4. ENVIRONMENTAL IMPACT ANALYSIS
E. GEOLOGY AND SOILS

1. INTRODUCTION

This section describes analyzes the potential impacts of the project regarding seismic-related hazards, geologic stability hazards, and soil erosion or the loss of topsoil. Information in this section is largely based on information and findings obtained in the report titled *Preliminary Geotechnical Engineering Evaluation for the Proposed Back Bay Landing – Mixed-Use Waterfront Development Legislative Approvals (GPA, CLUPA, Etc.), Bayside Drive and Pacific Coast Highway, Newport Beach, California* (herein referred to as the "Preliminary Geotechnical Study"), prepared by Leighton Consulting, Inc., dated March 2, 2012. The Preliminary Geotechnical Study is included in Appendix E of this Draft EIR.

2. ENVIRONMENTAL SETTING

a. Regulatory Framework

(1) Federal

(a) International Building Code

The International Building Code (IBC) is the national model building code providing standardized requirements for construction. The IBC replaced earlier regional building codes (including the Uniform Building Code) in 2000 and established consistent construction guidelines for the nation. In 2009, the IBC was incorporated into the 2010 California Building Code (CBC), and applies to all structures being constructed in California. The national model codes are therefore incorporated by reference into the building codes of local municipalities, such as the CBC discussed below. The California Building Code includes building design and construction criteria that take into consideration the State's seismic conditions.

(2) State

(a) Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (Public Resources Code Section 2621) was enacted by the State of California in 1972 to address the hazard of surface faulting to structures for human occupancy.[1] The Alquist-Priolo Earthquake Fault Zoning Act was a direct result of the 1971 San Fernando Earthquake, which was associated with extensive surface fault ruptures that damaged homes, commercial buildings, and other structures. The primary purpose of the Alquist-Priolo Earthquake Fault Zoning Act is to prevent the construction of buildings intended for human occupancy on the surface traces of active faults. The Alquist-Priolo Earthquake Fault Zoning Act is also intended to provide the citizens with increased safety and to minimize the loss of life during and immediately following earthquakes by facilitating seismic retrofitting to strengthen buildings against ground shaking. The Alquist-Priolo Earthquake Fault Zoning Act requires the State Geologist to establish regulatory zones, known as "earthquake fault zones", around the surface traces of active faults and to issue appropriate maps to assist cities and counties in planning, zoning, and building regulation functions. Maps are distributed to all affected cities and counties for the controlling of new or

[1] *The Act was originally entitled the Alquist-Priolo Geologic Hazards Zone Act.*

renewed construction and are required to sufficiently define potential surface rupture or fault creep. The State Geologist is charged with continually reviewing new geologic and seismic data, and revising existing zones and delineating additional earthquake fault zones when warranted by new information. Local agencies must enforce the Alquist-Priolo Earthquake Fault Zoning Act in the development permit process, where applicable, and may be more restrictive than State law requires. According to the Alquist-Priolo Earthquake Fault Zoning Act, before a project that is within an earthquake fault zone can be permitted, cities and counties shall require a geologic investigation, prepared by a licensed geologist, to demonstrate that buildings would not be constructed across active faults. If an active fault is found, a structure for human occupancy cannot be placed over the trace of the fault and must be set back. Although setback distances may vary, a minimum 50-foot setback is required. The Alquist-Priolo Earthquake Fault Zoning Act and its regulations are presented in California Department of Conservation, California Geological Survey, Special Publications (SP) 42, Fault-rupture Hazard Zones in California.

(b) Seismic Hazards Mapping Act

In order to address the effects of strong ground shaking, liquefaction, landslides, and other ground failures due to seismic events, the State of California passed the Seismic Hazards Mapping Act of 1990 (Public Resources Code Section 2690-2699). Under the Seismic Hazards Mapping Act, the State Geologist is required to delineate "seismic hazard zones." Cities and counties must regulate certain development projects within these zones until the geologic and soil conditions of the project site are investigated and appropriate mitigation measures, if any, are incorporated into development plans. The State Mining and Geology Board provides additional regulations and policies to assist municipalities in preparing the Safety Element of their General Plan and encourage land use management policies and regulations to reduce and mitigate those hazards to protect public health and safety. Under Public Resources Code Section 2697, cities and counties shall require, prior to the approval of a project located in a seismic hazard zone, a geotechnical report defining and delineating any seismic hazard. Each city or county shall submit one copy of each geotechnical report, including mitigation measures, to the State Geologist within 30 days of its approval. Under Public Resources Code Section 2698, nothing is intended to prevent cities and counties from establishing policies and criteria which are stricter than those established by the Mining and Geology Board.

State publications supporting the requirements of the Seismic Hazards Mapping Act include the California Geological Survey SP 117, *Guidelines for Evaluating and Mitigating Seismic Hazards in California*, and SP 118, *Recommended Criteria for Delineating Seismic Hazard Zones in California*. The objectives of SP 117 are to assist in the evaluation and mitigation of earthquake-related hazards for projects within designated zones of required investigations and to promote uniform and effective statewide implementation of the evaluation and mitigation elements of the Seismic Hazards Mapping Act. SP 118 implements the requirements of the Seismic Hazards Mapping Act in the production of Probabilistic Seismic Hazard Maps for the State.

(c) California Building Code

The California Building Code (also known as the "California Building Standards Code" or CBC) is promulgated under the California Code of Regulations (CCR) (Title 24, Parts 1 through 12) and is administered by the California Building Standards Commission (CBSC). The national model code standards adopted into Title 24 apply to all occupancies in California except for modifications adopted by State agencies and local governing bodies. The CBSC published the 2010 triennial edition in June 2010, which incorporated the 2009 IBC, as discussed above, and became effective January 1, 2011. The CBS may be adopted entirely or with revisions by State and local municipalities.

