4.6 Geology and Soil

This section describes the geologic and seismic conditions within the Project area and evaluates the potential for geologic hazard impacts associated with implementation of the proposed Project. This section is based in part on the following reports included in the Appendix F to this EIR:

F.1 *Response to Questions Regarding Geotechnical Review*, February 3, 2022, American Geotechnical, Inc.
F.2 *Addendum Report – Adding Geology to Current Site Plan*, May 28, 2021, American Geotechnical, Inc.
F.3 *Response to City of Laguna Niguel Geotechnical Review Sheet* Dated February 15, 2021 and *Notice of Incompleteness* Dated February 23, 2021, April 2, 2021, American Geotechnical, Inc.
F.4 *Geotechnical Review of Tentative Tract Map*, January 8, 2021, American Geotechnical, Inc.

The Geotechnical Reports for the Project were reviewed by the City's geotechnical consultant, Goffman, McCormick, and Urban Geotechnical Inc. (GMU) and conditionally approved on June 24, 2021 (Appendix F).

4.6.1 Setting

Geologically, the City and the proposed Project site are within the eastern portion of the San Joaquin Hills, a part of the Peninsular Ranges Geomorphic Province of Southern California. These hills are the product of the environmental conditions that have shifted and shaped the terrain during geologic time. The tectonic forces acting on the Peninsular Ranges over the past 1–2 million years have broadly compressed and warped geologically young marine sediments from the sea to elevations over 1,000 feet in these hills. These bedrock sediments have been continuously worn by erosion into the subtle, rolling hillsides characteristic of southern Orange County.

4.6.2 Existing Conditions

The Project site lies directly west of Crown Valley Parkway in the City of Laguna Niguel, approximately 40 vertical feet above the distal Arroyo Salado Valley (i.e., Salt Creek). From a regional standpoint, the parcel lies within the southwestern portion of the San Juan Capistrano 7.5-Minute Topographic Quadrangle Map (USGS, 1968, photo revised 1981). Elevations along Crown Valley Parkway are on the order of 360 feet above mean sea level (msl). A 2:1 (horizontal:vertical) fill slope on the order of 10 feet in height occurs along the east Project boundary above Crown Valley Parkway. This slope ascends to a relatively flat-lying, nearly rectangular-shaped pad area comprising the east area of the Project (Lot 1). This pad area has elevations of around 370 feet msl on the east and 380 feet msl on the west. An east-facing fill slope of varying steepness extends on the order of around 160 feet in height. It ascends from the western edge of the lower pad to another gently sloping surface. This upper surface extends between elevation 440 on the east to the western property boundary at around 450 feet in elevation msl.

As detailed in the following subsections, the Project site was previously developed with 41 condominiums in 1979. In 1998, the Via Estoril Landslide occurred damaging many of the condominiums and nine single-family homes further upslope and to the west, along Via Estoril Drive. The landslide was repaired between 1998 and 2000 with the construction of structural elements and grading of the site. Specifically, repair work involved installation of a caisson wall (64 caissons) with 414 tieback anchors and walers, removal of the 41 Crown Cove condominium buildings and associated structures, partial removal of the landslide mass, re-compacting and re-contouring the slope, installation of subdrains, and construction of a compacted fill buttress. During the remediation, manufactured slopes were created on the Property, which altered and graded the Property's natural topography and terrain. The repair work involved a site development permit approved by the City in 1999 and was overseen by a variety of consultants and technical experts, including American Geotechnical, Inc. (American Geotechnical) representing the Niguel Summit Homeowners Association. American Geotechnical developed the plans for construction including refinements, calculations, details, structural analysis and the preparation of the repair plans and provided the field services during the construction of the stabilization measure for the landslide.

Subsequent to the hillside remediation, routine and scheduled monitoring and investigation activities have been conducted on the landslide area to identify further landslides or settlement. Slope inclinometers were installed on the landslide slope to monitor slope displacement caused by expected downhill creep. Overall, minor creep movement has been detected during the 20 years of monitoring and these low rates of movement are consistent and expected with the landslide and buttress reaching equilibrium. The magnitude of the total movement is very small which can be expected in any hillside area consisting of clayey earth materials, particularly in southern California. The previously measured creep movement is expected to continue at a slow and manageable rate as the area continues to reach equilibrium. The slope creep is not an indication of slope instability.

Piezometers were installed to monitor groundwater levels, with readings suggesting groundwater levels are stable. The long-term trend in groundwater elevation is relatively stable, with no significant fluctuation during heavy rain years. The main factor contributing to stable groundwater levels is the in-place subdrain system installed during the landslide remediation, which according to the geotechnical study, is performing and functioning well. As such, piezometer readings in past monitoring sessions show the groundwater levels without significant fluctuation.

The underground and surface storm drain system was also reviewed by American Geotechnical, and it was determined the storm drain system installed as part of the remediation is properly functioning.

Based on American Geotechnical's ongoing monitoring and investigation activities that have taken place subsequent to the landslide, and recently as part of the proposed Project and prior development proposals, the landslide has come to equilibrium. Measured slope creep is typical of other slopes in the City and Orange County containing diatomaceous oriented bedrock.

On-site Geologic Units

The following topics discussed are the bedrock formations, surface deposit units, and two distinct generations of artificial fill which are each described in more detail below. Each are listed in age from oldest to youngest and are referenced below in the geology map Figures 4.6.A, and the detailed cross sections from the geology map in Figures 4.6.B, and 4.6.C.

<u>San Onofre Breccia Formation</u>

The San Onofre Breccia bedrock formation occurs west of a north-trending fault (CDMG) transecting the southwestern corner of the site (Figure 4.6.A, map symbol Tso). Indirect evidence supports its occurrence based on the presence of breccia-type bedrock encountered within the residual Via Estoril Landslide deposit. Its presence within the Via Estoril slide block is expected given its original location offsite and upslope.

At the center of the Project site, the breccia-type bedrock deposits include sandstone, claystone, and interbedded pebble to cobble breccia with clasts mostly composed of quartzite, quartz-schist, blue-green schist and gabbro. The sandstones and breccia are medium hard to hard and massive to crudely-bedded, while the clay stones are soft, plastic, sheared, and damp. In some areas the breccia-type deposits interfinger with the Monterey Formation forming a single undifferentiated unit.

<u>Monterey Formation</u>

The Monterey Formation occurs generally to the east of the CDMG fault trace (Figure 4.6.A, map symbol Tm). It interfingers with the San Onofre Breccia forming an undifferentiated unit within the central portion of the site. It occurs as a stand-alone formation to the east between two fault traces.

Monterey Formation bedrock encountered on site generally consists of thinly bedded diatomaceous siltstone to shale that is soft to moderately firm and locally indurate. The locally diatomaceous nature of the Monterey Formation materials are characterized by low dry unit weight.

Undifferentiated San Onofre Breccia/Monterey Formation (Map Symbol Tso/Tm)

As noted previously, the center of the Project site contains interfingered deposits from the San Onofre and Monterey Formations forming a single undifferentiated unit (Figure 4.6.A, map symbol Tso/Tm).

Capistrano Formation (Map Symbol Tc)

Capistrano Formation bedrock is depicted in regional geologic maps within areas to the north and south of the site. It is known to exist near the Monterey Formation and consists of very similar rock types, suggesting the Capistrano Formation bedrock is nearby. Prior investigations and grading reports reveal this bedrock unit also occurs in fault contact with the Monterey Formation along a north-trending fault beneath the extreme easterly margin of the site.

