4.5 GEOLOGY AND SOILS

This section describes the existing geological setting of the project site, identifies associated regulatory requirements, evaluates potential impacts, and identifies mitigation measures related to implementation of the proposed Villa Storia Planned Development (PD) Plan (proposed project). The following analysis is based upon the Updated Geotechnical Evaluation that was prepared for the proposed project by GeoTek, Inc. in 2014, and is incorporated by reference herein (GeoTek 2014). The Geotechnical Evaluation is included in Appendix E of this EIR.

4.5.1 Relevant Plans, Policies, and Ordinances

Federal

International Building Code

The International Building Code (IBC) is a model building code developed by the International Code Council that provides the basis for the California Building Code (CBC). The purpose of the IBC is to provide minimum standards for building construction to ensure public safety, health, and welfare. Prior to the creation of the IBC, several different building codes were used; however, by the year 2000, the IBC had replaced these previous codes. The IBC is updated every 3 years.

Occupational Safety and Health Administration Regulations

Excavation and trenching are among the most hazardous construction activities. The Occupational Safety and Health Administration (OSHA) Excavation and Trenching standard, Title 29 of the Code of Federal Regulations (CFR), Part 1926.650, covers requirements for excavation and trenching operations. OSHA requires that all excavations in which employees could potentially be exposed to cave-ins be protected by sloping or benching the sides of the excavation, supporting the sides of the excavation, or placing a shield between the side of the excavation and the work area.

State

California Geologic Survey

The California Geologic Survey (CGS) provides guidance with regard to seismic hazards. The CGS's Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards in California (1997), provides guidance for evaluation and mitigation of earthquake-related hazards for projects within designated zones of required investigation.

California Building Code

The 2013 CBC, which went into effect January 1, 2014, with portions of the energy regulations going into effect on July 1, 2014, is a model building code developed by the International Code

Council that sets rules specifying the minimum acceptable level of safety for constructed objects such as buildings in the United States. In addition, the CBC contains necessary amendments based on the American Society of Civil Engineers (ASCE) Minimum Design Standards 7-05. ASCE 7-05 provides requirements for general structural design and includes means for determining earthquake and other types of loads for inclusion in building codes. The provisions of the CBC apply to the construction, alteration, movement, replacement, and demolition of every building or structure, and any appurtenances connected or attached to such buildings or structures, throughout California.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act of 1972 (California Public Resources Code (PRC), Sections 2621–2630) regulates development and construction of buildings intended for human occupancy to avoid the hazard of surface fault rupture. The Act helps define areas where fault rupture is most likely to occur. The act groups faults into categories of active, potentially active and inactive. Historic and Holocene age faults are considered active. Late Quaternary and Quaternary age faults are considered potentially active and pre-Quaternary age faults are considered inactive. These classifications are qualified by the conditions that a fault must be shown to be sufficiently active and well defined by detailed site-specific geologic explorations in order to determine whether building setbacks should be established. Cities and counties affected by the zones must regulate certain development projects within the zones. They must withhold development permits for sites within the zones until geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting. The project site is not identified on an Alquist-Priolo Earthquake Fault Zoning Map.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act (PRC, Sections 2690–2699.6) addresses earthquake hazards from non-surface fault rupture, including liquefaction, landslides, strong ground shaking, or other earthquake and geologic hazards. The Seismic Hazards Mapping Act also specifies that the lead agency for a project may withhold development permits until geologic or soils investigations are conducted for specific sites and mitigation measures are incorporated into plans to reduce hazards associated with seismicity and unstable soils. The project site is not identified on a Seismic Hazards Map.

Local

City of Oceanside General Plan

State of California Law requires that each city prepare and adopt an approved General Plan that provides comprehensive, long-term guidance for the City's future. General Plans are also required to contain specific elements regarding different areas of planning; relevant elements

include Land Use, Environmental Resource Management, and Public Safety. While each element outlines policies, plans, and goals that guide the City to maintaining and improving each area of development, the Public Safety Element specifically addresses seismic hazards and geologic conditions. This element includes the following objectives:

1. Consider seismic and geologic hazards when making land use decisions particularly in regard to critical structures.
2. Minimize the risk of occupancy of all structures from seismic and geologic occurrences.
3. Provide to the public all available information about existing seismic and geologic conditions.