Title 24 sets forth the fire, life safety, and other building related regulations applicable to any structure fit for occupancy statewide for which a building permit is sought. Title 24 establishes general standards for the design and construction of buildings, including provisions related to seismic safety. The CBC provides standards that must be met to safeguard life or limb, health, property, and public welfare by regulating and controlling the design, construction, quality of materials, use and occupancy, location, and maintenance of all buildings and structures within its jurisdiction. Chapter 18, Soils and Foundations, of the CBS specifies level of soil investigation that is required by law in California. Requirements in Chapter 18 apply to building and foundations systems and consider reduction of potential seismic hazards.

(3) Local

(a) Newport Beach General Plan

The primary goal of the City of Newport Beach General Plan's Safety Element is to reduce the potential risk of death, injuries, property damage, and economic and social dislocation resulting from natural and human-induced hazards. The Safety Element specifically addresses coastal hazards, geologic hazards, seismic hazards, flood hazards, wildland and urban fire hazards, hazardous materials, aviation hazards, and disaster planning. The project's consistency with applicable General Plan safety goals and policies is provided later in this EIR section.[2]

(b) Newport Beach Building Code

The City of Newport Beach has adopted its own building code that regulates excavation and grading activities, drainage conditions, erosion control, and earthwork construction (including fills, embankments, and the use of earth materials as a structural component). This code provides for the approval of grading and building plans and inspection of grading construction and drainage control for projects. The Code incorporates by reference the 2010 Edition of the California Building Code (Volumes 1 and 2, including Appendices F and I, and Appendix A1 of Part 10) and all national codes and standards referenced therein, based on the International Building Code. The project would be processed by the City in accordance with the City's Building Code.

b. Existing Conditions

The topography of the majority of the project site is generally flat with elevation ranging from approximately eight (8) to 12 feet above mean sea level (MSL). However, the westernmost area of the site is immediately adjacent to Upper Newport Bay where on-site elevations are at sea level. Previous earthwork on the site has included limited grading and excavation and fills associated with the on-site parking lot and pump station. The pump station is not part of the project site and is not subject to future development (although minor façade improvements for visual compatibility with future on-site development would be implemented).

(1) Regional Geology

The project site is located on the landward side of a natural coastal barrier island formed by a transgressive sea and littoral ocean currents at the seaward edge of San Diego Creek drainage within Upper Newport Bay coastal estuary near the San Joaquin Hills. The Newport Bay estuary was originally formed as the lower

[2] *For ease of reading, the policy tables are located at the end of this EIR section.*

reach of the Santa Ana River. However, due to extensive widespread flooding in 1915-1916, the Santa Ana River realigned its course to the west. The bay is currently fed only by San Diego Creek and its tributaries.

The San Joaquin Hills lie within the northern part of the Peninsular Ranges geomorphic province which extends 900 miles southward from the Santa Monica Mountains to the tip of Baja California. Regional tectonic activity has uplifted the San Joaquin Hills into an elongated arched fold (anticlinorium) trending to the northwest from San Juan Capistrano and Huntington Mesa. This anticlinal folding has occurred as this entire section of the southern California coast was uplifted by the San Joaquin Hills blind thrust fault.

(2) Subsurface Soil Conditions

As part of the Preliminary Geotechnical Study, subsurface exploratory borings, soil sampling and Cone Penetrometer Test (CPT) soundings, followed by laboratory testing, were implemented within the project site to determine the subsurface soil conditions within the project site. Please refer to the Preliminary Geotechnical Study for further details of the subsurface soil testing and analysis methodology. The results of the field exploration indicate the presence of fill to depths that vary from approximately 6 to 8 feet below the existing grade at the test borings and potentially to a depth of 10 feet at in the eastern region of the site. The fill encountered at the boring locations consisted predominately of fine grained sands that exhibited loose to medium dense relative density on the basis of field testing.

The fill was underlain by native soils comprised of Quaternary estuarine deposits consisting of loose to medium dense relative density sands and silty sands to a depth of 20 to 25 feet which were underlain by medium dense to dense sands extending to at least the depths explored.

The native soil profile included a relatively thin (1- to 3-foot thick) layer of soft consistency clay at depths ranging from 8 to 10 feet below grade at the majority of the test borings and CPT locations. The depths at which this material was encountered corresponded to approximately 3 to 6 feet above MSL.

(a) Soil Expansion Potential

The near-surface soil encountered in the borings consisted of mainly sandy materials. Due to the granular nature of the soils, the expansion potential of the soils is expected to be very low.

(b) Soil Corrosivity

In general, soil environments that are detrimental to concrete have high concentrations of soluble sulfates and/or pH values of less than 5.5. By reference to Section 4.3 of ACI 318, the 2010 CBC provides specific guidelines for the concrete mix-design when the soluble sulfate content of the soil exceeds 0.1 percent by weight or 1,000 parts per million (ppm). The minimum amount of chloride ions in the soil environment that are corrosive to steel, either in the form of reinforcement protected by concrete cover or plain steel substructures, such as steel pipes, is 500 ppm per California Test 532. Concentrations of chloride ions above the stated concentration or other characteristics such as soil resistivity or redox potential may warrant special corrosion protection measures.

For screening purposes, composite bulk samples of the onsite soils to a depth of 5 feet below current grade were tested to provide a preliminary evaluation of corrosivity. Based upon the results of the screening tests, the near surface soils have “negligible” soluble sulfate contents and low chloride contents. The soils are considered to have a moderate corrosion potential to buried ferrous metal. However, the Preliminary

Geotechnical Testing acknowledges that additional testing should be performed during construction to verify the corrosion potential of subsurface soils.

(3) Groundwater Conditions

Groundwater was typically encountered at depths of approximately 6 to 8 feet below grade at the test boring locations during field exploration in 2009. These depths correspond to elevations of 3.5 to 8 feet above MSL. Due to the coastal location of the project site, groundwater levels vary in response to tidal fluctuations. Groundwater highs will likely approach tidal highs in the bay, and groundwater lows can be expected to drop below mean sea level.