Within the local area, the Capistrano formation commonly overlies the Monterey Formation creating bedrock that is difficult to distinguish from one another. However, geotechnical map data obtained from the adjacent tract to the north was used to project bedrock types onto the Project site (Figure 4.6.A, map symbol Tc). The Capistrano Formation crosses only a small portion of the northwestern site corner. This unit generally consists of clayey siltstone to silty claystone and local fine-to-medium grained sandstone. Deeper unoxidized parts of the formation tend to be black in color and omit a petroliferous odor. The rock is moderately firm, locally diatomaceous, and poorly bedded to massive.

Older Quaternary Landslide Deposits (Map Symbol Qlso)

Regional geologic maps published in 1974 indicate the presence of several large landslides upslope from the site to the west (Figure 4.6.A, map symbol Qlso). These large landslides occurred within and are underlain by the San Onofre Breccia. The development implications of these slides were addressed long ago during construction of the adjacent tract to the west. The 1974 regional geologic maps did not map any landslides within the area of the 1998 Via Estoril slide. Investigations conducted as part of the Via Estoril slide revealed the presence of an older existing landslide surface with a deeper rupture surface than the Via Estoril slide. The investigations concluded the older, deeper rupture had moved within the area offsite to the northwest. The deeper rupture was accounted for as part of the remedial grading design to stabilize the Via Estoril slide.

Recent Landslide Deposits (Map Symbol Qlsr)

Landslide deposits from the Via Estoril slide are buried beneath engineered fill along the western margins of the site in the steeper areas of Lot A (Figure 4.6.A, map symbol Qlsr). The slide deposits left in place following remedial grading consist of San Onofre Breccia bedrock. The material has the appearance of intact bedrock, apparently due to sliding of a significant portion of the landslide mass. This characteristic of the stabilized landslide material suggests there is little or no settlement risk associated with the existence of the stabilized landslide material in the steeper portions of the site.

<u>Engineered Fill Deposits (Map Symbol Ef1)</u>

Engineered fill deposits classified as Ef1 were placed during construction of the original townhome development at the site in 1979. These fills were placed under the observation and testing of Geosoils, Inc., as documented during final grading. The original limits of this fill were modified by subsequent grading associated with stabilization of the Via Estoril Landslide. In general, deposits of this fill remain in their original configuration within the eastern areas of the property, including the fill slope descending to Crown Valley Parkway (Figure 4.6.A, map symbol Ef1). The fill in this area was originally placed to a maximum depth of 14 feet, not including removals. The deeper fills were concentrated toward the southeasterly corner of the property in the vicinity of the former tributary channel.

Ef1 fill deposits occur along the eastern area of the site and consists of on-site sources of surficial, bedrock and older undocumented fill units. The fill was found to thicken from around 5 feet on the north to 25 feet near the southeastern corner of the site. The differences in fill thickness are attributed to tributary channels that required filling and older deep alluvium deposits that required greater depths of removal in contrast to the near-surface bedrock on the north that required less removal. The approximate subsurface location of the Ef1 fill is noted in cross sections presented in Figures 4.6-B and 4.6-C. The fill consists of variable lifts of clay, silty clay, and gravelly sands that upon investigation were found to be very competent, uniformly moist, and dense/stiff.

<u>Engineered Fill Deposits (Map Symbol Ef2)</u>

New engineered fill deposits placed during remedial grading after the Via Estoril Landslide are designated as Ef2 (Figure 4.6-A, map symbol Ef2). These fills were placed under the observation and testing of American Geotechnical, Inc., and documented during the final landslide repair. These fills are diatomaceous in nature and are characterized by low density and very high moisture. The eastern limits are generally coincident with the toe of an existing east-facing fill slope and a large gravity buttress. The western fill limits extend offsite into the Niguel Summit property abutting the east frontage of Via Estoril. The north and south fill limits generally follow the boundaries of the site. The thickest portions of this fill occur within the area of the gravity buttress along the western site margin where it extends up to around 75 feet below existing grades. The Ef2 fill deposits were also encountered within the central and west areas of the site.

The Ef2 fill was obtained from both on-site and off-site/imported sources. The approximate subsurface location of the fill is presented in cross sections Figure 4.6.B and Figure 4.6.C. The fill consists of variable lifts of clay, silty clay and gravelly sands that upon investigation were found to be very competent, uniformly moist and dense/stiff. Some of these fill areas contain diatomaceous soils characterized by lower density and very high moisture. These fill materials typically possess highly expansive and highly corrosive characteristics.

Subsurface Conditions

Groundwater Conditions

The presence of groundwater beneath the Project site is influenced by subsurface conditions upslope to the west. As previously stated, this area underwent significant grading modifications between 1998 and 2000 during the Via Estoril Landslide repair and construction work. Construction included installation of an extensive network of subdrains to control groundwater. These drains continue to perform as designed, minimizing the quantity of groundwater beneath the Project site.

Groundwater conditions offsite to the west largely occur in a narrow- zone above removal bottoms at the base of the fill. On the western margins of the site in Lot A, the thickness of fills and depth to groundwater is approximately 65 to 80 feet below existing grades.

Within the boundaries of the site, similar groundwater areas exist in narrow zones above the natural bedrock alluvium fill deposits. The depths of water beneath the central and eastern areas of the site range from approximately 35 to 40 feet below existing grades.

The long-term trend in groundwater elevation is relatively stable, with no significant fluctuation during heavy rain years. The main factor contributing to stable groundwater levels is the in-place subdrain system installed during the landslide remediation is performing and functioning well. As such, piezometer readings in past monitoring sessions show the groundwater levels without significant fluctuation.

Non-Seismic Geologic Constraints

Erosion

The erosion potential of soil is governed by the physical properties of the soil along with environmental factors such as rainfall, wind, topography, and vegetative cover. Erosion typically occurs from concentrated runoff on unprotected slopes or along unlined channels underlain by relatively erosion-prone earth materials (e.g., topsoil, soft alluvium, weakly cemented sandstone).

Slopes surrounding the site have been mass graded, constructed at slope ratios around 2:1 (horizontal:vertical), have a thick stabilizing cover of vegetation, and are equipped with a network of surface drains to prevent concentrated erosion. No tributary canyons or natural hillside areas remain on the site or within the adjacent areas.

Expansive Soils

Expansive soils typically contain certain clay minerals that expand in volume when they are wet or hydrated and occupy a larger volume than when they are dry or dehydrated. Volume changes associated with changes in the moisture content of near-surface expansive soils can cause uplift or heave of the ground when they become wet or, less commonly, cause settlement when they dry out.

The Project site is largely overlain with engineered fill which consist of variable lifts of clay, silty clay, and gravelly sands that were found to be very competent, uniformly moist, and dense/stiff and the expansion potential ranges from very low to medium. The expansion potential of the old fill at a depth of 30 feet is considered to be medium.

<u>Settlement or Subsidence</u>

Settlement or subsidence is the ground surface cracking in response to deep groundwater or petroleum withdrawal. This phenomenon can also occur where loose and/or porous and compressible earth materials are compressed by a body of overlying fill, in areas underlain by artificial fills having low relative densities and/or dryer than optimum moisture contents. Settlement occurs when stressed by the weight of a structure, as well as the weight of the earth materials. Settlement can also be aggravated by the introduction of water to the subsoil. Fill material and natural soil tend to be more compressible than bedrock materials (e.g., many "cut" areas).

