5.9 GEOLOGY AND SOILS

This section evaluates the geologic and seismic conditions within the City of Newport Beach and evaluates the potential for geologic hazard impacts associated with implementation of the proposed project. Information in this section is based on the following documentation:

- *Report of Geotechnical Investigation, Lido House Hotel – City Hall Site Reuse Project* (Geotechnical Investigation) prepared by GMU Geotechnical, Inc., dated December 4, 2013 (refer to Appendix 11.6, *Geotechnical Investigation*);
- *City of Newport Beach General Plan* (adopted July 25, 2006); and
- *City of Newport Beach Municipal Code*.

5.9.1 EXISTING SETTING

METHODOLOGY

In order to identify existing geologic and soil conditions and assess potential impacts associated with development of the proposed project, GMU Geotechnical, Inc. (GMU) conducted a Geotechnical Investigation. The scope of the investigation included background review, site reconnaissance, subsurface exploration program including soil borings, laboratory tests, engineering analysis, and report preparation; refer to Appendix 11.6.

SITE DESCRIPTION AND TOPOGRAPHY

The existing site improvements include concrete curbs and gutters, asphalt paved streets, parking lot drives and bays, along with concrete driveways, three two-story buildings and one single-story building that are of wood-frame construction with conventional foundations, along with adjacent hardscape and landscape improvements. The majority of the site is relatively flat and level; there are no slopes on the site. Elevations within the site range from a high of approximately 10.1 feet above mean sea level within the southeastern portion of the site to a low of approximately 7.3 feet above mean sea level within the southwestern portion of the site.

LOCAL GEOLOGY AND SUBSURFACE SOIL CONDITIONS

Published geologic maps indicate that prior to development (pre-1900s) the project site was part of the marshy area at the mouth of the Santa Ana River before it shifted westward to its current location. This marshy area consisted of estuary deposits in the form of sand bars and shallow marsh/lagoon areas. The Newport Bay area was developed into the current configuration in the early 1900s by dredging some areas and filling others to create the existing islands. Based on research and subsurface investigation performed as part of the Geotechnical Investigation, the project site is underlain by a thin veneer of these dredge materials overlying native estuary deposits. For ease of reference, these deposits are referred to as alluvial soil. Geologic materials observed beneath the site as part of the subsurface exploration are described below.

Dredged Fill (Qaf)

The dredged fill materials within the site originated from the estuary and near shore deposits in the bay. These materials consist of sand to silty sand that is moist to very moist, medium dense, with scattered shell fragments. Notable structure within these deposits was not observed during the Geotechnical Investigation.

Alluvium (Qal)

Alluvial soils were encountered underlying the dredge fill materials across the project site. Where encountered, these materials consist of gray and brown sands and silts with some clays. The materials are moist to wet and loose to medium dense, with no notable structure observed.

GROUNDWATER

Groundwater was encountered within drill holes and Cone Penetration Test (CPT) soundings at elevations of approximately 3.5 to 4.0 feet above mean sea level (depths of 4.5 to 5.0 feet below existing grades). Groundwater elevations across the site are likely primarily controlled by elevation of the water within the adjacent bay. It should be noted that the groundwater elevations measured during the subsurface exploration were affected by the time of day as it relates to the local tidal cycle, and therefore should be assumed to fluctuate with the tides, the lunar cycle, and recent rainfall events.

In order to better evaluate the groundwater data collected as part of the Geotechnical Investigation, the depths to groundwater were compared to the depth of historically high groundwater shown within the Seismic Hazard Zone Report for the Newport Beach Quadrangle. These maps indicate a historical high groundwater of less than 10 feet below ground surface, which is approximately five feet lower than the elevation of groundwater detected during the Geotechnical Investigation. Based on the above findings, groundwater may be encountered as high as four feet below ground surface.

GEOLOGIC HAZARDS

Faulting and Seismicity

According to the California Geological Survey, a fault is defined as 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 of time. An inactive fault is a fault that has not experienced earthquake activity within the last three million years. In comparison, an active fault is one that has experienced earthquake activity in the past 11,000 years. A fault that has moved within the last two to three million years, but has not been proven by direct evidence to have moved within the last 11,000 years, is considered potentially active.

The Alquist-Priolo Earthquake Fault Zoning Act, Public Resources Code Sections 2621-2624, Division 2, Chapter 7.5 regulates development near active faults in order to mitigate the hazard of surface fault-rupture. Under the Act, the State Geologist is required to delineate "special study zones" along known active faults in California. The Act also requires that, prior to approval of a project, a geologic study be conducted to define and delineate any hazards from surface rupture. A geologist registered by the State of California, within or retained by the lead agency for the project, must prepare this geologic report. A 50-foot setback from any known trace of an active fault is required.

The project site is not located within the published Newport Beach Quadrangle Alquist-Priolo Earthquake Fault Zone dated July 1, 1986, and no known active faults are shown on current geologic maps for the site. The nearest known active fault is the offshore segment of the Newport-Inglewood fault, which is located approximately 0.3 miles southwest of the project site and is capable of generating a maximum earthquake magnitude (M_w) of 7.5. The project site is also located over the surface projection of the San Joaquin Hills Blind Thrust and approximately 5.6 miles from its rupture surface, which is capable of generating a maximum earthquake magnitude of 7.1 (M_w). Given the proximity of the project site to these and numerous other active and potentially active faults, the project site would likely be subject to earthquake ground motions in the future.

Seismic-Induced Landslides

The project site is not located within an area mapped as having the potential for seismic-induced landsliding, as shown in Seismic Hazard Zone Map for the Newport Beach Quadrangle.

Liquefaction, Seismic Settlement, and Lateral Spreading

Seismic ground shaking of relatively loose, granular soils that are saturated or submerged can cause the soils to liquefy and temporarily behave as a dense fluid. Liquefaction is caused by a sudden temporary increase in pore water pressure due to seismic densification or other displacement of submerged granular soils. Liquefaction more often occurs in earthquake-prone areas underlain by young (i.e., Holocene age) alluvium where the groundwater table is higher than 50 feet below ground surface. The project site is designated as being within a zone having the potential for earthquake-induced liquefaction. In addition, the Geotechnical Investigation determined the project site has a moderate potential for adverse effects of liquefaction due to seismic-induced settlement.

Considering the project site's topography (relatively flat) and distance from the Back Bay, the Geotechnical Investigation determined that the project site has a low potential for adverse effects due to seismic-induced lateral spreading.

Static Settlement/Compressibility

In general, the upper 50 feet of subgrade soils within the project site are medium dense to dense granular sand materials with lenses of fine grain soils. The sand deposits are underlain by soft high plasticity silts. The Geotechnical Investigation indicates that the upper granular soils have low compressibility.