(4) Faulting and Seismicity

(a) Faulting

Based on criteria established by the California Geological Survey (CGS), faults can be classified as active, potentially active, or inactive.[3] Active faults are those having historically produced earthquakes or shown evidence of movement within the past 11,000 years (during the Holocene Epoch).[4] Potentially active faults have demonstrated displacement within the last 1.6 million years (during the Pleistocene Epoch), but do not displace Holocene Strata. Inactive faults do not exhibit displacement younger than 1.6 million years before the present. In addition, there are buried thrust faults, which are low angle reverse faults with no surface exposure. Due to their buried nature, the existence of buried thrust faults is usually not known until they produce an earthquake.

The seismically active Southern California region is crossed by numerous active and potentially active faults and is underlain by several blind thrust faults. Alquist-Priolo Earthquake Fault Zones (formerly Special Study Zones) have been established throughout California by CGS. These zones, which extend from 200 to 500 feet on each side of a known active fault, identify areas where potential surface rupture along an active fault could prove hazardous and identify where special studies are required to characterize hazards to habitable structures.

A literature review conducted as part of the Preliminary Geotechnical Study indicates that no known active or potentially active faults traverse the site, and the site is not located within an Alquist-Priolo Earthquake Fault Zone.

Two major faults are located in close proximity to the site, the Newport Inglewood (L.A. Basin and Offshore segments) located 2.5 and 2.8 miles from the site respectively, and the San Joaquin Hills Blind Thrust, located approximately 6.4 miles from the project site. A description of these faults is presented below:

Newport-Inglewood Fault Zone: The Newport-Inglewood Fault Zone is a broad zone of left-stepping en echelon faults and folds striking southeastward from near Santa Monica across the Los Angeles basin to Newport Beach. Altogether these various faults constitute a system more than 150 miles long that extends into Baja California, Mexico. Faults having similar trends and projections occur offshore from San Clemente

[3] *California Department of Conservation, California Geological Survey. "California Geological Survey - Alquist-Priolo Earthquake Fault Zoning Act," http://www.consrv.ca.gov/cgs/rghm/ap/Pages/main.aspx#what_is_fault. Accessed September 2012.*

[4] *Ibid.*

and San Diego (the Rose Canyon and La Nacion Faults). A near-shore portion of the Newport-Inglewood Fault Zone was the source of the destructive 1933 Long Beach earthquake. The reported recurrence interval for a large event along this fault zone is 1,200 to 1,300 years with an expected slip of 1 meter.

San Joaquin Hills Blind Thrust Fault: The seismic hazards in Southern California have been further complicated with the recent realization that major earthquakes can occur on large thrust faults that are concealed at depths between 5 to 20 kilometers (km), referred to as "blind thrusts." The uplift of the San Joaquin Hills is produced by a southwest dipping blind thrust fault that extends at least 14 km from northwestern Huntington Mesa to Dana Point and comes to within 2 km of the ground surface. Recent studies suggest that uplift of the hills began in the Late Quaternary and continues during the Holocene. Uplift rates have been estimated between 0.25 and 0.5 mm/yr. If the entire length of the fault ruptured, the earthquake has been estimated to generate a Magnitude 6.8 event.

(b) Ground Motion

The intensity of ground shaking at a given location depends primarily upon the earthquake magnitude, the distance from the earthquake source, and the site response characteristics which are dependent upon the subsurface stratigraphy. The location of the site relative to active faults indicates the subject site and the structures that would comprise the proposed development are likely to experience strong ground shaking during the life of the development. Peak horizontal ground acceleration (PGA) is generally used to characterize the amplitude of ground motion.

As part of the Preliminary Geotechnical Study, an evaluation of the seismic hazard relative to strong ground shaking was performed on the basis of probabilistic and deterministic methodologies. The results of the analyses indicate the design PGA is 0.495g[5] while the PGA associated with the Maximum Considered Earthquake (MCE) is 0.743g for the site. The details of the analyses are presented in Appendix D of the Preliminary Geotechnical Study.

(5) Seismic Hazards

The potential hazards evaluated in the Preliminary Geotechnical Study with regard to seismic conditions include fault rupture, soil liquefaction, earthquake-induced vertical and lateral displacements, and earthquake induced settlement. These hazards are described below. Seismic hazards could also include earthquake-induced flooding due to the failure of water containment structures, seiches, and tsunamis. These hazards are discussed and analyzed in Section 4.H, *Hydrology and Water Quality*, of this EIR.

(a) Fault Rupture

The project is not located within a currently designated Alquist-Priolo Earthquake Zone. No known active faults are mapped on the site. Based on this consideration, the potential for surface fault rupture at the site is considered to be low.

[5] *Site acceleration during a seismic event is measured as a percent of gravity, or "g". For instance, 0.49g is 49 percent of the force of gravity.*

(b) Liquefaction

Liquefaction is a seismic phenomenon in which loose, saturated, noncohesive granular soils exhibit severe reduction in strength and stability when subjected to high-intensity ground shaking. The mechanism by which liquefaction occurs is the progressive increase in excess pore pressure generated by the shaking associated with the seismic event and the tendency for loose non-cohesive soils to consolidate. As the excess pore fluid pressure approaches the in-situ overburden pressure, the soils exhibit behavior similar to a dense fluid with a corresponding significant decrease in shear strength and increase in compressibility. Liquefaction occurs when three general conditions exist: 1) shallow groundwater; 2) low density, non-cohesive sandy soils; and 3) high-intensity ground motion.

The project site is located in an area that has been identified by the State of California as being potentially susceptible to liquefaction. A site-specific evaluation of the potential for liquefaction conducted as part of the Preliminary Geotechnical Study confirmed the project site could be subject to liquefaction-related hazards.

(c) Lateral Spreading

The occurrence of liquefaction may also cause lateral spreading. Lateral spreading is a phenomenon in which large lateral displacement can occur on the ground surface due to movement of non-liquefied soils along zones of liquefied soils. For lateral spreading to occur, the liquefiable zone must be continuous, unconstrained laterally, and free to move along gently sloping ground toward an unconfined area. The strength reduction that occurs at the onset of liquefaction and the general continuity of the liquefiable layers interpreted from the field explorations provide planes of weakness for the overlying non-liquefied deposits to slide along toward the free faces of the submarine slopes. The potential for lateral spreading is, therefore, very high due to the topographic aspects of the site and the unprotected/unrestrained shoreline along the northern and western boundaries of the site.