Settlement potential usually increases with an increase in the depth of fill and natural soil (e.g., compaction). Where the depth of fill and natural soil vary, such as in areas where transitions and/or contacts exist between earth units having differing settlement potentials, the potential for differential settlement increases. The amount of differential settlement is of most concern since differential movements can result in distress. New fills also commonly undergo a certain degree of settlement both during and for a period of time following its placement. The amount of settlement is generally based on its thickness and other conditions of placement.

The development portion of the Project site is located on top of approximately 70 feet of previously compacted fill from the previous 41-unit development. This fill was never part of the landslide and has never shown any signs of instability. Given the timeframe in which the fill was placed, substantial amounts of further settlement are not expected to occur.

Seismically Induced Hazards

<u>Ground Shaking and Surface Fault Rupture</u>

The southern California region contains a wide variety of active faults. The occurrence of moderate and larger sized earthquakes is common within the region.

The nearest known active fault is the Newport-Inglewood Fault, approximately 4.3 miles to the west of the Project site. Ground shaking at the site generated by an earthquake on one or more of the active faults within the region will produce noticeable ground shaking. Homes throughout most areas of southern California can be expected to experience moderate to strong ground shaking.

The primary seismic effects associated with earthquakes are ground shaking and surface fault rupture. Ground shaking is typically considered the greatest source of potential damage to structures. Seismic shaking is characterized by the physical movement of the land surface during and subsequent to an earthquake which has the potential to cause destruction and damage to buildings and property. This includes damage resulting from damaged or destroyed gas or electrical utility lines; blockage of surface seepage and groundwater flow; changes in groundwater flow; dislocation of street alignments; displacement of drainage channels and drains; and possible loss of life. In addition, ground shaking can induce several kinds of secondary seismic effects, including liquefaction, lateral spreading, differential settlement, and landslides, all of which are described below.

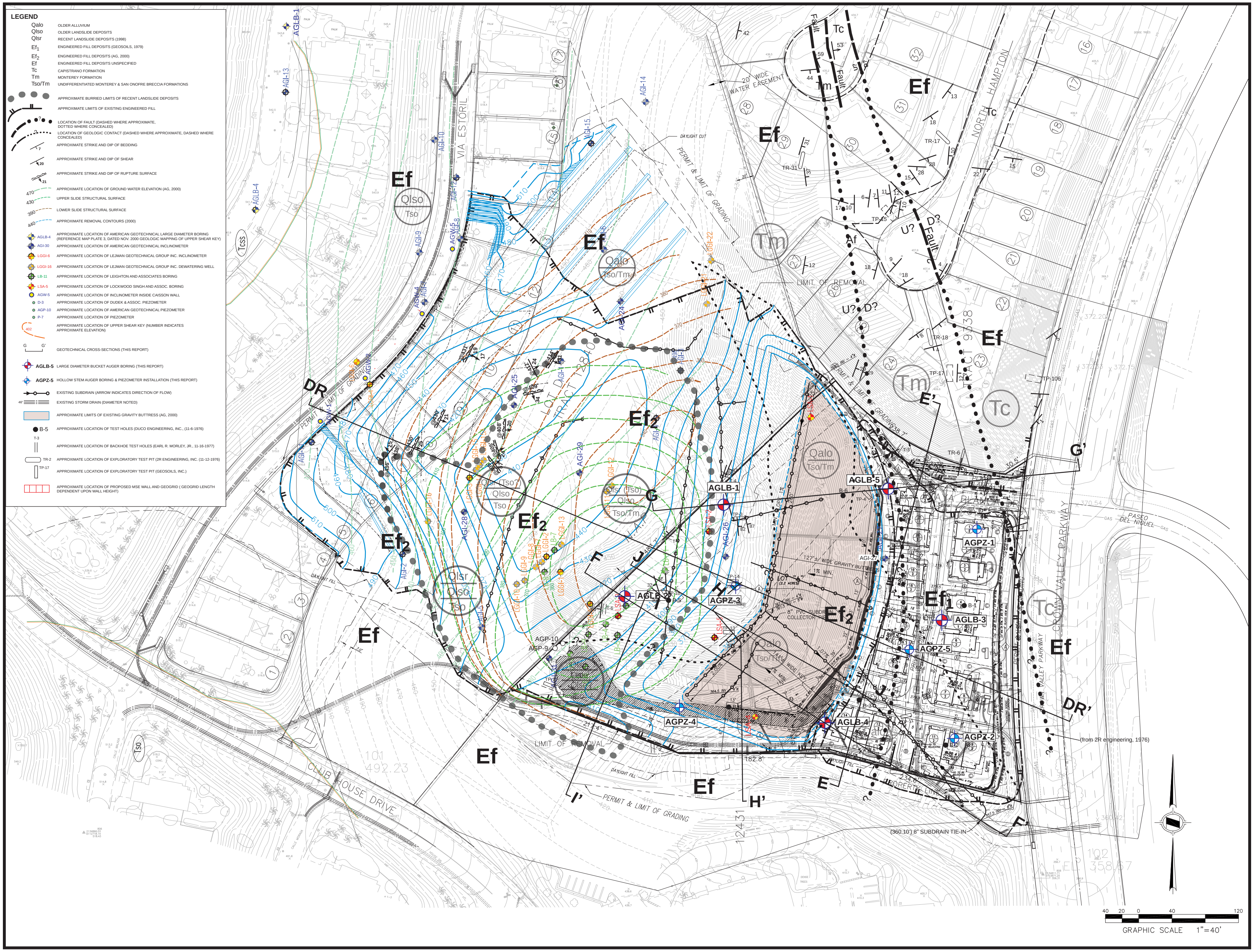
The intensity of seismic shaking during an earthquake depends largely on nature of the geologic units and materials comprising the upper several hundred feet of the earth's surface. The greatest amplitudes and longest durations of ground shaking occur on thick, water-saturated, unconsolidated alluvial sediments. Ground shaking can also cause ground failure or deformation due to lurching and liquefaction.

Surface rupture is the displacement and cracking of the ground surface that occurs along a fault trace. Unlike seismically induced ground shaking, which can affect a wide geographic area, surface rupture is confined to the area very near the fault.

As previously mentioned above, no known active faults are mapped as crossing the site or surrounding regions in close proximity to the site. Nor is the site and surrounding region depicted on any current Alquist-Priolo Earthquake Fault Zone Maps issued by the State of California. The nearest active fault to the site lies around 4.3 miles to the west, consisting of the Newport-Inglewood Structural Zone, a northwesterly trending strike-slip fault that crosses the western onshore margin of the Los Angeles Basin and extends offshore into the Continental Borderland.

<u>Liquefaction and Ground Settlement</u>

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, causing liquefaction. This loss of support can produce local ground failure such as settlement or lateral spreading that may damage overlying improvements. According to the current seismic hazard zone maps issued by the State of California, the site is not located within the boundaries designated for investigation of earthquake-induced liquefaction. The site earth materials consisting of predominantly clayey soil and rock types mitigate against risk of liquefaction.



Source: American Geotechnical, Inc. (05/2021).