Soil Expansion

Expansive soils are clay-rich soils that can undergo a significant increase in volume with increased water content and a significant decrease in volume with a decrease in water content. Significant changes in moisture content within moderately to highly expansive soil can produce cracking differential heave, and other adverse impacts to structures constructed on these soils. The expansion potential of the on-site dredged fill materials were assessed based on visual classifications, particle size distributions, Atterberg limits, expansion index, previous studies, and local experience.

According to the Geotechnical Investigation, the dredged fills mantling the project site have a very low expansion potential.

Corrosive Soils

Corrosive soils contain chemical constituents that can react with construction materials, such as concrete and ferrous metals, that may cause damage to foundations and buried pipelines. One such constituent is water-soluble sulfate which, if in a high enough concentration, can react with and damage concrete. Electrical resistivity and pH level are indicators of the soil's tendency to corrode ferrous metals. To evaluate the corrosion potential of the on-site soils to both ferrous metals and concrete, representative samples were tested for pH, minimum resistivity, soluble chlorides, and soluble sulfates. The results of chemical testing indicate that the on-site soils should be considered very mildly corrosive to ferrous metals and possess a negligible sulfate exposure to concrete; however, the Geotechnical Investigation recommends a moderate exposure to sulfates be considered in design for concrete placed in contact with on-site soils.

Soil Erosion

Soil erosion is most prevalent in unconsolidated alluvium and surficial soils, which are prone to downcutting, sheetflow, and slumping and bank failure during and after heavy rainstorms. Strong wind forces can also produce varying amounts of soil erosion of unconsolidated surficial soils. The project site is relatively flat and does not possess site conditions necessarily conducive to soil erosion.

Tsunamis

Tsunamis or seismic sea waves that have affected coastal southern California are generally produced by submarine fault rupture. Historical records indicate that the coast, from San Pedro to Newport Bay, has been affected by six significant tsunamis since 1868. The largest waves were on the order of six to eight feet. The most extensive recent damage occurred in harbor areas such as Los Angeles. The tsunami hazard associated with the Catalina fault offshore of southern California has previously been investigated. Tsunamis were simulated based on coseismic deformation of the sea floor and estimated that coastal run-up values are five to 13 feet, although run-up could exceed 23 feet depending upon amplification due to bathymetry and coastal configuration. Large earthquakes on the Catalina fault are relatively infrequent, with recurrence intervals of several hundred to thousands of years.

In 2009, the California Emergency Management Agency, California Geological Survey, and University of Southern California partnered in an effort to create tsunami inundation maps for California. The tsunami inundation maps were generated through a modeling process that utilizes the Method of Splitting Tsunamis (MOST). This computational program models tsunami evolution and inundation based on bathymetry and topography. The modeling also utilizes a variety of tsunami source events, including "realistic local and distant earthquakes and hypothetical extreme undersea, near-shore landslides." Using the source, bathymetry, and topography, the tsunami modeling yields a maximum inundation line. It is important to note that the published map does not represent inundation from a single event. Rather, it is the result of combining inundation lines from multiple source events. Therefore, the entire inundation region would not likely be inundated during a single tsunami event.

The Tsunami Inundation Map states that the "tsunami inundation map was prepared to assist cities and counties in identifying their tsunami hazard. It is intended for local jurisdictional, coastal evacuation planning uses only." Furthermore, the map conveys that it is not intended for regulatory purposes. With respect to probability, the map states that it contains "no information about the probability of any tsunami affecting any area within a specific period of time."

A Tsunami Inundation Map for Emergency Planning was published for the Newport Beach Quadrangle. The project site is located within the Tsunami inundation area; therefore, the project site is considered to have a high potential for being affected by tsunamis; refer to Section 5.11, *Hydrology and Water Quality*, for a discussion of potential impacts associated with tsunamis.

5.9.2 REGULATORY SETTING

FEDERAL

The purpose of the Federal Soil Protection Act is to protect or restore the functions of the soil on a permanent sustainable basis. Protection and restoration activities include prevention of harmful soil changes, rehabilitation of the soil of contaminated sites and of water contaminated by such sites, and precautions against negative soil impacts. If impacts are made on the soil, disruptions of its natural functions as an archive of natural and cultural history should be avoided, as far as practicable. In addition, the requirements of the Federal Water Pollution Control Act (also referred to as the Clean Water Act [CWA]) through the National Pollution Discharge Elimination System (NPDES) provide guidance for protection of geologic and soil resources.

STATE

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures used for human occupancy. The main purpose of the Act is to prevent the construction of buildings used for human occupancy on top of the traces of active faults. Although the Act addresses the hazards associated with surface fault rupture, it does not address other earthquake-related hazards, such as seismically induced ground shaking or landslides.

The law requires the State Geologist to establish regulatory zones (known as Earthquake Fault Zones or Alquist-Priolo Zones) around the surface traces of active faults, and to publish appropriate maps that depict these zones. The maps are then distributed to all affected cities, counties, and State agencies for their use in planning and controlling development.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act, passed in 1990, addresses earthquake hazards other than surface fault rupture, including liquefaction and seismically induced landslides. Seismic hazard zones are mapped by the State Geologist to assist local governments in land use planning. The California Geological Survey prepares and provides local governments with seismic hazard zones maps that identify areas susceptible to amplified shaking, liquefaction, earthquake-induced landslides, and other ground failures. The seismic hazards zones are referred to as "zones of required investigation" because site-specific geological investigations are required for construction projects located within these areas. Before a project can be permitted, a geologic investigation, evaluation, and written report must be prepared by a licensed geologist to demonstrate that proposed buildings will not be constructed across active faults. If an active fault is found, a structure for human occupancy must be set back from the fault (generally 50 feet). In addition, sellers (and their agents) of real property within a mapped Seismic Hazard Zone must disclose that the property lies within such a zone at the time of sale.

California Building Code

California building standards are published in the California Code of Regulations, Title 24, known as the California Building Code (CBC). The 2013 CBC applies to all applications for building permits. The 2013 CBC contains administrative regulations for the California Building Standards Commission and for all State agencies that implement or enforce building standards. Local agencies must ensure that development complies with the guidelines contained in the 2013 CBC. Cities and counties have the ability to adopt additional building standards beyond the 2013 CBC.

LOCAL

Newport Beach General Plan Safety Element

The primary goal of the Newport Beach General Plan Safety Element (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 type and location of hazards are identified, as well as policies and programs to minimize impacts. The following Safety Element policy related to geologic issues may be applicable to the proposed project. Refer to Section 5.10, *Hazards and Hazardous Materials* for policies regarding hazardous conditions within the City, and Section 5.11, *Hydrology and Water Quality* for policies pertaining to drainage and water quality, including tsunamis.

- New Development (S4.7)
  Conduct further seismic studies for new development in areas where potentially active faults may occur. (Imp 2.1, 27.1)

Newport Beach Local Coastal Program Land Use Plan

The City of Newport Beach Local Coastal Program Coastal Land Use Plan (CLUP) sets forth goals, objectives, and policies that govern the use of land and water in the coastal zone within the City of Newport Beach and Sphere of Influence (SOI), with the exception of Newport Coast and Banning Ranch. The following policy related to geologic issues may be applicable to the proposed project.