(d) Earthquake-Induced Settlement

Earthquake-induced settlements result from densification of non-cohesive granular soils which occur as a result of reduction in volume during or after an earthquake event. The magnitude of settlement that results from the occurrence of liquefaction is typically greater than the settlement that results solely from densification during strong ground shaking in the absence of liquefaction. According to the Preliminary Geotechnical Study, the post liquefaction seismically-induced settlements are expected to range from less than 1 inch to a maximum of approximately 2 inches, excluding vertical distortion attributed to lateral displacement and ground oscillation.

3. ENVIRONMENTAL IMPACTS

a. Methodology

The technical analyses supporting the impact conclusions in the following section were completed mostly based on the analysis presented by Leighton Consulting, Inc. as presented in the Preliminary Geotechnical Study. The conclusions in the Preliminary Geotechnical Study were primarily derived from the following tasks:

- Review of available geologic and geotechnical literature, reports, maps and agency information;
- Subsurface exploration consisting of excavation, logging and sampling of three (3) hollow-stem auger borings and nine (9) Cone Penetrometer Test (CPT) soundings;

- Collection of representative SPT samples, relatively undisturbed modified California sampler (ring) samples and bulk samples at selected depth intervals from the soil borings and transportation of the samples to a laboratory for testing;
- Laboratory testing of selected samples to evaluate engineering characteristics of the onsite earth materials within the exploration depths.
- Geotechnical evaluation of collected test boring and CPT data and relevant engineering analyses.

Please refer to the Preliminary Geotechnical Study contained in Appendix E for a detailed discussion of the subsurface exploration, soil sampling, and laboratory tests and procedures. Data and conclusions from the analyses in the Preliminary Geotechnical Study were used to determine potential impacts from the project to and from the site geology and soils parameters. These impacts were compared against the Thresholds of Significance set forth below to determine their significance.

b. Thresholds of Significance

Appendix G of the *CEQA Guidelines* provides a checklist of questions to assist in determining whether a proposed project would have a significant impact related to various environmental issues including geology and soils. Based on the following issue areas identified in Appendix G of the *CEQA Guidelines*, a significant impact due to geology and soils would occur if the project would result in one or more of the following:

Threshold 1: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury or death, involving (refer to Impact Statement 4.E-1):

- Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault,
- Strong seismic ground shaking,
- Seismic-related ground failure, including liquefaction, or
- Landslides;

Threshold 2: Result in substantial soil erosion or the loss of topsoil (refer to Impact Statement 4.E-2);

Threshold 3: Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse (refer to Impact Statement 4.E-1); and

Threshold 4: Be located on expansive soil, as defined in Table 18-1-B of the California Building Code (2010), creating substantial risks to life or property (refer to Chapter 6, *Other Mandatory CEQA Considerations*, and the Initial Study contained in Appendix A of this Draft EIR. No impact would occur in this regard.).

Threshold 5: Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater (refer to Chapter 6, *Other Mandatory CEQA Considerations*, and the Initial Study contained in Appendix A of this Draft EIR. No impact would occur in this regard.).

Threshold 6: Comply with any applicable plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan and municipal code) adopted for the purpose of avoiding or mitigating an environmental effect (refer to Impact Statement 4.E-3 below).

c. Project Design Features

There are no specific Project Features that relate to potential geology impacts. However, development of land uses proposed by the project would be subject to applicable codes and regulations, including the California Building Code and City of Newport Beach Municipal Code (local amendments to the CBC), which include provisions for seismic safety in design and construction of structures.

Also, with regard to impacts pertaining to soil erosion or the loss of topsoil, the project would implement numerous BMPs as detailed in the Water Quality Management Plan (WQMP) for the project. The analysis below refers to Section 4.H, *Hydrology and Water Quality*, of this Draft EIR for a listing of the BMPs proposed for the project.

d. Analysis of Project Impacts

(1) Seismic and Geologic Stability Hazards

Threshold	Would the project expose people or structures to potential substantial adverse effects, including the risk of loss, injury or death, involving: (i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issues by the State Geologist for the area or based on other substantial evidence of a known fault? (ii) Strong seismic ground shaking? (iii) Seismic-related ground failure, including liquefaction? (iv) Landslides?
Threshold	Would the project be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?

Impact 4.E-1 *Implementation of the project could expose people or structures to fault rupture, strong seismic ground shaking, strong seismic-related ground failure, liquefaction, landslides and other ground failure hazards. However, compliance with applicable regulatory requirements and implementation of the prescribed mitigation measure would reduce potentially significant impacts in these regards to a less than significant level.*

(i) Fault Rupture

The project site is not located within an established Alquist-Priolo Fault zone. The nearest active faults to the project site are the Newport-Inglewood Fault Zone (L.A. Basin and Off-shore segments) located 2.5 and 2.8 miles from the site respectively, and the San Joaquin Hills Blind Thrust, located approximately 6.4 miles from the project site. Active faults with the potential for surface rupture are not known to be located

beneath the project site. Therefore, the potential to expose people to impacts from fault rupture resulting from seismic activity during the design life of the buildings is considered less than significant.