Figure 4.6.A Preliminary Geotechnical/Geologic Map

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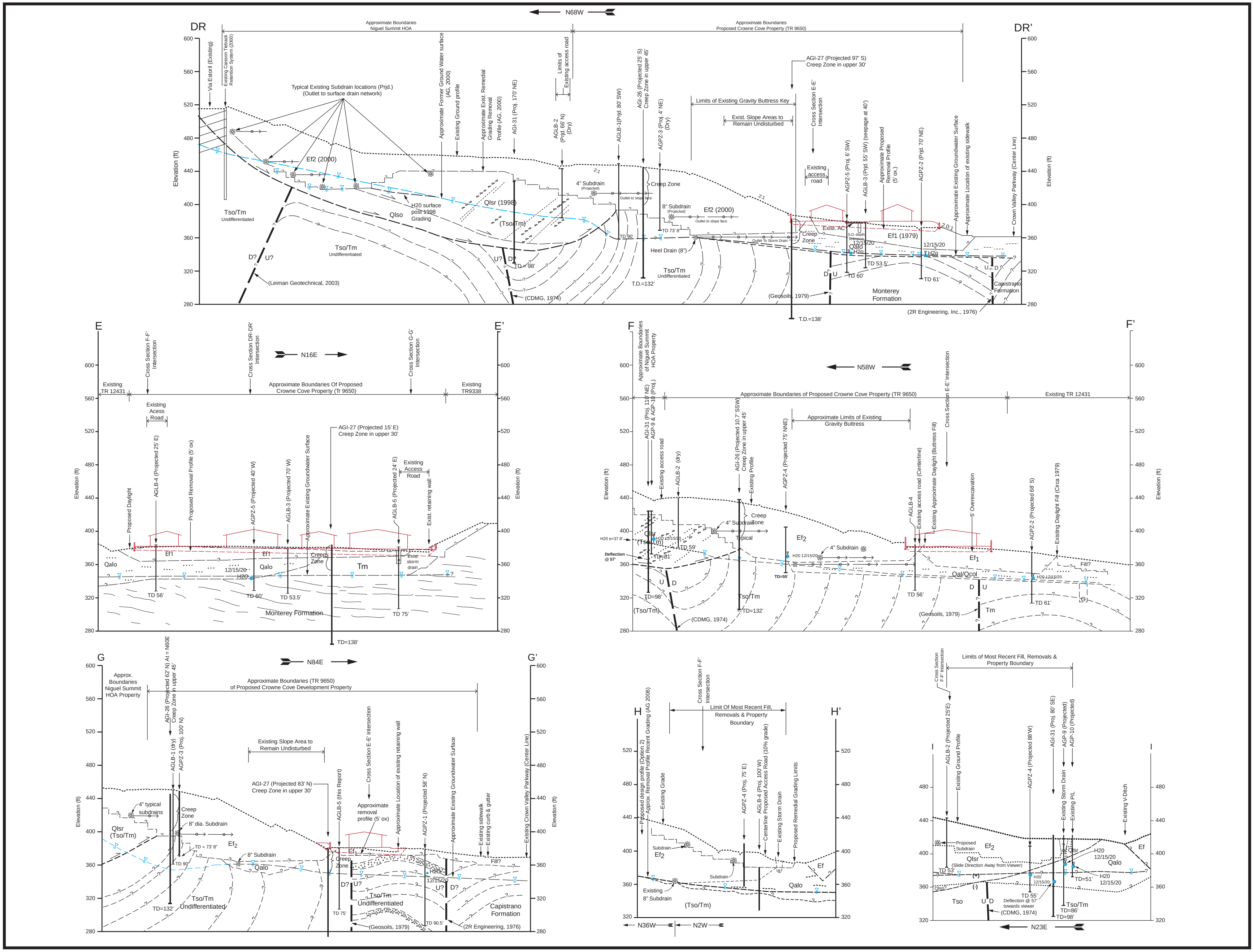

Source: *American Geotechnical, Inc. (01/2021).*

Figure 4.6.B Geotechnical Cross Sections

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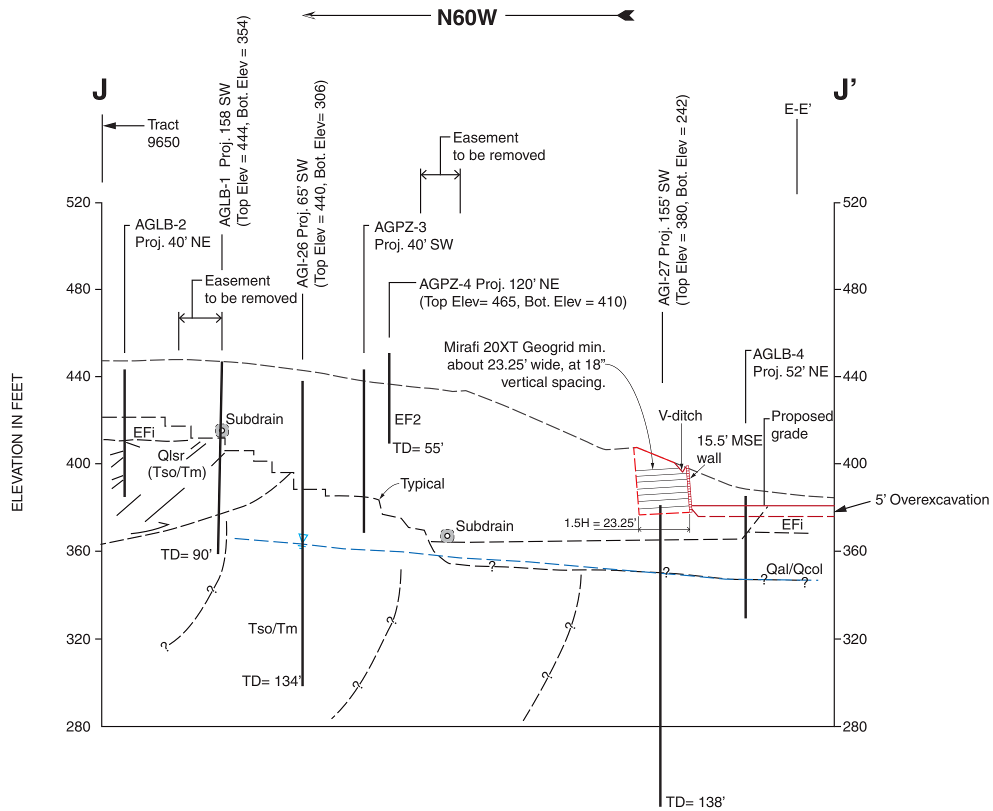

Source: American Geotechnical, Inc. (01/2021).

Figure 4.6.C Geotechnical Cross Section J-J

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<u>Slope Instability and Seismically Induced Landslide</u>

As previously stated, the 1998 landslide has been successfully remediated. Minor low-level downhill creep of the remaining portion of the central landslide, located offsite to the west, has occurred and is possible in the future. Such movements are expected to be of low magnitude, and according to the Project's geotechnical report prepared by American Geotechnical there have been no significant lateral movement or adjustments observed at the Project site.

According to the current seismic hazard zone maps issued by the State of California, a majority of the site is located outside the boundaries designated for investigation of earthquake-induced landsliding.

Paleontological Resources

The Project site bedrock units include the Middle- Miocene age San Onofre Breccia (Tso) and Monterey Formations (Tm), Undifferentiated Tso/Tm, the late Miocene to Pliocene age Capistrano Formation (Tc), Older Quaternary (Qlso).

A small portion of the northeastern corner of the site is underlain by the Capistrano Formation. The Capistrano Formation consists of marine shales and sands dating to the late Miocene and early Pliocene. This formation has provided many highly significant fish and marine mammal fossils. Capistrano Formation has a very high sensitivity for paleontological resources, which means fossils are considered scientifically significant and important for research.

