5.5 - Geology and Soils

5.5.1 - Introduction

This section describes the existing geology and soil setting and potential effects from project implementation on the site and the surrounding area. Descriptions and analysis in this section are based on information contained in the Geotechnical Investigation prepared by Terra Costa Consulting Group, Inc., included in this EIR as **Appendix F**.

5.5.2 - Regulatory Setting

Federal

The Clean Water Act including the National Pollution Discharge Elimination System (NPDES) is discussed in Section 5.7 Hydrology.

State

California Building Code (2007). The latest version of the California Building Code (CBC) is the 2007 edition. The California Building Code contains general building design and construction requirements relating to fire and safety, structural safety, and access compliance. CBC provisions provide minimum standards to safeguard life and limb, health, property, and public welfare by regulating and controlling the design, construction, quality of building materials, use, occupancy, location, and maintenance of all buildings and structures, as well as certain essential equipment.

Alquist-Priolo Earthquake Fault Zoning Act (1972). The Alquist-Priolo Earthquake Fault Zoning Act was enacted in 1975 and amended in 1993. Its intent was to provide policies and criteria to assist cities, counties, and state agencies with the responsibility of prohibiting the location of developments and structures for human occupancy across the trace of active faults. Furthermore, the Act is meant to provide the citizens of the state with increased safety and to minimize the loss of life during and immediately following earthquakes.

Seismic Hazard Mapping Act (1990). The Seismic Hazards Mapping Act) of 1990 (Public Resources Code, Chapter 7.8, Section 2690-2699.6) directs the Department of Conservation, California Geological Survey to identify and map areas prone to liquefaction, earthquake-induced landslides and amplified ground shaking. The purpose of the SHMA is to minimize loss of life and property through the identification, evaluation and mitigation of seismic hazards. The SHMA was passed by the legislature following the 1989 Loma Prieta earthquake.

California Health and Safety Code. The California Health and Safety Code address all aspects of health and safety including construction standards.

Local

Title 15, City of Newport Beach Municipal Code. Title 15 of the City Municipal Code addresses buildings and construction including electrical, plumbing, abatement of substandard buildings,

methane, flood damage prevention, etc. It incorporates California Codes (the California Building Code, California Plumbing Code, etc.).

City of Newport Beach General Plan, Safety Element. The Safety Element addresses coastal hazards, geologic hazards, seismic hazards, flood hazards, wildland and urban fire hazards, hazardous materials, aviation hazards, and disaster planning.

5.5.3 - Existing Conditions

Geologic Setting

The City of Newport Beach is located along the southwestern edge of the Los Angeles basin, adjacent to the Pacific Ocean. Newport Beach is located in the southern California geological region, which contains several active faults, including the Newport-Inglewood Fault Zone, the Norwalk fault, the Raymond Fault Zone, the San Andreas Fault Zone, the San Fernando Fault Zone, and the San Jacinto Fault Zone. The project site is located within approximately two kilometers of the Newport-Inglewood Fault Zone, the only active fault zone within or immediately adjacent to the City of Newport Beach (Safety Element, 2006). No additional active faults or fault zones are located on or near the project site. The project site is designated as a category 3 seismic hazard area in the City of Newport Beach Public Safety Element seismic hazards areas exhibit, which means that it poses moderate seismic risk to structures and citizens. This seismic risk is similar to many sites in Southern California.

The project site is situated on the landward side of a naturally formed coastal bar (or "barrier") of the type formed by a transgressive sea and littoral currents at the seaward edge of a stream delta or lagoon. The Newport Bay coastal estuary was originally formed as the lower reach of the Santa Ana River. However, in 1915, due to severe silting resulting from flooding of the Santa Ana River (and also the construction of a man-made channel), the Santa Ana River was realigned. The bay is currently fed only by San Diego Creek, which drains a comparatively small area of Orange County.

Site Topography and Bathymetry

Elevations across the site range from approximately +7.8 feet (NAVD 88; 0 ft NAVD is roughly equal to sea level) along West Balboa Boulevard to almost +10 feet near the central backbone of the site, then back down to about +5 feet at the U.S. bulkhead line that runs generally along the existing shoreline. From the U.S. bulkhead line, the nearshore bay floor slope descends at an inclination of approximately 10:1 down to an approximate elevation of -10 to -12 NAVD feet along the channel limit line.

Faults and Seismicity

A fault is a fracture in the crust of the earth along which rocks on one side have moved relative to those on the other side. Most faults are the result of repeated displacements over a long period. An active fault is one that has ruptured in the last 11,000 years. No faults, fissures, or shear zones were observed on the project site, and no previously identified faults were found to traverse the site. The

Newport-Inglewood Fault Zone lies approximately two kilometers from the project site, but the site does not lie within its Alquist-Priolo Earthquake Fault Zone.