The Public Safety Element includes the Public Safety Plan that includes definitions, maps, and mitigation information for seismic and geologic hazards that exist within the City of Oceanside.

City of Oceanside Building Code

Chapter 6, Building Construction Regulations, of the City of Oceanside Municipal code outlines the regulations and requirements for construction of buildings within the City's jurisdiction, including seismic and geologic safety design standards. The City adopts the most recent California Building Code as the local building code and makes amendments as needed.

4.5.2 Existing Conditions

Site History

The proposed project site is located in the City of Oceanside, north of Mission Avenue and State Route – 76 (SR-76) until south of Frazee Road and is bisected in a north-south orientation by Academy Road. A small portion in the northeastern section of the proposed project site is located east of Academy Road and north of Frazee Road. Just west of the project site is a hockey rink with a gravel parking lot that extends into the site. Stormwater and sewer piping, manholes, and easements already exist on the project site. Aside from fill related to existing facilities and vegetation removal, the project site does not appear to be heavily altered from its natural condition.

Regional Geologic Setting

The proposed project site is located in the Peninsular Ranges geomorphic province, one of the largest geomorphic units in western North America, extending approximately 975 miles bounded by the Pacific Ocean, the Gulf of California, and the Colorado Desert Province. The Peninsular Ranges are a series of northwest-southeast oriented fault blocks with the Elsinore Fault, the San Jacinto Fault, and the San Andreas Fault as the major fault zones. However, no major faults are found on the immediate project site area and immediate vicinity.

Site Geology

The proposed project site is approximately 35.59 acres with a high point of about 94 feet above mean sea level (amsl) in the northwestern corner and low points in the northeastern corner. Relief is on the order of ± 30 feet over the entire site.

Soil and Geologic Conditions

Underlying the proposed project site is mostly Tertiary age sedimentary bedrock and Quaternary age alluvium. Based on the Geotechnical Evaluation, the proposed project site is locally underlain by undocumented fill, colluvium, alluvium, and sedimentary bedrock. These soil types are further described below.

Soil Types

Undocumented Fill Material

Undocumented fill materials are found dispersed throughout the proposed project site with thicker areas of fill associated with existing roadways and easements. Where undocumented fill materials were found, the material generally consisted of clay silt sand. These soils are not suitable for supporting structural improvements, but can be evaluated to be incorporated to be used an engineered fill in the proper locations.

Colluvium

The Colluvium, described in general as a dark brown clay fine sand, covers the sedimentary bedrock in a thin layer across most of the site. The soil reaches depths of 3 to 15 feet from the surface. Further detail can be found in the Geotechnical Evaluation's exploratory boring logs.

Alluvium

These soils were found thicker on the eastern sections of the property and thinner in the western section where the bedrock is shallower. The alluvium generally was observed to be comprised of sandy silt clay and sandy clay silt. During exploratory boring (logs found in the Geotechnical Evaluation), the soils were found reaching depths of 16.5 to 51.5 feet from the surface. For the latter measurement, boring was terminated at 51.5 feet (see boring B-6 in the Geotechnical Evaluation). The soil was observed as medium brown and slightly porous becoming darker in color and moister with depth.

Bedrock

The bedrock found to underlie most of the proposed project site is tertiary age sedimentary bedrock of the Santiago Formation. This soil was found between 3 and 16.5 feet below the surface, with all the exploratory boring evaluations in which bedrock was found terminating at 16.5 feet in depth. The bedrock was generally found as a medium to coarse sandstone.

Geologic Hazards

Faulting and Seismicity

The San Andreas system and its associated faults account for the majority of Southern California's geologic structure, placing the proposed project site in a seismically active region. However, no known active fault exists on the proposed project site and the site is not found within the "Alquist-Priolo" Earthquake Fault Zone or a Special Studies Zone. These zones are designated by the Alquist-Priolo Earthquake Faulting Zone Act if faults are found within these zones that may pose a potential fault rupture risk to any structures, existing or future (Department of Conservation 2011). As such, no faults were identified by the Geotechnical Evaluation to exist in the geological study area.