4.6.3 Related Policies and Regulations

Federal Regulations

There are no federal regulations that are applicable to geology and soils resources relevant to the proposed Project.

State Regulations

<u>Alquist-Priolo Earthquake Fault Zoning Act</u>

The primary purpose of the Alquist-Priolo Earthquake Fault Zoning Act is to prevent the construction of buildings used for human occupancy on the surface trace of active faults. The act addresses only the hazard of surface fault rupture and is not directed toward other earthquake hazards. 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 issue locational maps to all affected cities, counties, and state agencies for their use in safe construction. Before a project may be permitted, a geologic investigation is required to demonstrate that proposed buildings would not be constructed across active faults. An evaluation and written report of a specific site must be prepared by a licensed geologist. If an active fault is found, a structure for human occupancy cannot be placed over the trace of the fault and must be set back from the fault (generally 50 feet) (California Department of Conservation 2013).

Seismic Hazards Mapping Act of 1990

The California State Seismic Hazards Mapping Act of 1990 addresses earthquake hazards other than surface fault rupture, including liquefaction and seismically induced landslides. The state establishes city, county, and state agency responsibilities for identifying and mapping seismic hazard zones and mitigating seismic hazards to protect public health and safety. The act requires the California Department of Conservation, California Geological Survey, to map seismic hazards and establishes specific criteria for project approval that apply within seismic hazard zones, including the requirement for a geologic and geotechnical report.

California Building Code

CCR Title 24 (California Building Code [CBC]) applies to all applications for building permits. The CBC (also called the California Building Standards Code) has incorporated the International Building Code, which was first enacted by the International Conference of Building Officials in 1927 and has been updated approximately every 3 years since that time. The current version of the CBC (2019) became effective on January 1, 2020.

Local agencies must ensure that development in their jurisdictions complies with guidelines contained in the CBC. Cities and counties can, however, adopt building standards beyond those provided in the code.

State Water Resources Control Board Construction Storm Water Program

Dischargers whose projects disturb 1 or more acres of soil or whose projects disturb less than 1 acre but are part of a larger common plan of development that in total disturbs 1 or more acres are required to obtain coverage under the General Permit for Discharges of Storm Water Associated with Construction Activity Construction General Permit under Order 2009-0009-DWQ. Construction activity subject to this permit includes clearing, grading, and disturbances to the ground such as stockpiling or excavation. The Construction General Permit requires the completion and implementation of a site-specific Storm Water Pollution Prevention Plan (SWPPP).

California Public Resources Code Section 5097.5

Public Resources Code (PRC) Section 5097.5 provides for the protection of cultural and paleontological resources and prohibits the removal, destruction, injury, or defacement of archaeological and paleontological features on any lands under the jurisdiction of State or local authorities.

Local Regulations

<u>Laguna Niguel General Plan</u>

The Laguna Niguel General Plan (LNGP) contains goals, policies, and plans that are intended to guide land use and development decisions. The Open Space/Parks/Conservation Element was designed to ensure the conservation of important historical, archaeological, and paleontological resources. Relevant policies regarding paleontological resources are listed below.

Open Space/Parks/Conservation Element

Goal 6.0. Carefully review sensitive hillside areas within the community.

- **Policy 6.2.** Consider significant natural features, including sensitive hillsides and ridgelines as part of the development process.

Goal 7.0. Recognize significant cultural sites or features within the community.

- **Policy 7.2.** Require mitigation of impacts to significant areas of archaeological and paleontological resources.
- **Policy 7.3.** Preserve uncovered resources in their natural state, as much as feasible to assure their preservation and availability for later study. Require that uncovered resources are documented and retained in an appropriate museum or institution.

Seismic/Public Safety Element

The City is in a seismically active region. The intent of the following goals and policies is to reduce the potential for loss of life, injury, or property damage from flooding, seismic, or other geologic hazards.

Goal 1. A reduction of impacts from natural hazards that may affect the City of Laguna Niguel.

- **Policy 1.1.** Mitigate potential adverse impacts of geologic and seismic hazards.
- **Policy 1.3.** Develop plans and programs to mitigate the effects of natural hazards.

4.6.4 Thresholds of Significance

Criteria for determining the significance of impacts related to geology and soils are based on criteria contained in Appendix G of the State CEQA Guidelines and the City's CEQA Manual. The proposed Project could have a significant impact on the environment if it would result in any of the following.

Threshold GEO-1.i *Directly or indirectly cause 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?*

Threshold GEO-1.ii *Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking?*

Threshold GEO-1.iii *Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground failure, including liquefaction?*

Threshold GEO-1.iv *Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides?*

Threshold GEO-2 *Result in substantial soil erosion or the loss of topsoil?*

Threshold 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 an on-site or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?*

Threshold GEO-4 *Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?*

Threshold GEO-5 *Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems in areas where sewers are not available for the disposal of wastewater?*

Threshold GEO-6 *Directly or indirectly destroy a unique paleontological resource or site or unique geological feature?*

Methodology

To evaluate potential hazards related to the Project pertaining to its geologic and soils conditions, a Geotechnical Report was prepared by American Geotechnical, Inc. (American Geotechnical) (Appendix F), which included field exploration (i.e., an exploratory soil boring), inclinometer readings, and laboratory testing to determine the characteristics of the subsurface conditions at the Project Site. In addition, relevant literature and materials were reviewed as part of the Geotechnical Report. The Project Site was explored by American Geotechnical in December of 2020 to verify site conditions. American Geotechnical was also the Engineer of Record during completion of the late 1998 - 2000 mass grading operations and structural slope system installed within the steep hillsides of the Project site and beyond as part of the 1998 Via Estoril Landslide slope remediation. The Geotechnical Reports were peer reviewed by the City's geotechnical consultant, Goffman, McCormick, and Urban Geotechnical Inc. (GMU) and conditionally approved.

4.6.5 Project Design Features and Standard Conditions of Approval

PDF GEO-1 The Project is to be subdivided into two lots, Lot 1 and Lot A. Lot 1 includes the 2-acre residential area and Lot A includes the 2.2-acre area of open space which consists of the previously remediated landslide and includes the 30-foot earthen "buttress" (a design feature previously approved and installed for geotechnical assurance of future landslide), planted erosion control, and installed storm drain system. Since Lot A is a lettered lot on the tentative tract map and no residential development is allowed on lettered lots, no residential home construction would occur on the remediated hillside.

PDF GEO-2 The residential building pads within Lot 1 will include Mechanically Stabilized Earth (MSE) walls up to 15.5 feet tall along the west perimeter of Lot 1 and 3.5 feet to 6 feet high along the east perimeter of Lot 1. The perimeter MSE walls bounding the west margin of the building pads and the 2:1 (horizontal:vertical) cut slope at the southwest margin of the building pads will be located at the toe of the compacted fill buttress built to stabilize the Via Estoril Landslide remediation.

In addition to the MSE walls, a series of retaining walls is proposed. On the north perimeter of Lot 1, a two-tier retaining wall is proposed. The upper tier retaining wall is up to 5 feet high and the lower tier retaining wall is 3.5 feet to 6 feet high. Up to 6-feet high radiant heat walls with or without retaining walls up to 4.3 feet high are also proposed surrounding Buildings 4 and 5 located on the south portion of Lot 1. An up to 6.5-foot-high retaining wall is also proposed on the west side of Building 5. An up to 2-foot-high retaining wall is proposed to be constructed along the 15-foot-wide access road located on the southeast side of Lot A adjacent to the proposed MSE walls along the west perimeter of Lot 1. All proposed slopes will have a slope ratio of 2:1 (horizontal:vertical) and if supporting a MSE or retaining wall, material must be approved fill.