- 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. (2.8.7-3)

Newport Beach Municipal Code

Chapter 15.04, Building Code

City of Newport Beach Municipal Code (Municipal Code) Section 15.04.010, Adoption of the 2013 California Building Code, adopts and incorporates by reference the 2013 Edition of the California Building Code, Volumes 1 and 2, including Appendix C, I, and all national codes and standards referenced therein, based on the 2010 International Building Code, as published by the International Code Council. The various parts of these codes and standards, along with the additions, amendments and deletions adopted in Section 15.04, constitute the Newport Beach Building Code.

Chapter 15.10, Excavation and Grading Code

Municipal Code Chapter 15.10, Excavation and Grading Code, regulates grading, drainage and hillside construction on private property and for similar improvement proposed by private interests on City right-of-way where regulations are not otherwise exercised. Section 15.10.060, Grading Permit Requirements, requires each application for a grading permit or building permit be accompanied by two sets of plans and specifications, and supporting data consisting of soil engineering and engineering geology report, or other needed documents, when required by the Building Official.

The soil engineering report shall include data regarding the nature, distribution, strength consolidation characteristics of existing soils, conclusions and recommendations for grading procedures, and design criteria for corrective measures when necessary, and opinions and recommendations covering adequacy of sites to be developed by the proposed grading. These listings shall not be interpreted to prevent the Building Official from requiring other information required to produce a safe and stable condition. Recommendations included in the report and approved by the Building Official shall be incorporated into the grading plans or specifications.

The engineering geology report shall include an adequate description of the geology of the site, including necessary maps and illustrations showing geographic distribution of the features described related to the proposed development, conclusions and recommendations regarding the effect of geologic conditions on the proposed development, and opinions and recommendations covering the adequacy of sites to be developed by the proposed grading. Recommendations included in the report and approved by the Building Official shall be incorporated into the grading plans and specifications.

Section 15.10.140, Grading Inspection, states that for engineered grading, it shall be the responsibility of the civil engineer who prepares the approved grading plan to incorporate all recommendations from the soil engineering and engineering geology reports into the grading plan. During grading all necessary reports, compaction data, soil engineering and engineering geology recommendations shall be submitted to the civil engineer and the Building Official by the soil engineer and the engineering geologist.

Section 15.10.150, Notification of Completion, requires final reports upon completion of the rough grading work and at the final completion of the work. The Building Official may require as as-graded grading plan, soil grading report, and/or a geologic grading report.

Chapter 15.14, Existing Building Code

Municipal Code Chapter 15.14, Existing Building Code, adopts and incorporates by reference the 2013 Edition of the California Existing Building Code and all national codes and standards referenced therein to the prescribed extent of each such reference. The various parts of these codes and standards are known as the Newport Beach Existing Building Code.

5.9.3 IMPACT THRESHOLDS AND SIGNIFICANCE CRITERIA

CEQA SIGNIFICANCE CRITERIA

Appendix G of the *CEQA Guidelines* contains the Environmental Checklist form that was used during the preparation of this EIR. Accordingly, a project may create a significant adverse environmental impact if it would:

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
  - 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 (refer to Section 8.0, *Effects Found Not To Be Significant*).
  - Strong seismic ground shaking (refer to Impact Statement GEO-1).
  - Seismic-related ground failure, including liquefaction (refer to Impact Statement GEO-2).
  - Landslides (refer to Section 8.0, *Effects Found Not To Be Significant*).
- Result in substantial soil erosion or the loss of topsoil (refer to Impact Statement GEO-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 GEO-4).
- Be located on expansive soil, as defined in Table 18-1-B of the California Building Code (2004), creating substantial risks to life or property (refer to Impact Statement GEO-5).
- Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water (refer to Section 8.0, *Effects Found Not To Be Significant*).

Based on these standards, the effects of the proposed project have been categorized as either a "less than significant impact" or a "potentially significant impact." Mitigation measures are recommended for potentially significant impacts. If a potentially significant impact cannot be reduced to a less than significant level through the application of mitigation, it is categorized as a significant unavoidable impact.

5.9.4 IMPACTS AND MITIGATION MEASURES

STRONG SEISMIC GROUND SHAKING

GEO-1 THE PROPOSED PROJECT MAY EXPOSE PEOPLE OR STRUCTURES TO POTENTIAL SUBSTANTIAL ADVERSE EFFECTS INVOLVING STRONG SEISMIC GROUND SHAKING.

Impact Analysis: Given the highly seismic character of the southern California region and proximity to active and potentially active faults, the project site would likely be subject to significant earthquake ground motion. Thus, potential impacts associated with strong seismic ground shaking at the project site are considered significant. According to the Geotechnical Investigation, the construction of the proposed project is feasible from a geotechnical standpoint. However, mitigation would be required to provide long-term site stability and proper support of proposed structures. Compliance with the City of Newport Beach grading and building requirements, including the most current CBC, and the recommendations provided in the Geotechnical Investigation would mitigate site hazards. Implementation of Mitigation Measure GEO-1 requires the proposed project to comply with the recommendations of the project Geotechnical Investigation, which stipulates appropriate seismic design which would reduce potential project impacts related to seismic ground shaking to a less than significant level.

Mitigation Measures:

GEO-1 All grading operations and construction shall be conducted in conformance with the recommendations included in the geotechnical report for the proposed project site prepared by GMU Geotechnical, Inc., titled *Report of Geotechnical Investigation, Lido House Hotel – City Hall Site Reuse Project, 3300 Newport Boulevard, City of Newport Beach, California* (December 4, 2013) (included in Appendix 11.6 of this EIR and incorporated by reference into this mitigation measure). Design, grading, and construction shall be performed in accordance with the requirements of the City of Newport Beach Building Code and the California Building Code applicable at the time of grading, appropriate local grading regulations, and the recommendations of the project geotechnical consultant as summarized in a final written report, subject to review by the City of Newport Beach Building Official or designee prior to commencement of grading activities.

Recommendations in the *Report of Geotechnical Investigation, Lido House Hotel – City Hall Site Reuse Project, 3300 Newport Boulevard, City of Newport Beach, California* are summarized below.

Site Preparation and Grading

The project site shall be precise graded in accordance with the City of Newport Beach grading code requirements (and all other applicable codes and ordinances) and the following recommendations. The geotechnical aspects of future grading plans and improvement plans shall be reviewed by a Geotechnical Engineer prior to grading and construction. Particular care shall be taken to confirm that all project plans conform to the recommendations provided in this report. All planned and corrective grading shall be monitored by a Geotechnical Engineer to verify general compliance with the following recommendations.