Earthquakes are classified according to their moment (measure of the amount of energy released), their magnitude (measure of maximum ground motion), and their intensity (a qualitative assessment of the effects at a given location). An earthquake has a single moment and usually one magnitude, but it can produce several intensities, since effects generally decrease with distance. An earthquake with a moment magnitude 6.0 releases 32 times the energy of a magnitude 5.0, and a magnitude 7.0 earthquake releases about 1,000 (32 x 32) times more energy than a magnitude 5.0 earthquake. There are several methods of calculating the magnitude of ground motion. Intensities are most commonly measured in accordance with the Modified Mercalli Intensity scale, which defines 12 levels of damage. The strength of seismic ground shaking at a certain location depends primarily on the magnitude of the earthquake, the distance from the source, the pathways the seismic waves travel through the earth, the response characteristics of the rock or soils underlying the site, and topography, particularly if a site lies in a valley or atop a hill. The level of damage depends on the size, shape, age, and engineering characteristics of the affected buildings and structures.

Geological Hazards

Fault Rupture Hazard Zones in California

The purpose of the Alquist-Priolo Geologic Hazards Zones Act is to "prohibit the location of most structures for human occupancy across traces of active faults and to mitigate thereby the hazard of fault rupture." The State Geologist is required to delineate potentially active faults that have a relatively high potential for ground rupture. No faults have been mapped across the site, and the project site is not located within a mapped fault-rupture hazard zone.

Ground Shaking

Seismic shaking is the geological hazard that has the greatest potential to severely impact the project site, given that the City of Newport Beach is located near several significant faults that have the potential to cause moderate to large earthquakes. Some of the faults caused moderate-sized earthquakes in the last century.

The nearest fault to the project site is the Newport-Inglewood/Rose Canyon Fault. According to the United States Geologic Survey (USGS), the maximum credible earthquake for the nearest segment of the Newport-Inglewood/Rose Canyon Fault is considered to be magnitude 7.2. Recent probabilistic seismic hazard evaluations show the peak ground acceleration on the site for a 10 percent probability of exceedance in 50 years to be 0.37 to 0.41g.

Slope Stability

Strong ground motions can also worsen existing unstable slope conditions, particularly if coupled with saturated ground conditions. Seismically induced landslides can overrun structures, people, or property; sever utility lines; and block roads, thereby hindering emergency operations. No previous landslides have been mapped on the project site, which is located in a flat portion of the City.

Soils and Subsurface Conditions

The subsurface soil investigation (Appendix F) revealed that the site is underlain by hydraulic fill, bay deposits, and, extending beyond the deepest testing (50 feet), older alluvial deposits.

- **Hydraulic Fill Soils.** The project site is generally underlain by five to six feet of loose to medium-dense, gray-brown, damp to wet, hydraulically placed sands and silty sands with occasional shell fragments. It is likely that granular soils were placed as the result of dredging during the development of Newport Harbor.
- **Bay Deposits.** The hydraulic fill sands are typically underlain by a 2- to 2½-foot thick, soft to firm, compressible sandy silt to silty clay bay mud, which is in turn underlain by relatively clean, medium-dense, gray sands with shells and shell fragments characteristic of Holocene-age bay deposits down to an elevation of approximately -20 to -26 feet NVAD.
- **Older Alluvial Deposits**. Dense to very dense, red-brown to gray, coarse "clean" sands generally characteristic of older fluvial/alluvial deposits underlie the project site area below the bay deposits.

Groundwater

Due to the coastal location of the project site, groundwater levels at the site can be expected to vary in response to tidal fluctuations. Maximum groundwater levels would likely approach tidal highs in the bay, and groundwater low levels may drop slightly below mean sea level.

Soil Liquefaction Potential

Liquefaction, a geologic process that causes ground failure, typically occurs in loose, saturated sediments primarily of sandy composition. Areas of Newport Beach susceptible to liquefaction and related ground failure (i.e., seismically induced settlement) include areas along the coastline that include the portions of the City in and around the Newport Bay. The loose to medium-dense, near-surface hydraulic fills and the bay deposits exhibit relatively low densities and consist of clean soils, making these materials susceptible to seismic-induced liquefaction and lateral spreading. The dense to very dense older alluvial deposits are not susceptible to liquefaction. However, potential liquefaction above these elevations could occur with a seismic acceleration of 0.20 g or greater.

