable.

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

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

9 **CEQA Impact Determination**

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

12 Mitigation Measures

13 No mitigation is required.

14 Residual Impacts

15 Impacts would not occur.

16 **NEPA Impact Determination**

17 This alternative does not apply to NEPA.

18 Mitigation Measures

19 Not applicable.

20 Residual Impacts

21 Not applicable.

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

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

1 **CEQA Impact Determination**

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

5 Mitigation Measures

6 No mitigation is required.

7 Residual Impacts

8 Impacts would not occur.

9 **NEPA Impact Determination**

10 This alternative does not apply to NEPA.

11 Mitigation Measures

12 Not applicable.

13 Residual Impacts

14 Not applicable.

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

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

22 **CEQA Impact Determination**

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

26 Mitigation Measures

27 No mitigation is required.

28 Residual Impacts

29 Impacts would not occur.

1 **NEPA Impact Determination**

2 This alternative does not apply to NEPA.

3 Mitigation Measures

4 Not applicable.

5 Residual Impacts

6 Not applicable.

7 **Operations Impacts**

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

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

22 **CEQA Impact Determination**

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

1 Mitigation Measures

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

4 Residual Impacts

5 Impacts would be significant and unavoidable.

6 **NEPA Impact Determination**

7 This alternative does not apply to NEPA.

8 Mitigation Measures

9 Not applicable.

10 Residual Impacts

11 Not applicable.

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

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

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

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

30 **CEQA Impact Determination**

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

1 Mitigation Measures

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

4 Residual Impacts

5 Impacts would be significant and unavoidable.

6 **NEPA Impact Determination**

7 This alternative does not apply to NEPA.

8 Mitigation Measures

9 Not applicable.

10 Residual Impacts

11 Not applicable.

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

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

22 **CEQA Impact Determination**

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

28 Mitigation Measures

29 No mitigation is required.

30 Residual Impacts

31 No impacts would occur.

1 **NEPA Impact Determination**

2 This alternative does not apply to NEPA.

3 Mitigation Measures

4 Not applicable.

5 Residual Impacts

6 Not applicable.

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

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

14 **CEQA Impact Determination**

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

17 Mitigation Measures

18 No mitigation is required.

19 Residual Impacts

20 No impacts would occur.

21 **NEPA Impact Determination**

22 This alternative does not apply to NEPA.

23 Mitigation Measures

24 Not applicable.

25 Residual Impacts

26 Not applicable.

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

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

7 **CEQA Impact Determination**

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

10 Mitigation Measures

11 No mitigation is required.

12 Residual Impacts

13 No impacts would occur.

14 **NEPA Impact Determination**

15 This alternative does not apply to NEPA.

16 Mitigation Measures

17 Not applicable.

18 Residual Impacts

19 Not applicable.

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

24 **CEQA Impact Determination**

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

27 Mitigation Measures

28 No mitigation is required.

1 Residual Impacts

2 No impacts would occur.

3 **NEPA Impact Determination**

4 This alternative does not apply to NEPA.

5 Mitigation Measures

6 Not applicable.

7 Residual Impacts

8 Not applicable.

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

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

17 **CEQA Impact Determination**

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

20 Mitigation Measures

21 No mitigation is required.

22 Residual Impacts

23 No impacts would occur.

24 **NEPA Impact Determination**

25 This alternative does not apply to NEPA.

26 Mitigation Measures

27 Not applicable.

1 Residual Impacts

2 Not applicable.

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

6 **CEQA Impact Determination**

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

11 Mitigation Measures

12 No mitigation is required.

13 Residual Impacts

14 Impacts would be less than significant.

15 **NEPA Impact Determination**

16 This alternative does not apply to NEPA.

17 Mitigation Measures

18 Not applicable.

19 Residual Impacts

20 Not applicable.

21 **3.5.4.3.8 Summary of Impact Determinations**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

<i>Alternative</i>	<i>Environmental Impacts*</i>	<i>Impact Determination</i>	<i>Mitigation Measures</i>	<i>Impacts after Mitigation</i>
	result in one or more distinct and prominent geologic or topographic features being destroyed, permanently covered, or materially and adversely modified.	NEPA: Not applicable	Not applicable	NEPA: Not applicable
	GEO-8b: Operation of the Alternative 6 would not result in the permanent loss of availability of any mineral resource of regional, statewide, or local significance.	CEQA: Less than significant	No mitigation is required.	CEQA: Less than significant
		NEPA: Not applicable	Not applicable	NEPA: Not applicable
<p><i>Notes:</i></p> <p>* Impact descriptions for each of the alternatives are the same as for the proposed Project, unless otherwise noted.</p> <p>† The term <i>not applicable</i> is used in cases where a particular impact is not identified as a CEQA- or NEPA-related issue in the threshold of significance criteria, or where there is no federal action requiring a NEPA determination of significance.</p>				

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1 **3.5.4.4 Mitigation Monitoring**

2 **Table 3.5-4.** Mitigation Monitoring for Geology

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

3

4 **3.5.5 Significant Unavoidable Adverse Impacts**

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

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

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

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