- *Demolition and Clearing*. Prior to the start of the planned improvements, all materials associated with the existing buildings to be removed, including footings, floor slabs, and underground utilities, shall be demolished and hauled from the site. The existing asphalt pavement sections, which are inadequate and severely damaged, shall also be demolished. The old asphalt and base materials generated from the removal of the existing pavement sections shall be either recycled or collected and hauled off-site.

  All significant organic and other decomposable debris shall be removed if on-site dredge fill materials are used as new compacted fill. Any oversize rock materials generated during grading shall be collected and hauled off-site. Cavities and excavations created upon removal of subsurface obstructions, such as existing buried utilities, shall be cleared of loose soil, shaped to provide access for backfilling and compaction equipment, and then backfilled with properly compacted fill.

  If unusual or adverse soil conditions or buried structures are encountered during grading that are not described within the *Report of Geotechnical Investigation, Lido House Hotel – City Hall Site Reuse Project, 3300 Newport Boulevard, City of Newport Beach, California*, these conditions shall be brought to the immediate attention of the project geotechnical consultant for corrective recommendations.

- *Corrective Grading – Buildings*. Existing dredge fill materials shall be overexcavated to a depth of at least four feet below the existing grades and these excavated materials shall be replaced as properly compacted fill placed at a minimum relative compaction of at least 92 percent as determined by American Society for Testing and Materials (ASTM) Test Method D 1557 and at 2 percent above optimum moisture content.

- *Corrective Grading – Exterior Parking, Driveway, and Hardscape Areas*. In order to provide adequate support of proposed exterior improvements such as parking lots and driveways, and hardscape features such as patios, walkways, stairways and planter walls, the existing ground surfaces in these areas shall be overexcavated to a depth of at least two feet below the existing grades and shallow foundations. These excavated materials can then be replaced as properly compacted fill at a minimum relative compaction of at least 92 percent as determined by ASTM Test Method D 1557 at 2 percent above optimum moisture content.

Temporary Slope Stability

During site grading, temporary laid back slopes up to approximately 4 to 5 feet in height are expected to be created during the construction of proposed low retaining walls. Temporary slopes to a maximum height of 4 feet may be cut vertically without shoring subject to verification of safety by the contractor. Deeper excavations shall be braced, shored or, for those portions of the sidewalls above a height of 4 feet, sloped back no steeper than 1:1 (horizontal to vertical). In addition, no surcharge loads shall be allowed within 10 feet from the top of the temporary slopes. All work associated with temporary slopes shall meet the minimal requirements as set forth by the California Division of Occupational Safety and Health (CAL/OSHA).

Post Grading and Ground Improvement

- *Utility Trenches*.

  - *Utility Trench Excavations*. Soils above the groundwater level shall be laid back at a maximum slope ratio of 1.5:1, horizontal to vertical. In addition, surcharge loads shall not be allowed within 10 feet of the top of the excavations.

    For deeper trenches, groundwater will be encountered and the contractor shall develop an approach for dewatering, shoring, and addressing shallow groundwater conditions. Sumping and pumping of free water from open excavations is not expected to result in dry and stable trench conditions due to the close proximity of the adjacent bay; therefore, a dewatering system shall be designed, installed, and operated by an experienced company specializing in groundwater dewatering systems.

    The dewatering system shall be capable of lowering the groundwater surface to a depth of 5 feet below the bottom of the trenches. Before implementing a dewatering system, a dewatering test program shall be conducted to evaluate the feasibility and efficiency of the proposed dewatering system. Dewatering shall be performed and confirmed by potholing or other means prior to trench excavation. Dewatering operations shall also comply with all NPDES regulations.

    Temporary shoring shall be required below the water table where saturated soils are encountered or where vertical trench sidewalls are desired. Shoring shall consist of metal, plywood, and/or timber sheeting supported by braces or shields. Lateral pressures considered applicable for the shoring design will depend on the type of shoring system selected by the contractor and whether the site is dewatered. Specific design values shall be calculated once the type of shoring is determined.

    The contractor shall retain a qualified and experienced registered engineer to design any shoring systems in accordance with CAL/OSHA criteria. The shoring engineer shall evaluate the adequacy of the shoring design parameters provided in the *Report of Geotechnical Investigation, Lido House Hotel – City Hall Site Reuse Project, 3300 Newport Boulevard, City of Newport Beach, California* and make appropriate modifications as necessary. The design shall consider local groundwater levels and that groundwater levels may change over time as a result of tidal influences.

- *Utility Trench Subgrade Stabilization.* Prior to pipeline bedding placement, the trench subgrades shall be firm and unyielding. If unsuitable subgrade soils are encountered, the contractor shall consult with the project Geotechnical Engineer to provide subgrade stabilization. Stabilization may generally consist of the placement of crushed rock or processed miscellaneous base. Crushed rock, if used, shall be encased in filter fabric. Specific recommendations would be dependent on actual conditions encountered.

- *Utility Trench Backfill.* Backfill compaction of utility trenches shall be such that no significant settlement would occur. Backfill for all trenches shall be compacted to at least 92 percent relative compaction subject to sufficient observation and testing. Flooding in the trench zone is not recommended. If native material with a sand equivalent less than 30 is used for backfill, it shall be placed at near-optimum moisture content and mechanically compacted. Jetting or flooding of granular material shall not be used to consolidate backfill in trenches adjacent to any foundation elements.

  Where trenches closely parallel a footing (i.e., for retaining walls) and the trench bottom is located within a 1 horizontal to 1 vertical plane projected downward and outward from any structure footing, a minimum 1½-sack concrete slurry backfill shall be utilized to backfill the portion of the trench below this plane. The use of concrete slurry is not required for backfill where a narrow trench crosses a footing at about right angles.

- *Surface Drainage*. Surface drainage shall be carefully controlled to prevent runoff over graded sloping surfaces and ponding of water on flat pad areas. All drainage at the site shall be in minimum conformance with the applicable City of Newport Beach codes and standards.

Foundation Design

The following preliminary foundation design recommendations are provided based on anticipated conditions at the completion of anticipated grading; however, these recommendations are based on conceptual plans that may be revised during the plan check process. Ultimate construction and grading within the project site shall be in accordance with all applicable provisions of the grading and building codes of the City of Newport Beach, the applicable CBC, and all of the recommendations of the project civil and geotechnical consultants involved in the final site development.

- *Geotechnical Design Parameters for Mat Foundations*. To minimize the adverse effects of earthquake-induced settlements and provide repairable foundation systems after the design earthquake, structural mat slab(s) are recommended to support the proposed structures.

- *Corrective Grading.* Existing fill and alluvial soils shall be excavated beneath the entire footprint of the structures to a minimum depth of at least 4 feet below the planned mat foundation. Removals shall extend laterally to at least 5 feet from the base of the outside of the mat foundation. Artificial fill/alluvium derived from the excavated soils shall be compacted to a minimum of 92% relative compaction per ASTM 1557.