(ii) Seismic Ground Shaking

As indicated in the Existing Conditions section above, the project site is located in a seismically active region. There is potential for significant ground shaking at the project site during a strong seismic event on the Newport-Inglewood Fault Zone and other active regional faults in the Southern California area. According to the Geotechnical Feasibility Study, based on the location of the faults in the region, the MCE is 0.743g for the site. Ground shaking at this intensity could result in significant damage to buildings and improvements associated with project implementation. This is considered to be a potentially significant impact. The City of Newport Beach requires that all new construction meet or exceed the City ordinances and policies and the latest standards of the CBC for construction in seismic hazard zones, which requires structural design that can accommodate maximum ground accelerations expected from known faults. While the Project would be required to comply with applicable seismic-related regulatory requirements, implementation of Mitigation Measure 4.E-1 would further ensure that potentially significant seismic-related groundshaking impacts would be reduced to a less than significant level. As part of the design-level geotechnical report that would be prepared for the project pursuant to Mitigation Measure 4.E-1, final design recommendations and parameters for the walls, foundations, foundation slabs, and surrounding related improvements including roadways, sidewalks, and utilities would be developed for the project. Implementation of the design parameters and recommendations in the structural engineering analysis and design would reduce the potential for significant damage to structures resulting from strong seismic ground shaking and the exposure of people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, to the maximum extent feasible. Mitigation Measure 4.E-1 would ensure that the recommendations in the design-level geotechnical report are included in the project's site preparation and building design specifications. As such, seismicity in the region and in the project area would have a less-than-significant impact on the project with implementation of the prescribed mitigation measures and compliance with applicable regulatory requirements.

(iii) Ground Failure

Liquefaction. As indicated in the Existing Conditions section above, the project site is located in an area that has been identified by the State of California as being potentially susceptible to liquefaction. The site-specific evaluation of the potential for liquefaction conducted as part of the Preliminary Geotechnical Study confirmed the project site could be subject to liquefaction-related hazards.

The liquefaction analysis indicated the potential for liquefaction in relatively thin strata typically no greater than 3 to 4 feet in thickness based upon the analysis of CPT data. However, several strata occurred at shallow depth below the water table particularly at the CPT locations near the shores that border the property. At these locations, the zones of liquefiable soils generally existed from several feet below the groundwater table to depths of 13 to 16 feet below grade. Other strata of potentially liquefiable soils existed at greater depth exhibiting thicknesses of 1 to 2 feet and were typically widely spaced within the respective profiles. Based upon the encountered conditions, generalized profiles were developed that suggest continuity in the potentially liquefiable soil layers and the likelihood that they extend to the submarine slopes.

The primary effects of liquefaction on structures supported at shallow depth below ground surface are loss of bearing capacity if liquefaction occurs within the zone of foundation influence below footings or settlement due to the consolidation of liquefied sediments if bearing capacity is not compromised. Based

upon the depths at which liquefaction is anticipated to occur and the probability that all structures (except the subterranean level of the parking structure) would be supported at shallow depth below existing grade, bearing capacity failures are not anticipated to occur. However, ground surface (earthquake-induced) settlement (as discussed below) and ground oscillation are anticipated and should be considered in design.

Ground oscillation is a phenomenon in which the surficial crust of nonliquefied soils becomes fissured as the mass responds to the oscillations induced by the shear waves propagating to the surface. As the ground shaking progresses, the non-liquefied mass may begin to break into large blocks bounded by fissures and these blocks may undergo horizontal displacements in different directions. Fissures that occur within the footprint of structures may result in large horizontal forces on foundation elements such as column pad footings that are located on opposite sides of a fissure which, in turn, could tend to pull apart the structure.

The lower level of the parking structure would be approximately 10 feet below the first level which is approximately level with current grade. Soils susceptible to liquefaction exist are expected to exist at or slightly below this elevation and would, therefore, present a serious risk of loss of bearing capacity and foundation support. Preparation of the parking structure area would require either improvement/densification of the soils to mitigate liquefaction potential or the use of a deep foundation system to transfer the structural loads to stable, non-liquefiable soils. Recommendations are presented in the Preliminary Geotechnical Study that report focus on either overexcavation of existing soils and recompaction to develop a structural fill layer below the foundation system to improve bearing capacity for static conditions and also provide some improvement and reduction in the potential for liquefaction to occur, or the use of a proprietary ground improvement technique to improve bearing capacity and reduce the potential effects of liquefaction. With implementation of the recommendations in the Preliminary Geotechnical Study, which would be refined in a design–level analysis per Mitigation Measure 4.E-1, along with the project's compliance to applicable codes and regulations, including the CBC and City of Newport Beach Municipal Code, potentially significant impacts regarding liquefaction would be reduced to a less than significant level.

Lateral Spreading. As discussed above, the project site is susceptible to liquefaction hazards. The occurrence of liquefaction would result in the potential for lateral spreading and load demand on the bulkhead system proposed for the development. The load demand induced by lateral spreading is expected to greatly exceed the load demands under static and pseudostatic conditions and is, therefore, expected to control the design of the bulkhead retention system. The Preliminary Geotechnical Study includes an analysis of the proposed bulkhead stability and recommendations for preliminary design. With implementation of the recommendations in the Preliminary Geotechnical Study, which would be refined in a design–level analysis per Mitigation Measure 4.E-1, along with the project's compliance to applicable codes and regulations, including the CBC and City of Newport Beach Municipal Code, potentially significant impacts regarding lateral spreading would be reduced to a less than significant level.

Earthquake-Induced Settlements. As discussed in the Existing Conditions section above, earthquake-induced settlements result from densification of non-cohesive granular soils which occur as a result of reduction in volume during or after an earthquake event. The magnitude of settlement that results from the occurrence of liquefaction is typically greater than the settlement that results solely from densification during strong ground shaking in the absence of liquefaction. According to the Preliminary Geotechnical Study, the post liquefaction seismically-induced settlements are expected to range from less than 1 inch to a maximum of approximately 2 inches, excluding vertical distortion attributed to lateral displacement and ground oscillation. The Preliminary Geotechnical Study includes recommendations to ensure liquefaction

and associated ground settlement are adequately addressed in the project design. With implementation of the recommendations in the Preliminary Geotechnical Study, which would be refined in a design–level analysis per Mitigation Measure 4.E-1, along with the project's compliance to applicable codes and regulations, including the CBC and City of Newport Beach Municipal Code, potentially significant impacts regarding earthquake-induced settlements would be reduced to a less than significant level.

Landslides. No slope areas considered susceptible to landslides or other slope failure exist on-site. Although the raised Coast Highway corridor bisecting the project site is sloped down to ground level on either side of the bridge approach, the roadway was engineered and constructed to industry standards, and therefore the potential for slope failure in this area is considered low. Given the distance of natural slope areas from the project site and relatively flat topography on-site, less than significant impacts related to landslides would occur.