Liquefaction

Soil liquefaction is a state of soil particle suspension caused by a complete loss of strength when the effective stress drops to zero. Liquefaction generally occurs under saturated conditions in soils such as sand and clay. Liquefaction usually occurs under vibratory conditions such as those induced by seismic events. This can lead to high soil mobility causing lateral movement, sliding, and other deformations. According to the Geotechnical Evaluation, liquefaction potential on the proposed project site is determined to be very low due to a lack of shallow groundwater table, the fine grain consistency of the alluvium, and the dense bedrock formation where potential for liquefaction would be determined negligible.

Settlement

Deeper alluvial soils have settlement potential from additional loads by introducing proposed project fill soils and hydro-collapse by introducing water to the soils. Both potential processes are considered to be non-seismic. The Geotechnical Evaluation used conceptual loading yields prepared for the proposed project site by Buccola Engineering, Inc. (Figure 2 in the Geotechnical Evaluation, Appendix E), to determine the load consolidation potential of the alluvial soils. Based on these conceptual yields, laboratory testing determined that 8 to 12 inches of soil settlement could occur due to the proposed project loading. Additional evaluation of soils is recommended. The alluvial soils found during exploratory boring were found to have existing very moist conditions and tested to have low hydro-collapse potential.

Expansive Soils

Soil expansion occurs when soils absorb water and increase in volume, which can cause structural damage. According to the Geotechnical Evaluation, the colluvium and alluvium exhibited low expansion potential, 21≤ EI (Expansion Index) ≤ 50, as per ASTM D 4829 methodologies and classifications. Two laboratory tests indicate the soils to have an expansion index of 34 and 37. Most of the proposed project site materials are determined to have very low to low expansion potential.

Tsunamis and Seiches

A tsunami is a high ocean wave generated by a submarine earthquake or volcanic eruption. A seiche is an oscillating wave in an enclosed or restricted body of water generated by ground motion during an earthquake. A seiche could cause a lake, reservoir or lagoon to overflow. The proposed project site is located

The Geotechnical Evaluation found the proposed project site to have negligible potential to be affected by tsunamis and seiches due to the site elevation and distance from an open body of water (approximately 5 miles from the Pacific Ocean). According to the Tsunami Inundation Map for Emergency Planning accessed from the State of California Department of Conservation, the proposed project site is outside the tsunami inundation area.

Landslides

Potential for landslides are also considered negligible. According to the City of Oceanside's Public Safety Element of the General Plan, no published reports, reconnaissance, or photographs show evidence of landslides (City of Oceanside 2002). During the investigation for the Geotechnical Evaluation, no evidence of landslides or instability was found.

Groundwater

Groundwater was not encountered as part of the investigation conducted for the Geotechnical Evaluation. As shown in Appendix B of the Geotechnical Evaluation, exploratory boring B-6 was drilled to 51.5 feet of low lying alluvial soils and groundwater was not encountered. However, should groundwater exist underneath the proposed project site, it would likely be found in the eastern portions alluvial soils.

4.5.3 Thresholds of Significance

The significance criteria used to evaluate the project impacts to geology and soils are based on Appendix G of the CEQA Guidelines. According to Appendix G of the CEQA Guidelines, a significant impact related to geology and soils would occur if the project would:

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 based on other substantial evidence of as 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 on- or off-site 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 waste water disposal systems where sewers are not available for the disposal of waste water.

4.5.4 Impacts Analysis

A. Would the project 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 based on other substantial evidence of as known fault? (Refer to Division of Mines and Geology Special Publication 42); strong seismic ground shaking; seismic-related ground failure, including liquefaction; or landslides?

No known active or potentially active faults exist on or adjacent to the proposed project site and it is not located within an Alquist-Priolo Earthquake Fault Zone. Ground surface rupture, or cracking of the ground surface due to an active fault is therefore, considered unlikely in the

proposed project area. Due to regional proximity to major known active fault zones such as the Lake Elsinore Fault, San Jacinto Fault, and Rose Canyon Fault, the proposed project site lies in a seismically active region. With incorporation of the geotechnical recommendations provided in the project's geotechnical study and adherence to the California Building Code requiring specific performance standards to minimize adverse effects of earthquakes and other geologic hazards, impacts relating to faulting and seismicity would be less than significant.