- *Design Parameters.* An allowable net static bearing capacity of 2,000 pounds per square foot may be used for design of the mat foundation(s). A lateral sliding coefficient of 0.35 is recommended. The mat thickness and amount of reinforcement shall be determined by a Registered (Structural) Engineer in the State of California.

- *Moisture Vapor Barriers*. Due to the existing shallow groundwater table, a vapor barrier equivalent to Stego 15 shall be utilized and installed in accordance with the *Report of Geotechnical Investigation, Lido House Hotel – City Hall Site Reuse Project, 3300 Newport Boulevard, City of Newport Beach, California*.

- *Water Vapor Transmission*. The moisture vapor barrier is intended only to reduce moisture vapor transmissions from the soil beneath the concrete and is consistent with the current standard of the industry for construction in southern California. It is not intended to provide a "waterproof" or "vapor proof" barrier or reduce vapor transmission from sources above the barrier. Sources above the barrier include any sand placed on top of the barrier (i.e., to be determined by the project structural designer) and from the concrete itself (i.e., vapor emitted during the curing process).

- *Floor Coverings*. Prior to the placement of flooring, the floor slabs shall be properly cured and tested to verify that the water vapor transmission rate (WVTR) is compatible with the flooring requirements.

- *Concrete*. Minimum Type II/V cement along with a maximum water/cement ratio of 0.50 and a minimum compressive strength of 4,000 psi shall be used for all structural foundations in contact with the on-site soils. In addition, wet curing of the concrete as described in American Concrete Institute (ACI) Publication 308 shall be considered. All applicable codes, ordinances, regulations, and guidelines shall be followed in regard to designing a durable concrete with respect to the potential for detrimental exposure from the on-site soils and/or changes in the environment.

- *Site Wall and Retaining Wall Design Criteria*.

  - *Retaining Wall Design Parameters.* Retaining walls shall be designed in accordance with the calculations provided in the *Report of Geotechnical Investigation, Lido House Hotel – City Hall Site Reuse Project, 3300 Newport Boulevard, City of Newport Beach, California*.

- *Screen Walls*. For standard screen walls on flat ground, footings shall be a minimum of 24 inches deep below the lowest outside adjacent grade. Wall foundations shall be reinforced with two #4 bars top and bottom, and joints in the wall shall be placed at regular intervals on the order of 10 to 20 feet. The wall foundation shall be underlain by at least a 2-foot-thick section of engineered fill.

- *Pole Foundations*. Pole foundations shall be at least 18 inches in diameter and at least 3 feet deep; however, the actual dimensions shall be determined by the project structural engineer based on the design parameters provided in the *Report of Geotechnical Investigation, Lido House Hotel – City Hall Site Reuse Project, 3300 Newport Boulevard, City of Newport Beach, California*.

- *Swimming Pool and Spa Recommendations*.

  - *Allowable Bearing and Lateral Earth Pressures*. The pool and spa shells may be designed using an allowable bearing value of 1,500 pounds per square foot. Due to the low expansive nature of the on-site soils, pool and spa walls shall be designed assuming that an earth pressure equivalent to a fluid having a density of 75 pounds per cubic foot is acting on the outer surface of the pool walls. Pool and spa walls shall also be designed to resist lateral surcharge pressures imposed by any adjacent footings or structures in addition to the above lateral earth pressure.

  - *Settlement*. It is anticipated that the swimming pool would be underlain by engineered fill. The swimming pool shall be supported by a minimum of 2 feet of engineered fill. The project structural engineer shall consider resisting buoyancy forces due to the potential groundwater table oscillations, which may occur during the life time of the pool.

  - *Temporary Access Ramps*. All backfill placed within temporary access ramps extending into the pool and spa excavations shall be properly compacted and tested in order to mitigate excessive settlement of the backfill and subsequent damage to concrete decking or other structures placed on the backfill.

  - *Pool and Spa Bottoms*. If unsuitable soils are encountered, the bottom of the pool or spa excavation may need to be overexcavated and replaced to pool subgrade with compacted fill. As an alternative, the reinforcing steel in the area of a transition area may be increased to account for the differences in engineering properties and the potential differential behavior.

  - *Plumping*. All plumbing and spa fixtures shall be absolutely leak-free. Drainage from deck areas shall be directed to local area drains and/or graded earth swales designed to carry runoff water to the adjacent street. Heavy-duty pipes and flexible couplings shall be used for the pool plumbing system to minimize leaking which may produce additional pressures on the pool shell. A pressure valve in the pool bottom shall be installed to mitigate potential buildup of pressure.

- *Cement Types*. For moderately corrosive soils, cement shall be Type II/V and concrete shall have a minimum water to cement ratio of 0.50.

- *Pool and Spa Decking*.

  - *Thickness and Joint Spacing*. Concrete pool and spa decking shall be at least 5 inches thick and provided with construction joints or expansion joints every 6 feet or less. All open construction joints in pool and spa decking shall be sealed with an approved waterproof, flexible joint sealer. Pool and spa decking shall be underlain by a layer of crushed rock, gravel, or clean sand having a minimum thickness of 5 inches.

  - *Reinforcement*. Concrete pool and spa decking shall be reinforced with No. 4 bars spaced 18 inches on centers, both ways. The reinforcement shall be positioned near the middle of the slabs by means of concrete chairs or brick. Reinforcing bars shall be provided across all joints to mitigate differential vertical movement of the slab sections. Structurally tying the decking to the pool wall is highly recommended and would require structural reinforcement of the decking and consideration for additional loading on the pool wall. If doweling is not performed, differential movement shall be anticipated.

  - *Subgrade Preparation*. Subgrade soils below concrete decking shall be compacted to a minimum relative compaction of 92% and then thoroughly watered to achieve a moisture content that is at least 2% over optimum. This moisture content shall extend to a depth of approximately 12 inches into the subgrade soils and be maintained in the subgrade during concrete placement to promote uniform curing of the concrete. Moisture conditioning shall be achieved with sprinklers or a light spray applied to the subgrade over a period of several days just prior to pouring concrete. Soil density and presoaking shall be observed, tested, and accepted by a Geotechnical Engineer prior to pouring the concrete.

- *Concrete Flatwork Design*.

  - *Thickness and Joint Spacing*. Concrete walkways and patios shall be at least 4 inches thick and provided with construction joints or expansion joints every 5 feet or less. Concrete walkways and patios shall be underlain by a 4-inch-thick layer of Class 2 crushed aggregate base (CAB), crushed miscellaneous base (CMB), or clean sand having a sand equivalent of at least 30, which shall then be placed on top of the soil subgrade, moisture conditioned to at least 2% over optimum moisture, and compacted to at least 90% relative compaction.