Overall, the Preliminary Geotechnical Study concludes that based upon the results of the geotechnical evaluation of the site, the proposed project is anticipated to be feasible based on geotechnical aspects of the site, but the potential for liquefaction and construction below grade in proximity to the water table would present challenges to be addressed in design and construction. However, the recommendations presented in the design–level analysis per Mitigation Measure 4.E-1, along with the project's compliance to applicable codes and regulations, including the CBC and City of Newport Beach Municipal Code, would ensure that all potentially significant seismic and geologic stability impacts are reduced to a less than significant level.

(2) Soil Erosion

Threshold	Would the project result in substantial soil erosion or the loss of topsoil?

Impact 4.E-2 *Implementation of the project could result in substantial soil erosion or the loss of topsoil. However, compliance with applicable regulatory requirements and implementation of the project's site design features would ensure that impacts related to erosion and topsoil loss are less than significant.*

Soil erosion refers to the process by which soil or earth material is loosened or dissolved and removed from its original location. Erosion can occur by varying processes and may occur in the project area where bare soil is exposed to wind or moving water (both rainfall and surface runoff). The processes of erosion are generally a function of material type, terrain steepness, rainfall or irrigation levels, surface drainage conditions, and general land uses. During construction, the project site would be subject to ground-disturbing activities (e.g., removal of the paved parking lot, excavation and grading, foundation and infrastructure construction, the installation of utilities). These activities would expose soils for a limited time, allowing for possible erosion.

Although project construction activities have the potential to result in the erosion of soils, this potential would be reduced by implementation of standard erosion control measures imposed during site preparation and grading activities. For instance, the project would be subject to all existing regulations associated with the protection of water quality. Construction activities would be carried out in accordance with the requirements of the National Pollutant Discharge Elimination System (NPDES) General Construction Permit issued by the Regional Water Quality Control Board (RWQCB) and in accordance with the project's Storm Water Pollution Prevention Plan (SWPPP). The SWPPP would incorporate Best Management Practices (BMPs) in accordance with the applicable local and state regulations to control erosion during the project's

construction period. BMPs could include, but are not limited to, water bars, silt fences, staked straw bales, development of and adherence to the construction SWPPP, avoidance of water bodies during construction, and development of and adherence to erosion and sediment control BMPs. Section 4.H, *Hydrology and Water Quality*, of this Draft EIR includes a detailed discussion of the applicable regulatory requirements and the project's consistency with such requirements. Implementation of a SWPPP and associated BMPs consistent with applicable regulatory requirements would ensure that impacts pertaining to soil erosion or loss of topsoil impacts from construction activities are less than significant.

During operation of the project, site design features and BMPs included in the project's WQMP, as described in detail in Section 4.H, would be implemented to ensure that erosion and runoff impacts remain less than significant. As discussed in Section 4.H, due to the nature of the high imperviousness associated with the existing conditions, proposed runoff rates would remain consistent or decrease due to the minor increase in landscaping under the proposed condition. Accordingly, the post-project site would not result in significant hydrology impacts downstream such that erosion would occur on- or off-site. Implementation of applicable site design features and BMPs in the WQMP, as well as compliance with applicable regulatory and permit requirements discussed in Section 4.H, would ensure that impacts related to erosion and topsoil loss during operation of the project are less than significant.

(3) Consistency with Regulatory Framework

Threshold	Would the project conflict with any applicable plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan and municipal code) adopted for the purpose of avoiding or mitigating an environmental effect?

Impact 4.E-3 *Implementation of the proposed project would not conflict with any applicable plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the General Plan and Municipal Code). This impact is considered less than significant..*

As discussed above, the project would comply with all applicable federal, state, and local laws and regulations related to geology and soils. The City of Newport Beach General Plan contains various policies related to geology and soils, including policies from the Harbor and Bay Element, Public Natural Resources Element, Safety Element. In addition, the City's Local Coastal Program Coastal Land Use Plan (CLUP) and the California Coastal Act also contain policies relevant geology and soils that are applicable to the project. As shown in **Table 4.E-1**, *General Plan Consistency Analysis*, **Table 4.E-2**, *Coastal Land Use Plan Consistency Analysis*, and **Table 4.E-3**, *California Coastal Act Consistency Analysis*, the project would be consistent with the applicable policies of the City's General Plan and Coastal Land Use Plan and the California Coastal Act, respectively, and therefore impacts in this regard would be less than significant.

Table 4.E-1

General Plan Consistency Analysis

Harbor and Bay Element	
Policy HB-8.12: Reduction of Infiltration. Include equivalent BMPs that do not require infiltration, where infiltration of runoff would exacerbate geologic hazards.	**Consistent.** As discussed in Section 4.H, *Hydrology and Water Quality*, of this Draft EIR, due to the presence of shallow groundwater, on-site infiltration of storm water runoff is considered infeasible. However, the implementation of the numerous Site Design features and LID BMPs described in this EIR section would effectively covey runoff from the site such that adverse geologic impacts do not occur as a result on project implementation. As discussed in Section 4.H, due to the nature of the high imperviousness associated with the existing conditions, proposed runoff rates would remain consistent or decrease due to the minor increase in landscaping under the proposed condition. Accordingly, the post-project site would not result in significant hydrology impacts downstream such that erosion would occur on- or off-site.
Natural Resources Element	
Policy NR-3.12: Reduction of Infiltration. Include equivalent BMPs that do not require infiltration, where infiltration of runoff would exacerbate geologic hazards.	**Consistent.** Please refer to the response to Policy HB-8.12.
Policy NR-4.4: Erosion Minimization. Require grading/erosion control plans with structural BMPs that prevent or minimize erosion during and after construction for development on steep slopes, graded, or disturbed areas.	**Consistent.** As discussed in detail in Section 4.H, *Hydrology and Water Quality*, of this Draft EIR, the project would comply with the requirements of the new General Construction Permit, which would require the implementation of Construction BMPs to minimize soil to minimize soil erosion. Site-design concepts for the project would maintain existing site drainage patterns which ultimately flow into Upper Newport Bay. Under natural conditions, runoff from the site would flow into Upper Newport Bay. Implementation of the project's Site Design and LID BMPs would ensure that flow rates and runoff volumes leaving the site in the post-project condition are treated and do not result in exacerbation of either erosion or sedimentation in Upper Newport Bay.
Safety Element	
Policy 4.7: New Development. Conduct further seismic studies for new development in areas where potentially active faults may occur.	**Consistent.** No active faults are expected to occur within the project site. As such, further evaluation of active faults is not necessary.