MSE walls and retaining walls must be designed in accordance with the recommendations included in the Geotechnical Reports.

PDF GEO-3 Prior to the issuance of a grading permit, the Applicant shall prepare a final geotechnical report based on the final rough grading plans and the final geotechnical report shall incorporate all of the recommendations included in the preliminary geotechnical reports included in Appendix F. The preliminary geotechnical reports included in Appendix F have established that the site is geotechnically suitable for development and a final geotechnical report is required to ensure all construction-level geotechnical recommendations and design parameters are included on the final rough grading plans.

SCA GEO-1 Applicant shall comply with the most current City building codes and CBC requirements, which stipulates appropriate seismic design provisions that shall be implemented with Project design and construction such as but not limited to the following:

- Temporary cuts shall be 1:1 (horizontal:verticle) and limited to 4 feet high.
- All buildings shall be designed with structural slabs/mat slabs to account for expansive and other soil influences.
- All walls shall be provided with an adequate backdrain system.
- All retaining walls shall be waterproofed from above the highest point of earth retained to the heel of the foundation or pile grade beam.
- Retaining wall backfill shall be placed in thin lifts (6 to 8 inches) and compacted by mechanical means.

SCA GEO-2 The proposed Project shall prepare and implement a SWPPP, in accordance with the Construction General Permit. The SWPPP shall list best management practices (BMPs) that shall be implemented to protect stormwater runoff and would include monitoring of BMP effectiveness. At a minimum, BMPs shall include practices to minimize the contact of construction materials, equipment, and maintenance supplies (e.g., fuels, lubricants, paints, solvents, adhesives) with stormwater. The SWPPP shall specify properly designed centralized storage areas that keep these materials out of the rain. If grading must be conducted during the rainy season, the primary BMPs selected shall focus on erosion control (i.e., keeping soil particles from detaching) and sediment control (i.e., keeping sediment on the site after it has been detached). Standard practices to be included in the SWPPP are as follows:

- Protect all storm drain inlets and streams located near the construction site to prevent sediment-laden water from entering the storm drain system.
- Prevent erosion by implementing one or more of the following soil stabilization practices: mulching, surface roughening, permanent or temporary seeding.
- Limit vehicular access to and from the project site. Stabilize construction entrances/exits to minimize the track out of dirt and mud onto adjacent streets. Conduct frequent street sweeping.
- Protect stockpiles and construction materials from winds and rain by storing them under a roof, secured impermeable tarp or plastic sheeting.
- Avoid storing or stockpiling materials near storm drain inlets, gullies or streams.
- Phase grading operations to limit disturbed areas and duration of exposure.
- Perform major maintenance and repairs of vehicles and equipment off site.

- Wash out concrete mixers only in designated washout areas at the construction site.
- Set up and operate small concrete mixers on tarps or heavy plastic drop cloths.
- Keep construction sites clean by removing trash, debris, wastes, etc. on a regular basis.
- Clean up spills immediately using dry clean-up methods (e.g., absorbent materials such as cat litter, sand or rags for liquid spills; sweeping for dry spills such as cement, mortar or fertilizer) and by removing the contaminated soil from spills on dirt areas.
- Maintain all vehicles and equipment in good working condition. Inspect frequently for leaks, and repair promptly.
- Cover open dumpsters with secured tarps or plastic sheeting. Clean out dumpsters only in approved locations on the construction site.
- Arrange for an adequate debris disposal schedule to ensure that dumpsters do not overflow.

SCA GEO-3 Mitigation of potential adverse impacts of geologic and seismic hazards through planning, design, and construction of Project by adhering to applicable City ordinances, policies of the current California Building Code (CCR Title 24), and per the results and recommendations of the geological study as seen in Appendix F.

4.6.6 Environmental Impact Evaluation

Threshold GEO-1.i *Would the Project directly or indirectly cause 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?*

Less Than Significant Impact. As stated previously, the Project site is not within a State of California defined Alquist-Priolo Earthquake Fault Hazard Zone and no known active faults transect the site. However, similar to much of Southern California, the Project site may be subject to some level of damaging ground shaking as a result of movement along the major active (and potentially active) fault zones that characterize this region. According to the Preliminary Geotechnical Investigation, the site is designated as Site Class C, which states that Geologic evidence is insufficient to demonstrate the existence of tectonic fault, or Quaternary slip or deformation associated with the feature, and more specific describes the Project site to have very dense soil and soft rock soil profiles. Based on the above, the potential threat to the site from a surface rupture hazard is considered low. Therefore, fault rupture is very unlikely at the Project site resulting in a less than significant impact. No mitigation is required.

Threshold GEO-1.ii	*Would the Project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking?*
Threshold 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 an on-site or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?*

Less than Significant Impact. Similar to all of the Southern California region, the Project site would be subject to moderate to strong ground shaking in the event of a major earthquake. Strong seismic shaking effects on the proposed Project resulting from large earthquakes originating from nearby faults could include landslides, ground cracking, and settlement. These effects are dependent on onsite geology and on the distance between the proposed Project area and the causal fault as previously mentioned. These faults include the Newport-Inglewood Fault, the San Joaquin Hills Fault, the Elsinore Fault, the Whittier Fault, and the San Andreas Fault. As a result, the proposed Project could be subject to future seismic shaking and strong ground motion resulting in structural damage.

Construction of the proposed project would be subject to applicable ordinances and requirements of the current California Building Code (CCR Title 24). The CBC provides requirements for foundation strength, tie-downs, shear strength, and other building requirements designed to withstand significant ground-shaking. Standard condition of approval **SCA GEO-1** notes the Project would be required to comply with the building design standards of the state and City. These standards require specific building design and construction practice appropriate for the City's earthquake zone.

Since the landslide that impacted the Project site in 1998, an extensive geotechnical repair was made to the hillside and the project geologists have had 20 years of monitoring of the repair. There are many other examples of repaired landslides in Southern California, but very few, if any, have the benefit of 20 years of monitoring prior to rebuilding.

As previously discussed in Section 4.6.2, during the past 20 years, geologists have been monitoring slope inclinometers. Slope inclinometers are measuring devices installed at depth in drilled wells. These devices can measure very slight movement of a hillside at various depths. The two decades of monitoring provide data that conclude there is no major landslide/hillside stability issues and only slight movement has been detected. This slight movement is indicative of the landslide and buttress settling to equilibrium and expected surficial slope creep, which is consistent with slopes and hillside areas consisting of clayey earth materials throughout Southern California. As a result, the anticipated slow rate of on-going creep movement in combination with the prior slope remediation would not cause a significant impact to the proposed development.

In addition to inclinometers, geologists installed peizometers to monitor groundwater levels. Groundwater is an important component of slope stability and measuring groundwater regularly can give an indication of potential future stability issues. The piezometers have provided data showing stable groundwater levels. The stable groundwater levels are primarily due to the properly functioning surface and subsurface drainage facilities constructed as part of the remediation.