Seismic Settlement

One of the most common phenomena during seismic shaking accompanying any earthquake is the induced settlement of loose, unconsolidated soils. Ground settlement due to seismic activity results from a densification of soils due to ground vibration as well as from reconsolidation of liquefied soils. For the project site, the majority of the potential for seismic ground settlement would be associated with potential liquefaction of the upper 20± feet of the hydraulic fills and bay deposits. The geotechnical study estimates that if soils were to liquefy, the total amount of induced settlement would be on the order of 1 to 4 inches.

Expansive Soils

Expansive soils are soils that can give up water (shrink) or take on water (swell). In the absence of proper remediation measures, these soils can cause problems for building foundations, roadways, and other paved areas. Onsite soils tests did not encounter expansive soils.

5.5.4 - Thresholds of Significance

According to the CEQA Guidelines' Appendix G Environmental Checklist, the following questions are analyzed and evaluated to determine whether impacts to geology and soils are significant environmental effects. Would the project:

a.) 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 issued by the State Geologist for the area or based on other substantial evidence of a known fault? (Refer to Division of Mines and Geology Special Publication 42.)
   ii. Strong seismic ground shaking?
   iii. Seismic-related ground failure, including liquefaction?
   iv. Landslides?

b.) Result in substantial soil erosion or the loss of topsoil?

c.) 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 an onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse?

d.) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?

e.) 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?

5.5.5 - Project Impact Analysis and Mitigation Measures

This section discusses potential impacts associated with the proposed project and provides mitigation measures where necessary.

Earthquakes

5.5-A: The project could expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground shaking and seismic-related liquefaction, and would not expose people or structures to such potential adverse effects with respect to:

i) 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? (Refer to Division of Mines and Geology Special Publication 42.)

ii) Strong seismic groundshaking.

iii) Seismic-related ground failure, including liquefaction.

iv) Landslides.

Project-Specific Analysis

Faulting

The project site is not located within a Fault-Rupture Hazard Zone, although the project is near the Newport-Inglewood/Rose Canyon Fault, located 1.86 miles east of the project site. No evidence of faulting has been mapped on the project site or has been inferred to cross the site. Accordingly, the likelihood of fault rupture occurring on the project site is considered low to negligible, and impacts associated with fault rupture would be less than significant.

Seismic Ground Shaking

The primary seismic hazard is ground shaking due to a large earthquake on one of the major active regional faults. According to the Geotechnical Investigation (Appendix F), a maximum probable seismic event along the active regional fault zones could potentially produce a peak horizontal acceleration of approximately 0.41g at the project site. Accordingly, as with most locations within Southern California, there is the potential for project structures to experience strong ground shaking within the lifetime of the proposed project, as a result of seismic activity originating from regional faults. California State law requires structures to incorporate earthquake-resistant design standards in accordance with the latest CBC and appropriate seismic design criteria; the adherence to this regulatory requirement would reduce potential impacts to less than significant.

Seismic-Related Ground Failure

As discussed above, the proposed project would most likely experience strong ground shaking as a result of seismic activity originating from regional faults, including the nearby Newport-Inglewood/Rose Canyon Fault. The potential for seismic-related ground failure is addressed in the following discussion with respect to seismic-induced liquefaction and settlement.

Seismic-Induced Liquefaction

The near-surface soils beneath the project site, which consist of loose to medium-dense hydraulic fills and bay deposits, would be subject to liquefaction during seismic events. It is expected that liquefaction could be triggered on the project site with a seismic acceleration of 0.20 g. As indicated above, the project site could experience a peak horizontal acceleration of approximately 0.41g at the project site, which would probably lead to liquefaction of onsite soils. Therefore, impacts associated with seismic-induced liquefaction would be potentially significant.

Seismic-Induced Settlement

Ground settlement due to seismic activity results from a densification of soils due to ground vibration, as well as from reconsolidation of liquefied soils. For the facilities under consideration, it is anticipated that the majority of the seismic ground settlement would be associated with the potential liquefaction of the upper 20 feet or so of the hydraulic fills and bay deposits. It is estimated that if these soils were to liquefy, the total induced settlement could be on the order of 1 to 4 inches. This is considered a potentially significant impact.

Landslides

The project site and the areas adjacent to the site are relatively flat. No landslides have been mapped on the project site. Therefore, no impacts associated with landslides would occur.

Cumulative

Soils and geologic influences are site-specific, and there is little, if any, cumulative relationship between the development of the proposed project and development within the greater cumulative project area. For instance, development at the project site would not result in altering geologic events or soil features/characteristics, such as ground shaking or seismic intensity; therefore, development at the project site would not affect the level of intensity at which a seismic event an adjacent site experiences. Accordingly, the proposed project would have no cumulative geology and soils impacts.