- *Reinforcement.* Concrete walkways and patios shall be reinforced with No. 3 bars spaced 18 inches on centers, both ways. The reinforcement shall be positioned near the middle of the slabs by means of concrete chairs or brick. Reinforcing bars shall be provided across all joints to mitigate differential vertical movement of the slab sections. Walkways and patios shall also be dowelled into adjacent curbs using 9-inch speed dowels with No. 3 bars or ½-inch steel or fiberglass bars at 18 inches on centers. If doweling is not performed, differential movement shall be anticipated.

- *Subgrade Preparation.* The subgrade soils below concrete walkways and patios shall be compacted to a minimum relative compaction of 92% and then thoroughly watered to achieve a moisture content that is at least 2% over optimum. This moisture content shall extend to a depth of approximately 12 inches into the subgrade soils and be maintained in the subgrade during concrete placement to promote uniform curing of the concrete. Moisture conditioning shall be achieved with sprinklers or a light spray applied to the subgrade over a period of several days just prior to pouring concrete. Soil density and presoaking shall be observed, tested, and accepted by a Geotechnical Engineer prior to pouring the concrete.

• *Pavement Design Considerations.*

- *Asphalt Pavement Design.* Based on an anticipated R-value of 40, which shall be obtained after precise grading of pavement subgrade areas, the following pavement thicknesses shall be anticipated:

Location	R-Value	Traffic Index	Asphalt Concrete (inches)	Aggregate Base (inches)
Car Parking Stalls	40	4.0	3.0	4.0
Drive Aisles	40	5.5	4.0	6.0

Asphalt pavement structural sections shall consist of CMB or CAB and asphalt concrete materials (AC) of a type meeting the minimum City of Newport Beach requirements. The subgrade soils shall be moisture conditioned to a minimum 2% above the optimum moisture content to a depth of at least 6 inches, and compacted to at least 92% relative compaction (per ASTM 1557). The CMB or CAB and AC should be compacted to at least 95% relative compaction (per ASTM 1557).

- *Concrete Pavement Design.* Driveways and appurtenant concrete paving, such as trash receptacle bays, would require Portland cement concrete (PCC) pavement. Assuming a Traffic Index (TI) of 6 to 7, a design section of 8 inches of PCC over 6 inches aggregate base (AB) shall be adequate. The AB shall be Class 2 compacted to a minimum of 95% relative compaction as per ASTM D 1557.

- *Full Depth Reclamation (FDR) Alternative Pavement for Parking Areas*. For re-grading of parking areas it is recommended that the most efficient pavement rehabilitation alternative to replacement with a conventional asphalt over base pavement section would be to utilize what is called "full depth reclamation" (FDR) utilizing a 12-inch-thick section of site reclaimed on-site AC and AB mixed with 6% cement to provide the new base for a new 4-inch-thick AC layer to be paved on top.

- *Permeable Interlocking Concrete Pavement (PICP).* The structural base thickness for permeable interlocking concrete pavers in designated parking areas shall be designed by the project civil engineer in order to meet storage requirements. This minimum section assumes a TI of up to 6.3 (assumes a TI of 5.5 for the mixed use of the drive areas in this portion of the site) and calls for a 3⅛ inch (80 mm) concrete paver, over compacted layers of 2 inches of bedding course sand (ASTM No. 8 aggregate), over 4 inches of ASTM No. 57 stone as open-graded base, over 6 inches of ASTM No. 2 stone as open-graded sub base, over a Class 1 geotextile fabric (highest strength) per AASHTO M-288. A Class 1 geotextile fabric (highest strength) shall be placed both vertically at the sides of all PICP excavations and on top of the compacted subgrade soil below the stone sub-base layer in order to protect the bottom and sides of the open-graded base and sub-base. This geotextile fabric must meet AASHTO M-288 Class 1 geotextile strength property and subsurface drainage requirements (see attached Table 3-3 and Table 3-4 from Page 31 of the ICPI Design Manual (2011) for AASHTO M-288 requirements).

- *Concrete Interlocking Vehicular and Pedestrian Pavers.* Portions of the project site would utilize 3⅛-inch-thick (80 mm.) vehicular concrete interlocking pavers placed on a section of at least 1-inch-thick bedding sand. These vehicular pavers are also planned in order to provide City of Newport Beach Fire Department vehicle access capable of supporting 72,000 pounds of imposed loading. The on-site soil subgrade in these site vehicular areas shall be scarified to a depth of 6 inches, moisture conditioned to at least 2% above the optimum moisture content, and compacted to at least 92% relative compaction. A geotextile fabric such as Mirafi 600X or equivalent shall be placed on top of the compacted subgrade across the entire vehicular interlocking paver area. Based upon the on-site soils having an estimated R-value of 40, a 12-inch-thick layer of Class 2 CAB, CMB, or equivalent shall be moisture conditioned to at least optimum moisture and compacted to at least 95% relative compaction in order to support the interlocking pavers. Concrete bands adjacent to the vehicular interlocking pavers shall consist of a design section of 8 inches of PCC over at least 6 inches of AB or equivalent, moisture conditioned to at least optimum moisture, and compacted to at least 95% relative compaction.

  In certain designated site pedestrian areas, 2⅜-inch-thick (60 mm.) concrete interlocking pavers placed on a section of at least 1-inch-thick bedding sand are planned. Prior to the installation of the pavers and bedding sand in these pedestrian areas, the on-site soil subgrade shall be scarified to a depth of 6 inches, moisture conditioned to at least 2% above the optimum moisture content, and compacted to at least 92% relative compaction. A 4-inch-thick layer of Class 2 CAB, CMB, or equivalent shall then be placed on top of the soil subgrade, moisture conditioned to at least optimum moisture, and compacted to at least 95% relative compaction in order to support the interlocking pavers in these pedestrian areas.

Geotechnical Observation and Testing

Additional site testing and final design evaluation shall be conducted by the project geotechnical consultant to refine and enhance the recommendations contained in *Report of Geotechnical Investigation, Lido House Hotel – City Hall Site Reuse Project, 3300 Newport Boulevard, City of Newport Beach, California* during the following stages of construction and precise grading:

- During site clearing and grubbing.
- During all site grading and fill placement.
- During removal of any buried lines or other subsurface structures.
- During all phases of excavation.
- During shoring installation.
- During installation of foundation and floor slab elements.
- During all phases of corrective, ground improvement, and precise grading including removals, scarification, ground improvement and preparation, moisture conditioning, proofrolling, overexcavation, FDR treatment, and placement and compaction of all fill materials.
- During backfill of structure walls and underground utilities.
- During pavement and hardscape section placement and compaction.
- When any unusual conditions are encountered.

Grading plan review shall also be conducted by the project geotechnical consultant and the Director of the City of Newport Beach Building Department or designee prior to the start of grading to verify that the recommendations developed during the geotechnical design evaluation have been appropriately incorporated into the project plans. Design, grading, and construction shall be conducted in accordance with the specifications of the project geotechnical consultant as summarized in a final report based on the CBC applicable at the time of grading and building and the City of Newport Beach Building Code. On-site inspection during grading shall be conducted by the project geotechnical consultant and the City Building Official to ensure compliance with geotechnical specifications as incorporated into project plans.