Although a prior proposal included residential development on the upper western portion of the site and was shown to be geotechnically stable, receiving conditional approval from the City's geotechnical consultant in 2013, the proposed Project, unlike the prior proposal, places the upper 2-acre portion of the site in a lettered lot on the tract map as outlined in project design feature **PDF GEO-1**. Since Lot A is a lettered lot on the tentative tract map and no residential development is allowed on lettered lots, no residential home construction would occur on the remediated hillside. Lot A would provide an open space area, access for maintenance, and an area for passive recreational activities.

The proposed Project includes a Mechanically Stabilized Earthen wall (MSE) at the toe of the slope of the landslide remediation area. The MSE wall is designed with geogrid, which extends back into the hillside for additional stability. The MSE wall also has some flexibility to account for slope creep or expansive soils. The Geotechnical Reports have analyzed the MSE wall location and design and determined it would not be detrimental to slope stability.

Factor of safety is a measurement of slope stability in different conditions. There is a long-term static factor of safety, which must be a minimum of 1.5, and a short-term pseudostatic/seismic minimum factor of safety of 1.1. The April 2, 2021, Geotechnical Report (American Geotechnical, Inc. Response to Comment No. 3, April 2, 2021) provides factor of safety calculations based on three different methodologies and cross-sections. The long-term factor of safety calculations are 1.823, 2.203, and 2.308, all of which exceed the minimum 1.5 factor of safety. The short-term pseudostatic/seismic factors of safety are 1.267, 1.601, and 1.264, all of which exceed the minimum 1.1 factor of safety.

In accordance with the project design features to maintain the existing remediated slope as open space (**PDF GEO-1)**, the installation of proposed MSE walls at the toe of the remediated slope (**PDF GEO-2)**, and inclusions of geotechnical recommendations into the rough grading plans (**PDF GEO-3)**, the Project site, including Lot A, would have factors of safety in excess of the minimum standards. Therefore, the Project site, including Lot A, would perform acceptably in response to strong seismic ground shaking from a regional earthquake of major magnitude and poses a less than significant risk from a future landslide or related geologic failure.

With implementation of proper grading and earthwork, slope stability, retaining walls, seismic design, construction materials, geotechnical observation, and testing and plan review in accordance with standard conditions and Project design, impacts from strong seismic ground shaking from a regional earthquake of major magnitude would be reduced to less-than-significant levels.

As previously discussed in Section 4.6.2, settlement or subsidence is the ground surface cracking, often in response to deep groundwater or petroleum withdrawal. The closest depths of groundwater beneath the central and eastern areas of the site are approximately 35 to 40 feet below existing grades. Due to the lowest recommended cuts during site preparation of five to ten feet, groundwater will not be reached and will not be affected, and therefore groundwater levels will not be impacted. In addition, the development portion of the Project site is located on top of approximately 70 feet of previously compacted fill from the previous 41-unit development. According to the Geotechnical Report prepared by American Geotechnical, this fill was never part of the landslide and has never shown any signs of instability. Given the timeframe in which the fill was placed, substantial amounts of further settlement or subsidence are not expected to occur and the American Geotechnical test results revealed generally low-level collapse responses. As a result, impacts from subsidence or collapse are less than significant.

Further discussed in Section 4.6.2, the Project site is not located within the boundaries designated for investigation of earthquake-induced liquefaction, as a result impacts from liquefaction are less than significant.

Threshold GEO-1.iii *Would the Project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground failure, including liquefaction?*

Less than Significant Impact. As stated previously, the Project site is not located within the boundaries designated for investigation of earthquake-induced liquefaction and groundwater levels beneath the entire site are deep and therefore the potential for liquefaction is low. Based on the above, the potential for the occurrence of liquefaction beneath the site with impact to the development is considered less than significant and no mitigation is required.

Threshold GEO-1.iv *Would the Project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides?*

Less than Significant Impact. As stated previously, the Via Estoril Landslide was successfully repaired between 1998 and early 2000 with the construction of the fill buttress along with permanent erosion control measures previously discussed. Review of installed inclinometers (permanent measuring devices installed within the hillside to measure movement) over the past 20 years within the remediated hillside indicate a consistently slow and a small magnitude of movement which is typical of slopes and hillsides with similar clayey earth materials within

Southern California. As previously discussed in Threshold GEO-1.ii and 3, such surficial slope movement is not indicative of greater slope instability. The Geotechnical Report has demonstrated adequate factors of safety to support residential development on Lot 1. Therefore, impacts associated with the prior landslide are less than significant with implementation of PDFs GEO-1, GEO-2, and GEO-3.

Based on review of recent slope creep data, the remediated Via Estoril hillside slope has shown no significant movement when compared to previous readings and the rates of movement have been found to be of low magnitude and incredibly slow. The geotechnical report concluded the recent low magnitude and slow creep is consistent with the landslide mass settling to equilibrium and ordinary surficial slope creep.

Based on the data measurements and site investigations, the geologic report concluded no significant movement of the slope should occur during the construction life and only typical slope creep influence will continue over time. As indicated previously, factor of safety is a measurement of slope stability in different conditions. Long-term static factor of safety must be a minimum of 1.5, and a short-term pseudostatic/seismic minimum factor of safety must be a minimum of 1.1. The April 2, 2021, Geotechnical Report (American Geotechnical, Inc. Response to Comment No. 3, April 2, 2021) provides factor of safety calculations based on three different methodologies and cross-sections. The long-term factor of safety calculations are 1.823, 2.203, and 2.308, all of which exceed the minimum 1.5 factor of safety. The short-term pseudostatic/seismic factors of safety are 1.267, 1.601, and 1.264, all of which exceed the minimum 1.1 factor of safety.

With implementation of standard conditions and Project design, impacts associated with slope stability and from a future landslide would be reduced to less-than-significant levels.

Threshold GEO-2 *Result in substantial soil erosion or the loss of topsoil?*

Less than Significant Impact. Erosion is a condition that could adversely affect development on any site. Site grading could temporarily exacerbate erosion conditions, but implementation of erosion control measures would limit such effects. The Construction General Permit, adopted by the State Water Resources Control Board (SWRCB) as Water Quality Order 2009-0009-DWQ (effective July 1, 2010), is required for soil disturbance activities that would be greater than 1 acre. The Project is expected to disturb an area greater than 1 acre and is subject to the requirements of the Construction General Permit. Also, several BMPs would be implemented during construction, including sediment and erosion control measures to prevent pollutants from leaving the site. Furthermore, LNGP Policy 1.1 requiring the mitigation of potential adverse impacts of geologic and seismic hazards would be adhered to per **SCA GEO-3**, resulting in a properly maintained, graded, and geologically stabilized site. With construction of MSE (**PDF GEO-2**) and retaining walls, and the installation of landscape and irrigation systems, implementation of applicable existing standards and requirements for grading and construction (**PDF GEO-3**) will reduce erosion potential. With implementation of **SCA GEO-1**, **SCA GEO-2**, and **SCA GEO-3**, impacts from soil erosion and loss of topsoil would be rendered less than significant and no mitigation is required.

Threshold GEO-4	*Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?*

Less than Significant Impact. Expansion index testing conducted as part of the geotechnical investigation report indicated that onsite soils have a very-low to medium expansion potential, but should be treated as having a high expansion potential due to the unknown source of materials consisting of fill from the 1979 development and native soils. With proper treatment, the on-site soils are considered suitable for use as compacted fill provided it is free of organic material and debris and the moisture content is adjusted to within a compactable range. Implementation of previously referenced **PDF GEO-3** requiring preparation of a final geotechnical report that shall incorporate all of the construction-level geotechnical recommendations and design parameters contained in the preliminary geotechnical reports included in Appendix F. The resulting construction-level geotechnical recommendations and design parameters contained in the final geotechnical report shall be incorporated into the final rough grading plans and implemented during removal and fill operations to verify such recommendations and design parameters are incorporated. When incorporated, impacts from expansive soils would be less than significant and no further mitigation is required.