Liquefaction typically occurs when a site is subjected to strong seismic shaking, on-site soils are cohesionless, groundwater is encountered within 50 feet of the surface, and with influence of other contributing factors such as relative densities, confining pressures, soil type, and grain size. As stated previously, the project site was not observed to be underlain by a shallow groundwater table, the alluvial soils present on the proposed project site were observed to be fine grained in size, and the remaining underlying bedrock was observed to be a relatively dense formation. As such, the Geotechnical Evaluation found that on the eastern portions of the proposed project site, where alluvial soils are found to be thicker, to have very low liquefaction potential, while in the central and western portions of the proposed project site, where the bedrock formation are found in shallower depths, to have a negligible liquefaction potential. However, due to that Planning Area specific Development Plans are not yet proposed, the Geotechnical Evaluation provides recommendations, as provided in mitigation measure MM-GEO-1 below, for future Development Plan specific geotechnical recommendations and foundation design. As specified by the recommendations in the Geotechnical Evaluation, foundations shall conform to the most recent CBC standards and shall be designed to include, but not limited to, the following: additionally laboratory soil expansion potential per ASTM D 4829; an allowable bearing capacity of 1500 pounds per square foot (psf) may be used for design of continuous and perimeter footings 12 inches deep and 12 inches wide, and pad footings 24 inches square and 12 inches deep; structural foundations may be designed to withstand a total settlement of one inch; a minimum 12 inches wide and 18 inches deep grade beam shall be utilized across large entrances; and installation of a moisture and vapor retarding system below concrete slabs on grade. With incorporation of MM-GEO-1, impacts would be less than significant.

Evidence does not exist that would support the existence of landslides or unstable slopes on the proposed project site. The California Department of Conservation Division of Mines and Geology's Landslide Hazard Identification Map No. 35 places the proposed project sites in Area 2, "Marginally Susceptible" to landslides. "Marginally Susceptible" is defined as an area with gentle to moderate slopes where landslides are rare, but potential hazards may exist on some steeper slopes within and surrounding the area (Tan 1995). Additionally, the Geotechnical Evaluation determined that the potential for landslides is negligible. However, due to that Planning Area specific Development Plans are not yet proposed, the Geotechnical Evaluation provides recommendations, as provided in mitigation measure MM-GEO-1 below, for future Development Plan specific geotechnical recommendations including constructed slopes. As

provided by the Geotechnical Evaluation, such recommendations include, but are not limited to, landscaping with deep rooted plants that require little irrigation, ensuring that landscaping is not overwatered, and constructed fill slopes shall be at a 2:1 gradient to ensure surficial stability. With incorporation of MM-GEO-1, impacts would be less than significant.

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

The project site currently consists of a vacant lot with exposed soils resulting in erosion potential. The potential for erosion would increase during construction as a result of vehicles, heavy equipment, and general earth work accelerating the erosion process. Wind erosion could occur on bare soils or where vehicles and equipment cause dust. Currently, the proposed project does not include finalized construction plans, therefore specific details relating to grading activities are not yet known. Once finalized construction plans are known from future specific Development Plans, erosion analysis would be done for the proposed project site. The proposed PD Plan provides a conceptual grading plan indicating that specific lot configurations in Planning Area 1 (Tentative Map for 65 individual lots) and five large master lots (Planning Areas 2, 3, and 4) would be established on the proposed project site with an estimated raw cut and fill volume of 181,000 cubic yards each. However, potential erosion impacts would be avoided by adherence to the erosion control standards established by the City's Grading Ordinance and through implementation of best management practices required by the storm water pollution prevention plan (SWPPP) (refer to Section 4.8, Hydrology and Water Quality for more information). Therefore, construction impacts related to erosion would be less than significant.

The proposed PD Plan proposes that the project site be developed with residential dwelling units with associated paved roadways and landscaping. Such features covering vacant land would inhibit erosion and proposed landscaping would stabilize soils thereby reducing erosion potential on the proposed project site. The Geotechnical Evaluation provides recommendations, as provided in mitigation measure MM-GEO-1 below, for landscape selection and maintenance to ensure that substantial erosion does not occur. As provided by the Geotechnical Evaluation, such recommendations include, but are not limited to, controlling surface drainage and selecting deep rooted landscape vegetation to minimize erosion during operation, and adherence to the City of Oceanside and County of San Diego grading ordinances, which include requirements for erosion control during construction. Therefore, with incorporation of MM-GEO-1, during the operational phase of the proposed project, impacts to erosion would be less than significant.