Source: PCR Services Corporation, 2013.

Table 4.E-2

Coastal Land Use Plan Consistency Analysis

CLUP Policy	Project Consistency Statement
2.8.6 Coastal Erosion	
Policy 2.8.6-5. Permit revetments, breakwaters, groins, harbor channels, seawalls, cliff retaining walls and other structures altering natural shoreline processes or retaining walls when required to serve coastal-dependent uses or to protect existing principal structures or public beaches in danger from erosion and when designed to eliminate or mitigate adverse impacts on local shoreline sand supply, unless a waiver of future shoreline protection was required by a previous coastal development permit.	**Consistent.** Pursuant to the BBL PCDP, new seawall/bulkhead structures in Planning Area 1 are restricted to the Highest High Water contour elevation of 7.48' (NAVD 88) and in Planning Area 2 to the 10' contour elevation (NAVD 88) to preserve the natural shoreline profile. The proposed future seawall/ bulkhead, consistent with the CLUP Policy and Coastal Act section 30235, is necessary for the protection of existing structures, including marina facilities and marina parking, and public utilities, which are threatened by ongoing erosion; the seawall/bulkhead will also provide support for, and protection of, the proposed public bayfront promenade which will extend along the bayfront and connect with regional coastal trails and Newport Dunes to the east. In addition, the proposed project is occurring within an urban harbor at a location isolated from the nearest open coastal shoreline and longshore littoral sand transport mechanism.
Policy 2.8.6-6. Design and site protective devices to minimize impacts to coastal resources, minimize alteration of natural shoreline processes, provide for coastal access, minimize visual impacts, and eliminate or mitigate adverse impacts on local shoreline sand supply.	**Consistent.** The proposed future seawall/bulkhead will be subject to additional City CEQA review, Site Development Review and permitting, as well as processing of a Coastal Development Permit through the California Coastal Commission for the seawall/bulkhead and the future project-level applications for the Back Bay Landing project. Any submitted design will conform to the then-current minimum elevation requirements set by the City of Newport Beach, and as described in the Back Bay Landing Project Description and PCDP to be at a minimum elevation of at least 10 feet above MLLW. This minimum is presently consistent with the City of Newport Beach Harbor Committee Report on Global Warming and Sea Level Rise Effects on Newport Harbor, but will be subject to future City and Coastal Commission requirements applicable at the time of project permitting. The location of the future seawall/bulkhead will minimize impacts to coastal resources, alteration of natural shoreline processes and eliminate or mitigate adverse impacts on local shoreline sand supply for several reasons: 1. The future seawall/bulkhead will be located landward of the mean highest high water line and landward of any potential wetlands or Waters of the U.S.; 2. The seawall/bulkhead is proposed along the edge of an existing, developed marina parking lot (Bayside Village Marina) within an urban harbor at a location

Table 4.E-2 (Continued)

Coastal Land Use Plan Consistency Analysis

CLUP Policy	Project Consistency Statement
	isolated from the nearest open coastal shoreline and longshore littoral sand transport mechanism; 3. Such seawall/bulkhead will provide protection from bayfront erosion and the sloughing off of tidal slope areas and associated siltation of adjacent navigable channels in the private marina; 4. The seawall/bulkhead will provide improved bayfront access and protection/support for a new minimum 12-foot wide public walkway/ promenade.
Policy 2.8.6-8. Limit the use of protective devices to the minimum required to protect existing development and prohibit their use to enlarge or expand areas for new or existing development. "Existing development" for purposes of this policy shall consist only of a principle structure, e.g., resident dwelling, required garage, or second residential unit, and shall not include accessory or ancillary structures such as decks, patios, pools, tennis courts, cabanas, stairs, landscaping, etc.	**Consistent.** The proposed protective devices would not be used to enlarge or expand area for new development. Moreover, as stated above, such seawall/bulkhead is consistent with Section 30235 of the Coastal Act which states that, "…seawalls …shall be permitted when required to serve coastal-dependent uses or to protect existing structures." The proposed future development on-site includes improvement of access to existing (e.g., the marina and marina parking) as well as new (dry stack storage and public bayfront promenade) coastal dependent uses, consistent with Policy 2.8.6-5.
Policy 2.8.6-9. Require property owners to record a waiver of future shoreline protection for new development during the economic life of the structure (75 years) as a condition of approval of a coastal development permit for new development on a beach, shoreline, or bluff that is subject to wave action, erosion, flooding, landslides, or other hazards associated with development on a beach or bluff. Shoreline protection may be permitted to protect existing structures that were legally constructed prior to the certification of the LCP, unless a waiver of future shoreline protection was required by a previous coastal development permit.	**Consistent.** The proposed future seawall/bulkhead (shoreline protection) is necessary to protect existing structures on the project site, including parking and accessways to the Bayside Village/Marina, a Coastal-dependent use, and a main water vault. These public and private improvements were constructed prior to the Coastal Act of the LCP so the policy is not applicable and/or unnecessary.
Policy 2.8.6-10. Site and design new structures to avoid the need for shoreline and bluff protective devices during the economic life of the structure (75 years).	**Consistent.** See discussion above; the bayfront protective device is needed irrespective of the location of any new structures at the project site. The future development project cannot be sited or designed to avoid the need for a seawall/bulkhead, since the shoreline protective device is needed to protect the existing marina as well as the proposed dry stack storage facility.
2.8.7 Geologic and Seismic	
Policy 2.8.7-2. Require new development to provide adequate drainage and erosion control facilities that convey site drainage in a non-erosive manner in order to	**Consistent.** As discussed in detail in Section 4.H, *Hydrology and Water Quality*, of this Draft EIR, although no streams exist on-site, runoff from the site would flow