Level of Significance: Less Than Significant Impact.

OTHER SEISMICALLY INDUCED HAZARDS

GEO-2 THE PROPOSED PROJECT MAY EXPOSE PEOPLE OR STRUCTURES TO POTENTIAL SUBSTANTIAL ADVERSE EFFECTS ASSOCIATED WITH SEISMICALLY INDUCED LIQUEFACTION AND SETTLEMENT.

Impact Analysis: As discussed in the "Existing Setting" discussion above, the project site is located within a zone mapped as having the potential for earthquake-induced liquefaction. In addition, groundwater was observed at depths of approximately 4.5 to 5.0 feet below ground surface and granular souls were encountered below the groundwater.

Analysis conducted as part of the Geotechnical Investigation indicates that relatively thin, discrete zones within the zone of artificial fill and alluvium below the water table may be subject to liquefaction during a design seismic event. The Geotechnical Investigation concluded the project site has a moderate potential for adverse effects of liquefaction due to seismic-induced settlement. Settlement calculations indicate approximately 0.7 to 2.9 inches of settlement could occur during the Maximum Considered Earthquake. Thus, impacts could be significant unless mitigated.

The City regulates geotechnical hazards associated with site development through its Municipal Code, including compliance with the CBC. Municipal Code Section 15.10.060, Grading Permit Requirements, requires each application for a grading permit or building permit be accompanied by supporting data consisting of soil engineering and engineering geology report, or other needed documents. Recommendations in the soil engineering report and engineering geology report and approved by the Building Official are required to be incorporated into grading plans and specifications. A preliminary Geotechnical Investigation has been prepared to identify existing soils and geotechnical conditions that occur within the project site, including preliminary recommendations pertaining to design and construction. The Geotechnical Investigation provides recommendations regarding site preparation and grading, temporary slope stability, post-grading and ground improvement, foundation design, concrete flatwork design, and pavement design, among other recommendations, that would be required to be incorporated into the design and construction phases of the proposed project (Mitigation Measure GEO-1). With implementation of Mitigation Measure GEO-1 potential impacts associated with seismically induced hazards would be reduced to a less than significant level.

Mitigation Measures: Refer to Mitigation Measure GEO-1.

Level of Significance: Less Than Significant With Mitigation Incorporated.

SOIL EROSION

GEO-3 THE PROPOSED PROJECT MAY RESULT IN SUBSTANTIAL SOIL EROSION OR THE LOSS OF TOPSOIL.

Impact Analysis: The project site primarily consists of impervious surfaces (developed land). The project site is essentially flat and does not possess site conditions necessarily conducive to soil erosion. However, during construction activities, soil would be exposed and there would be an increased potential for soil erosion compared to existing conditions. The project would be required to comply with all requirements set forth in the National Pollutant Discharge Elimination System

(NPDES) permit for construction activities, as enforced by the Santa Ana Regional Water Quality Control Board in order to prevent construction pollutants from impacting receiving waters, including implementation of typical Best Management Practices (BMPs) identified in the Storm Water Pollution Prevention Plan (SWPPP); refer to Section 5.11, *Hydrology and Water Quality*. Additionally, erosion and loss of topsoil as a result of wind (fugitive dust) would be minimized with implementation of Mitigation Measure AQ-1; refer to Section 5.6, *Air Quality*. With implementation of Mitigation Measure AQ-1 and compliance with NPDES requirements, erosion is not expected to be a significant impact to development and impacts would be less than significant.

Mitigation Measures: No mitigation measures are required.

Level of Significance: Less Than Significant Impact.

UNSTABLE GEOLOGIC UNITS

GEO-4 DEVELOPMENT OF THE PROPOSED PROJECT COULD BE LOCATED ON A GEOLOGIC UNIT OR SOIL THAT IS UNSTABLE, OR THAT WOULD BECOME UNSTABLE AS A RESULT OF THE PROJECT.

Impact Analysis: The project site is relatively flat and there are no documented landslides within or adjacent to the project area. Based on the project site's topography (relatively flat) and distance from the Back Bay, the Geotechnical Investigation determined that the project site has a low potential for adverse effects due to seismic-induced lateral spreading.

The Geotechnical Investigation indicated that the upper granular soils have low compressibility. Total static settlements are expected to range from one to two inches below the proposed buildings depending upon the foundation bearing capacity. However, the majority of static settlements would be completed by the end of construction. Thus, compliance with Mitigation Measure GEO-1 would reduce potential impacts associated with compressibility/static settlement to a less than significant level.

Refer to Impact Statement GEO-2 regarding seismically-induced hazards including liquefaction and settlement.

Mitigation Measures: Refer to Mitigation Measures GEO-1.

Level of Significance: Less Than Significant With Mitigation Incorporated.

EXPANSIVE SOILS

GEO-5 THE PROPOSED PROJECT MAY BE LOCATED ON EXPANSIVE SOIL CREATING SUBSTANTIAL RISKS TO LIFE OR PROPERTY.

Impact Analysis: The laboratory tests performed for the project site indicate that very low expansive soils are present. Visual descriptions indicate that the on-site dredge fill materials consist of sands and silty sands, while the underlying alluvial materials consist primarily of loose to medium dense sands to silty sands with occasional thick layers of moderately firm to very stiff silts and clays. Given the exploration and laboratory data, the Geotechnical Investigation concludes that the proposed improvements should be designed assuming very low expansion potential. The Geotechnical Investigation recommends that relatively non-expansive soils materials may be used to backfill retaining walls and that backfill material should be approved by the geotechnical consultant with respect to their characteristic prior to placement. In addition, due to the low expansive nature of the on-site soils, the Geotechnical Investigation provides recommendations for the design of pool and spa walls. Compliance with Mitigation Measure GEO-1 would ensure that potential impacts associated with expansive soils would be reduced to a less than significant level.

Mitigation Measures: Refer to Mitigation Measure GEO-1.

Level of Significance: Less Than Significant With Mitigation Incorporated.

CORROSIVE SOILS

GEO-6 DEVELOPMENT OF THE PROPOSED PROJECT COULD ENCOUNTER CORROSIVE SOILS POTENTIALLY RESULTING IN DAMAGE TO FOUNDATIONS AND BURIED PIPELINES.