Threshold GEO-5	*Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems in areas where sewers are not available for the disposal of wastewater?*

Less than Significant Impact. No septic tanks or alternative wastewater disposal systems are proposed as part of the Project. Therefore, soils would not be required to support septic tanks once the project is implemented. As a result, there would be no impact and no mitigation is required.

Threshold GEO-6	*Directly or indirectly destroy a unique paleontological resource or site or unique geological feature?*

Less than Significant Impact with Mitigation. As previously stated, the Project site was developed in 1979 as a 10-building townhome project with 41 condominium units. The catastrophic Via Estoril landslide destroyed part of the development on the site, as well single-family homes located above the site.

Following the landslide, the entire site was demolished to perform remedial grading necessary to stabilize the former landslide. The landslide was repaired which involved installation of a caisson wall with tieback anchors, removal of the 10 condominium buildings and associated structures, partial removal of the landslide mass, installation of subdrains, and construction of a compacted fill buttress.

Due to the Project site currently consisting of predominately engineered artificial fill and only a small portion protruding into fossil rich bedrock, the site does not contain any unique geological features and the likelihood of unearthing subsurface paleontological resources during construction is considered to be very unlikely.

However, it is possible that undiscovered paleontological resources could be encountered during ground-disturbing activities in native material within the bedrock that may contain such resources. Damage to or destruction of a paleontological resource would be considered a potentially significant impact under local, state, or federal criteria and mitigation is required. Implementation of **MM GEO-1** would ensure steps are taken to reduce impacts to paleontological resources in the event that they are discovered during construction, reducing this impact to a less than significant level and no further mitigation is required.

4.6.7 Cumulative Impacts

Less than Significant Impact with Mitigation. Cumulative development results in an increase in population and structures that could be exposed to hazardous geological conditions, depending on the projects location. Geologic and soil conditions are typically site specific and can be addressed through appropriate engineering practices, uniform site development, and construction standards designed to protect public safety and structures and to reduce adverse effects to soils. Cumulative impacts on geologic resources would be considered significant if a project would be impacted by geologic hazard(s) and if the impact could combine with off-site geologic hazards to be cumulatively considerable.

As identified in Figure 2.A and Table 2.A, there are no cumulative projects that are in close proximity to the proposed Project that would have the potential for intermingling geologic impacts that would create a cumulative geologic impact. According to the Geotechnical Report, implementation of the Project would not create any reasonably foreseeable risks to the existing residential properties to the west and north. Conversely, the existing development would not create any reasonably foreseeable risks to the Project. Therefore, no cumulatively considerable effects are identified for geology/soils, and cumulative impacts would be less than significant.

In addition, development in a seismically active region can put people and structures at risk from a wide range of earthquake-related effects. The existing level of seismic risk exposure represents a significant cumulative impact. However, various mechanisms are in place to reduce risks at the

Project level, including project-specific hazards evaluation processes mandated by the Seismic Hazards Mapping Act and City procedures, as well as the implementation of the CMC's seismic design construction standards.

A comprehensive analysis of slope stability was performed on the existing remediated hillside and the Project site. Long-term static factor of safety, which must be a minimum of 1.5, and short-term pseudostatic/seismic factor of safety, which must be a minimum of 1.1, were both calculated. The April 2, 2021, Geotechnical Report (American Geotechnical, Inc. Response to Comment No. 3, April 2, 2021) provides factor of safety calculations based on three different methodologies and cross-sections. The long-term factor of safety calculations are 1.823, 2.203, and 2.308, all of which exceed the minimum 1.5 factor of safety. The short-term pseudostatic/seismic factors of safety are 1.267, 1.601, and 1.264, all of which exceed the minimum 1.1 factor of safety.

As outlined in **PDF GEO-1,** the upper 2-acre portion of the Project site is designated a lettered lot, Lot A, on the tentative tract map. Since Lot A is a lettered lot on the tentative tract map and no residential development is allowed on lettered lots, no residential development would occur on the remediated hillside. In addition, **PDF GEO-2** and **PDF GEO-3** provide specifications of an MSE wall of varying heights at the toe of the hillside and geotechnical recommendations to be included on the rough grading plans.

Potentially adverse environmental effects associated with seismic and geologic hazards usually are site-specific and generally do not combine with similar effects that could occur with other projects in the City. Although there would be some residual level of risk because seismic and geologic hazards on a Project site cannot be entirely avoided, the proposed Project would not contribute considerably to a cumulative impact related to seismic and geologic hazards.

Similar to seismic and geologic hazards, potentially adverse environmental effects associated with paleontological resources are site-specific and generally do not combine with similar effects that could occur with other projects in the City. Furthermore, with implementation of **MM GEO-1**, any paleontological resources found on site would be evaluated and to the extent necessary, curated. The proposed Project would not contribute considerably to a cumulative impact related to paleontological resources.

4.6.8 Summary of Mitigation Measures

MM GEO-1 If paleontological resources are found during grading and construction within the Project, all work shall be halted immediately within a 200-foot radius of the discovery until a qualified paleontologist has evaluated the find.

Work shall not continue at the discovery site until the paleontologist evaluates the find and makes a determination regarding the significance of the resource and identifies recommendations for conservation of the resource, including preserving in place or collecting the resource to the extent feasible and documenting the find with an appropriate museum or university collection.

4.6.9 Significant Environmental Impacts

There are no significant environmental impacts associated with geology and soils with implementation of project design features **PDF GEO-1**, **PDF GEO-2**, **PDF GEO-3**, standard conditions of approval **SCA GEO-1**, and **SCA GEO-2**. Similarly, there are no significant environmental impacts associated with paleontological resources with implementation of mitigation measure **MM GEO-1**.

4.6.10 References

14 CCR 15000–15387 and Appendix A–L. Guidelines for Implementation of the California Environmental Quality Act, as amended.

American Geotechnical, Inc. February 3, 2022. Response to Questions Regarding Geotechnical Review.

American Geotechnical, Inc. May 28, 2021. Addendum Report – Adding Geology to Current Site Plan.

American Geotechnical, Inc. April 2, 2021. Response to City of Laguna Niguel Geotechnical Review Sheet Dated February 15, 2021 and Notice of Incompleteness Dated February 23, 2021.

American Geotechnical, Inc. January 8, 2021. Geotechnical Review of Tentative Tract Map.

City of Laguna Niguel. February 2022. City of Laguna Niguel CEQA Manual.

City of Laguna Niguel. 1992. General Plan for the City of Laguna Niguel. Available: http://cityoflagunaniguel.org/DocumentCenter/Home/View/1886. (Accessed: August 11, 2021.)

City of Laguna Niguel. 2021. City of Laguna Niguel 2021–2029 Housing Element. Available: https://www.cityoflagunaniguel.org/1352/Housing-Element-Update. Last revised: October 2021. (Accessed February 22, 2022).

City of Laguna Niguel, Laguna Niguel Municipal Code Title 9, Planning and Zoning. https://library.municode.com/ca/laguna_niguel/codes/code_of_ordinances?nodeId=TIT9PLZO(Accessed June 20, 2021).

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