Table 4.E-2 (Continued)

Coastal Land Use Plan Consistency Analysis

CLUP Policy	Project Consistency Statement
minimize hazards resulting from increased runoff, erosion and other hydrologic impacts to streams.	into Upper Newport Bay. Site-design concepts for the project would maintain existing site drainage patterns which ultimately flow into Upper Newport Bay. Implementation of the project's Site Design and LID BMPs would ensure that flow rates and runoff volumes leaving the site in the post-project condition are treated and do not result in exacerbation of erosion/ sedimentation other adverse hydrologic effects in Upper Newport Bay.
Policy 2.8.7-3. Require applications for new development, where applicable [i.e., in areas of known or potential geologic or seismic hazards], to include a geologic/soils/geotechnical study that identifies any geologic hazards affecting the proposed project site, any necessary mitigation measures, and contains a statement that the project site is suitable for the proposed development and that the development will be safe from geologic hazard. Require such reports to be signed by a licensed Certified Engineering Geologist or Geotechnical Engineer and subject to review and approval by the City.	**Consistent.** As discussed above, a Preliminary Geotechnical Study has been prepared for the project site and a conceptual future mixed-use project on the property. The Preliminary Geotechnical Study, as required by this policy, identifies the geologic hazards affecting the proposed project site, provides necessary mitigation measures, and contains a statement that such a conceptual project would be geotechnically feasible on-site but design-specific mitigation will be required to address liquefaction potential once a specific project has been proposed. Additionally, the report is signed by a licensed Geotechnical Engineer and has been subject to review and approval by the City.

Source: PCR Services Corporation, 2013.

Table 4.E-3

California Coastal Act Consistency Analysis

Coastal Act Section	Consistency Analysis
Development	
Section 30253 Minimization of adverse impacts. New development shall do all of the following: (a) Minimize risks to life and property in areas of high geologic, flood, and fire hazard. (b) Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs. (c) Be consistent with requirements imposed by an air pollution control district or the State Air Resources	**Consistent.** The applicable provision of the Coastal Act is Section 30253(a) with respect to minimizing risks to life and property from geologic hazards. A comprehensive list of Project Design Features and Mitigation Measures has been incorporated into the project. These would help to minimize seismic and geologic hazards to proposed project features and structures. These features and measures would work in concert with BMPs to ensure that geologic instability caused by surface erosion does not occur.

Table 4.E-3 (Continued0

California Coastal Act Consistency Analysis

Coastal Act Section	Consistency Analysis
Development	
Board as to each particular development. (d) Minimize energy consumption and vehicle miles traveled. (e) Where appropriate, protect special communities and neighborhoods that, because of their unique characteristics, are popular visitor destination points for recreational uses.	

Source: PCR Services Corporation, 2013.

4. CUMULATIVE IMPACTS

For geology and soils, the study area considered for the cumulative impact includes (1) the area that could be affected by proposed project activities and (2) the areas affected by other projects whose activities could directly or indirectly affect the geology and soils of the project site. Geology and soils impacts are generally site-specific and there is typically little, if any, cumulative relationship between the development of the proposed project and development within a larger cumulative area, such as the citywide development. For example, development at the project site as a mixed-use development would not alter geologic events or soil features/characteristics (such as groundshaking, seismic intensity, or soil expansion); therefore, the project would not affect the level of intensity at which a seismic event on an adjacent site is experienced. However, project development and future development in the area may expose more persons to seismic hazards. However, the project, as well as the foreseeable projects, would be required to comply with the applicable State and local requirements, such as the CBC. As such, potential impacts would be reduced to a less than significant level and to the maximum extent practicable under current engineering practices. Seismic impacts are a regional issue and are also addressed through compliance with applicable codes and design standards. For these reasons, the project's contribution to cumulative geotechnical and soils impacts would be less than significant.

5. MITIGATION MEASURES

Mitigation Measure E-1 Prior to issuance of a grading permit, the Applicant shall submit to the City of Newport Beach Community Development Department, Building Division Manager or his/her designee for review and approval, a site-specific, design-level geotechnical investigation prepared for each development parcel by a registered geotechnical engineer. The investigation shall comply with all applicable State and local code requirements and:

a) Include an analysis of the expected ground motions at the site from known active faults using accepted methodologies;

b) In consideration of the subterranean construction planned for the parking structure, include an evaluation of the groundwater table and its fluctuations through the installation of shallow observation wells.

c) Determine structural design requirements as prescribed by the most current version of the California Building Code, including applicable City amendments, to ensure that structures can withstand ground accelerations expected from known active faults;

d) Determine the final design parameters for walls, foundations, foundation slabs, utilities, roadways, parking lots, sidewalks, and other surrounding related improvements.

Project plans for foundation design, earthwork, and site preparation shall incorporate all of the mitigations in the site-specific investigations. The structural engineer shall review the site-specific investigations, provide any additional necessary measures to meet Building Code requirements, and incorporate all applicable recommendations from the investigation in the structural design plans and shall ensure that all structural plans for the project meet current Building Code requirements.

The City's registered geotechnical engineer or third-party registered engineer retained to review the geotechnical reports shall review each site-specific geotechnical investigation, approve the final report, and require compliance with all geotechnical requirements contained in the investigation in the plans submitted for the grading, foundation, structural, infrastructure and all other relevant construction permits.

The City shall review all project plans for grading, foundations, structural, infrastructure and all other relevant construction permits to ensure compliance with the applicable geotechnical investigation and other applicable Code requirements.

6. LEVEL OF SIGNIFICANCE AFTER MITIGATION

Compliance with applicable regulatory requirements and implementation of the prescribed mitigation measure would reduce potentially significant geology and soils impacts to a less than significant level.