Impact Analysis: Corrosive soils contain chemical constituents that can react with construction materials, such as concrete and ferrous metals, that may cause damage to foundations and buried pipelines. Testing conducted as part of the Geotechnical Investigation indicates that on-site soils would be very mildly corrosive to ferrous metals and possess a negligible sulfate exposure to concrete. Consequently, metal structures which would be in direct contact with the soil (i.e., underground metal conduits, pipelines, metal sign posts, metal door frames, etc.) and/or in close proximity to the soil (wrought iron fencing, etc.) may be subject to slight corrosion. The Geotechnical Investigation provides recommendations for reducing corrosion potential due to soil and groundwater; refer to Mitigation Measure GEO-1. The use of special coatings or cathodic protection around buried metal structures has been shown to be beneficial in reducing corrosion potential due to soil and groundwater. The potential for corrosion of ferrous metal reinforcing elements embedded in structural concrete would be reduced by the use of the recommended maximum water/cement ratio for concrete. The testing performed as part of the Geotechnical Investigation did not address the potential for corrosion to copper piping. On-site soils would be considered corrosive to copper unless a corrosion engineer determines otherwise. Mitigation Measure GEO-2 requires a corrosion engineer to be consulted during preparation of the Final Soils/Geotechnical Engineering Report. Compliance with the Building Code and Mitigation Measures GEO-1 and GEO-2 would reduce potential impacts associated with corrosive soils to a less than significant level.

Mitigation Measures: Refer to Mitigation Measures GEO-1 and the following:

GEO-2 Prior to issuance of a building permit, the City of Newport Beach Building Official or designee shall verify that the City has retained the services of a licensed corrosion engineer to provide detailed corrosion protection measures. Where steel may come in contact with on-site soils, project construction shall include the use of steel that is protected against corrosion. Corrosion protection may include, but is not limited to, sacrificial metal, the use of protective coatings, and/or cathodic protection. Additional site testing and final design evaluation regarding the possible presence of significant volumes of corrosive soils on site shall be performed by the project geotechnical consultant to refine and enhance these recommendations. On-site inspection during grading shall be conducted by the project geotechnical consultant and City Building Official to ensure compliance with geotechnical specifications as incorporated into project plans.

Level of Significance: Less Than Significant With Mitigation Incorporated.

5.9.5 CUMULATIVE IMPACTS

STRONG SEISMIC GROUND SHAKING

- **THE PROPOSED PROJECT, COMBINED WITH OTHER RELATED CUMULATIVE PROJECTS, MAY EXPOSE PEOPLE OR STRUCTURES TO POTENTIAL SUBSTANTIAL ADVERSE EFFECTS INVOLVING STRONG SEISMIC GROUND SHAKING.**

Impact Analysis: Due to the location and proximity of the project and cumulative projects sites, it is anticipated that the project site and cumulative projects sites would generally experience similar ground shaking associated with seismic activity. However, development of the proposed project and cumulative projects would be required to comply with the CBC in order to reduce potential impacts associated with strong seismic ground shaking to a less than significant level. Therefore, the project would not contribute to cumulative impacts and impacts in this regard are not cumulatively considerable.

Mitigation Measures: No mitigation measures are required.

Level of Significance: Less Than Significant Impact.

OTHER SEISMICALLY INDUCED HAZARDS, UNSTABLE GEOLOGIC UNITS, EXPANSIVE SOILS, AND CORROSIVE SOILS

- **THE PROPOSED PROJECT, COMBINED WITH OTHER RELATED CUMULATIVE PROJECTS, MAY EXPOSE PEOPLE OR STRUCTURES TO POTENTIAL SUBSTANTIAL ADVERSE EFFECTS ASSOCIATED WITH SEISMICALLY INDUCED LIQUEFACTION, LATERAL SPREADING, LANDSLIDING, SETTLEMENT, AND/OR GROUND LURCHING.**

- **THE PROPOSED PROJECT, AND OTHER RELATED CUMULATIVE PROJECTS, COULD BE LOCATED ON A GEOLOGIC UNIT OR SOIL THAT IS UNSTABLE, OR THAT WOULD BECOME UNSTABLE AS A RESULT OF THE PROJECT.**

- **THE PROPOSED PROJECT, AND OTHER RELATED CUMULATIVE PROJECTS, COULD BE LOCATED ON EXPANSIVE SOIL CREATING SUBSTANTIAL RISKS TO LIFE OR PROPERTY.**

- **THE PROPOSED PROJECT, AND OTHER RELATED CUMULATIVE PROJECTS, COULD ENCOUNTER CORROSIVE SOILS POTENTIALLY RESULTING IN DAMAGE TO FOUNDATIONS AND BURIED PIPELINES.**

Impact Analysis: The potential for expansive soils to impact new development at the project site is considered very low. In addition, the project site is not located on a geologic unit that is unstable; however the project site does include soils that have low compressibility and could result in static settlement. Further, the project site is subject to seismically induced hazards and corrosive soils. The geotechnical characteristics of each cumulative project site would be evaluated on a project-by-project basis, and appropriate mitigation measures would be required, as necessary to reduce potential impacts to a less than significant level.

The proposed project would be required to conform to applicable City criteria, adhere to standard engineering practices, and incorporate standard practices of the CBC. Additionally, Mitigation Measures GEO-1 and GEO-2 would require the project to incorporate all engineering recommendations contained within the Geotechnical Investigation to reduce impacts associated with seismically induced hazards, expansive soils, unstable geologic units, and corrosive soils. Therefore, the project would not contribute to cumulative impacts and impacts in this regard are not cumulatively considerable.

Mitigation Measures: Refer to Mitigation Measures GEO-1 and GEO-2.

Level of Significance: Less Than Significant With Mitigation Incorporated.

SOILS EROSION

- **THE PROPOSED PROJECT, COMBINED WITH OTHER RELATED CUMULATIVE PROJECTS, MAY RESULT IN SUBSTANTIAL SOIL EROSION OR THE LOSS OF TOPSOIL.**

Impact Analysis: Portions of the City and surrounding areas may contain soils that have erosion potential. Construction of planned and future cumulative projects could facilitate soil erosion and loss of topsoil. Grading activities leave soils exposed to rainfall and wind conditions that result in erosion. The geotechnical characteristics of each cumulative project site would be evaluated on a project-by-project basis, and appropriate mitigation measures would be required, as necessary, in addition to Federal and State requirements for mitigating erosion. Therefore, assuming cumulative projects implement project specific mitigation measures, cumulative soil erosion and loss of topsoil impacts would be less than significant.

The short-term effects of soil erosion during rough grading are not considered significant, given that the project site is essentially flat, and does not possess site conditions necessarily conducive to soil erosion. The project would be required to comply with all requirements set forth in the NPDES permit for construction activities, as enforced by the Santa Ana Regional Water Quality Control Board. Additionally, erosion and loss of topsoil as a result of wind (fugitive dust) would be minimized with implementation of Mitigation Measure AQ-1. Thus, the project would not contribute to cumulative impacts and impacts in this regard are not cumulatively considerable.

Mitigation Measures: No mitigation measures are required.

Level of Significance: Less Than Significant Impact.

5.9.6 SIGNIFICANT UNAVOIDABLE IMPACTS

No significant impacts related to Geology and Soils have been identified following implementation of the recommended Mitigation Measures GEO-1 and GEO-2 and compliance with the applicable Federal, State, and local regulatory requirements.