Mitigation Measures

Project Specific

MM 5.5-A.1 Prior to the issuance of a grading permit for Phase 3, the City of Newport Beach shall prepare a building foundation design to reduce the impacts of potential liquefaction and settlement. The foundation design shall conform to the recommendation of the geotechnical report prepared for the project, which include:

Site Preparation – excavation of minimum of 12 inches and recompaction to provide recommended subgrade density; all activities to be observed by a geotechnical engineer.

Foundation -- mat foundation for restroom facilities and small buildings and either a deep foundation system such as driven piles or stone columns with mat foundations for the Balboa Center. The specific foundation design for each proposed structure would require approval by the City of Newport Beach Building Department.

Marina – design specifications and construction techniques are recommended in the geotechnical report and shall be adhered to.

Cumulative

No mitigation measures are required.

Level of Significance After Mitigation

Project Specific

Less than significant impact.

Cumulative

No impact.

Soil Erosion or Topsoil Loss

5.5-B: The project would not result in substantial soil erosion or the loss of topsoil.

Project-Specific Analysis

The project site is located on relatively flat terrain and consists primarily of sandy soil. Construction activities associated with the proposed project would result in the mass grading of the entire site (during all three phases), which would leave the soil exposed. Construction activities would utilize best management practices in accordance with City requirements to reduce the potential for soil erosion by wind or water to a less-than-significant impact.

During Phase 3, any soils that are temporarily stockpiled as a result of the dredging for the proposed marina would comply with standard City requirements to prevent erosion from wind or water.

The long-term operation of Phase 3 would include the construction of impervious surfaces, landscaping, and a drainage system that conveys storm water from the surfaces to the bioswales and biocells. These project components would reduce the potential for long-term erosion and loss of topsoil to a less-than-significant impact.

Cumulative

Soils and geologic influences are site-specific, and there is little, if any, cumulative relationship between the development of the proposed project and development within the greater cumulative project area. Therefore, there would be no cumulative impacts associated with soil erosion or the loss of topsoil.

Mitigation Measures

Project Specific

No mitigation measures are required.

Cumulative

No mitigation measures are required.

Level of Significance After Mitigation

Project Specific

Less than significant impact.

Cumulative

No impact.

Unstable Geologic Location

5.5-C: The project would 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 an onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse.

Project-Specific Analysis

The proposed facilities on the project site may be exposed to unstable soils. Lateral spreading is slope instability that can occur in response to liquefaction. Lateral spreading typically develops on ground underlain by liquefiable soils or where free-face conditions can develop in a liquefiable soil, such as along Newport Bay or its drainage tributaries. The beach area of the project site along Newport Bay is likely to be vulnerable to lateral spreading, which could result in a significant impact on the proposed buildings.

Cumulative

Soil and geologic influences are site specific, and there is little, if any, cumulative relationship between the development of the project site and build-out of related projects in the area. Therefore, there would not be cumulative impacts associated with unstable geologic conditions.

Mitigation Measures

Project Specific

Implementation of Mitigation Measure MM 5.5-A.1 is required.

Cumulative

No mitigation measures are required.

Level of Significance After Mitigation

Project Specific

Less than significant impact.

Cumulative

No impact.

Expansive Soil

5.5-D: The project would not be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property.

Project-Specific Analysis

The onsite soils do not have expansion capabilities; therefore, the structures proposed in Phase 3 would not be affected by expansive soils.

Cumulative

Soil and geologic influences are site specific, and there is little, if any, cumulative relationship between the development of the project site and build-out of related projects in the area. Therefore, there would be no cumulative impacts associated with expansive soils.

Mitigation Measures

Project Specific

No mitigation measures are required.

Cumulative

No mitigation measures are required.

Level of Significance After Mitigation

Project Specific

No impact.

Cumulative

No impact.

Wastewater Disposal Systems

5.5-E: The project would not 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.

Project-Specific Analysis

Septic tanks or alternative wastewater disposal systems are not proposed in any of the project phases. The project would include lateral connections to the City of Newport Beach sewer mainlines. Therefore, no impacts would occur with project development.

Cumulative

Soil and geologic influences are site specific, and there is little, if any, cumulative relationship between the development of the project site and build out of related projects in the area. Therefore, there would be no cumulative geologic impacts associated with wastewater disposal systems.

Mitigation Measures

Project Specific

No mitigation measures are required.

Cumulative

No mitigation measures are required.

Level of Significance After Mitigation

Project Specific

No impact.

Cumulative

No impact.