C. 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?

Refer to response (a) above regarding landslides and liquefaction. According to the Geotechnical Evaluation, non-seismic induced settlement or subsidence could potentially occur to the deeper alluvial soils underlying the proposed project site. Hydro-collapse could potentially cause settlement of the alluvial soils. However, due to the very moist conditions that already exist in these soils, potential for hydro-collapse is considered negligible. As stated previously the proposed PD Plan does not provide finalized Development Plans for individual Planning Areas, therefore Buccola Engineering, Inc. provided conceptual yields for the proposed project site. Using the Conceptual Yield Study No. 3 (Figure 2 in the Geotechnical Evaluation, Appendix E) that proposes a maximum fill depth of 13 feet and removal of unsuitable fill approximately at a depth of 10 feet, soils were evaluated for the settlement potential. The Geotechnical Evaluation found that, with the proposed conceptual loadings, the alluvial soils could potentially settle 8 to 12 inches. As provided in the Geotechnical Evaluation, recommendations include, but are not limited to ensuring that engineering fill is moisture conditioned and compacted to a minimum 90% per ASTM D 1557, a settlement monitoring program for engineered foundations, and control joints spaced approximately 24 to 36 times the thickness of the foundation slab to control cracks. Therefore, incorporation of recommendations found in the Geotechnical Evaluation, provided as mitigation measure MM-GEO-1, for future specific geotechnical recommendations for each Development Plan, excavation/fill, and design would result in less than significant impacts related to soil instability.

D. Would the project 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?

According to the two expansion tests conducted by the Geotechnical Evaluation, the alluvial soil samples have expansive indexes (EI) of 34 and 37. According to Table 18-1-B of the Uniform Building Code (1994), these soils have a low expansion potential ($21 \leq EI \leq 50$). As such, and in addition to, incorporation of the geotechnical recommendations provided in the Geotechnical Evaluation, which include additional laboratory testing of sites upon completion of grading per ASTM standards, provided as mitigation measure MM-GEO-1, for the proposed project and adherence to the California Building Code requiring specific performance standards to minimize risk resulting from expansive soils, impacts would be less than significant.

E. Would the project 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?

The proposed project would be served by existing sewer facilities in or adjacent to the proposed project site. Therefore, septic tanks would not be necessary and no impacts would occur.

4.5.5 Mitigation Measures

MM-GEO-1 Prior to the issuance of the grading permit, the applicant(s) shall verify that the applicable recommendations of the Updated Geotechnical Evaluation for Proposed Residential Development 35.59±Acre Site, North of Mission Road and Highway 76 Oceanside, San Diego County, California prepared by GeoTek, Inc. in October 2014 have been incorporated into the project design and construction documents to the satisfaction of the City Engineer. Recommendations shall be held to performance standards within the applicable ordinances (including grading, construction, and landscaping regulations) of the City of Oceanside and County of San Diego as well as the standards provided in the most recent California Building Code which are intended to reduce risk related to geologic hazards.

Recommendations include, but are not limited to:

1. Additional review from GeoTek and specific geotechnical recommendation upon review of future individual Planning Area Development Plans;
2. Earthwork considerations for site clearing and preparation, remedial grading, engineering fill, constructed slopes, excavation, shrinkage and bulking, and trenching and backfill. All earthwork shall be performed in accordance with the applicable grading ordinances of the City of Oceanside, the County of San Diego, and the standards found in the most recent CBC;
3. Design recommendations for foundation design criteria including setbacks, soil corrosivity, and sulfate content. All foundation designs shall conform with the standards found in the most recent CBC and American Concrete Institute 318 (Building Code Requirements for Structural Concrete);
4. Retaining wall design and construction recommendations including backfill, drainage, and restraining;
5. Concrete construction considerations including concrete mix design, flatwork, and performance. Concrete construction shall be performed in accordance

with the standards of the most recent CBC and American Concrete Institute 318 (Building Code Requirements for Structural Concrete);

6. Post construction considerations for landscaping maintenance, planting, and drainage. Landscaping shall be designed and maintained in accordance to the City of Oceanside's Landscape Development Manual and Municipal Code;
7. A GeoTek representative to be present during grading and foundation construction.

4.5.6 Level of Significance After Mitigation

With the incorporation of mitigation measure MM-GEO-1, all impacts related to geology and soils would be less than significant.